

SCIENTIFIC AMERICAN

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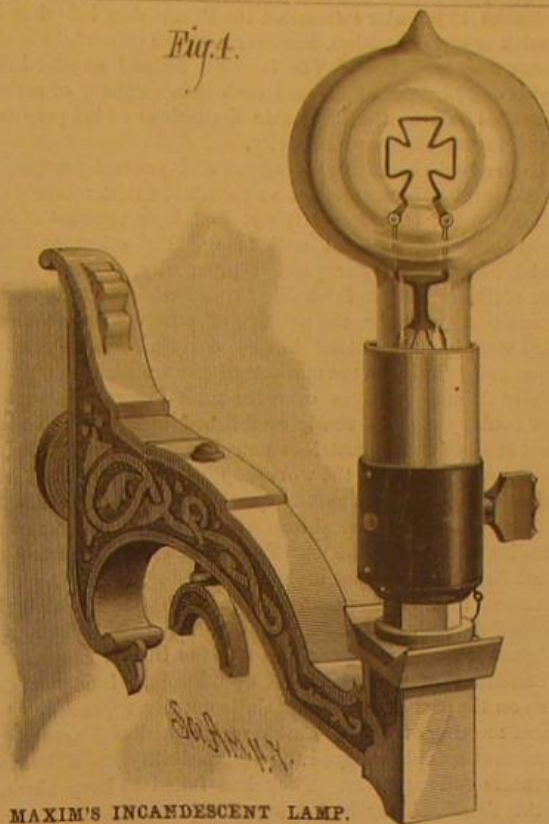
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RECENT DEVELOPMENTS IN ELECTRIC LIGHTING.

That the electric arc light has been gaining in public favor is evidenced by its permanent adoption in a large number of public halls, theaters, factories, warehouses and stores throughout the country; and its application to tunnels, mines, and engineering work by night, and to out-of-door illumination in streets, parks, and public places. It is also employed for lighting docks, and to a considerable extent by traveling shows. In its application to lighthouses and head-lights of steamers it certainly has no rival.

One of our prominent mechanical engineers, Mr. H. S. Maxim, of this city, has long been engaged in perfecting the electric light in its various forms, and has been one of the foremost in adapting it to special purposes. His dynamo-electric machines and electric light projectors for land and marine uses have been already illustrated in this journal, and not long since we published engravings of a new focusing lamp by the same inventor. We now give engravings of a new and remarkably efficient current regulator for electric light circuits, and illustrate a dynamo-electric machine, which is probably the largest ever built in this country. We also furnish views of Mr. Maxim's incandescent lamp which is now brought to public notice for the first time, although, as we are informed by the inventor, the lamp was made substantially in its present form some three or four years since. In fact, Mr. Maxim claims to be the pioneer in this direction.*

* The application for a patent on Mr. Maxim's incandescent lamp was filed October 4, 1878; the patent was granted August 10, 1880. The process of manufacturing carbon was patented July 20, 1880. The dynamo machine was patented June 8, 1880. The machine for regulating the current was patented June 8, 1880. A process for charging the lamps with vapors of gasoline was patented August 10, 1880.

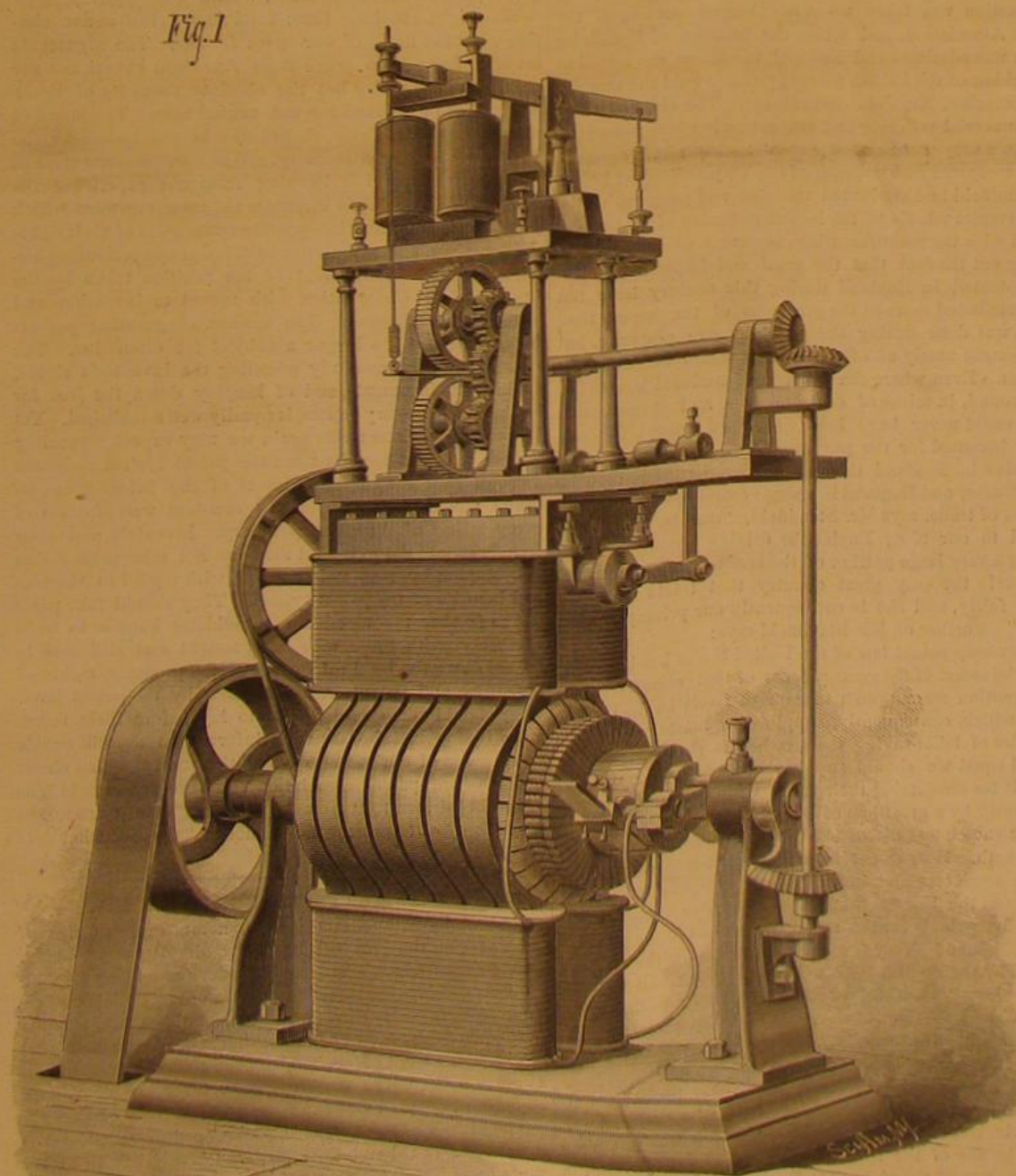


The current regulator, which is shown in perspective in Fig. 1 and side view in Fig. 2, controls the current perfectly, and proportionates it so accurately to the work to be done that it makes no difference whether there are fifty lamps in the circuit or only one, the current in the single lamp when used alone being the same as it is when the lamp is associated with forty-nine others in the same circuit.

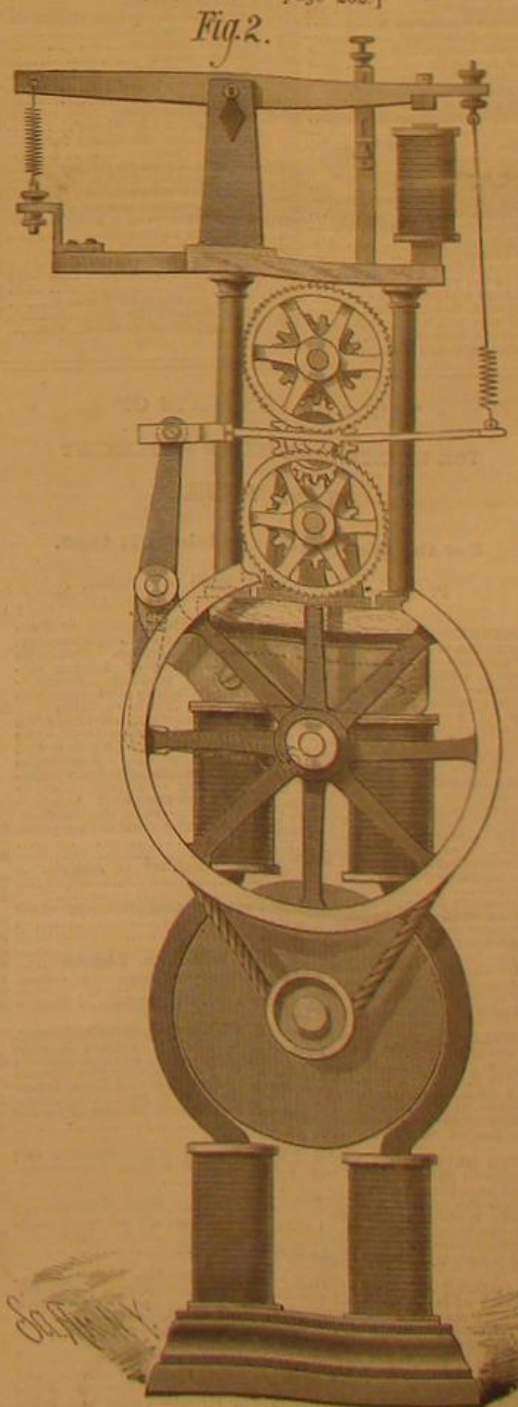
The manner in which this wonderful result is secured will be apparent on studying Figs. 1 and 2. In an electric lighting station, where a number of large machines like that shown in Fig. 3 are used, the field magnet of each machine will be excited by a small dynamo machine like that shown in connection with the current regulator in Figs. 1 and 2, and the strength of the current generated by the large machine depends on the degree of excitation of its magnets. If a strong current is desired the field magnets are strongly magnetized by their inclosing helices. If a very weak current is desired the magnets are but slightly excited, and the strength of the current may vary anywhere between these two extremes.

The commutator brushes of the exciting machine are arranged to swing on a bearing concentric with the commutator cylinder, so that by turning the brushes around to the neutral points the current is nil, and by turning it back nearly to the central position between the neutral points the current is the strongest that can be obtained from the machine. The current regulator is influenced by the current proceeding from the large machine and controls the mechanism which moves the commutator brush of the small machine, in this manner regulating the excitation of the mag-

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MAXIM'S CURRENT REGULATOR.



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THE RELATIONS OF CHEAP PATENTS TO INDUSTRIAL PROSPERITY.

The factors of American prosperity are many.

We have a magnificent country, to begin with; a territory of continental scope, made fruitful by a climate unsurpassed in kindly adaptation to needs of varied agriculture and the requirements of industrial activity. Our mineral resources are unrivaled in richness and variety. Our complex population embodies no small part of the best pluck and energy and intelligence of all civilized nations. Our free institutions favor individual and associated activity in all legitimate directions. With us men are respected as men and honored according to their deeds; the thoughtful laborer, whose practical sense or constructive ability adds new force or utility or convenience to the common possessions, far outranks in popular estimation the thoughtless inheritor of wealth or social position, however honored or useful his ancestry may have been. The laws are framed to guard the rights and liberties of all; and each man's sphere of action is limited only by the inevitable limitations of his personal force, intelligence, and integrity.

Under such conditions progress and general prosperity would seem to be inevitable, so inevitable that minor conditions might be safely left out in taking account of the great factors of national well being. But other nations, which do not share our present prosperity, are not destitute of like conditions favorable to industrial success. Some in addition enjoy age, the prestige of power, long accumulated wealth, an industrial history covering many generations, and priority in the markets of the world, which unite to give them advantages over the most favorably situated new country with its newly established industries. In the front rank of such countries stands Great Britain, which for many years has been the workshop of the world, and still retains a commercial supremacy which tells immeasurably in favor of her mechanical industries, in giving them a commanding position in the world's markets. Yet the trade of Great Britain languishes under a serious depression, which threatens to become permanent through the increasingly successful rivalry of other industrial nations—Germany, Belgium, France, and pre-eminently the United States.

The causes of this relative if not absolute industrial decline on the part of Great Britain is not far to seek. At a recent meeting of the Institution of Mechanical Engineers a prominent speaker charged the responsibility upon British inventors and engineers. They had failed to keep abreast of the times. They had allowed the inventors of other countries to displace their products even in British markets. The question was taken up at the August meeting of the London Association, and while the inaction of British inventors was admitted and deplored, the blame was traced to the working of the British patent system. Said the essayist of the occasion, Mr. John Standfield: "The chief cause of our commercial suffering and stagnation is a barbarous law, which to a very great extent prohibits science from developing the resources and strength of the empire." Just before Mr. Standfield had attributed the rise and progress of the British empire wholly to the inventive genius of its people, coupled with the manufacturing resources of the country, pointing out the fact that the great and important inventions patented in England during this century have not only contributed more to the greatness of the empire than all that was done during the previous five centuries, but have brought nearly all of the wealth which England now possesses. Even where the sources of national wealth lay underground, in mines of coal and iron and copper, such wealth could never have been developed except for machinery invented for the purpose. But invention is now less active in England than in France, Belgium, and the United States, and England is losing ground in consequence. This loss of trade, says Mr. Standfield, "may be directly attributed to our (i. e., England's) driving abroad or suppressing a very large portion of the seeds of our prosperity. America is the only great country that treats practical science fairly, and she is consequently our principal competitor." Further on Mr. Standfield says:

"The cheap patent law of the United States has been and still is the secret of the great success of that country. . . . The invention we suppress takes root freely in the United States, which, consequently, supplies our marts with large quantities of labor-saving tools, whereas if our laws were fair and equal we should supply their marts, and use the proceeds for purchasing their grain without impoverishing our country by a great loss of capital as at present."

In the subsequent discussion this point was dwelt upon at great length. How can it be expected, it was asked, that English engineers and inventors can compete with their brethren in the United States when the American can get twenty-five patents for the money which has to be paid for one in England? Very few inventors can pay the fees demanded by the English Patent Office. "The result is," said one speaker, "one-third of our inventors are driven to America, and another third are buried, the secret of their invention still with them." And this obviously covers but a part of the national loss, since the possible but never-to-be developed inventors in English workshops probably outnumber many times the actual inventors who undertake to put their ideas into working shape. This was put very clearly by one of the speakers. "He had heard it said in every quarter of the globe that English workmen had little or no inventive genius, although they improved things very well, but upon examination he said it would be found that the names to most of the American patents were English

names; and he felt certain that, if the cost of a patent in England were the same as in America, instead of 5,000 patents, the English should take out 45,000 to the Americans' 30,000. If placed on the same footing as the United States, a great impetus to trade would follow. It was evident that there was something wrong when America could pay £9 where England paid £6 per ton of iron, and 9s. instead of 6s. per day for labor, and yet beat the English in the open market. He thought it was the duty of the Board of Trade, when the country was losing its trade, to inquire as to the cause of it. There was only one reason for it, and that was the abundance of labor-saving tools used by the Americans, because their mechanics could get all their appliances protected so cheaply."

In the course of his remarks the essayist pointed out that by suppressing native genius through heavy patent fees, England had driven away many national industries in which she had once held a foremost place. The pianoforte trade was one, London being rapidly stocked with instruments made in New York. The watch and silk trades had been driven out of Coventry and Clerkenwell, while machine-made watches were being developed in America, where labor was 50 per cent dearer. Said the speaker: "The American cheap patents and labor-saving tools alone account for Coventry's and Clerkenwell's misery and decay, and for England's serious loss of revenue and national income. If our workmen were allowed to become inventors they would prove quite as well able to design and manufacture machinery for the construction of cheap watches as the Americans. On the present system our best mechanics, if they have any ambition, are compelled to emigrate to America, where alone they can find an opportunity of utilizing their genius."

Further on the speaker said: "The American patent laws have given the inventors of such small but generally useful articles as sewing machines such a good opportunity of universally introducing their inventions that it is now not worth the while of any manufacturer here or elsewhere to attempt to compete with the American houses. There are 4,000 skilled artisans employed in the United States in this small manufacture alone. While American organs of numerous descriptions are not only excellent but cheap, there is not a single cheap English organ known to the public."

"What has occurred to our piano and watch trade is now occurring—if it has not already occurred—in regard to the manufacture of locomotives and many other manufactures, to the partial ruin of our trade, wealth, and empire."

We might continue these forcible and instructive citations, but the limit of our space forbids. The arguments brought forward to prove from American experience not only the sound policy but the absolute necessity of lower patent fees in England are not needed here. The moral of the discussion, however, should not be overlooked by the friends of American industry. While our greatest rival in the industrial world is learning from our experience the wisdom of extending to inventors the encouragement which comes from a just and inexpensive recognition of their rights the American people must not be deluded by specious sophistries into an abandonment of the position taken by the framers of our Constitution with regard to inventions and letters patent therefor. The wisdom of granting patents for invention is no longer a subject for discussion. The sound policy of carefully guarding the inventor's rights, against infringements, and of keeping down the fees for issuing the necessary papers, is equally well established. Yet as soon as Congress meets again we may expect a puzzling variety of covert assaults upon the patent system under the guise of bills for the amendment of the patent laws—assaults which will demand the constant watchfulness of every friend of American industry. Inventors and their friends should see to it that they are not misrepresented at Washington by men uninstructed with regard to the uses and benefits of the patent system. They should take pains not to further the election of candidates known to be in sympathy with those who have sought and still seek to break down the legal safeguards of the property rights of inventors and patentees, as provided by the patent laws. They should take especial pains to lay before their representatives in both houses such information as will enable the framers of our laws to avoid the snares which clever agents of anti-patent associations are sure to weave in bills ostensibly drawn to "promote industry" and "encourage invention," or to protect the "innocent" users of what does not belong to them.

"MALARIAL" FEVER IN NEW ENGLAND.

Undoubtedly "malaria" covers a multitude of sins of ignorance on the part of physicians, almost every malady, the nature of which is not readily understood, being attributed in professional parlance to malaria or malarial complication. Still there is evidently some malefic influence, whether in the air, in the earth, or in the waters under the earth, that has been causing in New England the past summer almost as much suffering as the break bone fever has occasioned along our Southern coasts.

The history of the "malarial wave," as it is called, and its progress eastward and northward, is instructive. For forty years preceding 1865 New England had been practically exempt from the troublesome "chills and fever," "fever and ague," or "malarial fever," which prevailed more or less generally further West and South. There had been an epidemic of it after the war of 1812, and an earlier wave had

passed over the country after the war of the Revolution. As in the earlier instance, so in the later civil war, the return of afflicted soldiers from malarial regions was followed by a slowly developing malarial epidemic. The first cases among the stay-at-homes appeared along the railway traversing the shore of Long Island Sound. Gradually it spread into the interior, most rapidly along lines of public works. The upturning of new soil was supposed to cause the extension of the plague, though the same sort of work during the preceding forty years had never been followed by such results. It will be remembered that just after the war was a period of public improvement; in every thriving town streets were laid out and graded; public waterworks were introduced, and gas pipes were laid down in many villages—all requiring the employment of large gangs of laborers, recruited largely from the ranks of lately returned soldiers. It seems to us altogether more likely that the germs of the succeeding epidemic of "malarial" fever were imported by men who had taken the disease while on duty in the malarial regions of the South and West, than that they were developed or brought to the surface by the displacement of raw earth.

Very probably the interference with lines of natural drainage, incident to the construction of railways, waterworks, and the like, and the ponds and ditches left where earth had been taken out for embankments and roadways, furnished many appropriate places for the multiplication of the imported malarial germs. At any rate the progress of the epidemic was largely governed, if it was not hastened, by the progress of such works. Once widely prevalent, as it became in the course of four or five years along the main line of railway towns near the Sound, the natural movement of population sufficed to carry the epidemic into the interior.

Its progress up the Connecticut and other rivers and along lines of railway communication was traceable year by year, until there came a season, like the past summer, when the climatic conditions seem to have been specially favorable to the spread of the malady, and it became exceedingly prevalent, both as a distinct disease and an element complicating the symptoms of other diseases.

In the early part of the season the State Board of Health of Massachusetts undertook to investigate the subject, and has collected a mass of evidence which can hardly fail to throw a clearer light upon the nature and conditions of the epidemic. From reports in local papers it is clear that the troubles attributed to malaria have prevailed to an alarming extent, particularly along the Connecticut valley. Cases have appeared in every town from Connecticut to Vermont; and in Springfield, Holyoke, and other large places the number of cases has been very great. Heretofore this region has been not only a healthy one, but exceptionally free from troubles of this nature. In the Housatonic valley, in southwestern Massachusetts, around Barrington, for example, hitherto one of the healthiest districts in all the land, the malarial epidemic has been the severest ever known in New England. The disease is described by the visiting physician of the Board of Health as a genuine intermittent fever, many of the cases being very severe. The disease has attacked all classes of persons, some living at considerable distances from supposed malarial centers, and it counts its victims among the old, the middle aged, and the young, among new residents, old residents, and casual visitors.

The manner in which the epidemic sweeps through regions previously proverbial for their salubrity, seems to show that the disease is not of local origin and cannot be "in the air."

Before the results obtained by the inquiries of the Board of Health are compiled and digested, any opinion as to the actual propagation of the epidemic can be little better than a guess; nevertheless it may be safe to express the strong suspicion that wells and water courses, tainted by the fecal discharges of victims of the disease in one form or another, are more likely to prove the distributors of the poison than cold winds, night air, emanations from swamps, or any other purely aerial or malarial agency.

THE REVIVAL OF AMERICAN COMMERCE.

A commercial convention, called by the New York Board of Trade and Transportation, met in Boston, October 6, fifty-one important mercantile associations being represented. The chief subject proposed for consideration was the revision of the navigation laws under which the supremacy of our country in its own carrying trade has been lost. In 1855 American vessels carried \$405,000,000, and foreign vessels \$131,000,000 of our exports and imports. In 1879 foreign vessels took \$911,000,000, and American vessels only \$272,000,000. The greater part of our merchant marine is now engaged in the coasting trade, while its aggregate tonnage is more than a million tons less than it was twenty-five years ago.

The great question is, How are we to recover our commercial standing among commercial nations? At this writing but one session of the convention has been held. The problems which the delegates have in hand are of national magnitude, and of the most far-reaching importance. It is devoutly to be hoped that whatever decision they may arrive at may be such as will hasten the restoration of our mercantile marine to the honorable position it held before the war. During the past twenty-five years our mechanical industries have been pushed to the front rank among those of industrial nations. The next twenty-five years should see us marked an advance toward American commercial supremacy.

BENJAMIN PEIRCE.

In the death of Professor Benjamin Peirce, October 6, in the forty-seventh year of his professorship at Harvard College, America loses one of its ablest mathematicians and scientific men. Prof. Peirce was born in Salem, Mass., in 1809. He was graduated at Harvard in 1829; became tutor in 1831, University Professor of Mathematics and Natural Philosophy in 1833, and Perkins Professor of Astronomy and Mathematics in 1842. Between 1836 and 1846 he published a series of mathematical text-books, which, though never widely adopted in schools, have had a marked influence upon the mathematical teaching of this country. The founding of the observatory at Harvard was brought about by his lectures on the comet of 1843. His investigations in connection with the discovery of Neptune in 1846 made his name known and honored the world over. In 1849 he was appointed Consulting Astronomer to the "American Ephemeris and Nautical Almanac," for which he prepared a volume of lunar tables in 1853. The results of his labors on Saturn's rings were published between 1851 and 1855. His valuable services in connection with the United States Coast Survey led to his appointment as superintendent of that important work in 1867, an office which he held until 1874.

His "Treatise on Analytical Mechanics" appeared in 1857, and in 1870 was published an edition of 100 lithographed copies of "Linear Associative Algebra," a work remarkable for the power and boldness of its reasoning. More recently he delivered a course of Lowell lectures on "Ideality in Science," in the course of which he made the remarkable statement of problems of cosmical physics printed in this paper about a year ago.

FIREPROOF FERRYBOATS.

The repeated demands of the public for the use of fireproof material in building passenger steamers for inland navigation seem likely at last to be complied with. A company has been formed with a capital of \$10,000,000, to build excursion steamers for use in the waters around New York. They are to be not only indestructible by fire, but also impossible to sink. The use of fireproof material for the upper works and water-tight compartments in the hulls should be made compulsory in the construction of all new steamers carrying passengers on the inland waters of the country. In view of the fearful accidents that have happened ever since steam navigation became general, it is strange that such conditions have not long since been required of our shipbuilders; but evidently this greatly-needed reform will be brought about by the operation of that much-abused doctrine, the "survival of the fittest;" for if the public is offered a choice between a floating fire-trap, liable to be sunk like an egg shell, and an equally elegant but fireproof and non-sinkable craft, the fire-trap will soon cease running for lack of patronage.

But the excursion steamers are not the only vessels for which these reforms are urgently demanded. The ferryboats plying in the North and East Rivers, sometimes carrying more than a thousand passengers at a trip, are equally important subjects for radical treatment. It is true that there have been few serious accidents attended with large loss of life on these craft; but the possibility, yes, the extreme probability of such accidents, cannot fail to strike any one; built of light wood, thickly painted, oiled, or varnished, they would burn with great rapidity even with little draught; but when it is remembered that they are so built as to create the strongest kind of a draught throughout their whole length, it will be seen that within 20 minutes of an outbreak of a fire, there would be nothing left to burn. The greater part of the passengers would be burned or drowned, and there would be only a small number saved under favorable conditions; but if, for example, the fire started while the boat was in a pack of heavy ice midway in the river, there would be hardly a score escape alive. Such an accident happened on a Philadelphia and Camden ferryboat several years ago, but by great good luck the fire broke out on an early trip in the morning, when very few persons were on board, so that the loss of life was small.

Even a false alarm of fire would cause many deaths, since the panic that would result on board a ferryboat of the present style would drive a large number overboard. Some would voluntarily spring into the water to escape death by burning, while others would be forced over the side in the struggle of those in the center to get out.

All these dangers would be avoided if every passenger knew that the boat could neither burn nor sink; under such circumstances the cry of "fire" would produce no panic, and even in the most serious collision the passengers would know that there was no danger after the first shock. For these reasons it is evident that the proposed reforms in excursion steamers should be hastened into effect upon the lines of ferryboats also. But it is here that they will be slowest to make their way. The ferry routes are monopolies; their proprietors fear no competition such as threatens the owners of excursion steamers; they have large amounts invested in their present craft, and they will not voluntarily abandon these boats and go to great expense for others unless compelled to do so. If resort be had to Congress or the State Legislature to compel the needed change by statute, the companies have both money and influence enough to delay long, if not wholly to prevent, the passage of the requisite laws; consequently they can be reached only through their pockets or through the influence of an overwhelming public opinion. As before stated, they are independent of competition, and therefore it is difficult to

touch their pockets; hence public opinion alone is likely to bring about the desired change. Now, if they are called upon to abandon their present boats and build others of far more expensive types, they will stand a great deal of pressure from that indefinable force known as public opinion before they will yield—the great loss and expense involved will have the greater weight; but if any one can devise a plan by which their present fleet of steamers can be rendered fireproof and non-sinkable for a moderate outlay, there is little reason to doubt that they would be apt to regard such an improvement favorably. For example, the light woodwork of these boats has one advantage over iron; it will float if detached from the hull containing the boilers, engine, etc. Hence, if it can be rendered fireproof, the problem is solved at once. All that will be necessary will be to have all that portion containing the cabins, roadways, etc., detached from the hull, so that, no matter what might happen, the most important portion would readily float with all the passengers. Panics could be averted by numerous signs: "This boat can neither burn nor sink." The hull of the ferryboat should extend to the guards, which should project, as at present, beyond the upper works. These latter could be removed, made fireproof, and replaced at no great cost. The upper portion should then be built upon a heavy flooring, which should be wholly detached from the hull. To prevent displacement of one upon the other, vertical bolts should be used which would keep the two parts in position, but offer no resistance to separation on account of a downward strain. The shafts, wheels, and walking-beam should be so arranged as not to have any connection whatever with the upper works, and in case anything should happen to cause the hull to sink, it would go to the bottom, and leave the great box containing the passengers floating on the surface.

The inventor who can render wood fireproof without seriously impairing its buoyancy, will have not only the ferryboats, but the whole fleet of wooden passenger steamers, to remodel. If the new company successfully carries out its present programme, the old craft must conform to the new condition of absolute safety or go out of business. There is no more profitable field open for an inventor than a solution of the problem: How can a wooden steamer be rendered fireproof and non-sinkable at the least cost?

DESIGNS PRODUCED BY CRYSTALLIZATION.

A French inventor noticed the manner in which watery vapor in a warm room congeals against the glass during frosty weather and forms needle-like crystals, interlacing one another like the threads of a tissue. This observation gave him the idea of producing designs for textile fabrics by crystallizing various salt solutions on a sheet of clay. He first tried the sulphates of copper, zinc, iron, alumina, and magnesia. He covered five clean glass plates, each with the solution of one of these salts, placed them in a horizontal position, and allowed them to crystallize slowly by evaporation. He found further that the crystal form became more suited for his purpose when he added albumen, gum, starch, or gelatine to the solution, while at the same time the crystals became more resistant. He found also that different temperatures influenced the forms of the crystals, and that he could produce fantastic trees, flowers, stars, arabesques, roots, and even insects of interesting design. He went through many experiments, and ended by making the figures obtained permanent by electrotyping, for which purpose he caused the solutions to crystallize upon strong plates of copper or German silver. A clean sheet of lead, placed on the finished crystallization, gave, by hydraulic pressure, a metallic counterpart of the same. Or he used sheets of softened gutta percha, which received the impression and could be used in making a copper deposit in the electric bath.

The great problem, however, was to produce a continuous design which would fit around the rollers with which the patterns are printed on woven fabrics. The detached productions of the crystallization on his plates did not satisfy this condition. He substituted, therefore, in place of his flat plates, metallic cylinders similar to those used for producing the rollers for calico printing. By slowly turning them around their axis, while the solution on their surface evaporated, he obtained a design which satisfied the wants of the printer and the weaver for a continuous design without break in the whole length of the cloth.

There are, however, some objections left. The crystallization is capricious and not sufficiently even and uniform, often leaving blanks which are larger than are agreeable to the purchaser of the fabric; but this may be overcome by experience and precaution. Another objection, however, appears impossible to correct. The two sides of the patterns do not match when different widths are joined at the selvage of the cloth. It is argued that this is of minor importance, as generally dressmakers and tailors pay no attention to it.

Jacob Boll.

Prof. Jacob Boll, of Dallas, Texas, died September 29, while engaged in scientific exploration in Wilbarger County, of that State. Prof. Boll was a Swiss naturalist and geologist, a favorite pupil of Agassiz, and a man of distinguished scientific reputation. His name is honored in the Harvard Academy of Science, in Philadelphia, Paris, Geneva, Berlin, Zurich, and other seats of learning in Europe. In Texas, in the absence of a State geologist, for six years past his labors have been of great value to science and to the State.

HINTS TO THE YOUNG STEAM FITTER.

BY WILLIAM J. BALDWIN.
DRYING BY STEAM.

Three-fourths of all the manufacturing businesses outside of the metal trades, and many of them, use heat for drying purposes; and as various as are the businesses so also are the modes of drying, often the result of years of experiment.

No manufacturer of wooden articles can get along without a drying kiln. The laundry man or woman, the dyer, the hatter, the tobaccoist, the piano and organ maker, the dried fruit manufacturer, the japanner, the tanner, all must have a means of drying faster and more conveniently than can be had by exposure out of doors.

Usually steam is used in drying rooms and drying kilns because of its cleanliness, its even distribution, its safety from fire, its easy and quick management, and the cheapness of its maintenance.

The higher the temperature of a drying room the cheaper can the articles be dried. This may not appear plain at first to those who have studied the laws of equivalents, but nevertheless it is so, being caused by local conditions, which always prevent the utilization of all the heat. Thus, the greater the difference in temperature and the slower the movement of

diant heat that is thrown off, and giving a thoroughly uniform heat throughout the room. A A' are headers (often called manifolds), usually made of extra heavy pipe, to admit of tapping and threading, instead of using T's, the cost of the heavy pipe and the drilling and tapping being very much less as well as better and straighter than a header composed of many short pieces of large pipe and the necessary T's. (These remarks apply to all large coils.)

B B are the spring pieces, threaded right and left handed; C C, the leaves or sections of the coil; and D D, the coil stands. The stands are always in pairs, to admit of giving the necessary division and inclination to the pipes, and when viewed through the holes look like Fig. 2. The dotted lines are the centers of imaginary pipes to show the pitch. When coils are very wide in the direction of the length of the headers it is well to keep the coil stand 2 or 3 feet from the header at that end, to prevent the expansion from pulling the screws from the floor.

The distance between the holes in the standing coil header is usually about 12 inches, or as wide as the clothes-horses are from center to center.

The usual way to build these coils is to start at the bottom header, A', Fig. 1, and to put each leaf, C, together continu-

leaf should not exceed 40 feet under a back pressure of 2 pounds at the engine.

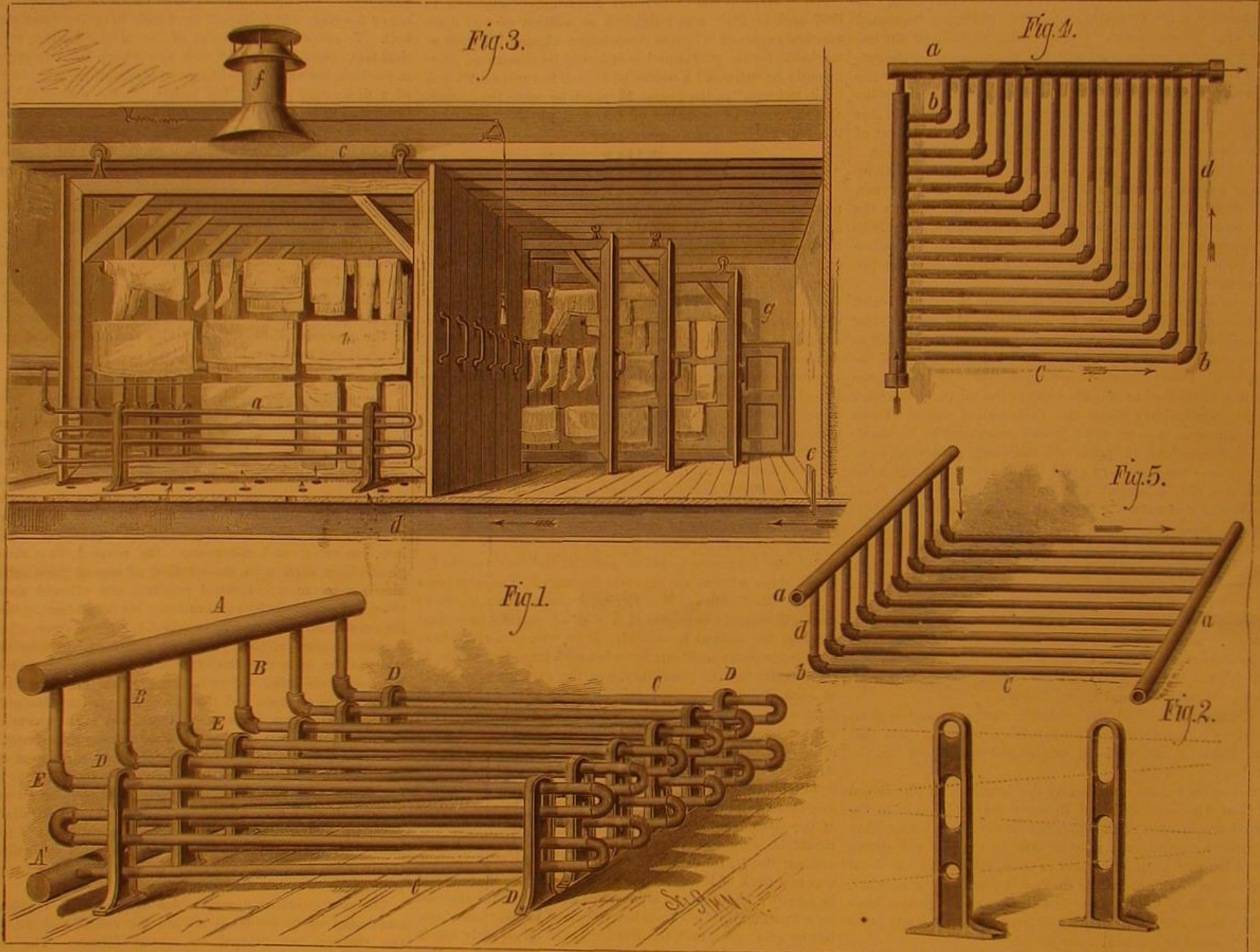
For exhaust steam the upper header should be large, 3 inches for 12 leaves of 40 feet each, or about 500 feet in the coil, giving good results, to be increased in proportion to the increase in leaves, a 4 inch pipe header being enough for a coil of from 900 to 1,000 feet, composed of leaves of 40 feet each.

Unless the exhaust steam is carried a long distance horizontally, 50 feet or more, the pipe leading to the header may be one or two sizes smaller than the header, provided it is large enough for the engine.

With steam of high tension, small pipe headers with T fittings may be used; but where the pressure is variable, a large header insures an equal distribution of steam to all the leaves.

Sometimes gridiron or floor coils are used on account of being cheaper, but the same amount of pipe in this form will not dry clothes as fast as the standing section coil.

Figs. 4 and 5 show gridiron coils of easy construction, a a being the manifolds or headers, b b right and left elbows, c c coil pipes right handed, and d d right and left handed spring pieces.



ARRANGEMENT OF PIPES FOR DRYING BY STEAM.

the air compatible with the amount of moisture to be carried off, the better the result in the laundry or dry kiln, or any place where rapid drying only is the object.

In no other place is the power of radiant heat (direct radiation) more manifest than in the drying room, and more failures can be traced to placing coils under skeleton floors, or flat on the floor, than any other cause, except, perhaps, an ignorance of the principles of piping, which so many consider can be done by any one who wears a pair of greasy overalls.

I have proved in many cases that the same amount of pipe or plate surface, distributed around and between the materials to be dried, will do the work in half the time it takes the heated air from an indirect coil to do it. This is no mistake; and further, wooden blocks can be dried lighter (proving there is more water driven off) by direct radiation than by indirect radiation, the times and temperatures being the same.

According to the above it is plain that in the construction of drying houses for most purposes the heating surfaces should be so placed and distributed that the direct heat rays from the iron could fall uninterrupted on the greatest surface possible of the materials to be dried.

Fig. 1 shows a perspective of a good arrangement of a direct radiation laundry drying room coil, utilizing all the ra-

ously, working upward until you reach the elbow, E; then, when all the leaves are so far constructed, with all the elbows looking up, with their left-handed thread uppermost, count in and mark the right and left handed spring pieces, B, then apply the upper header, A, and screw the whole up as nearly alike as possible.

Do not be persuaded to do away with the spring pieces and the elbows through economy, so as to connect the upper headers straight, as in a box coil; if you do you will have trouble should you want to take down a single leaf for repairs.

Fig. 3 shows sectional perspective view through a laundry drying room, a being the coil, b the clothes horse, c the suspended rail from which the horses hang, d fresh air inlet duct, e its damper or regulator, f ventilator with regulator, usually governed by a cord and bell crank, and drawn back by a spring; and g the space into which the horses are drawn, which of necessity must be as long as the horses.

This style of drying room gives the direct radiation of both sides of the leaf of the coil to the fabrics to be dried, and also exposes both sides of a fabric to the direct radiation of a section or leaf.

For high pressure steam 1 inch pipe is generally used in the coil; but if exhaust steam is to be used the pipes should be no smaller than 1 1/4 inch, and the total length of any one

In Fig. 4 the pitch of the pipes and headers are in the direction of the arrows.

These coils are often used in lumber dry kilns, but the same amount of pipe arranged around the walls in miter or wall coils will give much the better result, and will not be a receptacle for dirt, as a floor coil is, which must have a skeleton floor over it to walk over and pile the lumber on.

In large dry kilns on the direct radiation principle, where pipe enough cannot be put on the walls, and for the better distribution of the heat, rows of stanchions should be put up to hang the coils on, in such a manner as not to interfere with the gangways.

The tobaccoist prefers to dry without artificial heat, in a temperature of about 60°, with a rapid change of air through the windows. This appears to give dryness without brittleness, but at night and in damp weather they must close the windows, and to get their stock out in time recourse must be had to steam coils.

In experimenting for a well known tobacco manufacturer in fine cut, I found that radiators or box coils placed in the middle of the rooms gave the best result. Wall coils under the windows made the room warm, but did not dry quick, and the tobacco felt wet when brought into a cold room and allowed to remain for a short time. A strong ventilation with a temperature of 80° made it too crisp; but the

box coils placed in the middle of the rooms, with a temperature of 65°, with a small ventilation, with the currents of air in the room up at the center and down at the windows (contrary to the general principle of warming for comfort) gave a result which was declared good.

In piano-case manufactories, and where specialties in glued and veneered furniture of the best quality are made, the workmen are generally supplied with a drying cabinet of a size suitable to the pieces to be done, in which the work is heated before the glue is applied, and into which it is again placed to properly dry.

These cabinets are usually rectangular boxes, with holes in the bottom and top, to allow the air from the room to circulate through them so as to carry off the moisture. Their steam coils are usually of the gridiron pattern, flat on the bottom of the box, with the valves on the outside. Sometimes they are heated indirectly with the warmed air conveyed in tin pipes from a large coil placed in some favorable position.

Some manufacturers claim the quicker the work can be dried after gluing the better it will be.

It is not profitable to dry by forcing air, as with a fan or blower, in connection with a steam coil.

High pressure steam should be used in connection with a blower.

A temperature of 130° is considered good, and can be easily attained in a drying room.

The additional quantity of pipe necessary to raise the temperature of a drying room from 120° to 130°, if added again, will not raise it from 130° to 140°.

APPARATUS FOR COMBINING RECTANGULAR VIBRATIONS.

BY GEORGE M. HOPKINS.

There are several well known methods of combining rectangular vibrations to form the beautiful and instructive figures produced by M. Lissajous by means of two tuning forks carrying small mirrors and vibrating in planes at right angles to each other. The engraving shows still another method of accomplishing the same thing in a simple and inexpensive way; all the materials needed being a box about 24 inches square, two flat springs of wood, $1\frac{1}{4}$ inches wide, $\frac{1}{8}$ inch thick, and 24 inches long; or two springs of metal $\frac{1}{8}$ inch thick, 1 inch wide, and the same length. These springs are secured to the sides of the box at diagonally opposite corners, by stout screws, a block 1 inch thick and 4 inches long being placed between the end of the spring and the box, to give space for the vibration of the spring.

Upon the free end of each spring, and in the plane of its vibration, is cemented a piece of thin cardboard, having a longitudinal slit $\frac{1}{8}$ inch wide, parallel with the spring to which the card is attached. The slits in the two cards intersect each other at right angles, forming at their intersection a clear aperture $\frac{1}{8}$ inch square. The two cards are placed as near each other as possible without touching. One of the springs carries an adjustable weight, the use of which is to change the period of the vibration of the spring by placing it in different positions. The weight is shown in the engraving on the horizontal spring, but it may be shifted to the vertical spring when a slow vibration is required.

If the two springs are set in motion by snapping them simultaneously with the thumb and finger, the square aperture formed by the intersection of the slits in the two cards will move so rapidly as to appear like a band of light, *i. e.*, supposing the operator to be looking through the aperture toward the light. If the two springs vibrate in unison the band will either be perfectly straight, bisecting the angle formed by the two springs, or it will be elliptical or circular. By changing the period of the vibration of one of the springs so that the periods of the two springs will be to each other as 1:2, the band of light will assume the form of the figure 8. Make the vibrations as 2:3, and the figure representing the fifth will be formed, and so on throughout the whole range of compound vibrations.

To project these figures on a screen all that is required is to place a lamp at one side of the slitted cards, and a magnifying glass of about six inches focus on the other side, as indicated in the engraving. An easy way to hold the magnifying glass in position is to place the handle in a hole in a board, the latter resting on the top of the box. This rude device admits of moving the lens forward or backward, and to the right or left, as may be required.

Arranged in this manner the figures may be made to occupy an area of 12 to 16 inches square on the screen. The same method applied to a lantern slide produces figures of any required size. Of course the construction of the apparatus is materially different in this case, and the workmanship necessarily finer.

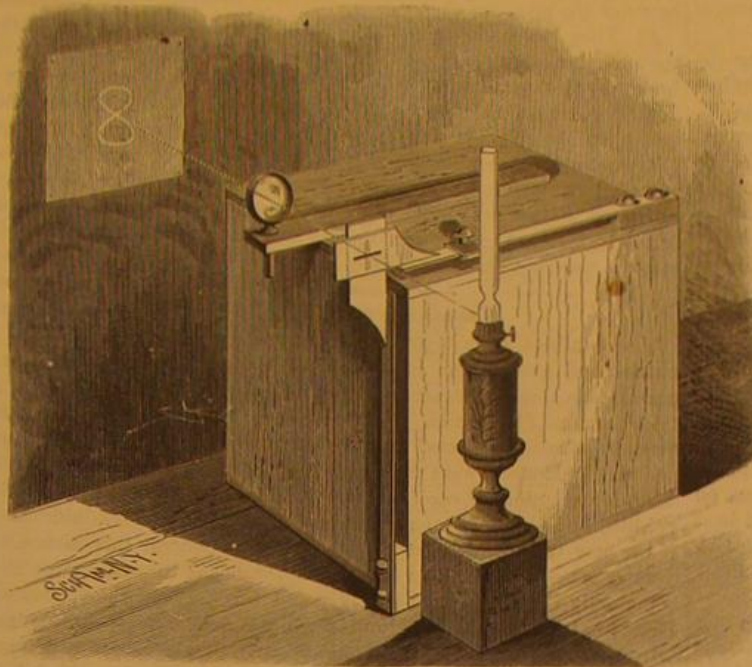
If continuous action is desired electro magnets may be applied as in the electrical diaphan described by me in this journal some months since.

A Cesarean Operation.

Twelve Philadelphia physicians lately assisted at the delivery of Mrs. William Burnell, by cesarean operation. The mother is a dwarf, thirty-two years old, and forty-two inches high. Owing to a peculiar deformity it was seen that it

would be impossible for her to give birth to the child in the usual manner. Porro's method was adopted.

An incision was made on the median line of the abdomen, and the abdominal walls were cut through. The womb was removed, an incision made in it to correspond with those in the abdominal walls, and the infant released. After that the womb was restored to its bed and closed, and the other parts brought together. The clothing and all articles in the room were subjected to a solution of carbolic acid spray, according to Lyster's method, during the operation. The pulse of the woman remained excellent throughout the whole of this severe trial, and all her symptoms were favorable. At last reports both mother and child were doing

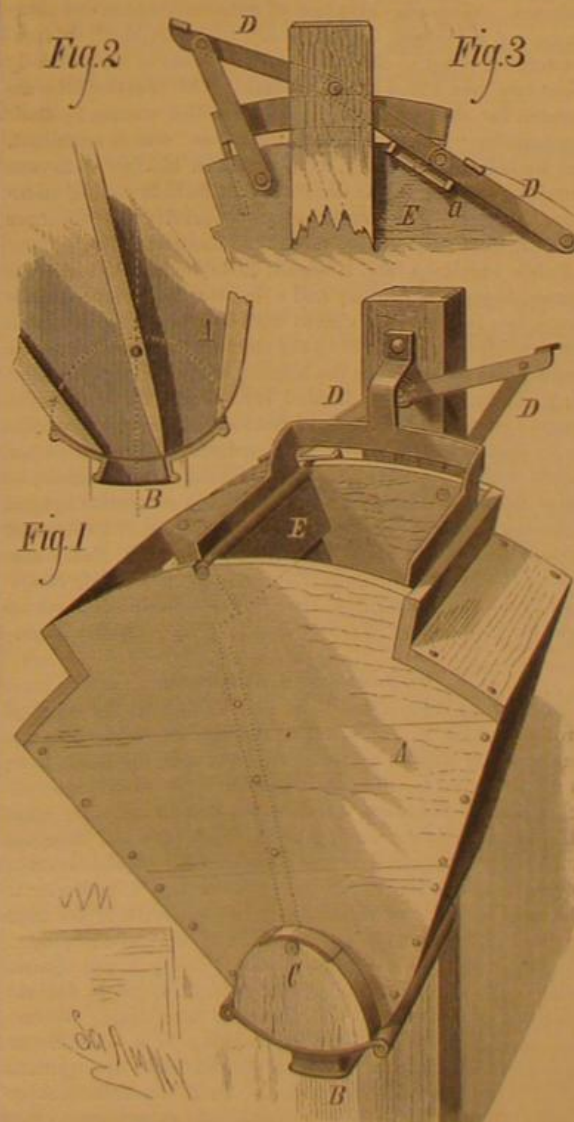


APPARATUS FOR COMBINING RECTANGULAR VIBRATIONS.

well. Both would have died except for the heroic treatment adopted.

NEW GRAIN METER.

The grain meter shown in the engraving is designed to be used chiefly on thrashing machines, and can be readily attached to any separator, requiring no extra devices, except an elevator to carry the grain to it from the grain chute.



BARNARD'S GRAIN METER.

The weight of the grain does the work of measuring by simply oscillating the measuring box on its pivot. It will be seen that none of the power applied to the thrashing machine is consumed by the grain meter, which is entirely au-

tomatic and only requires to be supplied with empty sacks. The inventor informs us that actual use has proven that this meter is accurate and reliable and a great saver of labor.

In the engraving, Fig. 1 is a perspective view of the grain meter; Fig. 2 is a detail view of the locking mechanism; and Fig. 3 shows the valve at the bottom of the measuring box.

The box, A, is of quadrantal form, made convex at its lower end, and fitted to a concave valve, B, which is concentric with the pivot, C, upon which the box, A, oscillates. To the side of the box next its support are attached two jointed locking braces, D, which alternately lock the box in one or the other of its positions, and across the top of the box above the central partition which divides the box into two equal compartments, there is a wicket, E, whose pivot is extended beyond the side of the box and provided with two equal and opposite arms, *a a*, which are capable of touching the joints of the braces, D, and of unlocking them, so that the measuring box may swing and discharge one of the compartments, while the other is brought under the chute to be filled. The wicket, E, is operated by the pressure of grain when the compartment of the measuring box becomes filled. It will be noticed that the valve, B, having an opening of the same size as the opening of one of the compartments, only one side of the measuring box can be discharged at a time. Two stokers are attached to the standard supporting the measuring box, and brush the surplus grain from one compartment of the box, A, to the other. The speed with which the apparatus operates is controlled entirely by the quantity of grain flowing from the thrasher.

This useful invention was recently patented by Mr. George W. Barnard, of Economy, Wayne county, Ind.

The Color Blind Score.

Connecticut is, we believe, the first State to pass a law prescribing certain regulations to be observed by railroad companies in regard to this subject. If all the other States should follow suit, and each of them enact a law as crude, vexatious, unjust, and annoying as this pioneer specimen, the skilled ophthalmic experts all over the land may safely count upon having a good time, however it may be with locomotive engineers and others who have rendered long and acceptable service upon our best managed roads. There is sure to be blundering, short-sighted work, when legislators who have no practical and scarcely any theoretical knowledge of railroad operation, undertake to remedy supposed defects in the system which in some unaccountable way have escaped the notice of the shrewdest and most capable managers; and the liability to blunder is none the less when the mercenary greed of a selected corps of professional experts is to be satiated at the rate of two dollars a head for the great army of railway employes whose duties require them to have anything to do with the form and code of signals. And so the companies must be taken in hand, and reliable and long-tried engineers, who have never had an accident on the road, driven from service because they can't read letters three-eighths of an inch long at a distance of 25 feet, or sort colored worsteds in a scientific manner, or see red and green precisely as some other people do, although they are able to discriminate just as sharply between the two, and be as little liable to confound or mistake one for the other. The logic of facts shows conclusively that the danger from color blindness, about which such a hue and cry has been raised, is greatly exaggerated, and that in no single one of the many careful and searching investigations that have been made in the past history of railroads, has the cause of an accident been traced to color blindness, nor has this particular cause even been suggested or suspected, so far as we have been able to ascertain from the record.—*National Car Builder.*

The Voice.

Dr. Ward, of New York, says on this subject, of the many agents which have more or less influence on the voice, the four principal are climate, dress, diet, and exercise. Change of climate may cause some slight deleterious effect on the larynx, but this influence is greatly overestimated. The present fashionable style of dress is decidedly unhealthy. The chest and abdomen are unnaturally confined, the lungs and other organs acting abnormally. All clothing should be loosely attached to the body, and the dress worn high. Avoid as much as possible appearing in full dress. The throat should not be wrapped in comforters, boas, etc. Chest protectors should not be worn, and the feet should be guarded against wet. The diet of the singer should be bland as well as nutritious. Of the different kinds of meat, venison, poultry, roast beef, and lamb are the easiest to digest, and due proportion of fat should be taken as a heat-supplying principle to the body. Cooked vegetables, unless too highly seasoned, are easily digested. Salads, cut cabbage, cucumbers, etc., should be avoided. Pastry should be invariably discarded. Dinner at noon, followed by a light tea at nightfall, is a rule which, if rigidly adhered to, will be a safeguard against all ordinary attacks of indigestion. In order that the act of singing be properly performed, it is absolutely necessary that the stomach be nearly

empty. Alcoholic beverages should not on any consideration be indulged in by vocal artists.

For the full development and preservation of the vocal cords several rules must be observed. The exercises must be regularly and systematically practiced; they must always be within the register; they should never be pushed to the point of fatigue; they should never be made use of when the vocal organs are attacked with cold, no matter how slight. Always practice standing upright, so as to allow of full play of the lungs and accessory vocal organs. Bodily exercise is especially beneficial to the singer. In short, learning to sing is learning to be healthy.—*The Monthly Magazine*.

Ice at High Temperatures.

Prof. Thomas Carnelley writes as follows to the *Chemical News*:

Numerous experiments which I have made during the last few weeks on the boiling points of substances under low pressures, the details of which will shortly be published, have led to the following conclusions in reference to the conditions necessary for the existence of any substance in the liquid state. These are two in number, viz.:

1. In order to convey a gas into a liquid the temperature must be below a certain point (termed by Andrews the critical temperature of the substance), otherwise no amount of pressure is capable of liquefying the gas.

2. In order to convert a solid into a liquid the pressure must be above a certain point, which I propose to call the critical pressure of the substance, otherwise no amount of heat will melt the substance.

If the second of the above conditions be true, it follows that if the necessary temperature be attained, the liquefaction of the substance depends solely on the superincumbent pressure; so that if by any means we can keep the pressure on the substance below its critical pressure, no amount of heat will liquefy it, for in this case the solid substance passes directly into the state of gas, or, in other words, it sublimates without previous melting.

Having come to this conclusion, it was easily foreseen that if these ideas were correct it would be possible to have solid ice at temperatures far above the ordinary melting point. After several unsuccessful attempts I was so fortunate as to attain the most perfect success, and have obtained solid ice at temperatures so high that it was impossible to touch it without burning one's self. This result has been obtained many times and with the greatest ease, and not only so, but on one occasion a small quantity of water was frozen in a glass vessel which was so hot that it could not be touched by the hand without burning it. I have had ice for a considerable length of time at temperatures far above the ordinary boiling point, and even then it only sublimed away without any previous melting. These results were obtained by maintaining the superincumbent pressure below 4.6 mm. of mercury, i. e., the tension of aqueous vapor at the freezing point of water. Other substances also exhibit these same phenomena, the most notable of which is mercuric chloride, for which latter the pressure need only be reduced to about 420 mm. On letting in the pressure the substance at once liquefies.

On the Absolute Invisibility of Atoms and Molecules.*

By PROF. A. R. DOBSON.

Maxwell gives the diameter of an atom of hydrogen to be such that two millions of them in a row would measure a millimeter, but under ordinary physical conditions most atoms are combined with other atoms to form molecules, and such combinations are of all degrees of complexity; thus, a molecule of water contains three atoms, a molecule of alum about one hundred, while a molecule of albumen, according to Mulder, contains nine hundred atoms, and there is no reason to suppose albumen to be the most complex of all molecule compounds. When atoms are thus combined it is fair to assume that they are arranged in the three dimensions of space, and that the diameter of the molecule will be approximately as the cube root of the number of atoms it contains, so that a molecule of alum will be equal to

$$\left(\sqrt[3]{100} = 4.64\right) \frac{4.64}{2000000} = \frac{1}{431000} \text{ mm.,}$$

and a molecule containing a thousand atoms will have a diameter of $\sqrt[3]{1000} = 10.00$ mm. Now, a good microscope will enable a skilled observer to identify an object so small as the $\frac{1}{10000}$ mm. Beale, in his works on the microscope, pictures some fungi as minute as that, and Nobert's test bands and the markings upon the *Amphipura pellucida*, which are of about the same degree of fineness, are easily resolved by good lenses. If thus the efficiency of the microscope could be increased fifty times ($\frac{1}{50} = 0.02$) it would be sufficient to enable one to see a molecule of albumen, or if its power could be increased one hundred and seven times it would enable one to see a molecule of alum.

Now, Helmholtz has pointed out the probability that interference will limit the visibility of small objects; but suppose that there should be no difficulty from that source, there are two other conditions which will absolutely prevent us from ever seeing the molecule.

1st. Their motions. A free gaseous molecule of hydrogen at the temperature of 0° C., and a pressure of 760 mm. mercury, has a free path about $\frac{1}{10000}$ mm. in length, its velocity in this free path being 1,800 m. per second, or more than a mile, while its direction of movement is changed millions

* Read before the American Association.

of times per second. Inasmuch as only a glimpse of an object moving no faster than one millimeter per second can be had, for the movements are magnified as well as the object itself, it will be at once seen that a free gaseous molecule can never be seen, not even glimpsed. But suppose such a molecule could be caught and held in the field so it should have no free path. It still has a vibratory motion which constitutes its temperature. The vibratory movement is measured by the number of undulations it sets up in the ether per second, and will average five thousand millions of millions, a motion which would make the space occupied by the molecule visibly transparent, that is, it could not be seen. This is true for liquids and solids. Mr. D. N. Hodges finds the path of a molecule of water at its surface to be 0.0000024 mm., and though it is still much less in a solid it must still be much too great for observation.

2d. They are transparent. The rays of the sun stream through the atmosphere, and the latter is not perceptibly heated by them as it would be if absorption took place in it. The air is heated by conduction and contact with the earth, which has absorbed and transformed the energy of the rays. When selective absorption takes place the number of rays absorbed is small when compared with the whole number presented, so that practically the separate molecules would be too transparent to be seen, though their magnitude and motions were not absolute hindrances.

Lightning Strokes.

The fatalities from lightning are very much greater in number and extent than is generally supposed. In European Russia alone the deaths for five years—1870-74—were 1,452 men and 818 women. No fewer than 4,092 fires are here also officially reported from the same cause during this period. In Prussia, where the registration of the causes of death is exceptionally careful, 1,004 persons were reported as killed by lightning in the nine years from 1869 to 1877. If we may trust the report of our Registrar-General this country is more fortunate in this regard, for during the same period only 194 such deaths are registered for England and Wales; but our returns are admittedly incomplete.

In Austria—from 1870 to 1877 (eight years)—lightning occasioned upward of 40,000 fires, and destroyed more than 1,700 lives. In Switzerland the returns seem curiously variable. For example, in 1866 only three such deaths are reported; while in 1877 we find as many as thirty. Of the deaths by lightning in France, M. Boudin some years ago collected statistics, which showed that during the thirty years, beginning in 1834 and ending in 1863, as many as 2,038 people were struck dead by lightning in that country. During the last ten years of this period the deaths amounted to 880, and of these only 243 were women. Nothing, indeed, is more striking in these statistics than the uniform preponderance in the numbers of the male over those of the female sex. With the exception of Sweden—where, for some reason not explained, and not easily to be imagined, this preponderance is not so observable—there seem to be generally about two men killed to one woman. The traveler who accounted for the immunity of the Swedish women by their comparative "lack of personal attractions" was as ungallant, and we believe, moreover, as incorrect in his fact as he was certainly wanting in the decorum that forbids jesting on serious subjects. The country seems invariably to suffer more from the town; the village more than the great city.

Public buildings fare, it seems, little better than private houses, though a century and a quarter has elapsed since Franklin's famous experiment with the kite demonstrated the possibility of controlling the electric fluid, and nearly a century has passed since the learned, taking interest in lightning conductors, were divided into hostile factions on the famous question of "knobs or points." Mr. Anderson estimates that at least one-half, and perhaps two-thirds of the public buildings, including the churches and chapels, of Great Britain and Ireland, are without any protection against lightning; while it is believed that not five out of a thousand private houses are fitted with conductors. St. Paul's was among the first buildings in Europe to be protected, Benjamin Franklin's "lightning rods" having been first set up over Sir Christopher Wren's dome in 1768.—*London News*.

On Sound as a Nuisance.

For a long time it has been well known to the medical profession that in various critical states of the human system absolute silence, or the nearest possible approach to it, is not the least important condition to be secured. Accordingly muffled knockers, streets covered with straw or spent tan, and attendants moving about with noiseless step, are universally recognized as the signs and the requirements of severe disease. But the truth that noise is a contributor to the wear and tear of modern city life has scarcely yet been realized by the faculty, not to speak of the outside public. Consequently, while a zealous war is being urged against other anti-sanitary agencies, no general attempts for the abolition of superfluous noise have yet been made. We cannot, perhaps, give anything approaching to a scientific explanation why sound in excess should have an injurious effect upon our nervous system. Prof. Berthelot has recently shown, by a careful series of experiments, that sound waves do not, like thermic and luminous vibrations, set up chemical changes in bodies submitted to their influence; but our inability to give an account of the fact does not affect its existence. We feel that noise is distressing, exhaustive. The strongest man after days spent amidst noise and clatter, longs for relief, though he may not know

from what. It may even be suggested that the comparative silence of the sea-side, the country, or the mountains, is the main charm of our summer and autumn holidays, and contributes much more than does ozone to restore a healthy tone to the brains of our wearied men of business. Indeed, if we consider, we shall find that this is the most unnatural feature of modern life. In our cities and commercial towns the ear is never at rest, and is continually conveying to the brain impressions rarely pleasant, still more rarely useful or instructive, but always perturbing, always savoring of unrest. In addition to the indistinct but never-ceasing sea of sound made up of the rolling of vehicles, the hum of voices, and the clatter of feet, there are the more positively annoying and distracting elements, such as German bands, organ grinders, church bells, railway whistles, and the like. In simpler and more primitive times, and to some extent even yet in the country, the normal condition of things is silence, and the auditory nerves are only occasionally excited. It is scarcely to be expected that such a change can be undergone without unpleasant consequences.

The question has been raised, why should some noises interfere with brain work by day and disturb our rest at night so much more than others? A strange explanation has been proposed. We are told that sounds made incidentally and unintentionally—such as the rolling of wheels, the clatter of machinery (except very close at hand), the sound of footsteps, and, in short, all noises not made for the sake of noise—distress us little. We may become as completely habituated to them as to the sound of the wind, the rustling of trees, or the murmur of a river. On the other hand, all sounds into which human or animal will enters as a necessary element are in the highest degree distressing. Thus it is, to any ordinary man, impossible to become habituated to the screaming of a child, the barking and yelping of dogs, the strains of a piano, a harmonium, or a fiddle on the other side of a thin party-wall, or the clangor of bells. These noises, the more frequently we hear them, seem to grow more irritating and thought-dispelling.

But while admitting a very wide distinction between these two classes of sounds, we must pause before ascribing these differences to the intervention or non-intervention of will. We shall find certain very obvious distinctions between the two kinds of sound. The promiscuous din of movement, voice, and traffic, even in the busiest city, has in it nothing sharp or accentuated; it forms a continuous whole, in which each individual variation is averaged and toned down. The distressing sounds, on the other hand, are often shrill, abrupt, distinctly accentuated and discrete rather than continuous. Take, for instance, the ringing of bells: it is monotonous in the extreme, but it recurs at regular intervals. Hence its action upon the brain is intensified, just as in the march of troops over a suspension bridge each step increases the vibration. The pain to the listener is the greater because he knows that the shock will come, and awaits it. Very similar is the case with another gratuitous noise, the barking of dogs. Each bark, be it acute or grave, is in the highest degree abrupt, sharply marked, or *staccato*, as we believe a musician would term it. Though the intervals are less regularly marked than in the case of church bells, we still have a prolonged series of distinct shocks communicated to the brain. Well might Goethe say,

"Vor allem
Ist das Hundegebell mir verhasst;
Klaffend zerreisst es das Ohr."

All the other more distressing kinds of noise possess the characters of shrillness, loudness, and of recurrent beats or blasts.

As an instance of an undesigned, unintentional noise being distressing to those within ear-shot, we may mention the dripping of water. A single drop, whether penetrating through a defective roof, falling from the arch of a cavern, or issuing from a leaky pipe, and repeated at regular intervals, is as annoying as the tolling of a bell, the barking of a dog, or the short, sharp screams of a fretful infant. The only difference is that the noise is not heard as far. We may hence dismiss the "will" theory, and refer the effects of noises of this class to regularity, accentuation, and sharpness.

It is particularly unfortunate that the multiplication of sound should accompany, almost hand in hand, that increase of nervous irritability and that tendency to cerebral disease which rank among the saddest features of modern life. A people worn out with overwork, worry, and competitive examinations might at least be spared all unnecessary noise. Many persons cannot or will not understand how necessary silence is to the thinker. A friend of the writer's, engaged in investigating certain very abstruse questions in physics, is often compelled to throw aside his work when an organ grinder enters the street, and suffers with acute pain in the head if he attempts to go on with his researches.

We should therefore propose, as measures of sanitary reform, the absolute prohibition of street music, which is more rampant in London than in any other capital in Europe. The present law, which throws upon the sufferer the burden of moving in the matter, is a mere mockery. Another necessary point is the abolition of church bells. In these days of innumerable clocks and watches every one can tell when it is the time for divine service without an entire neighborhood being disturbed for some twenty minutes at a time. Nonconformist places of worship collect their congregations without this nuisance. Further, all dogs convicted of persistent barking should be disestablished. And lastly, harmoniums, American organs, and wind instruments in general should be prohibited, except in detached houses.—*Journal of Science*.

THE WOOL SORTER'S DISEASE.

The danger which lurks in the dust and dirt of old rags, and especially hair and wool, is, during their manipulation preparatory to being transformed into paper, felt, or cloth, a very serious matter for the workmen employed. The exceedingly unclean condition in which the bales of rags and hair are received in the factories necessitates their being first cleaned and sorted by hand, and this operation is often fraught with the gravest consequences, scattering sometimes the seeds of loathsome and fatal diseases. The sorting room is provided with tables, at each of which is a worker, usually a woman; at her side is an open bale, from which she chooses a handful at a time and deposits on the table; this liberates a great deal of dust. In many cases the dust contains the germs of the horrible disease called "anthrax," "malignant pustule," "charbon," and "Siberian plague." These germs possess singular vitality and virulence, developing in the human subject the loathsome and fatal malady called "wool sorter's disease." It is not, however, confined to wool, as the germs of the fungoid organism, "*Bacillus anthracis*," are found in every description of hair and wool, and most frequently in the Siberian horse manes, which are largely imported in England for the manufacture of hair cloth. Neither is the disease confined to the sorters; the infected dust is mingled with the air and gets outside the works, or it is distributed among manure dealers who buy the refuse dirt. This has recently been conclusively proved by cases in Glasgow, Bradford, and elsewhere.

Manufacturers in England are therefore contemplating the disinfection of all dangerous hair and wools. It is proposed to empty the bales in a fanning arrangement, burn the coverings, or, soaking them in refuse sulphuric acid, changing them into manure by the addition of gypsum as a drier. The fine dust blown out by the fan is to be discharged under the fire bars of a steam boiler, where it will be promptly and effectively destroyed. The heavier dust falling on the bottom, and now sold for manure making, is to fall at once into a lead tank with sulphuric acid and treated like the coverings; this dust from hair and wool is rich in phosphates and ammonia, and is, therefore, a valuable fertilizer, while the acid increases its fertilizing properties and utterly destroys any germs present. Carbolic acid is to be used for disinfecting the hair, as chloride of lime or bleaching powder injures the fiber.

In order to show the urgency of these precautions we recite some of the details of one of the cases lately reported in an English medical journal: William Otley, aged 63, employed by Mitchell Brothers, Bradford, to prepare mohair after it had passed through a washing and scouring process necessary to manufacture it into yarn. He had first a small pimple upon his chin; this increasing and making him feel unwell, he staid home. A physician was sent for, and found swelling of the under jaw setting in. As the pustule increased rapidly, and constitutional symptoms showed themselves, the malignity of the case was soon recognized and all hope of staying the disease was lost. Three days later the patient died. On the morning of that day the doctor took a little blood and serum from the affected part, and, submitting it to a microscopic examination, discovered the organism known as "*Vaccellus anthracis*," now universally recognized among pathologists as the cause of splenic fever in cattle, and that form in which it is identical with wool sorter's disease.

No doubt the pimple on the chin had been innoculated by the virus, the development of which caused the man's death. After his decease the upper part of his body underwent a most rapid decomposition.

A NEW FIRE APPARATUS.

The portable standpipe fire extinguishing apparatus, invented by Abner Greenleaf, of Baltimore, appears to be the most meritorious original addition to the armory of firemen that has been made for many years. It has been on trial in this city during the past year, and on several occasions has proved of the highest practical utility. It is made in three sections, the lower being mounted permanently on trunnions, while the other two are carried on a side rack. On reaching the fire the two upper sections are coupled with the first, making a pipe fifty feet long. The pipe is raised in a minute by means of a hand wheel at the rear of the truck, and quickly connected at the base with the water supply. A shorter substitute for the upper section of the pipe is carried for use when the fire is so low that the nozzle height of thirty-five feet is sufficient. Different sized nozzles can be used with both lengths of pipe. The apparatus is supported by the truck wheels, and weighs 6,500 pounds. The great advantage of the tower lies in its getting a solid stream of water forty or fifty feet nearer the fire by raising the point of delivery. By means of a flexible pipe at the top of the tower, operated from the ground, the stream can be projected in any direction, sweeping an entire block if necessary. This contrivance presents a marked advantage over self-supporting ladders for several reasons. It is not necessary to provide for the weight and safety of men aloft. The man on the truck, in comparative safety, has full freedom of action, and can be cool enough to direct the stream to the points most needing attention. Less power is required at the engine to raise the water to the desired height, the friction of the pipe being less and the course more free from bends. The pipe can be put in working condition in three minutes after its arrival in front of a building on fire; and in several instances in this city it has been the means of saving valuable property in which the

fire would otherwise have been beyond control. It is intended eventually to have one portable pipe to each battalion of the fire service, so located that two or three can be brought to bear at any fire.

FALL OF A METEORIC STONE.

It has been doubted by some if ever a meteoric stone has been found which had also been seen to fall. It is well known that the meteorites in our mineralogical cabinets have been picked up in various parts of the world, and it is by their chemical composition that they are judged to be of cosmical origin. At the other side the observation of falling meteors is quite common, but seldom, if ever, has the falling body been found, hence the doubt in regard to them which exists still in many minds. Any record, therefore, of the observed falling of such a stone and its finding, while still hot, on the spot where it fell, is of interest. Such a record was recently furnished by Mr. W. Emerson Mead, of New York, the tenant of whose cottage near Schroon Lake makes the following report, dated September 23:

"Last night, while it was dark outside, the clouds being black and heavy, it became at once light as noonday. I jumped to the window, and saw the barn plain as during the day time, at the same time the house was shaken from cellar to garret. I went out of the house to investigate, and found, twenty feet from the house, a red-hot stone weighing about 135 pounds, and having indented the soil about six inches, and in a direction as if it had come from the northeast. I threw kerosene on it, and this burned up at once, so did sulphur. The next day it was seen by a number of people, and \$25 offered for it. It was not sold, however."

By order of the owner a little house is being built over the spot, and the stone left in position for the benefit of scientists to study its position and peculiarities.

Petroleum Abroad.

The *American Mail* predicts a vast increase in the consumption of petroleum during the next five years. It has been forcing its way among the "exclusive races," such as the Chinese, the Persians, the Moors, etc. The natural persistence of those eminently conservative peoples, who worship old things and old usages, was considerably strengthened by their fear of kerosene. Both the British and American consuls in China and Persia now report that the people are surmounting their fears and their prejudices and taking to the use of petroleum. A late report from our consul at Tripoli, of Barbary, states that petroleum is daily becoming more popular in that country, and the fears at first entertained in regard to its explosiveness are gradually disappearing. It is now used by all the city Arabs, and gradually reaching out to the country people. The same is true of India. Wherever our petroleum goes, our exporters should see that our lamps go with it. They should also remember that, in addition to its utility and superiority as an illuminator, its cheapness is its principal recommendation to those Eastern millions. Cheap petroleum and simple, safe, and inexpensive lamps should be our motto.

The New Comet.

On every evening since its announcement, interesting observations have been made at my observatory of the splendid telescopic comet now visible in the western evening sky.

The comet was discovered in this country at the Ann Arbor Observatory on the 13th of September, 1880, in R. A. 14 hours 38 minutes, north declination 29 degrees 20 minutes, and so announced in the papers last Saturday morning. On Saturday afternoon, however, a telegram was received by me from Europe via Washington, announcing its discovery by Hartwig at Strasburg, on the 29th ult., one day previous to its discovery in this country, in R. A. 14 hours 8 minutes, north declination 29 degrees 45 minutes. It is a superb telescopic object, and when seen by me on the evening of its announcement it was situated about 3½ degrees below Alphecca, or Alpha Corona Borealis. The next evening (October 3) it was in the same field of the telescope with that star, and presented a very fine appearance. Last evening—October 4—it was very close to the star Delta Corona Borealis. It is just visible to the naked eye, but it is not growing any brighter as was at first hoped, although it will doubtless be visible for some time. It has a large bright head with a sparkling nucleus, and a faint tail about two degrees in length. The head is nearly as bright, in the telescope, as the great cluster in Hercules. The tail points upwards or away from the sun. It is moving about 3 degrees daily in an easterly direction, or nearly in a line drawn from Alphecca to Altair in the Eagle. It is a beautiful object, and its scientific value will be very great. By following the direction of its motion just given no one will have any trouble in finding the comet with quite a small telescope, and it will be well worth the search.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., October 5, 1880.

The Wrong Journal Credited.

An article designating the qualifications incident to "a model workman," which appeared in this paper a few weeks ago, should have been credited to the *American Machinist*, instead of the publication to which the credit was accorded. If publishers would be more punctilious in crediting the source from which their articles are derived, much annoyance would be saved to the editor and publisher entitled to the credit.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Northern District of New York.

ROGERS vs. BEECHER et al.—BIRCH BEER PATENT.

Wallace, J.:

1. A patentee is entitled to the presumption of priority which his patent affords, and this presumption is only overcome by clear and satisfactory proof to the contrary.
2. The plaintiff is obliged, in order to recover damages, to prove affirmatively that the defendants have employed the invention patented, and having in this case failed to do so satisfactorily, the bill was dismissed.

United States Circuit Court.—Eastern District of Pennsylvania.

HOFFMAN vs. YOUNG.—PATENT SURVEYOR'S TRIPOD.

Butler, J.:

1. A mere aggregation of old parts without any new result issuing from the united action is not patentable.
2. Old parts to be patentable must combine in operation and by their joint effect produce a new result. They need not act simultaneously, but if so arranged that the successive action of each contributes to produce the result, which, when obtained, is the product of all the parts, viewed as a whole, a valid claim for this combination may be sustained.
3. No rule of universal application has been laid down defining a patentable combination, but two things are always necessary; first, a novel assemblage of parts exhibiting invention; second, the co-operation of parts in producing a new result.
4. By the term "co-operation" the courts do not mean merely acting together or simultaneously, but united to a common end—a unitary result.

By the Commissioner of Patents.

HUNTLEY et al. vs. SMITH.—PATENT MIDDINGS PURIFIER.—INTERFERENCE.

Marble, Commissioner:

1. When the party last in Office does not in his preliminary statement allege a conception of the invention in controversy earlier than the record date of the party first to file his application, it does not overcome the *prima facie* case made by the date of application, and judgment on the record should be rendered against him.
2. The mere fact that an earlier application was made by the party disclosing the invention in dispute cannot avail to give a *prima facie* date of invention in this proceeding, unless there is some reference in the later application which serves to connect it with the former.
3. While the filing of an application does not prove reduction to practice, it establishes the fact of invention.
4. Applications diligently prosecuted evince a faith on the part of the inventor in the practicability of the invention equal to that which would follow from a reduction of the same to practical form, and the latter is not a condition called for in the statute.
5. In cases of long delay to prosecute the invention beyond mere description, either by applying for a patent or by a reduction to practical form adapted to use, the question of abandoned experiment or conception will arise and should be considered a factor in the case.

The Electric Telegraph as an Aid to Fishermen.

From time immemorial the fishermen of the Mediterranean shores, of Cornwall, and of the Scandinavian coasts, have been directed in their work by lookouts stationed upon cliffs to discover the approach of the finny schools. Of late the enterprising fishermen of Norway have called to their aid the electric telegraph, laying down more than twelve hundred miles of wire, to bring the fishers into instant communication with the watchers, and to notify the fish merchants where to go for supplies. The Norwegian coast gives employment to 40,000 fishermen during a large part of the year.

Elevated Railway Traffic.

The number of passengers carried on all the lines of elevated railway in New York, the year ending September 18, 1880, was 60,386,073, divided as follows:

Third avenue.....	31,168,686
Ninth avenue.....	5,237,541
Total New York Elevated.....	36,406,227
Sixth avenue.....	21,143,638
Second avenue.....	2,836,188
Total Metropolitan Elevated.....	23,979,826

Steamboats in Venice.

A company has been organized to introduce steamboats in the place of the gondolas which have so long held dominion in the street canals of Venice. This, a London journal remarks, may fairly be considered the climax of modern utilitarianism, a fitting supplement to the railway up Vesuvius, and the steam launches of the Nile. Travelers will of course lament the change and denounce the vandalism of the age; but they will take the steamboats and leave the few leaky gondolas that may ply to the undisturbed patronage of aesthetes.

THE NIAGARA RIVER BRIDGE.—The credit for the admirable engineering skill displayed in the reconstruction of the railway bridge across the Niagara River, is due to Mr. L. L. Buck.

RECENT DEVELOPMENTS IN ELECTRIC LIGHTING.

(Continued from first page.)

nets of the large machine, and consequently controlling the current in the external circuit.

On the top of the magnets of the exciting machine there is a platform supporting a train of gearing, consisting of two ratchet wheels mounted on shafts carrying spur wheels which mesh into an intermediate wheel connected with the pivotal support of the commutator brushes by bevel gearing and a vertical shaft. The ratchet wheels are a short distance apart, and between them there is a double faced pawl, which is capable of engaging one or both of the ratchet wheels, or of moving between them without touching either. This pawl is reciprocated by an oscillating shaft at the rear of the magnet, which takes its motion from a small crank on a shaft above the armature and between the helixes of the magnets. The crank shaft receives a comparatively slow rotary motion from the shaft of the armature.

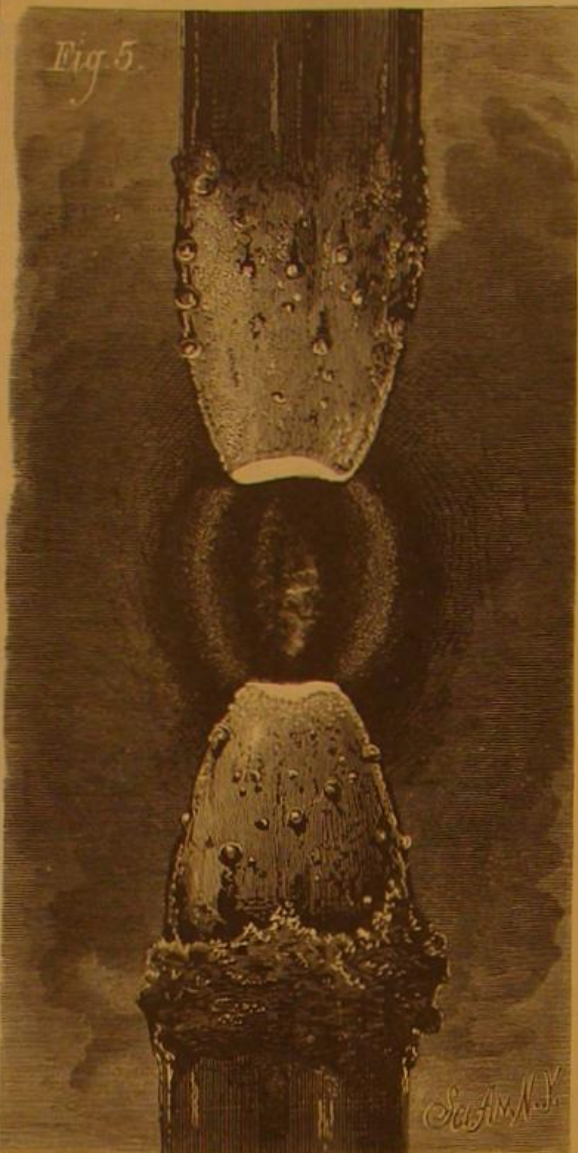
Above the ratchet gearing there is a table supported by pillars from the platform, and upon this table near one side there is an electro-magnet of high resistance, which is connected with the circuit wires, and is influenced by the current in the same manner as the incandescent lamps, which are connected in multiple arc. An armature is suspended above the electro-magnet by a nicely pivoted scale beam, and the downward movement of the armature is opposed by an adjustable spiral spring at the opposite end of the scale beam. The excursions of the scale beam are limited by stop screws in a vertical post near the electro-magnet. The end of the scale beam is prolonged beyond the armature to receive a rod, by which it is connected with the elongated end of the oscillating pawl playing between the ratchet wheels. The rod which connects the scale beam and the pawl is rendered elastic by the insertion of a short piece of spiral spring, to admit of the free action of the pawl in catching the teeth of the ratchet wheels. When the strength of the current is augmented by the removal of several lamps from the circuit, the armature of the regulator magnet is drawn down, permitting the pawl to engage with the lower ratchet wheel, which is turned one notch at a time until the commutator brushes are moved, so as to reduce the exciting current, and consequently diminish the current in the lamp circuit. Should the current diminish beyond the normal strength the armature is released, the spring moves the scale beam, bringing the pawl into engagement with the upper ratchet wheel, when the result will be opposite to that just described.

The incandescent lamps, in connection with which this regulator is more especially intended to be used, are connected in multiple arc; that is, they are connected across two parallel wires, so that the current is divided up between all of the lamps in the same circuit. Now, it is obvious that, when a number of the lamps are removed the current would, under ordinary circumstances, be much stronger in the lamps that are allowed to remain in the circuit, but when the regulator is applied there is no perceptible difference in the light given out by the lamps, whatever may be the number in circuit.

As many as sixty-four lamps have been brought up to over thirty candle power each in a single circuit by the machine shown in Fig. 3, and the lamps have been removed from the circuit until only one remained and then all replaced, the regulator meanwhile adapting the current perfectly to the widely varying conditions.

The incandescent lamp shown in Fig. 4 consists essentially of a glass globe containing an attenuated atmosphere of hydrocarbon vapor, in which is placed the carbon conductor, which is rendered incandescent by the electric current. The conducting wires, instead of being fused into the glass of the globe, are surrounded with a semi-clastic cement, which is capable of withstanding both heat and pressure. This cement insures a perfect and durable joint between the platinum elec-

trodes and the glass. It is estimated by Mr. Maxim that the large dynamo-machine will supply a current to 200 of these incandescent lamps. The machine certainly has great power, and generates what might be called



THE ARC ELECTRIC LIGHT. CARBONS, NATURAL SIZE.

a giant current, which is capable of heating eighty feet of No. 9 iron wire to incandescence, and of maintaining a 10 inch arc between two 1 1/4 inch carbons, shown in Fig. 5. The light from these carbons when one inch apart is simply immense, and the heat is like that of a blast furnace.

Mr. Maxim's interests are identical with those of the United States Electric Light Company, of this city, whose offices are located at 120 Broadway. This company is doing a great deal toward the introduction of the electric light in all forms, and have recently established a central station in the vicinity of Madison square, from which several radiating wires extend to public buildings in that locality. We hope at an early day to be able to chronicle the introduction of the small electric lamp into offices, stores, hotels, and private dwellings.

MISCELLANEOUS INVENTIONS.

Mr. George E. Eastman, of Muskegon, Mich., has patented a vehicle seat, whose ends and back are joined together with angle irons that enter corresponding vertical corner slots; the seat frame is mitered and secured in place by metallic plates, that are blind slotted into the corners.

Mr. Charles R. Kinchan, of Springfield, Ill., has patented a simple device for more readily and accurately circling and leveling the hair springs of watches. It consists of a sliding and rotating rod holding the spring, and fixed adjustably in a vertically adjustable stud or pillar that is connected with the top plate of the watch.

Mr. Enos G. Boughton, of Pittsford, N. Y., has patented an improved drying apparatus for drying substances such as fruits, vegetables, hops, meats, etc. The moisture is evaporated from such materials with dry air at ordinary temperature without the application or use of artificial heat, so that the natural flavor of the fruit is preserved.

An improved attachment for the key boards of musical instruments has been patented by Mr. Christopher C. Reynolds, of Kelseyville, Cal. The invention consists in a series of levers pivoted adjacent to each other in such a manner that they can be acted upon by a moving sheet which has the notes cut out or raised, and passes between two feed rollers, which draw it under the lower ends of the above-mentioned levers, having a cord or wire attached to the upper ends, the said cords or wires passing over or through suitable bridges, and being attached to the upper ends of a series of fingers resting on the keys of the instrument. By means of a crank the feed rollers are rotated, thus moving the music sheet as is necessary, and at the same time a roller arranged adjacent to and parallel with the row of fingers is rotated in such a manner as to assist in depressing the fingers, thereby relieving the music sheet from undue strain.

Mr. Philip B. Bicknell, of Lincoln, England, has patented an improved dark lantern for the use of policemen, watchmen, and others. It is an improvement on that general form of lantern which is constructed with a rounded front side and a flat or slightly concave rear side adapted to lie against the wearer, and in which the front portion is hinged to a back plate attached to the waist belt, so that the front portion may fold outwardly with the lamp to give access to the latter.

A closet or safe, which may be concealed in a wall and provided with secret devices for giving entrance thereto, has been patented by Mr. Nicholas Huettner, of Kenosha, Wis. The invention consists in a box fitted with a hinged cover that is held closed by sliding catches, and thrown open by a spring when released, and having combined with it a rockshaft and crank lever for operating the catches.

Mr. Humphrey J. Williams, of New York Mills, N. Y., has patented a carpenter's bench hook that can be easily set in position, adjusted, and removed. The invention consists, essentially, of a tubular shell carrying a toothed plate on its top, set at right angles thereto, the shell being longitudinally divided into two sections that inclose an eccentric rod or screw, by means of which the sections are spread apart.

An improved vehicle spring brace has been patented by Mr. Charles A. E. Simpson, of Portsmouth, Ohio. The invention relates to means for preventing lateral

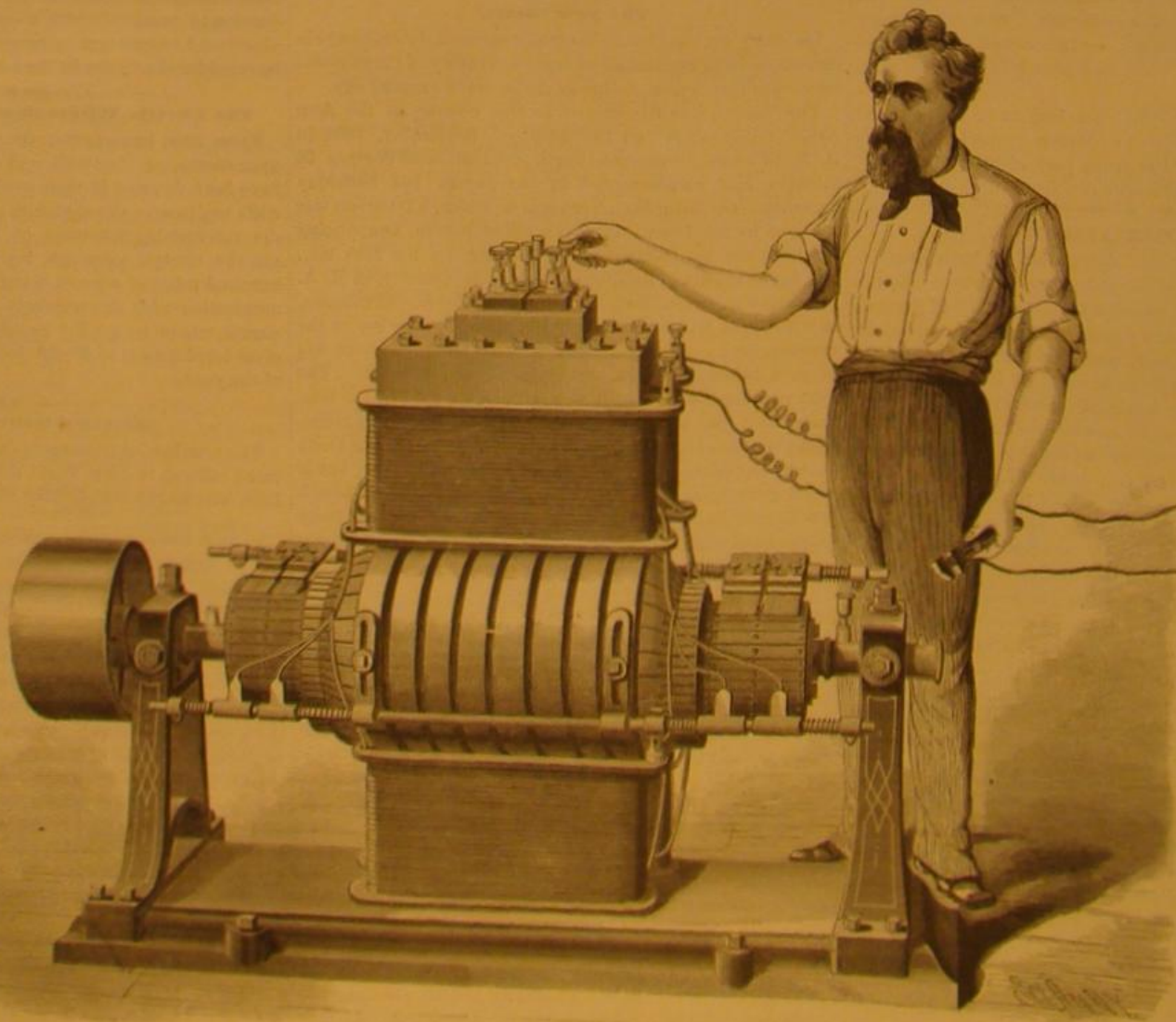


Fig. 3. MAXIM'S DYNAMO-ELECTRIC MACHINE.

vibrations of the springs when they are depressed by the load or body of the vehicle in passing over rough surfaces or in ascending or descending a hill.

Mr. Aaron D. Cheney, of Three Oaks, Mich., has patented an improved apparatus for hatcheling or straightening and removing the gummy matter and roots from hair combs or other snarled and tangled hair. The invention consists in a bed or table fitted with hatcheling and combing teeth arranged in a peculiar manner. These teeth are carried by blocks fitted to slide in the bed to allow change or removal of the teeth and the substitution of fine and coarse teeth one for the other, as required.

LONG-BILLED PARROT AND BANKSIAN COCKATOO.

A very singular form of cockatoo is that which is known as the Philip's Island, or the long-billed parrot. This bird is only found in the little island from which it derives its name. It may probably become extinct at no distant period, as its singularly shaped beak renders it an object of attraction to those who get their living by supplying the dealers with skins and various objects of natural history; and its disposition is so gentle and docile, that it readily accommodates itself to captivity. Philip's Island is only five miles in extent; and it is a very remarkable fact that this long-billed parrot is never found even in Norfolk Island, though hardly four miles distant.

Its favorite resorts are among rocky ground interspersed with tall trees, and its food consists mostly of long and succulent vegetable substances. The blossoms of the white hibiscus afford it a plentiful supply of food, and in order to enable it to obtain the sweet juices of the flowers the tongue is furnished with a long, narrow, horny scoop at the under side of the extremity, not very unlike the human nail. As earth has often been found upon the long upper mandible, the bird is believed to seek some portion of its food in the ground, and to dig up with its pickaxe of a bill the ground nuts and other subterranean vegetation. This opinion is strengthened by the fact that another species of parrot belonging to the same country is known to seek its food by digging.

One species of this genus has been known to imitate the human voice with much accuracy. This is the southern Nestor, or the kaka of the natives (*Nestor hypopolius*).

The birds which belong to the genus Nestor may at once be known by their extraordinarily long upper mandibles, which curve far over the lower, and remind the observer of the overgrown tooth so common in the rat, rabbit, and other rodent animals. Some persons suppose the long-billed parrots to form a link between the parrots and the cockatoos.

The Philip's Island parrot is dark brown on the upper surface of the body, but takes a grayish hue on the head and back of the neck. Each feather of the upper surface is edged with a deeper tinge, so that the otherwise uniform gray and brown is agreeably mottled. The cheeks, throat, and breast are yellow, warming into orange on the face. The inner surface of the shoulders is olive-yellow, and the abdomen and both tail coverts are deep orange-red. The tail is moderately long, and squared at the extremity.

The banksian cockatoo is a good representative of a very curious genus of cockatoos resident in Australia. The plumage of these birds, instead of being white or roseate, as in some other cockatoos, is always of a dark color, and frequently dyed with the richest hues. About six species belong to this genus, and they all seem to be wild and fierce birds, capable of using their tremendously powerful beaks with great effect. Their crests are not formed like those of the common cockatoo, and the tails are larger and more rounded.

The Banksian cockatoo is only found in New South Wales, inhabiting the vast brush district of that land. Its food is mostly of a vegetable nature, consisting chiefly of the seeds of the banksia; but the bird will also eat the large and fat grubs of different insects, mostly of a coleopterous nature, which it digs out of the trunks of trees with its strong bill.

The flight of this handsome bird is rather heavy, the wings flapping laboriously, and the progress being rather

slow. It seldom mounts to any great height, and as a general fact only flies from the top of one tree to another. The eggs are generally two and sometimes three in number, and are laid in the hollow "spout" of a green tree, without any particular nest.

The chin of the adult male is deep rich black with a green gloss. A broad vermilion band crosses the whole of the tail, with the exception of the two central feathers, and the external webs of the outside feathers. The female is also greenish black, but her plumage is variegated with numerous spots and bars of pale yellow.

Eastport Sardines.

Eastport, Maine, depends for its prosperity almost entirely upon its fishing interests, large quantities of cod and other fish being caught within a few miles of the town. The putting up of small herrings sardine fashion has latterly become a prominent industry, giving employment to many fishermen and cannerymen. The fish are very abundant at certain seasons, sometimes a hundred hogsheds being taken at one time. Large weirs are constructed along the shores and



LONG-BILLED PARROT AND BANKSIAN COCKATOO.

around the islands of Passamaquoddy Bay, and the fish, swimming in with the tide, are caught behind them. When the tide falls and the fish are crowded into narrow spaces, they are dipped out in great quantities. When taken to the extensive factories along the shores the fish are cured by boiling in oil, like sardines, and put up in small boxes in imitation of genuine sardines. The business is said to be controlled by New York firms. The fish are also potted and put up in various other ways. The large herrings taken during the winter are frozen and shipped to market in barrels.

England's 100-ton Gun.

A successful trial of England's new 100-ton gun was made September 22. Loaded with 441 pounds of pebble powder (in cubes of 1 1/4 inch) it drove a 2,000 pound projectile 43 feet into a sand butt. The velocity of the projectile was 1,536 feet a second.

The Daddy Long-legs in England.

For some four years past Miss E. A. Ormerod—a lady living at Dunster-lodge, Isleworth, who takes a great interest in meteorological and agricultural matters—has been collecting observations on injurious insects and plant life from all parts of the United Kingdom, and the success of her work may be imagined from the fact that this year some 400 observers—some as far north as Caithness—have sent in reports. These reports will not be published in the usual annual form until the observations of the entire year are completed. Enough is, however, now known of the great damage done this year, and of the experience gained in the destruction of these pests, to enable farmers and gardeners to protect themselves to a very great extent from their ravages in the future.

The reports from all parts of the country show that great damage has been done by the grubs of the *Tipula oleracea*—known better by the popular name of "daddy long-legs." Previous observations have shown wet weather to be favorable to the development of this fly, and the experience of the present year is quite in harmony with them. The eggs deposited in the clover stubbles last autumn produced myriads of grubs—as many as 150 to 200 sometimes in a square yard—which have been destructive to crops generally, but especially to corn. The grub works by gnawing the plant through, or partly through, beneath the surface of the ground, thus wasting far more than it needs for food, and as it can bear being thoroughly immersed for more than three days and nights, and can (at least, exceptionally) support a temperature of -10° —that is, 10° below zero, or 42° of frost—winter influences are not to be looked to for any very efficient help against it. The experiences of the present year also show that when the grub is fairly established in a field, special applications or dressings on the grub itself do but little towards killing it, and that the best remedies in a "grub run" field are dressings of guano, or of any quick acting manure that will stimulate and encourage a healthy and vigorous plant growth. The great lesson of the year is, that greater attention should be given in the autumn to the thorough cleaning of the ground.

The clover stubbles are the headquarters of the *Tipula oleracea* for egg-laying, and the legless grubs lie just below the surface, and, except when torpid, require to eat. What is needed is either to kill them at once, which can be done, to a great extent, by paring and burning, or to starve them out before the new crop is put in by thorough cultivation. The grub is very active and feeds on many plants, so that mere common cultivation does but little towards getting rid of it; but if the ground is thoroughly worked, and the rubbish collected and burnt at once, the attack in the coming season has been found to be very much lessened. The soil is thus put in a good state to run the next crop on, many grubs are destroyed by being either thrown up to the birds, burnt, or buried too deep to come up again, and if a sufficient time has been allowed to elapse before putting the new crop in, a very large number will have been starved out. All the reports of careful observers show that farmers have good cause to be thankful for the work done by birds in the destruction of insect pests. Starlings, rooks, and lapwings—all

of which are scarcer now than a few years ago, the cold and wet destroying large numbers—are powerful helpers in keeping down these injurious ravagers of our crops. Another pest, which has appeared in unusual numbers during the past two months, is the mangel-wurzel fly (*Anthomyia beta*), which does harm by its small, legless maggot gnawing away the inside pulp of the leaves between the upper and lower sides. This has, however, but rarely caused any serious mischief in this country, and as the reports of the past week all show that the rains are fast recovering the injured crop, the loss from its ravages will not probably be large this year. Among the other more prominent pests this year is the celery fly and the wheat midge (*Cecidomyia tritici*), the latter being very prevalent in some of the southern and midland counties. Miss E. A. Ormerod will be always pleased to receive from any persons specimens of insects or maggots doing injury to plant life, together with an account of their ravages, whether in the garden or in the field. Sue-

cessful treatment in any case will be welcomed, and proper forms will be sent to any one for filling in the information, and also a copy of the annual report containing the observations of the year. In Ireland, especially, a few additional observers would be welcomed.—*London Times*.

BATOIDEI, OR RAYS.

BY A. W. ROBERTS.

The rays or skates resemble sharks in their organization, but not in their external form. The body has a round and



FIG. 3.—BARN-DOOR SKATE.

rhomboid form, the sides of which are represented by the large pectoral fins, which are attached to the hind part of the head. The snout is pointed and elongated; the mouth, nostrils, and gill openings are situated on the under side of the body. (See Fig. 3, showing the egg of a blunt-nosed skate, partially cut away, displaying the young skate with umbilical sac.) The narrow and long tail of the rays generally has two dorsal and one anal fin, the latter unequal in its lobes. Their eyes show a very remarkable peculiarity, consisting of a fringed curtain that hangs down from the upper border of the iris, and covers part of the pupil. The eggs of the rays are wider than those of the shark's, have a less transparent case, and resemble flat cushions with long coiled strings at the four corners.

The "torpedo," "cramp fish," or "numb fish" (*Torpedo occidentalis*), the "prickly ray" (*Raja Americana*), the "barn-door" skate (*Raja laevis*), the "spotted ray," "sting ray," "butterfly ray," "cow-nosed ray," and "monk fish," belong to this family, and are more or less common on our coast.

The sharks and the rays come together so closely as regards their eggs and structure that it is hard to determine where the departure or blending of the two families takes place. For instance, take Fig. 2, showing the eggs of the shark or dog fish, common on the British coast, and the eggs of rays common on our coast, Figs. 1 and 3. In each

case the eggs are of a softish, horn-like consistence, so that they are not liable to be broken or easily penetrated. The general shape of the egg has been aptly compared to a pillow case with strings tied to the corners or sides, the inclosed pillow being the young shark. The long curling, tendrilous, and silky appendages speedily affix themselves to seaweeds, shells, or other objects, and from their form and material anchor the egg firmly. To enable the little ray or shark to breathe there is an aperture at one end of the egg, through which the water passes in sufficient quantity to renovate the blood. And in order to permit the inclosed fish to make its escape when sufficiently developed, the end of the egg nearest to the shark's head is formed so as to open by the slightest pressure from within. After the newly born skate has left the egg, there is no perceptible external change in the shape, for the egg, being elastic, closes up as before. One of the most common skate eggs found on our outer coast is shown in Fig. 1, life size. This is found of various sizes, and often of various tints, although it is usually of a very dark brown or rich olive green. It will at once be recognized by the illustration given. This egg is the production of one of our largest skates, known as the sharp-nosed skate, and harmonizes well with the strange, weird-like aspect of the creature from which it is produced. If one of these eggs is picked up in the early part of the year, it will usually be found to contain the young of one of these animals, not a very prepossessing creature, but very interesting to students of embryology. Perhaps the reader may remember Hogarth's "Gate of Calais," where a fisherwoman has upon her knees a huge skate, in whose countenance the painter has wickedly infused an expression precisely like that of the storm-beaten, withered old dame who holds it.

Another Mastodon.

The remains of a large animal, probably a mastodon, were discovered in an old swamp near Hopestown, Ill., September 18. The tusks are nine feet long, twenty six inches in circumference at the base, and weigh 175 pounds each. The lower jaw with teeth is well preserved. The teeth are perfect, though somewhat worn. One weighs eight pounds, and is twenty-one inches in circumference. Several of the leg bones are in good condition. The thigh bone is two and a half feet long, and the tibia three feet. The ribs and backbone are in bad condition as the back of the animal was only three feet below the surface of the ground.

Rhode Island Scallop Fishing.

The scallop season of Narragansett Bay began September 15. By sunrise the scallop grounds were covered with boats, each carrying from two to four dredges and two men. The lawful limit to each boat is fifteen bushels a day. There was landed at Providence the first day about 350 bushels. Visiting the shops at the landing place a reporter of the *Journal* found scores of men and some women, standing up to long benches with knife in hand, separating the pure white muscle or "eye" from the shells and refuse with two or three motions, which display great dexterity, and are acquired by long practice. The muscle is unusually large and plump this year, so they will average about a gallon to every bushel in the shell. Twelve and a half cents a gallon is paid for cutting out, and an experienced cutter will flip the shells from about two bushels an hour. The ruling price is eighty cents a gallon, but if shippers crowd the market and the weather is warm they bring much less.

Pacific Salmon.

While the habits of many of our valuable food fishes are well known, there is yet much to learn in regard to the salmon, and especially those of the Pacific coast. An English traveler by the name of Pennant was the first to call attention to them, and gave the Indian names to the various species. After him came a German who Latinized the popular names. When the territory came into the possession of the United States other descriptions were given, but as the observations were made at different periods of the year, and as the salmon differ according to season, some thirty species were made where there existed but five. The flesh of the salmon in the spring is of a clear white color, with the advance of the season it changes to pink, then to a deep red, and finally becomes mottled, and in some cases almost black. In the early part of the season the scales are silvery and loose, but later they become embedded and dull, while those on the back disappear. The teeth, from being small and fine, grow large, and sometimes reach half an inch in length. The cartilaginous snout and the lower jaw grow out, while the upper jaw hooks down.

Of many of the habits of these salmon we are still ignorant, but we know they spawn in fresh water and then go down into the salt. Professor Jourdan says that in April, when the Columbia is high, they appear to be attracted from the ocean, probably by the cooler water of the river. They turn into the river, and as soon as they feel the influence of the current they go right up. Near the mouth of the river, and where the water is the least discolored, they can only be taken by the seine. They take the hook in salt water or in perfectly clear fresh water. Up the Columbia the salmon journey, and are found away up in Montana, and following the Snake and its tributaries they penetrate into British Columbia. The salmon will continue up stream as long as water can be found deep enough in which to swim. At the head waters of the river they often present a pitiable sight. They are frequently found with their heads smashed from contact with the rocks, their eyes knocked out, their fins scraggy, and otherwise bruised and injured. Here, after spawning, as they can go no further, unable to obtain food, they die in large numbers, and very few of them which penetrate thus far ever reach the ocean again. The last month or so that they are running up the Columbia they are unfit to eat, being poor in flesh, often covered with blotches and sores, and generally in a poor condition. There are about one and a half million salmon taken annually in the



Fig. 2.—Eggs of Dog-Fish.



EGG OF SHARP-NOSED SKATE.—(*Raia Americana*.)

Columbia River, amounting to about 30,000,000 lb. in weight. It has been feared by some of the large canners on the Columbia that the supply might be diminished from the large number annually taken, but probably enough escape the nets and spawn to keep up the supply. The principal salmon used for canning on the Columbia is the Chinook or spring salmon.

Pond Lilies.

An exchange gives the following information in regard to pond-lily culture. A tub of some kind, some garden soil, and water are all the requirements; a

tub may be made from a portion of a cask, and if desired it may be sunk in the ground. Place in the tub good soil enough for the roots, perhaps a quarter full will be sufficient; put in the plant; it is not necessary to plant it, merely pressing the stem into the soil will answer. The big affair which passes for the root is really the stem, which lies along the bottom of the pond. One side of this produces roots which take a strong hold of the soil, as every one who has tried to get up one knows, while buds producing the leaves and flowers are on the upper side. When the tub is filled with water no further care is required during the summer, except to supply water as it may be needed, as it is not likely that the rains will make up the loss by evaporation. Unless the tub can be so protected that it will not freeze solid it should be moved to the cellar at the approach of cold weather. Only enough water need be left in the tub when it is moved as will be needed to keep the soil moist.

Deep Sea Trawling.

In the trawling and dredging operations of the Fish Commissioners' steamer Fish Hawk three different trawls or dredges are used—the beam trawl, the otter trawl, and the harrow dredge. Before the dredges are thrown out the depth of the water is ascertained by a sounding apparatus, a modification of Sir William Thomson's. No depths are ever taken without ascertaining temperatures. The thermometer used is the Negretti and Zambra, which has the advantage of recording temperatures more quickly than the Miller and Cassella. Lieut. Tanner, U. S. N., commanding the Fish Hawk, has devised an ingenious method of reversing the thermometer when it reaches bottom, so that no intermediate temperatures are recorded. The depth being ascertained, the operation taking but a few moments, and the temperature being recorded, dredging commences. The steamer has a reeling engine forward, around the drum of which a steel wire rope, three-eighths of an inch in diameter, is coiled. Two kinds of trawls are used for dredging, the beam trawl and the otter trawl. The beam trawl, which is copied after those used by the English and Dutch fishermen in catching turbot and sole in the German Ocean, is some 16 feet across, with a purse-formed net some 35 feet long, the meshes being about $1\frac{1}{2}$ inch at the beam, and diminishing rapidly in size toward the tail of the net. A boom is rigged out from the foremast, which is at right angles with the ship. The trawl connected with the steel wire is hauled up by steam power and lowered into the water. The steel wire runs through three pulleys, and is attached by a rope to an accumulator, made of a series of rubber disks, which regulate the strain. In order to preclude chance of accident, it being better to lose the trawl than the steel rope, the trawl is fastened to the rope by means of a detachable, which has two jaws to it. If the trawl should catch on a rock and a tug take place, the steel rope being more valuable than the trawl, the detachable unloosens itself. At a strain of 4,000 pounds the trawl would be detached. The steel wire will stand a dead pull of 8,700 pounds. Care is taken to prevent all kinks in the steel rope when winding or unwinding, for a kink diminishes its strength just 50 per cent. The beam trawl is lowered gradually. When the beam touches the surface of the water, it being weighted down on both ends by strap-shaped irons called runners, it sinks parallel with the bottom. Then the vessel is allowed to drift backward, if such be the condition of the tide, or she is moved away from the trawl by reversing the screw. The trawl is then like a big bag, with its mouth wide open, which is drawn dredge-like across the bottom. In a sailing craft, as the luggers, the trawl is worked from the stern, the vessel being kept under easy sail. After the trawl has remained down some 20 minutes it is hauled up. As the hoisting engine is on the upper deck, it would be inconvenient to dump what is taken in the trawl. As the net comes up, the top being suspended from the wire rope from the beam, the tail of the bag is opened on the lower deck, the end of the purse being unloosened, and the varied contents pour into a trough, which has a series of wire bottoms of various degrees of fineness. About 40 minutes are sufficient to make a dredging.

The otter trawl works somewhat in the same way as the beam trawl, only instead of a transverse beam of wood or iron, the sides are held by two pieces of heavy wood, in shape something like center boards. These are weighted at the bottom with iron keels. The net is about the same shape as the beam trawl. The two weighted pieces of wood sink the net, the net itself having floats of cork above and leads below. As the net is drawn under water by the movement of the vessel, the two pieces separate, flaring out. As the net is hoisted the pieces of wood close up, and the mouth of the bag is shut. The advantage of the otter trawl is that it is less costly and more easy of storage, being the form usually employed by English yachts. It is more convenient for dredging in shallow water, but is not, perhaps, quite as certain in its effects as the beam trawl.

A third kind of dredge is used for clay bottoms and only for scientific purposes; this is the harrow dredge. In using this the object is to tear up the bottom some feet in advance of the bag, so that the forms embedded in the bottom may be secured. There is an iron harrow, which is in front of a net which is covered with canvas to protect it from tearing, the mouth of the net being extended by an iron frame. The possible use of the first two trawls by our fishermen is a fact which ought not to be overlooked. It is true that at present we do not have on our coast any varieties of flat fish of as good quality as those caught in the German Ocean.

But still the contingency might arise when such nets could be found serviceable. The pole flounder, which is by far the finest variety of flat fish we have in our waters, can only be caught to advantage by means of trawls, and when once the merits of this fish have been determined, there is no doubt that our fishermen will profit by such experiences as the United States Fish Commission has given them.

Swarming Extraordinary.

D. N. Kern relates in the *Ohio Farmer* the following experience with a swarm of Italian bees: The first swarm came out May 5, and was put in a hive filled with comb. On the 19th of May the second swarm came out, and was hived with a weak swarm. On the 20th the third came out, and was hived with the second and the weak swarm. On the 21st the fourth swarm came out. Mr. Kern caught the queen and killed it, and put the swarm back to the old colony. On the 23d the fifth swarm came out. He caught two queens and killed them, and put the swarm back again. On the 24th, at nine o'clock A.M., the sixth swarm came out. He caught two queens again and killed them, and put the swarm back again. The same day, at three o'clock P.M., the seventh swarm came out again. This time he hived them in an old straw hive, and set them on top of the old hive. In the evening of the 25th he shook them down in front of the old hive again, and that settled for the time the swarming fever of the old hive. But on the 26th of June, the first young swarm threw out a very large swarm, and on July 3d threw out a second swarm, and about five minutes later a swarm came out of the old hive again. He hived both swarms together and sold them for \$200 cash. All these swarms made 235 pounds of comb honey.

New Substitute for Rubber.

This artificial composition, which answers the purpose of genuine caoutchouc or gutta percha, can be employed, according to Dankworth and Sanders, of St. Petersburg, either alone or in connection with other resinous substances. According to *Ackermann's Gezeirbezeitung*, this new product affords an inexpensive means for a perfect isolation of wires for electrical purposes. The composition is elastic, tough, not so sensitive to external influences as caoutchouc or gutta percha, and is not injured by high pressure or high temperature. It is prepared in the following manner:

A quantity of coal tar oil, or equal parts of coal and wood tar oil, which is to constitute a third part of the whole mixture, is poured into a large kettle, together with an equal quantity of hemp oil, and is heated for several hours, either over steam or an open fire, to a temperature which lies between 252° and 288° Fah. (it should not exceed the latter), until the mass becomes so ductile that it can be drawn in long threads, and the remaining third, consisting of a quantity of linseed oil, which has been thickened by boiling, is then added.

With this composition from five to ten per cent of ozokerite and some spermaceti should be mixed. The mass is then heated again for some hours at the same temperature as above, and finally from seven to twelve per cent of sulphur are added. The mixture thus obtained is cast into forms and treated the same as caoutchouc.

The proportions of the three oils may be slightly varied according to the practical purposes for which the composition is to be used.

Wood Products of Norway.

The *Building News* (London) states that a great revival has lately taken place throughout Norway in all departments of the timber and planed-wood trades, which have suffered severely from a protracted depression. The wood pulp manufacture, however, has fared better, the demand from Great Britain and France being persistently on the increase. At the commencement of the year there were 21 factories at work, the production for the last three years being as follows: 1877, 295,700 cwt., value £78,300; 1878, 386,482 cwt., value £96,000; 1879, 400,000 cwt., value £90,000. Although the production in 1879 exceeded that of the previous years, prices were lower, from the great local competition; but as esparto grass has risen in value, it will very soon favorably influence the price of wood pulp, the more as the English paper makers contracted pretty largely for paper pulp during the winter, to the amount of 2,000 tons in excess of the ordinary demand. The wood pulp used in England contains about 50 per cent of moisture, but the French paper makers prefer having it air-dried, containing only 8 per cent. There are also four mills employed in making millboard from paper pulp. These are used for band-boxes, and are all sent to England.

Fine Linen.

According to the *Building News* a piece of linen has been found at Memphis containing 540 picks to the inch, and it is recorded that one of the Pharaohs sent to the Lydian king, Croesus, a corselet made of linen and wrought with gold, each fine thread of which was composed of 360 smaller threads twisted together! The ancient Egyptians wove a fabric called the "linen of justice," or "justification." So beautiful and valuable was it that it was esteemed the most acceptable offering to the "Restorer of Life." A few hand looms can still be seen at work in the Eastern bazaars of Cairo, the cloth woven in which rivals in texture, color, and design the finest glass screens of Munich.

Correspondence.

Fire Apparatus in Cities.

To the Editor of the Scientific American:

In our large cities, when a building is discovered to be on fire, any one having the required key opens the door of the nearest of the little iron fire alarm boxes secured to the telegraph poles, giving an electric signal indicating the location of the burning building. This signal is transmitted to the fire department stations, where but a moment before mild looking horses were quietly munching their feed, and a general air of peace prevailed among both horses and men. But at the sound of the signal a scene of the wildest methodical activity prevails. Of their own accord the horses hasten to their places in front of the steam fire engine; one man lights the previously arranged fuel under the boiler of the engine; another harnesses the horses; the driver springs to his seat, grasps the reins, the station doors are opened, and away they start. All this within about seven seconds after the sound of the signal. Arriving at the fire the engine's pump is connected by hose to the nearest hydrant; a hose carriage is driven alongside and lays a hose from the engine to the burning building; by about the time a nozzle is coupled to this hose the engine has sufficient steam to commence pumping; the hose fills out roundly, and a stream of water is conducted to the burning building. And so with each steam fire engine that has been signaled; men with ladders climb with their hose to the roofs of the burning and adjacent buildings to secure advantageous positions for conducting the water; and if the burning building is of only ordinary size and combustibility, the fire is very soon conquered. But in case the fire occurs in a large warehouse stocked with combustible merchandise, and gains considerable headway before it is discovered, which is frequently the case with our present iron shutters, it may then become startlingly apparent that the inch and a half or two inch streams of water are unable to speedily conquer the element. Recently the writer happened to be in a good position to view a fire of this kind. It appeared as if the streams of water were almost entirely evaporated in passing through the flames, that very little water reached the source of the fire, and that the utmost exertions of the firemen were required to save the neighboring warehouses, and possibly the whole river front of buildings, from destruction. It occurred to me, as I watched the flames streaming high in the air, that in such a case a fire apparatus capable of throwing a stream of water four or eight inches in diameter to a distance of five hundred feet, when directed at an inclination of 45°, was needed. Such an apparatus would have to be in connection with several of the fire hydrants now in use in order to receive sufficient water. Or perhaps the delivery hose of several of the steam fire engines connected to one large swivel nozzle mounted on wheels, and planned similar to those used in the gold regions for washing down auriferous banks of earth, would answer. Such a stream, by reason of its weight and solidity, would pass through the flames to the source of the fire, and thus prove more effective than several small streams. It appears that each small stream of water acts on the principle of an ejector carrying with it by friction fresh air, thus in a measure aiding combustion. The safety and prosperity of our cities are so dependent upon our fire departments, that any means for rendering them more efficient is of vast importance, and successful inventions in this line would be pretty sure to afford inventors a rich harvest.

L. L. D.

New York, October 6, 1880.

RECENT INVENTIONS.

An improvement in grain separators has been patented by Messrs. William S. Bright and Samuel Thomas, of Letart, W. Va. The object of this invention is to furnish grain separators so constructed that the light grain, the chaff, and chaff will be separated from the grain by an air blast, and the cockle and other small seeds will be separated by screens.

An improved filter has been patented by Mr. Louis R. Sassinet, of New Orleans, La. This invention relates to a means for filtering the water collected in cisterns of ordinary construction in order to render it fit for drinking, cooking, and other purposes.

An improved stove truck has been patented by Mr. Hiram Shuman, of Buck, Pa. The invention consists in combining with a platform parallel locking shafts supported on fixed and swiveled casters, and an intermediate shaft parallel to the shafts, levers being attached to the latter and connected with the intermediate shaft.

An improved elevator for barrels, etc., has been patented by Mr. Latham W. Greenleaf, of Terre Haute, Ind. This is an improvement on the elevator for which Letters Patent No. 220,137 were granted to the same inventor September 30, 1879, the object being to better adapt them for use in elevating and lowering barrels and other articles from one floor to another in storehouses, warehouses, and other places, and which shall be so constructed as to load and unload themselves while in motion.

An improvement in stone crushers has been patented by Mr. Charles G. Buchanan, of Brooklyn, N. Y. The object of this invention is to produce a parallel and sliding motion upon the lower portion of the crushing plates for the purpose of increasing the pressure, and, if desired, reducing the product to a greater degree of fineness.

TIN PLATE INDUSTRY.—THE PROCESS OF MANUFACTURE.

In the last issue of the *London Iron Exchange* received at this office is an interesting history of the manufacture of tin plates from about the year 1600 up to the present time. Omitting the historical portion of the writer's account, we extract from the article a description of the methods now employed in the manufacture of this useful article.

The British Association have recently visited the Dyferyn Iron and Tin Plate Works at Swansea, situated on the river Tawe, with a view of informing themselves regarding the practical workings of this important industry. The same association met at Swansea 32 years ago, since which time great advances have been made in the processes of manufacture. From the 40 mills now running within a radius of 3 miles in the Swansea valley about 20,000 boxes of finished tin plate are turned out weekly, or 1,000,000 boxes annually, which is estimated to be equal to about one-third of the entire export.

But how tin plates are made is information likely to most interest the reader:

In the first place, says the writer, we have what is termed bar iron, several feet long, about 7 inches wide, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in thickness, rolled according to the plates required at so many pounds per foot. It is cut in what may be termed a jack-in-the-box or steam shear, say about 19 pounds, to a piece which will eventually be rolled into 16 sheets of 20 inches long by 14 inches wide, 112 of such sheets forming a box, and weighing when tinned nearly 1 cwt.

This piece of iron is first placed in a reverberatory furnace, heated to redness, put through the chilled rolls, and rolled in what is termed thick, five times; reheated and rolled in singles twice; doubled, reheated, and rolled, three times; doubled, reheated, and rolled, twice; doubled, reheated, and rolled in eights, twice, until they are stretched out to the required length and thickness. The length of the bar exceeds by about one inch the width of the sheet to be made, so as to allow for the shearing process, and the bar is therefore rolled with its axis parallel to that of the rolls. Great attention is necessary in the construction and management of the mill furnaces, so that the heating of the bar and sheet for rolling may be effected with the utmost regularity, and without the formation of scale on the surface of the bars or sheets; for when scaling takes place from the draught in the furnace being too keen or the heat raised too high, the quality of the iron is injured; the scale, if subsequently rolled into the iron, leaves a rough surface on the plates in the after process of separating and pickling. The plates are then sheared, and the rough edges taken off. The iron of 19 pounds or thereabouts makes 16 sheets, which, being cut in half, leaves 8 sheets in a piece closely wedged. Girls with small iron hatchets open or separate them. They are then termed black-plate. From one ton of bar iron about 16 $\frac{3}{4}$ cwt. of black-plate is made; the loss is termed shearing, and is worked up again in the forge fire. The plates are next sent to be pickled, i. e., immersed in heated dilute sulphuric acid, known as oil of vitriol.

This process is done by aid of a patent, known as Hutchings' patent pickling machine. The plates are placed in a brass cradle or receptacle, lifted by a hydraulic, then dropped down into a round wooden or lead tank containing the o. v.; the cradle is then made to revolve by means of steam power, to enable the liquid to rush between the sheets, which revolution is retained. They are lifted again by the hydraulic, dropped into a tub, a little apart from the last, containing water only, the cradle revolving as in last tub, so that the water may rush between the sheets to cleanse or wash away all trace of the acid, when taken up again the plates are clean and bright as silver. They are next subjected to a bright red heat, which lasts from 12 to 24 hours, in closed iron annealing pots in a reverberatory furnace; they are well covered on the top to prevent the plates from being burnt; the heat is kept as high as it can be without softening them to such a degree as to cause them to stick so fast together as to prevent their separation when cold.

They next pass singly through cold rolls, three, four, or more times, as may be deemed requisite. These rolls are highly polished, and must be set in accurate order to give the plates a perfectly flat set and well polished surface. Again they are annealed or softened at a lower temperature than the first, as their surfaces would be damaged by being in any degree stuck together. Pickled again as before, excepting that the liquid is considerably weaker than previously, placed in cast iron troughs containing clean water renewed by a stream constantly flowing through, they are then taken in hand singly, and scoured if necessary with sand and hempen pads before being delivered to the tinman.

Now comes the last process. The sheets are iron only so far. They next reach the tin house, and are placed in a trough containing clean water, ready for the tinman, as he is termed, who then picks them up and puts them singly in a grease pan containing palm oil, to soak, and after being there for a short time the tinman places the sheets in a large iron pot containing molten tin, with a covering of palm oil. Here it unites with the tin, to which it has a strong affinity. When he has performed his part the plates are handed over to the next man, called a washman, whose pot contains pure molten tin; after they have soaked in his pot a little, he raises them with a tongs on to the hob as he requires them, brushes the surface of both sides of each sheet, and after dipping them into another pot containing molten tin again, they are sent through rolls which work in a large pot containing palm oil, and the speed at which the rolls move regulates the quantity of tin to be put on each sheet. They are

afterward raised from the rolls (under which they have been passing) by a youth, called a riser, handed to two young women, who rub them in bins or boxes containing bran, one after the other, which takes off the grease; another girl, called a duster, gives them a further polish with a skin duster, and takes them to the assorting room, where every plate passes inspection, and, if not up to the mark, is sent back for rectification. After passing through that ordeal they are counted and weighed by young women, made up into boxes according to the different sorts, handed to boxers or packers, who pack them in elm boxes, marked by branding irons as per order, and finally placed in the railway truck to be forwarded to their various destinations. It may be a surprise to some to know that a tin plate passes through about thirty hands from the bar to the railway truck, but is handled no less than 105 times. Such is a simple account of tin plate making.

MECHANICAL INVENTIONS.

Mr. Elijah Cravens, of Osage Mission, Kan., has patented an improvement in the class of automatic car couplings in which each drawhead is constructed with a horn and provided with a pivoted draw bar or clevis, which, when two cars meet, drops over the horn on the opposite draw head and thus locks the cars together. The improvements relate to details of construction and a peculiar combination of the various parts, which render it practical and efficient.

Mr. Charles A. Tucker, of Brooklyn, N. Y., has patented an improved nut lock, designed especially for securing nuts on bridge bolts, carriage bolts, and the like.

Mr. Frank P. Simonds, of Natick, Mass., has patented a simple device for freeing boots, which is rapid and efficient. The device operates by two eccentrics, which are oppositely arranged in respect to each other, and are connected with a strap which is drawn over the boot on the tree with a reciprocating motion.

An improved barrel making machine has been patented by Messrs. David Murray and Thomas W. McGregor, of Rushford, Minn. The object of this invention is to provide in a single machine the several mechanisms and devices for trussing and working the ends of barrels, kegs, etc., preparatory to receiving the heads.

Mr. Albert T. Bleyley, of Conception, Mo., has patented a car coupling, so constructed that cars of the same height or different heights will couple themselves when run together, and which can be uncoupled from the tops of the cars.

Mr. William Brown, of Fort Cameron, Utah Ter., has patented a hollow iron railroad tie, of rectangular cross section, having a concave bottom, and having end ledges formed on its top to prevent the spreading of the rails.

Researches on Batteries.

The author has found two methods for obviating the inconvenience that chemical action in batteries is never entirely arrested when the circuit is open. One of these methods is based upon the absorbent power of animal charcoal, and is applicable to all the cases where the depolarizing liquid is a metallic salt. He has constructed a sulphate of copper battery, in which the copper solution cannot be diffused through the zinc. He takes an ordinary Calland element, at the bottom of which is placed a stratum of powdered copper sulphate, covered with bone-black, washed, and powdered. The zinc is placed in the upper part of the jar, and is separated from the copper sulphate by the bone-black. The element thus arranged resembles a Minotti battery, in which bone-black is substituted for sand. The zinc remains entirely unaffected. The second method, more general than the first, consists in taking as a depolarizing body a liquid which gives a precipitate on mixture with the liquid which attacks the zinc. The diaphragm separating the two liquids is thus rendered completely impermeable. The precipitate formed in its pores must be a conductor of electricity and must be capable of electrolysis.—A. D'Arsonval.

Improvement of the Bunsen Battery.

This improvement, made by Mr. Azapis, consists chiefly in replacing the acidulated water in which the zinc is immersed by a solution of about 15 per cent of cyanuret either of potassium, of caustic potash, of sea salt, or of ammonia salts. The liquid in the porous vessel which contains the carbon plate remains the same as usual. This improvement has the advantage that, while the intensity of the current is the same as in the Bunsen element, the zinc plates do not need to be amalgamated, and the consumption of zinc is considerably less, while the constancy and the durability of the current are remarkable. A battery improved in such a manner, which consisted of 25 elements, and in which ordinary ammonia salts were employed, was used without interruption for four days in succession, and during the evening for the purpose of producing an electric light. Another advantage of the battery is that it gives out very little odor.

The Exportation of Apples.

Over 40,000 barrels were shipped to Europe from this and other American ports during the last week of September, and large quantities are expected to follow. It is a year of extra bearing in most parts of this country, while in England and other parts of Europe the apple crop is a failure. It is estimated that half a million barrels will be exported this season. Two years ago—a good apple year—333,000 barrels were shipped to Europe.

AMERICAN RAZORS.

Among the industries which have been transplanted to this country during recent years none has had greater prejudice in favor of foreign products to overcome, or has started from a higher level of practical excellence, than the manufacture of fine razors.

For twenty years or more the establishment of Mr. J. R. Torrey, 34 Southbridge street, Worcester, Mass., has had a national reputation for the variety and quality of the razor-strops it has turned out. More recently Mr. Torrey has formed with his son and Mr. Joseph Turner, a practical razor maker, the J. R. Torrey Razor Company, and organized under the most favorable conditions an establishment for the production of razors of the finest quality.

Here the steel in the bar, the horn and ivory in the raw state, are taken in hand, blades are forged and ground, handles are made, and every step of the work of producing finely finished razors is going on under the same personal supervision. The making of the paper cases, their lettering in gold, and the etching of the razor blades, are all included in the work of the establishment. Hence our American cut-throats are no longer obliged to send to Europe for razor blanks and handles, as they are now made of equal excellence on our own soil.

The methods and processes employed at Sheffield have been greatly improved upon, and the J. R. Torrey razors have taken high rank in competition with the best that Europe produces.

CREMATION OF THE DEAD.

Exactly how to dispose of the ashes of the dead in the most satisfactory manner, after cremation is accomplished, is still a question. The ancient practice was to deposit the ashes in a funeral urn, to be preserved in a tomb or other sacred place. This is also the modern custom. But if tombs are to be required then there is not much need for cremation, as the corpse may as well be buried in the tomb without cremation.

A recent American patent consists in providing a parlor bust of the deceased, cut in marble, and in making a hole in the back of the bust, wherein the ashes are to be deposited after cremation of the body.

A further improvement, suggested by one of our lady correspondents, is to prepare a wet mixture of cements for artificial stone or marble, and sprinkle the ashes of the deceased into the mixture, which is then to be cast or pressed into the form of busts, statuettes, or other objects. In this way various members of a family might possess enduring portions of the ashes of the departed one.

Pneumatic Tubes supersede Cash Boys.

The incessant calls for cash boys, which formerly made shopping in our larger establishments so wearisome, if not exasperating, were silenced and the terrors of shoppers greatly mitigated by the introduction of electric calls. An enterprising Philadelphian has gone a step further, and displaced the dusty skurrying of cash boys and cash girls by a system of pneumatic tubes. Under the new system an inspector and wrapper is stationed at each counter, who will receive with the money and goods the seller's check. While the goods are being wrapped up the cash with the proper vouchers will be transmitted to a centrally located cashier, who will return the change through the proper tube. There are two such tubes leading from each counter to the cashier's inclosure. One of the tubes is to carry the money to the cashier, and the other is to return the change and accompanying check to the counter again. The "carriers" which work inside of the tubes are little cylindrical boxes of sheet steel, lined with green baize, and protected at each end by diminutive felt cushions. Each carrier is of the exact diameter of a silver dollar, and is capable of holding thirty of the latter pieces or a much larger sum. By means of a steam engine and exhaust pump in the cellar, with proper attachments leading therefrom, the air is being constantly exhausted at the cashier's end of the tube and at the counter end of the tube of each pair; and when a "carrier" is placed in the mouth of either tube, it is immediately drawn to the other end, and is there delivered automatically by an apparatus devised for the purpose. This system not only saves time and noise, but the wages of an army of boys or girls, besides discharging a large amount of fresh air into the building, greatly improving the ventilation.

The Factory Laws in Switzerland.

A short time ago the Swiss Government enacted laws restricting the time during which the workmen might be employed in factories, and forbidding the employment of children under 15 years of age. It appears now that this law works so injuriously that the State counsel is embarrassed about it and advocates its abolition, as many Swiss manufacturers have founded new establishments abroad, while others are removing their old plant entirely in order to escape the restrictions imposed, especially the limitations of the hours of labor, contending that the capital invested does not yield sufficient returns when the factories have to be idle for 14 to 15 hours out of every 24. This objection could be easily met by employing two sets of workmen, each working 8 hours a day; while with three sets of hands the factory could be kept going night and day.

The restricting laws would ere this have been abolished were it not that the working classes are agitating against its repeal. The result of the struggle in little republican Switzerland is looked upon with interest.

The standard gallon of the United States contains 231 cubic inches. H. W. Johns' Asbestos Liquid Paints are sold by this measure, and, although they command a higher price than any others, they are more economical owing to their wonderful covering qualities and superior durability. They are strictly pure linseed oil paints of a higher grade than have ever before been offered to the public, and are in use upon the finest and most extensive structures in this country, among others the United States Capitol at Washington, the Metropolitan Elevated Railroad of New York, etc. Samples of twenty-eight newest shades of dwellings sent free. H. W. Johns Mfg Co., sole manufacturers, No. 87 Maiden Lane, New York.—*Adv.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue. The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Chard's Extra Heavy Machinery Oil.
Chard's Anti-Corrosive Cylinder Oil.
Chard's Patent Lubricants and Gear Grease.
R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Steam Yacht Wanted.—Send description, speed, and lowest cash price, to Lock Drawer C, Meredith, N. H.

A. J. Emery, Mechan. Engineer, 7 Cortlandt St., N. Y.

For Sale, on account of increase of power, one 24 x 48 Corliss Engine, with three boilers and equipment complete. Now in use, but deliverable in November next. For particulars address Natchez Cotton Mills Company, Natchez, Miss.

2 Steam Yachts for sale. Geo. F. Shedd, Waltham, Mass. Factory for sale or lease. Building 40 x 100 feet; forge shop 30 x 100 feet; 12 lots; steam power. Burr & Co., 212 West St., Brooklyn.

Shafting Straighteners. J. H. Wells, Vineland, N. J.

The genuine Asbestos Cement Felting consists of fine long asbestos fibers and a cementing compound, which forms a light, porous, fireproof covering, partaking of the nature of a felt and a cement. It is prepared ready for use, can be easily applied by unskilled workmen, and forms the most effective, durable, and economical non-conducting covering in use for steam pipes, boilers, and other heated surfaces. H. W. Johns Manuf. Co., 87 Maiden Lane, New York, sole manufacturers.

Wanted.—A Second-hand Engine Lathe, back gear, screw cutting, in good order. Address, giving description and price, Glass Works, Poughkeepsie, N. Y.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1 1/2 Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, borders, etc., sent on receipt of \$2. Palm & Fechteler, 425 Broadway, New York city.

The Eureka Mowing Machine now is acknowledged as the best in the market. It has taken the first premium in nearly every State Fair this year. Prices to suit the times. Send for illustrated circular to Eureka Mower Company, Towanda, Pa.

The Boomer & Boschert Press Co. have in daily operation, at the Am. Ind. Fair, a complete cider mill and cider jelly manufactory. New York Office, 15 Park Row.

Packing once tried always used. Phoenix Packing from 1-16 up in spoons or on coils. Phoenix Packing Company, 108 Liberty St., N. Y.

Gas Machines.—Be sure that you never buy one until you have circulars from Terrill's Underground Meter Gas Machine, 39 Dey St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsburg, Pa. Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 51 Dey St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forrepaugh, Jr., & Bros., 331 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 21 and 24 Liberty St., New York.

For Patent Shapers and Planers, see ill. adv. p. 230.

Presses, Dies, and Tools for working sheet metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Pumps, Shears, etc. E. Lyon & Co., 40 Grand St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J. Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. Important, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H. Silent Injector, Blower, and Exhauster. See adv. p. 232. Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'rs. 23d St., above Race, Phila., Pa. Don't buy until you see the \$4 Drill Chuck; holds 0 to 9-16. A. F. Cushman, Hartford, Conn.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y. Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted to send their full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

For Wood-Working Machinery, see ill. adv. p. 232.

Eclipse Portable Engine. See illustrated adv., p. 232.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See ill. adv. p. 233.

For Separators, Farm & Vertical Engines, see adv. p. 230.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Clark Rubber Wheels adv. See page 237.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 141. 4 to 40 H. P. Steam Engines. See adv. p. 232.

Nellis' Cast Tool Steel, Castings from which our specialty is Flow Shares. Also all kinds agricultural steels and ornamental castings. Nellis, Shriver & Co., Pittsburg, Pa. Rollstone Mac. Co.'s Wood Working Mach'y adv. p. 237.

C. J. Pitt & Co., Show Case Manufacturers, 226 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hearnshaw, Williamsport, Pa.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 232.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 235.

For Yale Mills and Engines, see page 232.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's adv. p. 230. For Mill Mach'y & Mill Furnishing, see ill. adv. p. 221.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 232.

NEW BOOKS AND PUBLICATIONS.

THE VICTORIA REVIEW. Published at Melbourne, Australia, by the Victoria Review Publishing Company, and edited by H. Mortimer Franklyn, Esq.

This is one of the best magazines that comes to this office from any country. The Victoria Review is published monthly, and its contributors are among the most able and profound writers of the day. The July number, just received, contains papers from several eminent writers, and to better convey an idea of the nature of the publication we append a list of the writers and the subjects of their several contributions in the July issue: Lewes' History of Philosophy, by C. Hamilton Bromby (Tasmania); Nineteenth Century England, by the Rev. W. H. Fitchett; A Few Words about Béranger, by John F. Perrin (New Zealand); Proportional Representation, by Guido Padelletti (Florence); Modern Biology, by Edward B. Sanger (Adelaide); The Place of Religion in Fictitious Literature, by Miss C. H. Spence (Adelaide); A Venetian Dramatist, by James Smith; Sermons on Genesis by Dr. Bromby, by the Very Rev. the Dean of Melbourne; Goethe's "Faust" and Byron's "Manfred," by R. Colonna-Close; The Affairs of Europe, by Emilio Castelar (Madrid); A Menacing Comet, by Richard A. Proctor; The Decay of Matrimony in Victoria, by the editor; The Contemporary Thought of Great Britain, Europe, and the United States. We would like to see this Review more widely circulated than it has heretofore been in this country, for it merits an extensive subscription list, if it is published in a remote English colony on the other side of the globe. We would, therefore, recommend it to the patronage of students and all thoughtful persons, who, we are sure, will be both interested and benefited by receiving the publication regularly. D. Appleton, 3 Bond street, New York, receives subscriptions and furnishes the numbers to their subscribers as soon as they are received.

MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1880. By Henry V. Poor. New York: H. V. & H. W. Poor. 8vo, cl., pp. 1077. \$5.

Poor's Manual grows fatter and more widely useful every year. This the thirteenth annual number gives the mileage, stocks, bonds, cost, traffic, earnings, expenses, and organizations of something like 1,400 railroads, with an appendix containing a full analysis of the debt of the United States and of the several States.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Vol. V. Mexico, 1880.

The present issue of this valuable scientific publication, which we have just received from the society, embraces the first three numbers of the fifth volume (third series). The articles, as usual, pertain to a wide range of scientific subjects, are very interesting, and give evidence of conscientious study and much painstaking labor on the part of the authors. The contents, in addition to the society's proceedings, embrace contribu-

tions from Sr. Fernandez on the "Determination of the Length of the Seconds Pendulum in Mexico at 2,363 Meters above the Sea Level;" Sr. Leal on a "Study of Mortality in the City of Leon de Aldamas;" Sr. Ramirez on the "Mineral and Metallurgical Productions of Guadalupe in San Luis Potosi;" Sr. Reyes, "Meteorological Observations;" and Sr. Archiga, "Note on the Saltpit of Sayula." In addition to these signatures, there are various notes and translations by the editors, making altogether a collection which well sustains the high standard reached by the preceding volumes. We congratulate the Mexican Society of Geography and Statistics on having so many earnest workers in its ranks, and wish it every success.

ELEMENTARY TREATISE ON ELECTRIC BATTERIES. From the French of Alfred Naudet. Translated by L. M. Fishback. New York: John Wiley & Sons. \$2.50.

Telegraphers, and all others who have to do with or desire to study the nature and management of the various types of electric batteries, will find M. Naudet's book very serviceable. The translator's fitness for his task is generally vouched for by the capable electrician of the Western Union Telegraph Company, Mr. George d'Infeville.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) L. H. C. asks: 1. How many two quart Bunsen cells will be necessary to run a Duboscq's electric light regulator? A. About 50. 2. Is the following a proper formula for the battery fluids: for porous cell—1 gallon water, 1 lb. bichromate of potash, 1 1/4 parts sulphuric acid; in outside jar—1 part sulphuric acid to 12 of water (by measurement)? A. Yes.

(2) D. H. F. asks: Will a dynamo-electric machine produce a continuation of sparks between two or more electrodes in the circuit, or must an induction coil be placed in the circuit? A. An induction coil will be required. 2. What is the best material to make the electrodes of? A. Platinum. 3. Why are the buttons on telegraphic instruments platinum tipped? A. Because it is refractory and unoxidizable. 4. Does not every electro-magnet placed in an electric circuit act as so much of a break or resistance coil to the current? A. As so much resistance.

(3) H. S. writes: I wish to build a cistern to hold twelve thousand gallons. It can't extend over five and a half feet below the surface, on account of the quicksand. What shape and dimensions are required to secure the greatest strength in walls? How many brick will it take to build it? A. A cistern twenty feet diameter and five feet deep will hold the quantity named. The number of bricks cannot be given, without knowing the thickness of the walls, and this will depend somewhat upon the nature of the soil backing the walls.

(4) C. W. H. asks: 1. On what part of the axle of a buggy wheel is the greatest friction while the vehicle is in forward motion? A. It depends upon the surface over which the wheel is traveling, the size of the wheel, and the load. Generally a little forward of the vertical line. You may determine this point in any given case by examining an axle long in use, and see where has been the greatest wear. 2. If a wheel could be suddenly freed from its axle while the vehicle was in motion, would the wheel run on with accelerated motion—in other words, if the speed of the vehicle continued the same, could the free wheel pass it? A. No.

(5) G. S. H. writes: 1. I wish to build a small steam yacht; I wish it entirely for speed. The boat must be sufficiently large to carry 500 lb., besides boiler and engine. I have an engine, 2 inch bore by 4 inch stroke. What size boiler and boat will I require, and the speed I can make with same? A. Length 18 to 20 feet by 4 1/2 feet beam, by 28 inches deep; engine, 2 inch cylinder by 4 inch stroke; boiler, upright tubular, 22 inches diameter by 40 inches high; tubes, 1 inch or 1 1/4 inch diameter by 24 inches long.

(6) C. W. asks: 1. Would it not be as well in making the dynamo machine described in SUPPLEMENT, No. 161, to wind the wire round the armature instead of lengthways? A. No. 2. Would the machine be strong enough to magnetize small bars of steel? A. When made according to directions given in the SUPPLEMENT, yes.

(7) J. N. J. asks: Will it require a stronger dam or dike to hold a large body of water than it does to hold a very small body? A. Leaving out of consideration the effect of waves, the depth being the same in both cases, there would be no difference in the strength of dam required.

COMMUNICATIONS RECEIVED.

On Boiler Explosions. By L. H. K.
On Hydraulic Cements. By J. D.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
Granted in the Week Ending

September 21, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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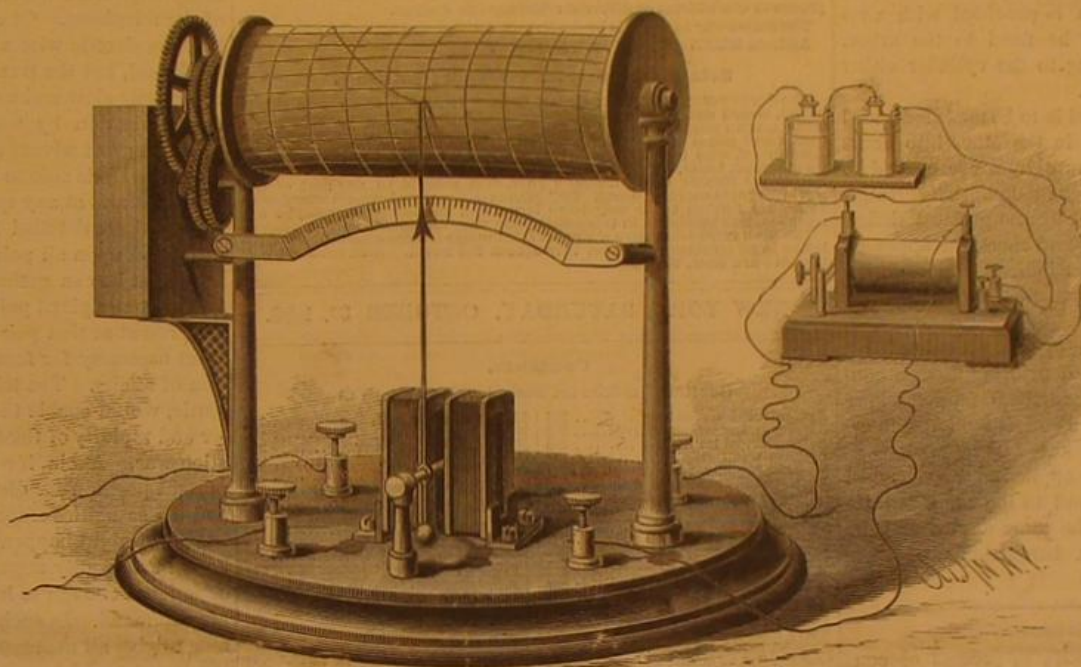
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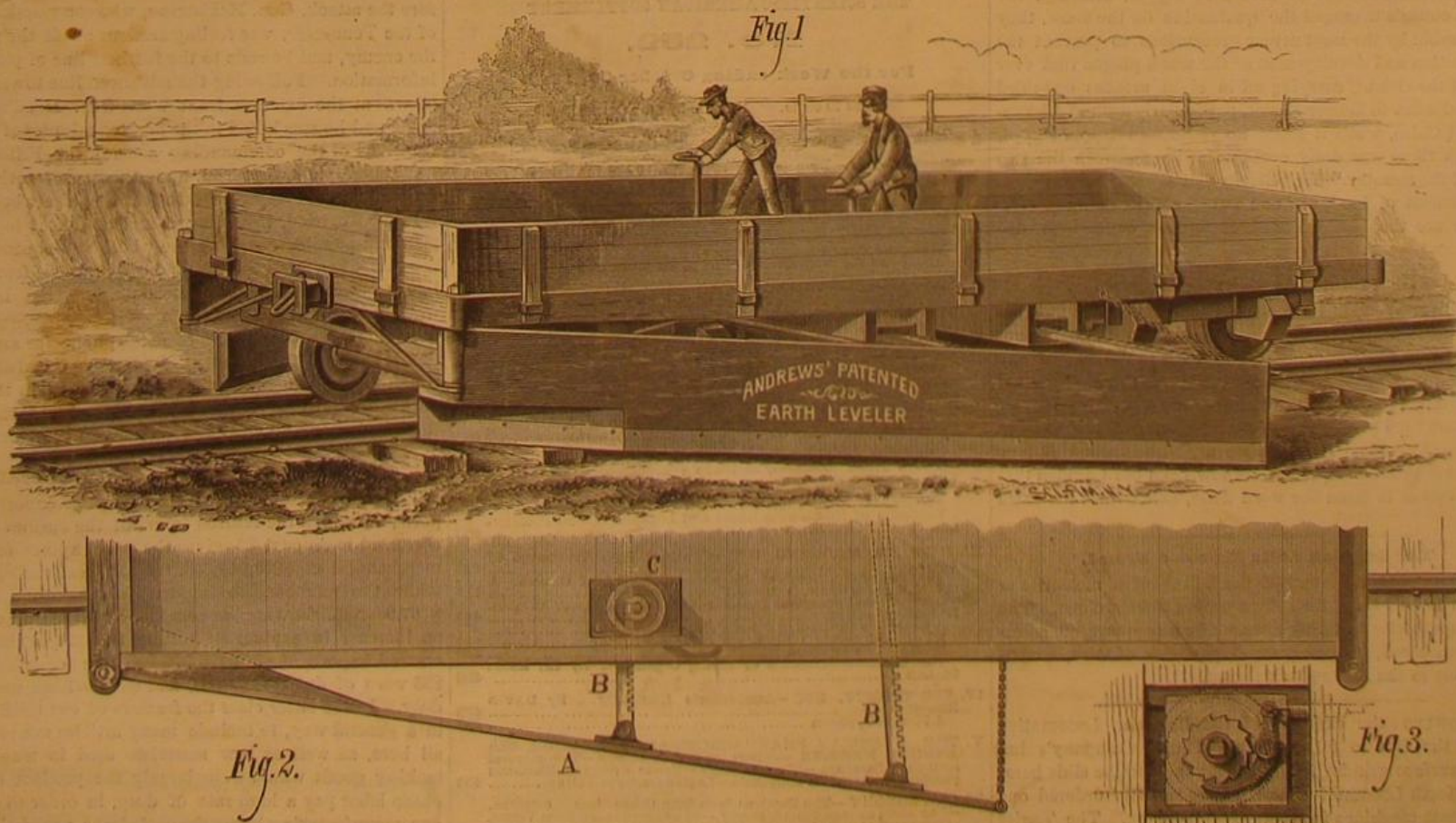


Fig. 2.

Fig. 3.

ANDREWS' LEVELING ATTACHMENT FOR EARTH CARS.

parts of the instrument are mounted. The scale is supported by vulcanite studs projecting from the columns, and to one of the columns is attached a clock movement provided with three sets of spur wheels, by either of which it may be connected with the arbor of the cylinder. One pair of wheels connects the minute hand arbor of the clock with the cylinder, revolving the cylinder once an hour; another pair of wheels connect the hour hand mechanism with the cylinder, so that the latter is revolved once in twelve hours; while a third pair of wheels give the cylinder one revolution in six days.

This instrument is designed especially for making prolonged tests of different batteries in order to determine their characteristics. It is provided with four binding posts, two of which connect the wires of the batteries under test with the helixes. The other binding posts are connected respectively with the posts supporting the needle and with the journals of the recording cylinder. These posts receive wires from an induction coil capable of yielding a spark from one-eighth to one-quarter inch long.

The induction coil is kept continuously in action by two Bunsen elements, and a stream of sparks constantly pass between the elongated end of the index and the brass cylinder, perforating the intervening paper and making a permanent record of the movement of the needle. To render the line of perforations as thin as possible, the end of the index is made sharp and bent inward toward the cylinder. The spur wheels are placed loosely on the arbor of the cylinder, and the boss of each is provided with a set screw by means of which it may be fixed to the arbor. This arrangement admits of giving to the cylinder either of the speeds, as may be required.

The paper upon which the record is to be made is divided in one direction into degrees and in the other into hours and minutes. The hour and minute lines are curved to coincide with the path of the end of the index. The greatest strength of current being indicated by the greatest deflection from the central line of the record sheet, the approach of the index toward the central line indicates a diminution of the current, which is faithfully recorded by the passing sparks.

These records may be duplicated by using the sheet as a stencil and employing the method of printing used in connection with perforating pens. When the tests are of long duration the action of the induction coil is rendered intermittent by an automatic switch connected with the clock.

This method of recording may be applied to the electrical dynamometer, to electric meters, and to the more delicate galvanometers; and substantially the same device may be applied to recording thermometers, barometers, and other delicate meteorological instruments.

A New Ferry House.

The Hoboken Ferry Company have in process of construction at the terminus of the Delaware, Lackawanna, and Western Railroad, at Hoboken, a new ferry house, which, from its quaint, Queen Anne style of architecture, attracts considerable attention. The roof presents the curious appearance of being covered with snow. This is produced by the use of H. W. Johns' asbestos roofing, which is being extensively employed on factories and public buildings throughout the country. The snow-white roof, in contrast with the brilliant color of the walls of the new ferry house, gives a striking and showy effect to the structure.

M. DE LESSEPS does not believe in the efficacy of quarantines. He recalls that in 1834-5 in Egypt, although the foreign consuls managed the quarantine on the coast, they were unable by the most severe precautions to prevent the introduction and development of the worst plague that ever ravaged the Orient, carrying off in eight months one-third the population of Lower Egypt, particularly around Alexandria and Cairo, while it made no victims in Upper Egypt, although there was daily communication between the two parts of the country. He believes that sanitary precautions, improvement of food, air, and water, cleanliness, and temperance are the best preventives against contagious diseases.

Dr. Holmes on Spelling Reform.

Dr. Oliver Wendell Holmes says, in a letter to a member of the English Spelling Reform Association: I should not care to be an obstructive (if I could be) in the way of any well organized, scholarly attempt to reform our English and American language. But you must allow a fair share of old square-toed prejudices in their personal likings to old square-toed people. I hate to see my name spelled *Homes*, yet I never pronounce the *l*. I know from old Camden that its derivation is from the word *holm*, and I want the extra letter.

The Schroon Lake Meteor a Fraud.

The circumstantial story of the falling of a meteorite at Schroon Lake a short time since proves to be a cheat. The alleged meteorite is simply a mass of white quartzite, somewhat weathered, inclosing small particles of mica, a common stone in the Adirondack region.

FOLLOWING the example of the Baldwin Locomotive Works, the first to introduce the Tanite Company's improved surface grinder for perfecting locomotive slide bars, the Danforth Locomotive Works have recently ordered one of the same machines for their establishment. The Tanite Company are also busy filling an order for several tons of emery wheels for the French Government.

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NEW YORK, SATURDAY, OCTOBER 30, 1880.

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THE TELEPHONE ON THE BATTLEFIELD.

The development of the telephone has been so rapid and so recent that it has not yet been extended to all the fields of usefulness for which it is destined. Thus we believe it has not only never been used in actual battle, but it has had few if any opportunities to show its capacity even upon the fields of mimic war, Grand Army reviews, and mock battles. Yet it is evident that no more important use could be found for it than a great commander could make in a general engagement. In these days when a plan of battle includes the management of three or four great armies on each side, all under one head but scattered over wide areas and separated from each other by great distances, it is necessary that the commander-in-chief should have the most rapid communication with his different corps commanders, and be able to judge of the situation at any given point by reports instantaneously conveyed. In recognition of the importance of this necessity there are signal corps and telegraph brigades attached to the army staff of all great countries, but up to the present time they do not seem to have appreciated the telephone sufficiently to make it an important part of their equipment.

A means of conveying information, instructions, and orders rapidly and accurately during an engagement cannot be too highly regarded. The field telegraph was a long step in the right direction, but telegraphic messages are open to many objections which would be wholly avoided by the use of the telephone. Of course it may be taken for granted that the electric wire will hereafter be in general use on the battlefield, but the transmission of words letter by letter is necessarily slow and uncertain compared with the ease of communication by word of mouth; hence the telephone affords a great advantage to the general having it available for use. He is able to learn in a moment the exact condition of affairs at any quarter of the field. Not only can he communicate detailed instructions and receive specific information upon all points bearing upon the attack and defense, but he can gather some knowledge of the state of affairs at any given point, even though there may be no officer present at that point having the experience and judgment necessary for forming a proper estimate of the condition of affairs. The telephone, conveying the sounds of the battle, would enable the general to determine by the character and rapidity of the fire at that point how serious the situation was. Again, if a general of division defending an important position far distant on the flank should be killed, and the casualties among the brigade commanders should be heavy, it might happen that the senior officer living might be not sufficiently acquainted with the field, or not of wide experience enough to handle properly the force left under his command. In such a case the general-in-chief would be able to give all necessary instructions and orders direct from headquarters.

Moreover, this instrument cannot fail to diminish the danger to the general in command. It will not be necessary for him to advance to points under fire in order to confer with his corps commanders. Of course no general would hesitate to expose himself wherever the necessity existed for so doing, but inasmuch as the fate of an army may depend upon the life of the commander, it is desirable to reduce to the minimum the possibility of his sudden taking-off. As an example of this the case of Gen. McPherson may be cited. When Gen. Hood relieved Gen. Johnston in the command of the Confederate Army before Atlanta, he made a sudden violent attack upon Gen. Sherman's left. Just before the attack, Gen. McPherson, who commanded the Army of the Tennessee, was feeling anxious about the position of the enemy, and he rode to the furthest line of pickets to get information. Following the advanced line toward the left, he was at the extreme front when Gen. Hood's onset was made and he was killed in the first ten minutes of the action. Deprived of the commanding general, the Fifteenth Corps was routed and swept back upon the Seventeenth, and for a time there was every reason to fear that the whole position would be carried, involving a serious defeat to Gen. Sherman and possibly changing the whole subsequent course of the campaign. Had the telephone been in use from the front line to Gen. McPherson's headquarters, the latter's life would not have been lost.

The important requisites of a telephone for army use are that it shall be simple, not easily deranged, and able to stand rough usage. There is no reason to doubt that these essentials can readily be obtained, and then the constant use of the telephone in all army operations will be assured.

WHAT WE BUY AND SELL ABROAD.

The official statement of United States exports and imports, in which the returns from all the custom houses are corrected to August 23, gives the total exports of domestic merchandise at \$823,946,333, for the year ending June 30, while the merchandise imports for the same time were \$667,954,746, showing, as compared with the previous year, an increase in exports amounting to \$125,605,563, and increased imports of \$222,176,971. Of the imports, \$459,652,883 were of dutiable goods, and \$208,301,863 were free of duty. In the latter class the framers of our tariff intended, in a general way, to include many articles not produced at all here, as well as raw materials used in manufactures, making goods which were largely the product of foreign cheap labor pay a high rate of duty, in order to encourage our manufacturing industries. A large proportion of the value of the imports free of duty is covered in the two items of coffee and tea, which we received last year to the value

of \$80,143,390, as compared with similar receipts amounting to \$61,934,437 for the year preceding. Of chemicals, drugs, dyes, and medicines, about half our imports are free and half dutiable, the latter amounting last year to \$5,764,698, and the former to \$6,738,862, the free goods showing an increase of 59 and the dutiable of 25 per cent, as compared with the imports of the year preceding. But the most remarkable showing in the increased imports of free goods is found in the item of hides and skins, other than furs. These constitute a raw material, the bringing of which here from abroad to be manufactured involves the use of a large amount of capital and the employment of a great number of hands, whether the manufacture be only so far carried out as to produce leather, or whether, as with the greater proportion, it is carried forward into the making of boots and shoes. In 1878-9 we had a full average import, amounting to \$15,959,017, but for 1879-80 our receipts were far greater than ever before in the history of the country, footing up \$30,002,254. In the other articles free of duty which enter most largely into our manufactures, we find that the imports of India-rubber and gutta percha have increased from \$6,063,088 to \$9,606,239, rags for paper-makers from \$2,402,457 to 5,474,737, raw silk from \$8,371,025 to \$12,024,699, and block, bar or pig tin from \$2,312,297 to \$6,223,176. The large capital and increased employment of labor necessitated by this larger use of raw material requiring so much work to fit it for the requirements of the public will at once be evident.

When we come to the imports of dutiable goods, however, such as are generally brought here in competition with the productions of our own manufactures, we find in most branches an increase quite as great as that noticed in our imports of free raw materials, a fact which would tend to discredit our general industrial prosperity were it not that we have such cumulative evidence to the contrary, and can see that these increased imports, bought from the superabundant proceeds of two bountiful crops, are but supplementing demands upon our own manufacturers which the latter find themselves unable to fill. Thus, in cotton manufactures, although the mills at Fall River, Lowell, and other places, have been producing more goods than ever before, our imports for 1879-80 were \$29,929,366, as against \$19,928,310 for the year preceding. So, too, in manufactures of wool, although our imports have increased from \$24,355,801 in 1878-9, to \$33,911,093 in 1879-80, the home industries in this line have been remarkably prosperous. In iron and steel and their manufactures the business has not been so steadily prosperous as in some other branches, because of the intense speculative fever which dominated that market during a great portion of the year, but there was a great improvement in the many industries embraced in this line as compared with the condition of the trade for the year preceding. It is to be particularly noted also, in this connection, that while our increased imports of this class were enormous, by far the largest items were of pig and old and scrap iron, which, considering the work necessary to turn them into marketable products as finished goods, may properly be considered as raw material. In fact these two items alone constitute more than half our imports of iron and steel and its manufactures for the past year, figuring for \$27,956,144, as against \$2,054,885 in 1878-9, while all our other imports in this class, such as castings, steel and iron rails, machinery, cutlery, files, saws, and tools, foot up to but \$26,757,844 in 1879-80, as against \$7,392,363 in 1878-9.

When we turn to the other side of the account, however, and look at the items which make up our increased exports, it is not at all surprising to find that in the shipment of manufactured goods we have only just about held our own, and that our larger shipments are almost entirely in grain, cotton, and provisions. Of the latter we had an unprecedented abundance, and the marketing thereof furnished the people with the abundant means which has enabled them to purchase so freely of manufactures. On this account the ambition to build up a trade in our manufactured goods in foreign markets has been, this year, to a great extent, held in abeyance, in the presence of an active and generally more remunerative home trade. Of course this has been only a temporary condition, to be probably followed by more earnest efforts than have ever before been made to enlarge the sale of our manufactures abroad, for, aside from the fact that we can hardly expect a continuance of such magnificent harvests, the great enlargement of our manufacturing facilities during the past year will compel those interested in such lines to seek wider markets, if they would place their trade on a permanently prosperous footing. There never has been a time more propitious than the present for the putting forth of the most zealous efforts in this direction. Labor is comparatively cheap, but at the same time all the necessities of life are sold at such reasonable rates that the condition of the workman is much better than in former years, when we had a vitiated currency and wages were much higher; American manufacturers, too, have now won such a position in most of the markets of the world that they will not have to encounter the prejudices which were formerly a chief obstacle in developing foreign trade, but they will find customers everywhere not only willing but desirous to meet them on grounds which cannot fail to be mutually advantageous.

HORSE RAILWAYS IN EUROPE.—Ten years ago the horse railway, or "tramway," was scarcely known in Europe. Now there are fully 700 miles of "tramways" in Germany, Great Britain, France, and Belgium.

BLIGHT OF PEAR TREES.

BY T. J. BURRILL, PROFESSOR OF BOTANY AND HORTICULTURE, ILLINOIS INDUSTRIAL UNIVERSITY, URBANA, ILL.

The writer has been very fully convinced by many observations and varied investigations, that this dreaded disease of the pear tree is caused by a minute organism belonging to a group of the lowest fungi, best known as *Bacteria*. These organisms require high powers of the microscope to detect their presence, hence the failure by microscopists to find anything to which the disease could be attributed. Much larger parasites, animal and vegetable, have been sought for, but sought for to no purpose, except to thoroughly establish the fact that insects and the ordinary parasitic fungi on plants were not the cause of the disease. *Bacteria* have not been known as active agents in the destruction of living plants, and microscopical investigations have not usually been of the peculiar kind to reveal them. But these organisms do occur, and may always be found in the bark of pear trees actually undergoing the change which we call blight. They multiply with rapidity and become excessively numerous, thousands in a minute drop placed under our microscope. They move to and fro with a slow, undulating, twisting, tumbling motion. They gradually elongate, becoming two or three times as long as wide, and then divide transversely into two equal parts, the joints clinging together for some time, but eventually separating entirely. The fluid which contains them may become dry and the life processes of the minute things apparently stopped for an indefinite length of time, when, by the addition of water, they recommence their movements and otherwise exhibit the phenomena of life.

Upon careful examination of the tissues of infected trees, we find that the stored starch grains gradually disappear. The protoplasm may not be destroyed, and the walls of the cells are left in most cases without the slightest trace of perforation or other injury. The disease is pre-eminently one of the bark. The wood, except in the case of very young shoots, is not affected. The water from the roots, passing as it does through the wood, may, and often does, ascend for months to living leaves above, while the bark is dead entirely around the stem or branch for several inches or even feet. The upper portion of course ultimately dies, unless as may happen when the cambium is not destroyed, a new bark is formed underneath the dead one. The leaves are invaded by the destroyer, but the sudden destruction often witnessed is especially due to the girdling effects upon the limb or trunk.

The progress of the disease in the tissues of the plant is always slow. The bacteria are not carried by the circulation in the fluids of the tree, but gradually work their way by their own powers of movement through the imperforated walls of the cells. These walls must present an almost unsurmountable barrier to their progress from cell to cell. Indeed, the puzzle really is how they get through at all. In old wood the cell walls become pierced with minute pores, but no such thing exists in the cells containing the stored materials upon which the bacteria live. The walls of such cells, though permeable by water, have no openings which the highest powers of the microscope reveal, either before or after the change produced by blight. The thick cells of the liber (*bast*) or inner fibrous layer are really proof against the invasion by the bacteria. Not unfrequently a continuous layer of these cells separates the diseased parts from those perfectly healthy. It may be that the progress of the malady is thus checked in some plants, while in others, with less bast, its course is uninterrupted.

In the fermentation which occurs of the starch, and presumably of other carbonaceous materials, carbonic acid, butyric acid, and hydrogen are formed. This is very different from the results of putrefaction or ordinary decay, and especially indicates the agency of bacteria, for the butyric fermentation is only known as a consequence of their action.

Having now indicated the changes which take place in the still living but infected cells, and having found an organism capable of producing these changes, it remains to show that this organism really does cause the phenomena observed. The proof is direct and it is believed conclusive. It consists in artificially introducing the bacteria into the healthy bark of living trees and noting the results. If in a great number of cases the disease follows such inoculation, plainly spreading from the minute puncture required, and if we are reasonably certain no other active agent is thus introduced, can the conclusion be avoided that the bacteria which we see multiplying and spreading from cell to cell, do certainly cause the observed changes, and thus the disease? This has been done in the most careful manner, and, in case of the pear tree, has been followed by disease in sixty-three per cent of the inoculations!

In a few of the operations small pieces of diseased bark were inserted as in budding, but in most cases the inoculations were performed by dipping a needle or sharp pointed knife into the fluid (distilled water) containing many bacteria taken from diseased trees, and thrusting the wetted instrument into healthy bark. As a counter check a clean needle or knife was frequently inserted in a similar manner in the bark.

In a row of fifty-five pear trees, three years old, certain evidence of blight followed in sixty-three per cent of the inoculations with bacteria, in no case from the puncture with a clean instrument, and in one case only spontaneously, i. e., without conscious introduction by myself. Many ap-

plications of bacteria to the uninjured surface of the bark and the leaves were without result.

Inoculations in a similar way with virus from the diseased pear in apple and quince produced disease identical in every respect with that in the pear. Of those in the apple, thirty per cent only were successful, while one hundred per cent of the inoculations in quince clearly communicated the disease. In the apple the percentage successful was much reduced by the failure of all the inoculations in the bark of portions more than one year old. This may have been due to temporary causes, not to uniform conditions.

Here, then, is given the change in the tissues, a living thing known to produce such changes discovered, and its active agency confirmed by trial. Is it not more than probable that the bacteria really cause the disease?

The experiments above referred to (inoculations) were made during July and August, 1880, and papers based upon these and previous investigations were read by the author before the recent meeting of the American Society of Microscopists, at Detroit, and of the American Association for the Advancement of Science, at Boston. Examinations have since confirmed an expressed opinion that the disease of the peach tree, known as the "yellows," is also due to bacteria. The peach tree parasite, if such it may be called, is less in transverse diameter, being only 1 mm. (0.0000343 inch) thick, and has shorter articulations. The length of what seems to be the typical form is 3.5 mm. (0.0001202 inch). The physiological effects seem to be very nearly the same. The stored starch is destroyed and the cells left otherwise intact.

DESTRUCTION OF OYSTERS BY PETROLEUM.

The setting up of a large petroleum refinery on the shore of San Francisco Bay has been followed by the destruction of the shell fish along a wide reach of shore and the driving away of the shoals of food fish which formerly gave occupation and profit to many fishermen. The question has been before the California Academy of Sciences, and the evidence produced seems to be conclusive that the waste and refuse of the oil works floated upon the water and washed upon the shores are the sole cause of the heavy losses to the fishermen and markets of San Francisco.

A corresponding conflict of interest prevails in this region. The oil works at Hunter's Point have had the effect of spoiling a wide area of shore and river—East River, Hell Gate, and beyond—which once produced large quantities of fish, oysters, and clams. The oystermen and fishermen of Newark Bay and the adjacent waters complain that since the oil works have been established at Constable Hook the refuse oil from them has almost entirely driven the fish from those waters and has seriously injured the oyster crop. Just now they are complaining bitterly against the proposed extension of pipe lines in the waters of Newark Bay and the Hackensack River. The oyster trade of the bay is immense, it being one of the best of our northern fields for oyster seedlings. The fear is that the leakage from the pipes will injuriously affect if not entirely destroy this important industry. The fear is not without just foundation; but the petroleum industry is of such overwhelming magnitude and importance, and is operated by such heavy combinations of capital, that it is doubtful whether, even by an appeal to the State Legislature, the New Jersey fishermen will be able to arrest the evil which threatens them.

The Trans-Sahara Railway.

On his return to Marseilles recently, the chief of the Trans-Sahara Railway expedition, Colonel Flatters, reported the practicability of a route about 200 kilometers south of El Golea, in 24° north latitude. The expedition found a reasonable amount of water, never having been three days without it, and in the course of the exploration a lake was discovered full of fish and surrounded by vegetation. The general character of the soil was a hard sandstone, though for 80 kilometers there was an arid belt of very hard limestone. The whole country is much infested with snakes and lizards, and among the wild animals were antelopes in great numbers. The tamarisk tree grows luxuriantly in the Sahara, acquiring a development of three and a half yards in circumference. The price of salt is enormous, 100 kilos of this necessary article being valued at four slaves. As each slave is estimated at 900 francs, the cost of 2½ pounds of salt is about 28s. Colonel Flatters met with great friendliness on the part of the Tovarags, and he entertains no doubt as to the feasibility of the project.

Tin in Maine.

Referring to our recent article on tin mining in Maine a correspondent in that State writes that the promise of the mine at Winslow continues to be most encouraging, indeed far better than that offered by the best Cornwall mine at an equal depth from the surface. He adds that "with every day's work the seams are widening and rapidly converging towards what must at no great depth prove a champion vein of large dimensions."

Our correspondent is of the opinion, however, that the western portions of the State give indications of more valuable deposits of tin. In this region are extensive belts of gneissoid ledges interspersed with fluor spar, and in several places in Cumberland county fine specimens of cassiterite have been taken from what appear to be well defined seams. Some of these seams were laid open in rock cuttings for railways some years ago, but those who did the blasting knew nothing of mineral ores, and the geologists were looking for other things.

TOOTHED-WHEEL WIRE FENCE.

The engraving represents an improved wire for wire fences recently patented by Mr. Jacob Stoll, and being introduced by Messrs. Jacob Stoll & Co., of Fountain City, Wis. In this wire the usual rigid barb is replaced by a toothed wheel which is capable of revolving, thereby avoiding injury to cattle which may come into contact with it, while it affords a perfect barrier to the passage of either large or small animals.

The wire, as will be seen by reference to the engraving, is made with alternate twisted and looped sections, the latter being pressed inward at the middle to form bearings for the spur or toothed wheels and to receive the wires which bind the two sides of the loop together and also form the main support of the toothed wheels.

Fig. 1 shows a portion of the wire complete, and Fig. 2 shows the parts in detail.

This form of fence wire has a great advantage over those having fixed barbs, as the toothed wheels simply prick the animals without tearing their skin or flesh.

Further information in regard to this invention may be obtained by addressing Messrs. Jacob Stoll & Co., as above.

Another Sinking Railway.

An addition must be made to the list of railway submergences printed in this paper some months ago. One day last summer a strip of railway, eight rods in length, near Ravenna, Ohio, suddenly sank, leaving in its place a pond out of which flowed a stream "the size of a barrel," bearing large numbers of white shiners, sunfish, and rock bass. Gravel, to the amount of 4,000 loads, was thrown into the opening and a new bed made for the road; but the work was no sooner completed than it followed the original part into the same mysterious cavity.

NEW HAMMERLESS GUN.

Mr. William W. Greener, of St. Mary's Works, Birmingham, England, some few months ago turned his attention to breech-loading guns without hammers. The points primarily considered were the important ones of durability and simplicity, combined with safety and easy manipulation, and the engraving shows a gun in which Mr. Greener has successfully combined these essentials.

Fig. 1 is a longitudinal section of the gun, and Fig. 2 is a view from the under side, with the lock plate removed. The barrels are hinged to the breech frame in the usual manner; but instead of the ordinary gun lock without side hammers, the tumblers, A, are made nearly in the form of an elbow lever. These tumblers have their upper ends curved forward, and are provided with a small rounded point, which is arranged to strike through a small hole at the center of the breech piece instead of the ordinary firing pin. The lower front portions of the tumblers, A, are extended forward in the form of a flat arm, and these arms are curved laterally inward, so that their inner ends nearly meet at the center, as shown in Fig. 2, each arm terminating with a small rounded projection on its lower side. These tumblers, A, are located in a recess which also contains the mainspring.

To one of the projections in rear of the joint is pivoted a pendant, C, which plays loosely in a vertical slot in the center of the front arm of the breech frame, directly in front of the converging arms of the tumblers. This pendant has a hook-shaped projection which engages under the front ends of the arms of the tumblers, so that when the rear ends of the barrels are raised the hook raises the arms of the tumblers far enough to permit the dogs, B, to engage in a notch in the tumblers, thus automatically cocking the arm.

To hold the hook, C, back far enough to engage with the arms of the tumblers, a pin extends through a projection on the under side of the barrels. The usual style of triggers are arranged to operate upon the rear arms of the dogs for firing the arm.

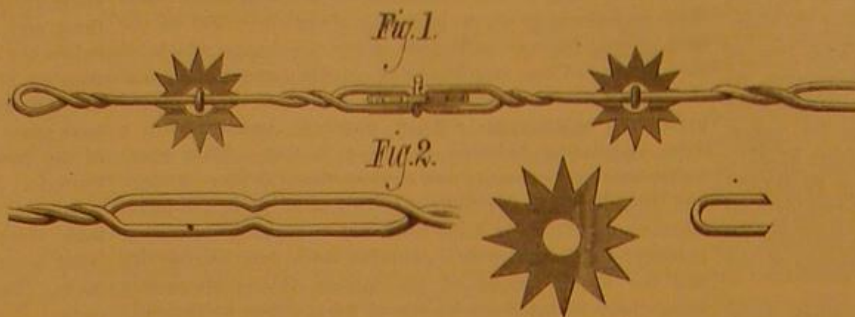
Yale's Heliometer.

The heliometer in process of construction for the new observatory of Yale College will have a six inch aperture and eight foot focal distance. Though an inch less in aperture than the largest instruments in Europe, it is expected that this will be unsurpassed in working efficiency. The cost of the new instrument will be about \$10,000.

The Gabble of Science.

The tendency nowadays to bow down to science, and to measure everything by its scientific standing or importance, has a ridiculous side as well as a good one. The *London Times* comments as follows:

"The popularization of science has its drawbacks, and perhaps not the least of them is the sort of worship, analogous to that of very young ladies for the curate of the parish, which is offered by silly people to those who are—or, more frequently, who are supposed to be—the chief representatives of scientific learning. The absurdities of the so-called aestheticism are not peculiar to gentlemen who lunch upon the sight of a lily, but have their close analo-



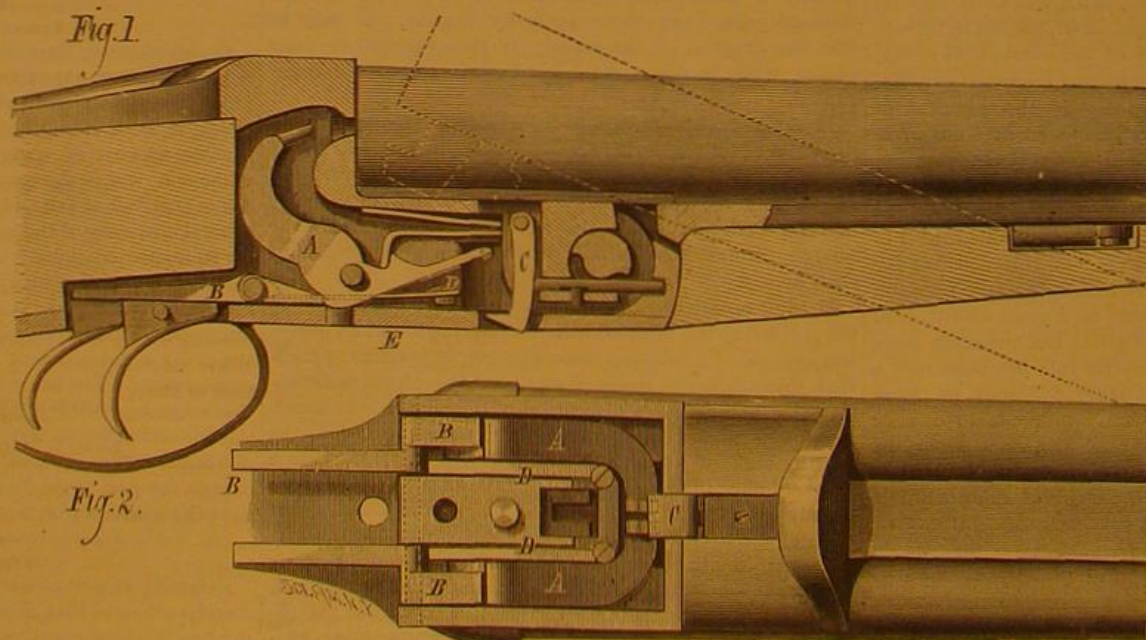
TOOTHED-WHEEL WIRE FENCE.

gies among those who profess to be scientific. There is a scientific jargon as well as an art jargon, both of them, in the lips of most people, concealing, or it may be even exposing, the most profound ignorance of the respective subjects of discourse. And there is a widely spread want of knowledge that the writer who has most successfully popularized a given question is not of necessity the one who is best acquainted with its depths."

The Mountains of North Carolina.

A correspondent of the *Tribune*, who went to the mountains of Tennessee and North Carolina "to avoid the heats of a Northern summer," writes as follows from the summit of Roan Mountain, 6,367 feet above the sea:

The prospect is magnificent; the grandest scenery in the United States east of the Yosemite. Over 100 mountain tops, not one of them less than 4,000 feet in height, are in full sight. This uplift in the heart of the Alleghanies, the Unaka range to the north, the Blue Ridge to the south, is declared by Prof. Gray, of Harvard, to be "the most beautiful mountain east of the Rockies." The flora on its sides changes with its increasing altitude. Chestnuts, sycamores, and maples clothe the base of the mountains, yellow birches and magnificent wild cherries line its sides, and beeches, alders, fir balsams, and immense groups of rhododendrons crown all but the very crest. On the top are 1,500 acres of the richest mould; the winds sweep the crest too fiercely for trees. Here botanists love to come to study mountain flora. Pro-



GREENER'S HAMMERLESS GUN.

fessors Gibbs and Goodale, of Harvard, have left us, but seven other scientists remain to seek health and to study science. Here they find mountain heather, superb groups of rhododendrons, azaleas, and other shrubs and grasses that can be found nowhere else in America. They will not grow at lower altitudes or on the same height in other places.

The fauna of these mountains is that of much colder regions. Little snow birds abound. They find the temperature their nature craves a thousand miles this side of Canada. An occasional eagle, numerous buzzards, and many robins fly around. Great clouds of fog fill the valleys, and at times sweep the mountain top. But the atmosphere is of

such slight density that no moisture is felt even in the midst of a cloud. Waves of fog roll visibly by and fold one in their white embrace, but leave everything dry; dampness is a thing unknown. The hygrophant morning and evening records from 85° to 96° of moisture, a very large percentage; yet no dampness is felt on dress or skin. The springs are delightfully cool. The one nearest the hotel is only 13° above freezing. Ice is unneeded here.

NEW INVENTIONS.

An improvement in hand trucks, patented by Mr. William May, of Binghamton, N. Y., consists of a double hook hinged on the lower part of the truck frame, so that it may be thrown up or open to rest upon the toe or end cross bar of the device, and operate, in combination with a hook that slides on the central longitudinal bar of the truck, to take hold of and hold a barrel, cask, or large box, the double hook being so hinged that it can be turned or folded down for the purpose of adapting the hand truck for the conveyance of bags or other articles that might be injured by contact with them.

A toy bank, made in such a manner that coin cannot be shaken out through the inlet openings, has been patented by Mr. Edward L. Gobisch, of Jersey City Heights, N. J. The invention consists in combining with the top of a toy bank a flattened inlet tube having keepers attached to the lower ends of its edges, wires sliding in the keepers, and carrying a plate, so that when the bank is inverted the inner end of the inlet tube will be covered, and the escape of coin prevented.

An improvement in the class of heating stoves and grates in which cylindrical pipes are employed to form the inner side walls of the same, the pipes being open at the ends to allow air to enter and pass through them, and thereby become heated, has been patented by Mr. Ross Hall, of Millersburg, Ohio. The invention consists, first, in forming the inner wall or walls of the fire chamber or space of a stove or grate of pipes, having in cross section the form of a triangle (preferably an equilateral triangle), securing a greater heating surface than is practicable with pipes of cylindrical or oval form.

Mr. Enos P. Miles, of Clay Center, Kan., has patented improvements in the arrangement and operation of the evaporating pans and the furnace flues and dampers for regulating the direction and quantity of heating passing under them, the object of which is to supply to the pans a gradually decreasing heat suitable to the successive stages in converting the juice to sirup.

An improved balance slide valve has been patented by Mr. Edmund Haug, of Whistler, Ala. The object of this invention is to secure equal steam pressure upon the top and bottom of a steam engine valve as soon as expansion takes place in the cylinder.

Mr. Thomas B. Cook, of New Lancaster, Ind., has patented an apparatus for filling ditch scrapers, so constructed that the scrapers can be filled more rapidly and with less labor than when the ordinary apparatus is used. The invention consists in a lever anchored at one end by a double clevis, two chains, and two stakes, and provided with a hook and chain to receive the scraper. A shoe or wheel supports the free end of the lever.

An apparatus for raising and lowering the sashes and covers of forcing boxes, cold frames, and similar uses, so constructed that a number of sashes and covers can be raised at the same time and by the same operation, has been patented by Mr. Lewis G. Stocking, Burlington, Iowa.

A combined ash sifter and bucket, so constructed that the ashes may be sifted in a room without raising a dust, has been patented by Mr. Charles C. Burnett, of Iowa City, Iowa, and which, at the same time, will be convenient in use, strong, and durable.

The invention consists in a combined ash sifter and bucket formed of the bucket made with an offset and slots in its upper part, and having a pivoted bail, the sieve having a supporting flange and a handle, and the sliding guard plate to prevent fine ashes from escaping.

Mr. Charles H. Shaw, of Troy, N. Y., has patented a durable and effective clasp that can be attached to the bracelet without soldering.

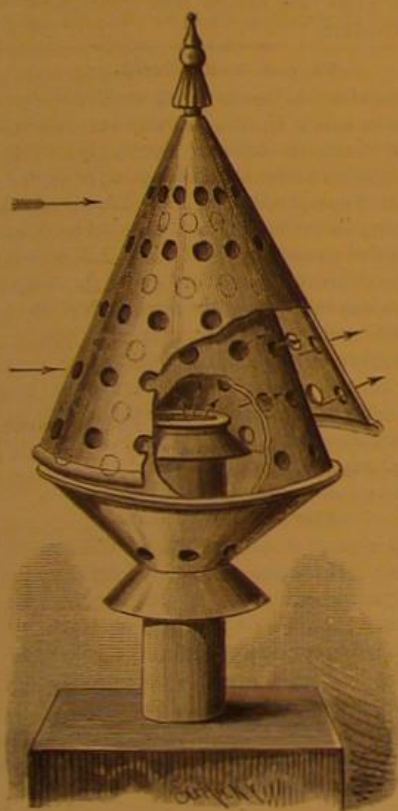
Mr. John A. Harrington, of Groesbeck, Texas, has patented a simple device for preventing the tire from becoming loose because of the shrinking of the felly, and for preventing the loosening and rattling of the spokes.

Method and Apparatus for Destroying Fire Damp.

When fire damp or carbureted hydrogen has accumulated in large quantities in a mine it has been the custom heretofore to vacate the mine and fire the gas. This process is ordinarily attended with great danger, and it has been found that the gas, when lighted, will, in most cases where the gas is heavy, first burn slowly, and as the flame increases in volume the gas will become highly heated from contact therewith, and, being driven into a confined space, will be caused to explode with great violence, and will destroy the timbering of the mine and choke up its passages with debris, which will render them inoperative and oftentimes result in the loss of life. Robert Blackledge, of Enfield, Conn., seeks to overcome this danger by the employment of a great number of separate flash torches or rockets, that are to be distributed over the mine in various places, wherever the gas may be accumulated, and that may be lighted at such points simultaneously or in quick succession, so that the gas will be lighted at a new point before the flame from the first point lighted shall have reached the second point. By this means the gas may be ignited at the farthest point from the pit's mouth first, and carry the gas flame, after damp, and smoke forward toward the mouth of the pit or the nearest draught outlet, where the greater part of the poisonous gases of combustion and the gases remaining unconsumed will escape with the draught harmlessly. The method and apparatus for accomplishing this was patented September 21, 1880.

NEW CHIMNEY CAP AND VENTILATOR.

We give an engraving of a novel and simple chimney cap recently patented by Mr. William D. Bartlett, of Amesbury, Mass.

**BARTLETT'S CHIMNEY CAP AND VENTILATOR.**

It is designed to meet all the conditions necessary to the perfect working of a chimney or ventilator, and works equally well in a high wind or perfect calm. In this respect it is claimed that this device has great advantages over others intended for the same purpose, and in its construction it is certainly as simple as could be desired.

The chimney cap consists of a perforated cone closed at the bottom and forming a housing around the escape flue, which cap is fitted with a perforated conical hood that is slightly larger than the fixed cap, and is hung loosely at its apex, so that it may swing freely. The holes in the hood do not register with those in the fixed cap, so that as the hood is pressed by the wind against the cap the openings are closed on the windward side, while there is free exit at the opposite side.

The cones are broken away in the engraving to show the internal construction.

This device is adapted equally well to chimneys and to ventilating shafts or flues.

The Comet in Pegasus.

The comet discovered by Lewis Swift in the constellation of Pegasus is as large as any nebula north of the equator, except the nebula in the triangles and the great nebula in Andromeda. It can be seen in moonlight, but is not a bright object. It may be the comet of 1812, but this is a mere surmise. The condensation and nucleus are eccentric, evidently indicating the presence of a tail greatly shortened. The comet is so nearly in opposition that the tail is about on a line joining the earth and sun. Its slow motion indicates that it is either approaching the earth or receding in almost a direct line. If approaching it may be an object of great interest. Its apparent size indicates that it is either quite near the earth or else enormously large.

Paper Making Industries in China.

The Commissioner of Customs at Wuhu (China), in a report recently issued, states that paper is very extensively manufactured in the numerous little villages situated in the valleys among the hills, about eight miles to the southeast of the city of King-hien. It is made from the bark called T'an-shu-p'i, the paper-mulberry tree bark, and wheat straw, which, after having been well washed and boiled with a certain proportion of lime, is again washed, and then exposed to dry for a whole year on the sides of the hills, in spots where the grass and brushwood have been previously cleared away for this purpose. After the year's exposure, it is washed once more, and then pounded on a stone with a large wooden hammer; it is supposed to require 1,400 blows from this hammer to reduce it to the necessary consistency; after which it is removed to another building, and left to soak until it becomes quite a pulp, in a large earthenware vessel, containing a liquid glue, made from boiling the branch of a tree called the Yangkowi'ng, a species of hooked vine. This pulp is then put into a cistern of water, and well stirred up with a stout stick. A finely made bamboo frame, or sort of long oblong sieve, is taken by two men, one at either end, and dipped twice into this liquid, which is made to run equally over the whole surface, somewhat after the manner in which the photographer allows the developing solution to run over his plate. By this means, a thin and tolerably even layer is left, which soon partially dries and forms the sheet of paper, and which is removed by simply reversing the frame. As soon as a sufficient number of sheets has been made, they are taken to the drying room. This room contains a large brick oven, coated on the outside with lime, and built up to within a few feet of the roof. Upon the top of this oven the paper is placed, in parcels of about a foot in thickness, until perfectly dry; after which sheet by sheet is damped once more, and while still moist, is by means of a soft brush made to adhere to the sides of the oven for a short time, to undergo its final process of drying. It is then taken away to the packing room, and made up into bales, weighing from 80 to 120 catties each, the catty being equivalent to 1½ lb. avoirdupois. The largest sized paper is about one "chang" (11¼ feet) long, and is worth one dollar a sheet. This particular size of paper is made entirely from the T'an-shu-p'i, but the smaller sizes are composed of a mixture of the above-mentioned bark, or the bark of the paper-mulberry tree, and wheat straw. This paper is known by the name "Suan-chih," and is considered a good quality paper in the Chinese markets.

The Grotto Under Mount Rossi, Sicily.

The eruption of Mount Etna in 1669, says *La Nature*, was the most formidable of historic times. The side of the mountain opened for a length of about four miles, and there issued from it a torrent of lava four miles broad, which, after destroying several villages and half of the city of Catane, flowed into the sea and formed a promontory two miles long by half a mile wide and sixty feet high. At the same time the scoria and sand thrown out by the craters formed a mountain with a double crest, that was at first called Monti della Rovina, and later Monti Rossi, on account of the reddish color that the scoria on the two crests assumed through the oxidation of the iron contained in it. The higher of the two crests is about 800 feet above Etna, and about 3,000 feet above the sea. In the interior of the cone of Mount Rossi there are two immense extinct craters, exhibiting the characteristic funnel-shape, and the sides of which are formed of scoria in a decomposing state. Up to 1823 no one had had the curiosity to descend to the bottom of these craters; but at this period the intelligent observer, Mario Gemellaro, undertook their exploration. He saw with some surprise a horizontal aperture at the bottom of one of the cavities, and entering it with a torch, he found, after traversing a suite of corridors resembling the galleries of a mine, a large well, into which he caused himself to be lowered by means of ropes. At some feet from the bottom of this well he found a vast rectangular room, at the further end of which there was a passage which grew smaller and smaller, and at last became impassable. This remarkable grotto, which was named Grotto della Palombe, is situated exactly in the center of Monti Rossi. It has now been opened to travelers, the descent being facilitated by a stairway, and the cavern being illuminated by magnesium light instead of the former resinous torches.

Concussions as the Cause of the Oil Fires.

To the Editor of the Scientific American:

Having noticed in your columns the troubles of the oil regions, I thought I would make a few experiments with a view to learn the true reason of the tanks being fired. I find that under certain conditions a mixture of oil vapor and water vapor can be fired by concussion. I would suggest as a remedy a floating cover to each tank. The amount of oil lost by evaporation would pay the cost of such cover, and it would always act as an extinguisher. Heavy thunder is the probable cause of the fires. D. F. STAFFORD.

Skipanon, Clatsop Co., Oregon, October, 1880.

TWINKLING OF THE STARS.—This is generally conceded to be due to moisture in the upper air. M. Montigny, in a paper published in *Les Mondes*, holds that very pronounced twinkling of the stars indicates either commotion in the upper regions of the atmosphere or a sudden fall of temperature there, thus denoting the conditions of an early appearance of bad weather.

Rare Elephants.

There are now on exhibition in this city two peculiar elephants brought from the mountains of the Malay peninsula, about 800 miles from Singapore. They are remarkable for their small size, being respectively 28 and 36 inches tall; and for being covered with a thick coat of bristly hair or wool. They are supposed to be from five to seven years old. In size they resemble the extinct elephants of Malta, and it covering, those of Siberia. Their woolly coat is attributed to the circumstance that they live high upon the mountains where the climate is cold. The species appears to be all but unknown to naturalists, the pair being the first that have survived the passage through the heated low country to the coast and the subsequent journey by sea. The sailors on the steamer which brought them—the *Oxfordshire*, Captain C. P. Jones—named them Prince and Sidney. They are described as playful and harmless, and they keep their little trunks stretched out to strangers to be petted. They love to be scratched on the under side of the trunk close to the mouth, and they hold their trunks curled back over their heads as long as any one scratches them. Like elephants of larger growth, they keep up a swaying motion, either sidewise or forward and backward. When a visitor lets one of the little fellows take his hand he delicately curls his proboscis around it and carries it gently to his mouth. Then he trumpets his satisfaction.

IMPROVED NURSERY CHAIR.

The engraving shows a light and convenient nursery chair recently patented by Mr. J. C. Klett, 260 West 37th street, New York city. When in use it appears as in Fig. 1, but it is readily folded into the compact form shown in Fig. 2.

Fig. 1**Fig. 2****KLETT'S NURSERY CHAIR**

The chair is composed of a back, two hinged sides, and a hinged seat, all of which are provided with hooks or catches for retaining them in position while the chair is open for use. The chair is also provided with a pivoted shelf which serves as a stay for the sides and is readily separated from the other parts for packing. This chair is very convenient for regular every day use in the nursery, and is a necessity for persons traveling with children. It folds so compactly and is so light that it may be readily carried in the trunk.

Further information may be obtained by addressing the inventor as above.

Lowell Mills Burned.

Two important Lowell mills, the Chase and the Faulkner, were destroyed by fire October 6. The former was of brick, 225 feet long by 60 wide and 68 feet high, five stories on the front elevation and six in the rear, with a one story L, used as a boiler house. The mill contained 12 sets of cards, 6,600 spindles, 60 broad looms, 40 of them newly equipped last year. It was built in 1863, and gave employment to 300 hands.

The Faulkner mill was of brick, 91 by 54 feet, five stories high, and a three story L, 25 by 54 feet. It had 8 sets of cards, 2,720 spindles, and 44 looms, employing 100 hands. The annual production of the two mills was 750,000 yards of fancy cassimeres and cloakings, consuming 600,000 pounds of wool.

Preserving Rubber Instruments.

Various articles and instruments made of rubber are apt, with time, to become dry, to crack, grow brittle, and lose their elasticity. Dr. Pol recommends the following simple mixture: Water of ammonia, one part; water, two parts; in which the articles should be immersed for a length of time, varying from a few minutes to one half or one hour, until they resume their former elasticity, smoothness, and softness.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to recognize the planets.

M. M.

POSITIONS OF PLANETS FOR NOVEMBER, 1880.

Mercury.

Mercury will probably be seen after sunset early in November. The planet will be 9° south of the sun in declination, and will set about an hour after the sun on the 1st. The best time for seeing Mercury will be on the 3d or 4th. The crescent moon will pass east of Mercury on the morning of the 4th.

Mercury will approach the sun, and will scarcely be seen after the 15th.

Venus.

On November 1 Venus sets at 6h. 14m. P.M. On November 30 Venus sets at 6h. 46m. P.M.

It will be brilliant in the southwest all through November, setting farther and farther south until the 21st. The crescent moon will pass eastward of Venus on the 4th.

Mars.

Mars is not likely to be noticed in November. On the 1st of the month it rises at 6h. 26m. A.M., and sets at 4h. 45m. P.M.

On the 30th Mars rises at 6h. 16m. A.M., nearly an hour before sunrise, and may perhaps be seen preceding the sun and about 2° north of the sun in declination.

Jupiter.

Although Jupiter has passed its best position, ordinary observers will scarcely perceive its diminished brilliancy.

On November 1 Jupiter rises at 3h. 47m. P.M., and souths before 10 P.M., at an altitude of 51° in this latitude.

The moon passes north and east of Jupiter on the 13th. On the 30th Jupiter rises at 1h. 48m. P.M., and passes meridian before 8 P.M.

Making our observing hours between 8 and 10 P.M., we find from the "American Nautical Almanac" that the two satellites nearest to Jupiter (the 1st and 2d) may be seen to pass from the face of Jupiter nearly together on November 1, so that Jupiter will be seen at first with two moons only; on November 8 the same two may be seen to enter upon the planet's face again nearly together.

On November 9 the first satellite may be seen to come out from the shadow of Jupiter; on the 16th and 23d this satellite will go behind Jupiter.

On November 24, while the first is in transit, the second will disappear by going behind Jupiter, so that Jupiter may be seen with only two moons.

On November 10 the largest satellite will be seen to move slowly away from Jupiter, and the smallest moon will come out from the shadow. On the 17th the largest satellite may be seen to move toward Jupiter, while the smallest is again hidden in eclipse.

On November 28 the third will enter the shadow of Jupiter early in the evening and remain more than two hours, when it will come out and slowly regain its brightness.

Saturn.

Saturn follows Jupiter, coming to the meridian 50 minutes later, all through the month of November, and reaching an altitude about 4° higher than Jupiter.

On the 1st Saturn rises at 4h. 27m. P.M. On the 30th at 2h. 24m. P.M.

The moon passes east of Saturn on November 14.

Saturn appears small and pale beside the glowing color of Jupiter, but it even surpasses Jupiter in interest. Of its eight satellites, very few can be seen with ordinary telescopes. Titan, the largest, was west of the planet on October 7, and nearly at its greatest distance. As this moon goes around Saturn in a little less than 16 days, it will be seen again far west of the planet on October 23, and far east of Saturn on the last day of October. Its revolutions around can be counted in this way.

Japetus can probably be readily seen in its orbit path far from Saturn, and requiring about 80 days for a revolution.

A telescope which will show Rhea, the next smallest satellite, will afford a great source of interest, as Rhea goes around the primary in 4½ days, and its motion can be seen in one evening.

The ephemeris of these satellites, published by Mr. Mentz in the "Astronomische Nachrichten," gives Rhea as in conjunction with the center of Saturn, and below the base of the planet, on November 12, a little after midnight, Washington time.

A good telescope of three inches aperture will enable an observer to see Rhea at that time.

Uranus.

Uranus rises on November 1 at 1h. 46m., and on the 30th at 11h. 52m. P.M.

Its diurnal path is almost wholly between midnight and noon.

Neptune.

Neptune is in excellent position early in the month, on the meridian near midnight, at an altitude of 62°. On November 30 Neptune crosses the meridian circle at 10 P.M.

The Electrical Spur.

As a supplement to the electrical bit, noticed by us some time ago, it may now be stated that Mr. G. Hüttmann, imperial equerry at Vienna, employs the electrical current in a very ingenious manner in order to facilitate the management of the horse, especially for ladies.

To the left side of the saddle a small box which contains a galvanic battery and an induction coil is fastened. From this apparatus two silk coated wires are conducted to a special girth-leather, which end into two blunt metallic brushes touching the flank of the horse at that place where usually the spur is applied. These wires are also connected with the riding whip, which has two ivory knobs. By a pressure of the finger upon one of these knobs the current is closed and conducted to the wire brushes, where it acts as a spur in a strong and sudden manner, while when the other knob is touched a weak and continued current is originated, acting like the pressure of the thigh of the rider.

The electricity may not only be used by ladies, but will also prove useful to the equestrian performer in the circus in order to manage several horses at the same time, and to the groom in order to prevent horses from crib-champing and other bad habits. In Paris electricity is also used for preventing carriage horses from running away, a battery being connected with the bit of the horse.

THE FAN-TAILED POODLE.



The *Deutsches Familienblatt*, of Berlin, gives the above, which it styles "A new American invention—dedicated to the Society for Preventing Cruelty to Animals."

Hot Ice.

In his experimental investigations of the boiling points of substances under low pressures, Mr. Thomas Carnelley has been able to maintain water in the solid state at temperatures far above the boiling point of water. The conditions under which it is possible thus to heat ice he describes as follows:

"1. In order to convert a gas into a liquid the temperature must be below a certain point (termed by Andrews the critical temperature of the substance), otherwise no amount of pressure is capable of liquefying the gas. 2. In order to convert a solid into a liquid the pressure must be above a certain point, which I propose to call the critical pressure, otherwise no amount of heat will melt the substance. If the second of the above conditions be true, it follows that if the necessary temperature be attained, the liquefaction of the substance depends solely on the superincumbent pressure, so that if by any means we can keep the pressure on the substance below its critical pressure no amount of heat will liquefy it, for in this case the solid substance passes directly into the state of gas, or, in other words, it sublimates without previous melting."

By maintaining a pressure below 4-6 millimeters of mercury—that is, the tension of aqueous vapor at the freezing point of water—Mr. Carnelley was able to keep water frozen in a vessel so hot that it would burn the hand. Other substances also exhibit these same phenomena, the most notable of which is mercuric chloride, for which latter the pressure need only be reduced to about 4-20 mm. On increasing the pressure the substance at once liquefies.

Shooting Oil Wells with Nitro-glycerine.

A few years ago nitro-glycerine was only used in the oil wells in the very small quantities of one or two quarts at a time. Within a short period it has become a very important agent in bringing petroleum to the surface. When exploded in the oil wells over the oil-bearing rock it opens wide seams, through which the oil flows with great force and freedom, thus saving much labor and expenditure of capital. There is now used in every well that is drilled from thirty to two hundred pounds, which is worth eighty cents a pound to the producer. It costs about thirty cents to manufacture, and nets fifty cents on every pound to the manufacturer. Thousands of pounds are consumed every month, and there is a growing demand for it.

A correspondent of the *Sun*, who had assisted at the reopening of one oil well by the explosion of 100 pounds of nitro-glycerine at its bottom, gives the following description of the operation: A cartridge case or shell of tin, 15 feet long, was lowered into the casing of the well by means of a wire rope, and then filled with water. The glycerine was then poured into the shell, and, being heavier than water, forced the latter to flow out. When all the glycerine had been poured in the shell was lowered 1,800 feet into the well, and there rested on what is called an "anchor," 25 feet from the bottom. It was now ready to be set off. There was about 700 feet of oil above the shell. Through the center of the shell ran a small tin tube, inside of which was a small iron rod in four pieces. On the end of each piece was placed a common percussion cap. At the top of this rod was a tin plate so arranged that anything dropped down through the

casing would strike it, and the force of the falling article would set off the caps, which would in turn explode the nitro-glycerine. The charge was exploded by dropping a small piece of iron tubing into the well. At the moment of discharge "the earth trembled violently, then came a dull sound, and a second later there rose into the bright moonlight, 100 feet high, a solid stream of oil, which fell on everything near, and continued to fall for three minutes. This stream of oil was one foot in diameter when it began to flow, but it soon settled down to a stream of about 1½ inches, which is a natural flow."

AGRICULTURAL INVENTIONS.

A sulky plow, patented by Mr. Thomas T. Harrison, of Aubrey, Kansas, is an improvement on the sulky plows for which Letters Patent No. 218,734 were issued to the same inventor August 19, 1879. The improvement simplifies the construction and renders the plow more easily controlled.

A fruit gatherer, for gathering oranges and other fruit without bruising or injuring the fruit or trees, has been patented by Mr. Levi J. Knight, of Manatee, Fla.

Mr. Lewis Y. Lenhart, of Red Wing, Minn., has patented a seed planter, so constructed that it may be operated from the drive wheel or by hand power, as the character of the ground may require.

Messrs. William V. Morgan and Thomas W. Hackman, of Allerton, Iowa, have patented an improved sulky plow so constructed that the plows may be easily attached to and detached from the carriage, and may be readily adjusted and controlled.

Mr. John H. McPherson, of Xenia, Ohio, has patented a tooth for grain drills, so constructed that it can be readily detached for sharpening and for convenience in passing from place to place, and which will swing back should it strike an obstruction.

Thread from Wood.

The manufacture of thread from wood for crochet and sewing purposes has, it is said, recently been started at the Aby Cotton Mill, near the town of Norrköping, in the middle of Sweden. The manufacture has arrived at such a state of perfection that it can produce, at a much lower price, thread of as fine quality as "Clark's," and has from this circumstance been called thread "à la Clark." It is wound in balls by machinery, either by hand or steam, which, with the labeling, takes one minute twelve seconds, and the balls are packed up in cardboard boxes, generally ten in a box. Plenty of orders from all parts of Sweden have come in, but as the works are not yet in proper order there has hardly been time to complete them all. The production gives fair promise of success, and it is expected to be very important for home consumption.

The Public Domain.

The annual report of Commissioner Williamson, of the General Land Office, shows that there were surveyed during the fiscal year ending June 30, 1880, 15,699,253 acres of public lands and 652,151 acres of private land claims. This is an increase in the amount of public lands surveyed of 725,347 acres over that of the last year. This great increase is attributed to the operation of the act of March 3, 1879, which led to a great increase in the number of applications by private individuals for public surveys. Disposals of public lands during the year were made as follows:

	Acres.
Cash entries.....	850,740
Homestead entries.....	6,045,570
Timber culture entries.....	2,193,184
Agricultural college scrip.....	1,280
Locations with military bounty land warrants.....	88,522
Swamp lands patented to States.....	3,757,888
Lands certified for railroad purposes.....	1,157,375

The area of public lands surveyed in the different States and Territories during the last year is as follows:

	Acres.		Acres.
Arizona.....	308,521	Nebraska.....	709,179
California.....	3,792,690	Nevada.....	938,694
Colorado.....	2,775,601	New Mexico.....	1,634,156
Dakota.....	2,130,808	Oregon.....	1,052,221
Idaho.....	225,657	Utah.....	440,555
Louisiana.....	80,504	Washington Territory.....	847,595
Minnesota.....	236,253	Wyoming.....	184,449
Montana.....	302,413		

In addition to this, surveys were made of private land claims in three States and Territories, as follows: California, 58,708 acres; Arizona, 149,258 acres; New Mexico, 444,184 acres. The total area of public lands surveyed from the beginning of surveying operations up to the close of the last year is shown to be 752,557,195 acres, leaving an estimated area yet unsurveyed of 1,063,231,727 acres.

The Chester Steel Castings Company have just completed another addition of 60x90 feet to their works at Chester. The superiority of their steel castings for many purposes is becoming better known by locomotive and steam engine builders and machinists generally, and their orders have increased largely. They claim that their castings finish up smoother, admit of a finer polish, and will resist a greater amount of wear and tear than iron forgings, and require less labor in finishing, as a casting can be made nearer finished size than a forging.

An Elevated Railway for Costa Rica.

The government of Costa Rica has entered into a contract with J. Mosen-Chiarin for the construction of an elevated railroad from San José, the capital, to Rio Sucio, there to connect with the railroad in course of construction from Limon. The work is to begin within six months from August 9, and to be ready for traffic within ten months from the same date.

On the Production of Ice and Cold by the Binary Absorption System of C. Tessié du Motay and Aug. I. Rossi. Patented Feb. 3 and June 8, 1880.

In the different systems so far used for the production of ice and cold (excepting the air machine and the Carré machine), recourse has been had to the volatilization of a liquid by relieving the pressure exerted by its vapors on itself by means of a vacuum pump, driven by a steam engine, a mechanical compression, aided by the cooling produced by a circulation of water in a condenser, being invariably the means employed to effect the liquefaction of the vapors, so as to render the cycle of operation continuous. A difficulty has been encountered at the start.

With most of the liquids to which preference has been given the tensions of their vapors, at the temperatures of ordinary running water, reach very high figures. These pressures follow a physical law, keeping an absolute and mathematical relation with the temperatures. In most temperate climates, during the warm season, running waters, or such as are supplied from hydrants in cities, are at a temperature not below 75° Fah., and even more. In these conditions liquid ammonia has a tension of 150 to 160 lb. per square inch; chloride of methyl, 80 lb.; methyl ether, 78 lb.; sulphurous dioxide, 60 lb. In tropical climates, and under many latitudes in the United States where waters are above 85° and 90° Fah., the above figures are higher yet. These may be found the causes of many unsuccessful attempts made to introduce industrially the manufacture of ice.

These pressures render difficult the keeping of joints tight. Hence leaks follow, causing a loss of material and consequent failing in production; in short, the successful operation of these machines is interfered with. The machines have to be carefully constructed, at a great cost, and require for some of these liquids very elaborate and complicated mechanism.

Large quantities of water are necessary for the condensation of the vapors, otherwise the outflowing water will reach temperatures much above 75° Fah., and as a consequence the resulting pressures will be much above the figures above quoted. This question of condensing water plays a very important part in the introduction of ice machines for specific purposes. In certain industries, such as in breweries, where this water is scarce or has to be paid for, it has been found to be a cause of exclusion of many machines. Certain of the liquids employed besides have special chemical properties, which render their use attended with other causes of trouble; among other properties, their action upon metals when in presence of water.

In the "Practical American," vol. 1, No. 5, New York, May, 1880, it is stated that the destruction of a large anhydrous sulphurous oxide machine (system of Mr. R. Pictet, of Geneva), which was in operation in St. Louis during the meeting of the American Association for the Advancement of Science, in 1878, was caused by an accident of this kind; a small pin hole in a casting having given access to more moisture, the sulphurous dioxide employed was transformed into sulphuric acid, causing the moist spot to become more and more corroded, until at last, in one night, all the gas escaped through this hole, and thus was lost the whole charge of the machine, some 4,200 lb., and the condenser destroyed.

About a year ago Messrs. C. M. Tessié du Motay and Auguste I. Rossi, in experimenting on the ethers, have found that, in general, the ethers formed by the acids, as well as their alcoholic radicals, possess the property of absorbing sulphurous dioxide, some of them to the extent of 300 times their volume of gas in certain conditions, ordinary ether standing foremost. They have based on this property a new system for the artificial production of ice and cold, which they have called the "binary absorption system," a graphical description of which has been given in this paper (February 21, 1880).

In this system the liquid employed is the ethyl-sulphurous dioxide obtained from ordinary ether by saturating the latter with sulphurous gas. This liquid, at a temperature of 60° to 65° Fah., has no pressure and can be kept readily in glass bottles at 80° to 90° Fah; it has only a few pounds tension—2 to 5 pounds. Thus a machine charged with it, when stopped, will actually show no pressure on the gauges, and even a vacuum at rest, if the temperature is low; while with the other liquids mentioned above, even the stoppage of the machine does not prevent the pressure of the vapors inside to soon reach its point of equilibrium with the temperature outside, and even at as low temperature as 32° Fah., sulphurous dioxide alone, as used in the Pictet machine, has still 15 pounds per square inch of pressure; exerting thus a constant and increasing pressure on the vessels containing it, and in case of a small leak starting causing the entire loss of the charge. What is said here of sulphurous dioxide applies with still more force to the liquid ammonia, methyl chloride, methyl ether, all liquids of which the vapors have higher tensions yet than sulphurous dioxide at the same temperatures.

Now, if such a binary liquid is evaporated under a vacuum it is resolved into its two constituents, the mixed vapors entering the pump together, then under a small compression ether liquefies first, a few pounds pressure being sufficient for it, even with waters such as are met in tropical climates. The ether thus liquefied absorbs in the condenser the vapors of sulphurous dioxide, reconstituting the "binary liquid," and thereby avoiding the excess of mechanical compression which would have been otherwise necessary to effect this

liquefaction of the dioxide. Thus to the work of compression of the pump is substituted a power of chemical affinity and absorption of the less volatile absorbent for the vapors of the most volatile. Thus, to the advantages of low pressure of ether are combined the advantages of intensity of cold produced by the volatilization of the sulphurous dioxide, avoiding its drawbacks. In presence of water and of the ether the sulphurous dioxide is transformed, not into "sulphuric acid," as before, but into "sulphuric acid," the action of which acid upon metals is insignificant if not absolutely null. The sulphurous acid being an extingisher relieves the ether of one of the drawbacks of its use, and acting as self-lubricant renders the greasing of the working parts unnecessary.

In a machine on exhibition at Messrs. C. H. Delamater & Co.'s, foot of 14th street, N. R., which has been running several months, making 6 tons of ice daily, the pressures in the condenser in normal and regular running have been of 14 to 15 pounds, reaching as low as 10 and 11 pounds in best conditions, and not higher than 20 to 23 pounds in the most unfavorable conditions of water, etc.

The water used for condensation has been $\frac{1}{4}$ to $\frac{1}{2}$ that used and necessary for a Pictet machine of same production, the pressures being $\frac{1}{2}$ to $\frac{1}{4}$.

In these conditions of pressure the machine has worked easily and without wearing, the gauges stopping at 0 when machine was stopped, thus rendering leaks impossible at rest, and reducing them to a practical minimum when running. After several weeks of running, day and night, the machine was examined and the different parts working were found in perfect order, showing that there has not been any corrosive action of the liquid upon metals.

Owing to the small pressures, these machines are much simpler in their details of construction; all complicated valves, cocks, or other mechanical contrivances required for others can be dispensed with, three ordinary globe valves, such as are used for steam, being all that is necessary. Their attendance is easy, as it can be ascertained from parties who have them in use in breweries.

The machine working at C. H. Delamater & Co. since April, has been making 6 tons daily of solid, merchantable ice, which was readily disposed of in the market as fast as made, at prices leaving a large margin for profits. This machine, which is still in full operation, is open to the examination of the public.

The New York Ice Machine Co. (Room 54, Coal and Iron Exchange Building), which has bought the rights to the patents of Messrs. C. Tessié du Motay and Aug. I. Rossi for the United States, have one of these machines working successfully at Ph. Schaefer's Brewery, 59th street and 10th avenue, where it gives entire satisfaction. The proprietors consider it a "simple, practical, easily attended machine," doing all it was guaranteed to do. It cools the cellars of said brewery, keeping them at 40° Fah.

Several other machines are either in course of construction or being put up at other breweries or for making ice in and outside of this city.

Another machine which is completed now and will be ready to work at Hotel Vendome, in Boston, Mass., as soon as this hotel will be opened to the public, will have to cool provision rooms, wine rooms, cellars, making besides half a ton of ice for consumption and 200 carafes daily.

Hose Pipe Nozzles.

Who is going to invent the nozzle of the future? There is no nozzle that we have ever seen that seems to us to control the stream it delivers as it should do. Instead of projecting a solid stream for a long distance, the water breaks soon after leaving the nozzle, and soon sprays and breaks up altogether. We often hear of steamers throwing 250 and 300 feet, but we recently heard a veteran chief say that he had yet to see the apparatus of any kind that would throw a solid stream 100 feet. The difficulty may be all with the water, which is naturally inclined to separate, but we are of the opinion that part of the trouble lies in the construction of the nozzle. An experiment made at Boston by putting a core into a play pipe, and thus dividing the stream into four parts, depriving it of its rotary motion, showed a gain of thirty feet in distance playing. But even this does not seem sufficient. Our steamers give us power enough for throwing, and the hose in use gives every facility for carrying a large volume of water; there should be some means devised for delivering that volume in a solid stream at long distances. Great difficulty has been found in making nozzles operate uniformly at all times. A manufacturer of steamers once found a nozzle that gave him great satisfaction; with it his steamers could throw greater distances than with any he had ever tried before. He ordered half a dozen just like it. The half a dozen were made precisely like the first, but never equaled it in delivering water. There is much to be learned yet regarding this question of delivering water on fires, and the exact relations existing between pressure, hose, play pipes, nozzles, and the friction of water more clearly understood. —Fireman's Journal.

Dried Potatoes in California.

A California inventor has made a machine for pressing and drying potatoes so that they will keep for years, yet preserve their natural flavor. No chemicals are used in the operation of curing, everything being done by a simple machine capable of pressing six hundred bushels of potatoes in twenty-four hours. The machine not only presses the potatoes, but lays them on a tray in a concave form with

the hollow side down. After the pressure they are put into a drying apparatus, where they remain for two hours, then they are ground into coarse meal resembling cracked rice.

The first shipment of these preserved potatoes to Liverpool, last year, brought a large profit. The average price of potatoes in San Francisco is about twenty-five cents a bushel. Dried, they brought in England forty-five shillings a hundredweight, or at the rate of a dollar and a half a bushel for green potatoes. This year preparation has been made for drying and shipping large quantities. It is said that there are three hundred thousand acres of uncultivated land on the western slope of the Coast Range, near San Francisco, especially adapted to potato growing. The fogs and mists from the ocean supply sufficient moisture, and the soil yields bountifully. The only problem heretofore has been where to market the product.

MECHANICAL INVENTIONS.

Mr. August P. J. Bossel, of Virginia City, Nev., has patented an improvement in bench planes which consists, first, in a novel construction, arrangement, and combination, with the plane bit, of a toothed plate or rack, and a pinion for adjusting the bit, and a wedge for holding it when adjusted; and also in a novel arrangement of the handle of the plane and devices connected therewith for adjusting said handle at different positions.

An improved baling press has been patented by Mr. John Grizzel, of Augusta, Ark. The object of this invention is to furnish presses for baling cotton and other materials, so constructed as to compress the material very quickly, and which can be conveniently and easily operated. The invention cannot be readily described without engravings.

Mr. George W. McArthur, of Laingsburg, Mich., has patented a machine for cutting hoops from poles, which is so constructed as to adjust the knife automatically to the bends of the pole and cut the hoops of uniform thickness.

An elevated scale beam for head blocks has been patented by Mr. John A. Reynolds, of Danville, Penn. The object of this invention is to provide the head block of a saw-mill with an elevated scale beam that may be at all times plainly visible, and upon which may be boldly marked the scale measurements, so that the mill operative may at a glance ascertain the thickness of the log upon the head block and readily adjust the log relatively to the saw in order to cut from it any required thickness of material.

The Blanket Brigade.

While in Boston attending the great celebration, Chief Leshure had a fine opportunity of seeing the working of the blanket brigade of that city, as applied to a fire in an elegant Park-street club house. The furniture, which was of the most costly description, was gathered together in the center of each room and covered with the carpets as they were stripped from the floor, and then the mammoth rubber blankets were spread over the whole, before the streams from six different hose pipes were let on the burning roof. The whole building was of course deluged, so that the water ran down the stairways in rivulets, but owing to the protection of the blankets, the percentage of loss on the furniture was comparatively small. Mr. Leshure came back more enthusiastic than ever concerning the organization of a Springfield blanket brigade. —Springfield Republican.

Ocean Temperatures in the Pacific and Atlantic.

Herr von Boguslawski has been led, from a comparison of the results of recent deep sea investigations, to the following conclusions respecting the temperatures of the Atlantic and Pacific oceans: 1. The water of the North Pacific is, in its whole mass, colder than that of the North Atlantic. 2. The water of the South Pacific is, down to 1,300 meters (4,225 feet), somewhat warmer than that of the Atlantic, but below the depth colder. 3. The bottom temperatures are generally lower in the Pacific than the Atlantic at the same depths and in the same degree of latitude; but nowhere in the Pacific are found such low bottom temperatures as in the Antarctic portion of the South Atlantic, between 36° and 38° south and 48° and 33° west longitude, in which bottom temperatures of -0.3° C. to -0.6° C. have been measured. 4. In the western parts of the Pacific, and the adjoining parts of the East Indian Archipelago, the temperature of the water reaches its minimum at depths between 550 and 2,750 meters (1,787 and 8,937 feet) remaining the same from this depth to the bottom. In the whole of the Atlantic the temperature from 2,750 meters (8,937 feet) to the bottom gradually though very slowly decreases.

A REMARKABLE instance of lightning ascending vertically is reported to the French Academy of Sciences as having occurred last month at Paris. M. Trecul relates that during a violent storm just at nightfall of the 19th ult., he saw flashes rising vertically, and apparently starting from the tips of lightning rods, though he is not sure that they started from them. The flashes went out in a kind of luminous ball, diminishing in the intensity of the light from the center toward the circumference. One of the smallest of these had an oval shape of from 8 to 10 inches in width, terminating the column of fire. On two occasions two of these luminous spaces, having risen at a distance apart about equal to the space between two lightning rods, suddenly darted toward each other at right angles to their vertical course and went out on uniting, making no flash and no noise.

APPARATUS FOR DETERMINING THE ELECTRIC CHARGES OF FALLING RAIN.

When it was demonstrated by Benjamin Franklin that thunder clouds were masses of watery vapor charged with electricity, the conclusion was very natural that the rain falling from such clouds might possess the same charge, and the electricians of a former generation contrived apparatus to prove this and to estimate the amount of the charge. In consequence of the advance of electrical science and the multiplicity of various pieces of novel apparatus, the old contrivances are now nearly forgotten, but our attention has been called to this subject by the recent suggestion that the ignition of petroleum tanks, now so alarmingly frequent, may sometimes be caused by rain from a thunder cloud.

It may, therefore, be well to give to the readers of the SCIENTIFIC AMERICAN an engraving of one of these pieces of apparatus as it was in use nearly a century ago by investigators of atmospheric electricity. It consists of a globe, *g*, of brass wire attached to a conducting wire, *h h*, which passes through a long glass tube, *k l*, supported by an insulating stand, *c*, placed on the window sill, *b*, and a few cords, *d*, attached to the upper sash, *e*, the lower sash, *a*, being raised. The end of the wire is provided with a brass ball, *m*, reaching over a table, *t*, on which a gold leaf electrometer, or any other equivalent apparatus, may be placed, which, being brought into contact with, or even in the vicinity of the charged globe, *m*, will indicate the electric charge of the rain.

Experiments with this apparatus have shown that the drops of occasional showers are most always more or less charged with electricity, and that it is only totally absent during foggy, moist days and rain storms of long duration; that on the contrary, sudden rainfalls after a clear spell are always charged, and that, as was expected, the strongest charges are obtained during thunder storms. Even traces of electricity have been occasionally observed without any rain falling, the air itself being charged.

DAVEY'S SIMPLEX MOTOR.

We give engravings of a form of motor for small powers, invented by Mr. Henry Davey (and called by him the "Simplex"), which is being constructed by his firm, Messrs. Hawthorn, Davey & Co., of Leeds. This little engine is exceedingly simple and direct in its construction, and it is probable that it may take a not unimportant place among the small power motors in the improvement of which so much has been done of late years. Mr. Davey's machine is in reality a steam engine, in so far that it works almost entirely by steam, but as a steam engine it has the special feature that it has no boiler, in the sense at least of any vessel containing a considerable quantity of water. A reference to the engravings will show that it has a single cylinder only, made with a very large piston rod so that the area above the piston is much greater than that below. The space above the piston is, in fact, the real working cylinder, while the space below is only a compressing pump. The steam distribution is effected by a slide valve shown in Fig. 2, while the pump chamber has connected to it two small single-beat valves, one (Fig. 1) opening inwards, and the other (Fig. 2) opening outwards into a coil which lies within the furnace, this coil taking the place of the boiler. It is inclosed in a cast iron casing lined with fire-brick, and the fire is placed below it, as shown. The way in which the engine works is as follows: On its up-stroke the piston draws a quantity of air into the cylinder below the piston, and along with this air a small quantity of water is always taken in. This last comes about by the help of the little cup above the suction valve, into which a fine stream of water is constantly running. On moving downwards the mixture of air and water is first compressed up to a point determined by the working pressure of the engine, and then pushed through the delivery valve into the coil, when the little puff of water is

at once flashed into steam. There is no valve between the delivery valve of the pump and the slide valve, but perfectly free communication, and each time a new portion of water is introduced into the coil, a corresponding portion of steam passes away to the steam cylinder. Here it works exactly in the usual way, about which nothing more need be said. It will be seen that the engine may be briefly described as a steam engine which has no boiler, but takes in its feed water as it requires it instead of working always from a large reservoir of steam and water. The air does not appear to play any appreciable part in driving the piston; its chief use is to insure that the water, when sent into the coil, is really blown in as spray, and not allowed to drop or run in.

One of the first of these motors (having a cylinder 3.5 inches

economical of steam, although this has not been attempted in the first instance. There is plenty of room in the world for all the small engines that have yet been brought out, and we shall be glad to hear that Mr. Davey has been successful in getting his well into use.—*Engineering*.

Color Blindness in Dyeing.

While the attention of scientific experts is being called to this subject, in reference to railroad employes and all persons concerned in the distinguishing of colored lights and signals, as connected with the necessary precaution in the protection of human life in traveling, it might not be deemed an undesirable opportunity for us to call the attention of our special community to the immediate bearing which this defectiveness of vision has on operative dyers. It will readily be granted that no artisan has more necessity for extreme nicety of ocular discernment in shades of color than the one whose whole occupation is among them; and that on the critical truthfulness of his vision depends the accurate production and reproduction of tints, which to fail in would cost serious sums to his employer.

Color blindness, in the full meaning of the term, is not likely to exist among dyers, but it is not only likely, but very possible to produce at least some of the effects by the changing of colors; that is to say, the workman who has his eyes engaged constantly on a red, for instance, if put on to a green may find himself in trouble, and so on through various colors. Now, as to tint shades, is it not very evident that the impression received on the eye by looking on one tint continually will incapacitate the sight for the perception of a true and exact shade of that color?—and yet extreme accuracy is demanded. Let a dyer working on a red for some time have his attention turned to a blue, and will he not at first see a purple?

Most certainly, because the visual rays are fraught with red, and when brought to bear upon the blue, blend with it, at first strongly, and gradually thereafter.

All have not been gifted alike; it is evident that with some workmen this affection may be still more injurious than with others. Those of bilious temperament are subject to a yellowish influence on the vision, which must of necessity prove fatal to the truth of observation in color.

There is no sense more exquisitely delicate than that of sight, and there is no man more dependent on its ability than the dyer.

In taking up the trade of dyeing the early learner knows nothing of the nature of his sight, but goes at it as though it were plowing, or any other calling in which the sensitiveness of the eye is not called into requisition at all. But how important is the constitution of the eye to him who is engaged in a study of colors which must be carried to the most minute perfection. Now, how necessary is it that an examination by a qualified expert should decide on the healthy state of the eye before the trade is chosen. And still further, how advisable is it that occasional examination should be made by a doctor of the eyes of every workman in the dye-house, to decide whether there is any decrease of visionary power, and to prescribe the fitting treatment if there is.

Every employer should consider this matter, and see if his interest is not concerned in it; for the health of the sight of a good, faithful man is as much their concern as the bodily health is his.

While on this subject we may as well suggest the very simple practice to testers of colors of having a purely white material as a plain on which to rest the sight when alternately viewing colors; by this means the eye is enabled to take in the succeeding tint without any influence from the former one.—*Textile Colorist*.

Invaded by Slugs.

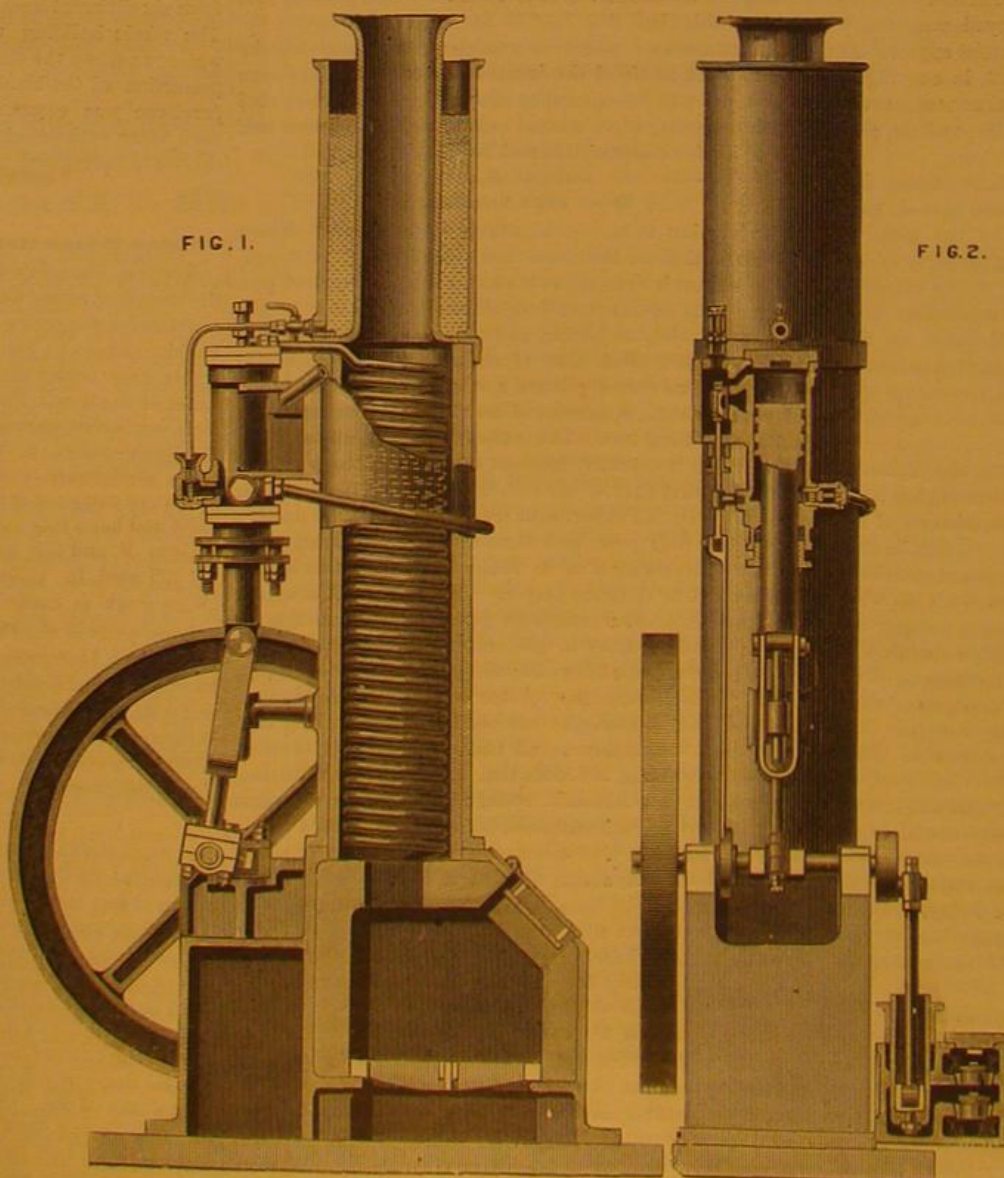
Four or five years ago a Rochester gentleman received from Germany a box of bulbs in which he found a number of large slugs. They were unwisely set free in one of the city parks



APPARATUS FOR DETERMINING THE ELECTRIC CHARGES OF FALLING RAIN.

in diameter, and 4 inch stroke) has been for some time at the Engineering Laboratory of University College, where the students have made a number of experiments with it, working under various conditions. The motor has been very considerably improved since this particular one was made. In his later engines Mr. Davey has used a small separate pump set on the top of the cylinder, instead of employing the space under the piston for a pump, and in the larger sizes he is making the cylinder double-acting.

This little motor is very substantially made, it takes up very little space, is easily started, and has no explosive boiler, and we do not see why it should not be made very



DAVEY'S SIMPLEX MOTOR.

where they seemed to have thrived to an alarming degree, spreading over the city in a way to make them a serious nuisance. They are much larger than any native slugs, measuring from four to six inches in length, and are likely to become very injurious to vegetation.

NOTE ON TURPENTINE, ROSIN, AND ALLIED PRODUCTS.*

Of the turpentine collected in this district very little is shipped North. Most all of it is distilled upon the water courses near the pine forests. The small quantities of crude turpentine now sent North are used in making printer's ink.

Turpentine is distilled in copper stills now. Formerly iron stills were used. Then the resulting oil was red. When the first copper still was used in Wilmington the clear uncolored oil shipped North was rejected, because it was not considered genuine "spirits."[†]

All crude turpentine is distilled with water. The part which water plays in the process will be seen hereafter.

The present distinction as to the grades of rosin are somewhat different from *yellow* and *transparent*.

It is not the presence of water which makes rosin *yellow*. If water gets into rosin, which it does sometimes by accident, the rosin becomes opaque. All the better grades of rosin are yellow or amber color, more correctly; but the term "yellow rosin" is not used here commercially or otherwise. The grade of the rosin depends, first, upon the quality of the turpentine, and second, upon the skill in distilling. "Virgin turpentine," the first exudation from a newly chipped tree, if skillfully distilled, will yield "window-glass rosin," of which there are two or three grades. If by any means water gets into prime rosin it becomes opaque. This accidental addition of water must take place after the rosin has been drawn off from the still.

"Yellow dip" turpentine, which is the running of the second and subsequent years, yields the medium grades of rosin; while the "scrapings," the inspissated gum from the

This rosin passes through a strainer before it reaches the vat, to rid it of foreign substances, such as straw, pine cones, chips, etc. From the vat it is bailed by wooden buckets, fixed on a long handle, into the barrels.

Rosin is graded by standard samples fixed upon by the "Produce Exchange."

The yield of oil of turpentine from "virgin dip" is about six gallons to barrel.

The yield of oil of turpentine from "yellow dip" is about four gallons to barrel.

The yield of oil of turpentine from "scraping" is about two gallons to barrel.

Other products now attract our attention, viz., the distillation of rosin oil.

The rosin oil of commerce is produced in the following way: Rosin is introduced into an iron still, the lower grades being used for this purpose, and heat is applied until the temperature reaches from 316° to 320° F. Water and pyroligneous acid and naphtha come over first, and for some time, until the rosin is exhausted of naphtha. The heat is then raised to near the red heat of iron, when the rosin boils, and water and oil of rosin distill over together. This is crude rosin oil. It is a heavy, nearly opaque, whitish viscid fluid, opalescent on the surface.

This crude rosin oil is rectified by redistillation, and the resulting oil is transparent, dark-red by transmitted light, with a decidedly bluish cast by reflected light. It is deeply opalescent, more so than petroleum oil.

The residuum left in the still is a black mass with a shining fracture, giving the hues of crystal aniline.

Other products still remain to be spoken of, viz., *naphtha* and *oil of tar*.

Tar when distilled yields pyroligneous acid, water, *naphtha*, or spirits of tar, and *oil of tar*. The *naphtha*, when purified by a second distillation, is clear and of a very pleasant terebinthinate odor. The *oil of tar* comes over in the latter part of the process, and a black residuum remains in the still resembling pitch. All but the last-named of these articles have a commercial value.

Tar is distilled in iron retorts, just as rosin is. There are many complex bodies which have come to the attention

THE DOWD TUNNELING SYSTEM.

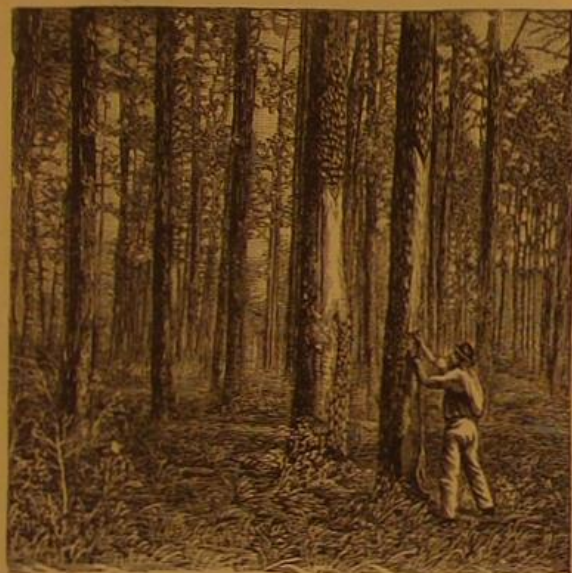
FIGURES 1 and 2, see next page, illustrate the Dowd tunneling system, in perfecting which the inventor, Mr. O. B. Dowd, of 122 East Nineteenth street, New York City, has been engaged for some years past. It furnishes means of excavating for and constructing tunnels in soft and treacherous ground, and under great pressure.

The system provides a shield absolutely safe for the workmen while passing through strata of hard and soft mud, quicksand, "land springs," poisonous gases, etc., and capable of passing bowlders and making an entrance in rock.

It provides for excavating the immense amounts of silt, clay, etc., by steam power instead of manual labor to insure rapid progress, and it provides for the construction of a tunnel with water and gastight walls, having strength even under pressure of about four tons to the square foot to allow a margin of safety of 50 to 1, and to resist constant pounding of heavy trains on its inverted arch; at the same time it has the longitudinal rigidity of a tubular bridge, so that in parts passing through "land springs" or exceptionally soft pieces of ground there is no danger of breaking out cross sections of the tunnel. (Special attention has been called to this difficulty by able engineers, and the trouble was practically illustrated by the breaking out of portions of the Cleveland tunnel, under Lake Erie, the sections retaining their cylindrical form and moving several feet from line of the remaining tunnel.)

A water and gas tight joint is formed in the rear of the shield, and in the front edge of the tunnel sections afford firm and reliable support for hydraulic jacks by which the shield is propelled and guided.

Figure 1 is a longitudinal sectional elevation of a portion of a tunnel, and the shield employed in its construction. A represents a cylindrical iron shield of great weight and strength, having internal diameter slightly greater than external diameter of tunnel, B. The shield is made watertight in front by an adjustable head (C), composed of strong



COLLECTING TURPENTINE.

tree facings, yields an inferior rosin, from very dark to almost black. The black rosin is not due to burning in the still, as has been stated.

Anhydrous rosin is the greater part of the stock produced; the opaque rosins, being accidental, are limited.

The following description of the process of distillation may explain further.

A fifteen-barrel copper still (barrel weighing 220 lbs. each) is charged early in the morning. Heat is applied until the mass attains a uniform temperature of from 212° to 316° F. This is continued until the accidental water, that is, the water contained in the crude turpentine as it comes from the forest, has been driven off.

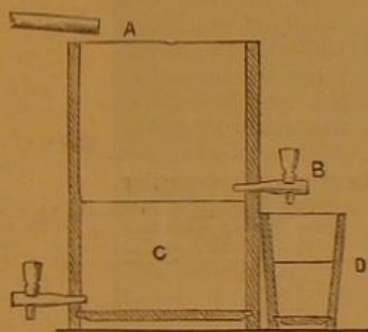
The first product distilled over is pyroligneous acid, formic acid, ether and methylic alcohol, with water. This is known as *low wine*.

All the accidental water having been distilled off, a small stream of cold water is now let in, so that the heat is kept at or below 316° F., the boiling point of oil of turpentine. The oil of turpentine and water now come over, and the mixture is caught in a wooden tub. This tub is constructed as follows:—

The distillate is caught at A from the still and separates into water and oil. At B there is an overflow spout, which discharges into the tub D. The water is kept low enough in the lower part of the tub to prevent its overflowing through the cock B into the receptacle D. From this receptacle it is put into oak casks, well made with iron hoops, and securely glued inside.

The distiller tests the quality of the flow from time to time in a proof glass. The distillation is continued until the proportion of fluid coming over is nine of water to one of oil of turpentine. At this stage the heat is withdrawn, the still cap is taken off, and the hot rosin, which remains in a fluid state in the still, is drawn off by a valvular cock at the side of the still near the bottom.

* By Thomas F. Wood, M.D., in *New Remedies*.
† The commercial name for oil of turpentine.



TUB FOR SEPARATION OF TURPENTINE FROM WATER.

of the manufacturers during their operations. Some of them have been very intelligently worked out and identified by Mr. William A. Martin, the chemist of the works we have visited. Some remain to be investigated. Terebinthine products have always been exceedingly interesting chemically, and just now we are moving toward practical commercial results. I am expecting to announce, at no distant day, that we have made a sure step in the right direction.

The English Channel Tunnel.

The works which are going on at Abbot Cliff Tunnel, between Folkestone and Dover, on the Southeastern Railway, in connection with the sinking of a shaft for testing the geological formations of the locality, with a view to the formation of a tunnel between England and France, were inspected July 20, and pronounced satisfactory by M. Léon Say and the French engineers, including M. Duval, M. Oretton, and the Count de Montebello. A shaft 90 feet deep has been sunk from the level of the engine house at high water, and a heading has been driven to the level of high water mark for the purpose of depositing the chalk. Powerful machinery has been fixed for the purpose of driving an atmospheric drill, with which it is intended to drive a heading as far as Dover, a distance of three miles, under the line of railway, the heading at Dover to be 300 feet deep. The experiments are being carried out under the direction of Colonel Beaumont and Captain English. The Southeastern Railway Company have made a grant of \$30,000 for the purpose.

Food Value of Root Crops.

Chemical analysis gives the following results with regard to the food values of different root crops:

Total Amount of Nitrogenous or Flesh-forming Material.	Pounds.
In 1,000 pounds of potatoes	39.03
In 1,000 pounds of mangolds	11.25
In 1,000 pounds of sugar beets	10.00
In 1,000 pounds of turnips	21.25
In 1,000 pounds of carrots	18.12
Total Amount of Carbonaceous or Fat-forming Material.	Pounds.
In 1,000 pounds of potatoes	337.4
In 1,000 pounds of mangolds	107.2
In 1,000 pounds of sugar beets	174.4
In 1,000 pounds of turnips	81.7
In 1,000 pounds of carrots	159.1



A TURPENTINE STILL.

iron sections, and has a large central opening in which is fastened by bolts, etc., the collar, D, which forms the bearing for shaft, E. This shaft carries the strong rotating steel tunneling arm, F, on each side of which are blunt edge cutting tools.

The arm is about one foot in front of shield head. G is a cog-wheel upon shaft, E, for revolving it, which is effected by two oscillating compressed air or steam engines, as shown in cut on opposite sides of the cog-wheel, G. (When steam is used the smoke-pipe is connected with the ventilating exhaust tube, to carry the smoke out of the tunnel.) Shaft E is hollow and has a tube within it extending to the junction with arm, F, and the arm has two longitudinal water passages indicated in cross-sectional view, Figure 2, by dotted lines; each is connected with the water passages shown on either side of arm, F. A tube in the shaft is arranged so that by a part revolution of it the connection can be made so as always to drive the water through the side of the arm which is moving forward.

The shield being in place, the shaft and arm are moved slowly, revolving in either direction, and small quantities of water are forced through the shaft and arm to dissolve the silt and clay as they are scraped from the heading by the cutters, and form a semi-fluid, about the consistency of thick cream, according to the amount of water forced in, so that the arm is found to move easily in this sort of disk of soft material. Between this and the head of shield another disk forms, about a foot thick, of much harder consistency, and in silt or clay remains adhering to the head of the shield. It is sometimes found desirable to force compressed air through the shaft and arm, and good results are obtained. The air disintegrates and drives the earth from the front of the arm, and forms minute bubbles, and gives greater elasticity to the silt, etc., allowing the arm to move freely.

It should be observed that no part of the disk in which the arm moves is a vacuum or air-filled space, as this can occur only in exceptionally firm silt or clay; on the contrary there is a constant pressure on all sides of the arm and on the head

of the shield—the pressure in difficult portions of the work being as great as four tons to the square foot.

The shield is pressed forward by hydraulic jacks, H, H. In excavating for a full size railroad tunnel eight twelve-inch bore jacks should be used, of strength capable of bearing a test of about 3,000 tons combined moving power, but arranged to work advantageously for the comparatively small power usually required of them.

Bars, I I, connect by socket joint with the pistons of the jacks, and reach back to the front edge of the iron tunnel, on which they have a reliable support. The jacks force the shield forward; at the same time the shaft and arm revolve and cut and mix the silt with the injected water, and the semi-fluid silt is pressed backward through pipes, J J, and falls into the car, K.

This car should be of sufficient strength to carry the silt removed from a section of the heading about four feet long.

When the shield is advanced until its rear end reaches the front end of the tunnel section, the gates, L L, are closed, stopping the flow of silt, etc., the car is drawn to the mouth of the tunnel by a wire rope, and the load dumped through gates in the bottom of the car. The course of the shield may be changed by shutting the cocks in the pipes leading from the pumps to the jacks on that side toward which it is to be directed, and allowing the remaining jacks to advance the opposite side.

The tunnel itself is made of solid sections of cast iron pipe, entirely free from any longitudinal seams—this form being used for economy of construction and to give greater resistance to crushing force than the previously-made iron tunnels; for instance, the second Thames, the sections of which are made up of smaller pieces bolted together.

The desired form of R. R. tunnel is a slight oval about

Several of these sections being in place, and under pressure from the jacks, four steel or iron links, or bars, O O, are placed while hot upon lugs cast on the interior of the section, as shown, drawing them together by shrinkage while cooling.

These links may be used with say five hundred tons each, or about two thousand tons combined contracting power, and in very bad ground two more bars may be used in other lugs cast on the side of the tunnel sections, to insure very great longitudinal rigidity. The packing between the sections form a water-tight joint, and it will be seen the form of joint illustrated admits of repacking at any time from the interior of the tunnel, in case a slight leak occurs.

Among minor details of the system may be mentioned the use of the well known sand ejector, but of peculiar form, consisting of a large portable tube with a smaller air tube within it extending to the end of the larger pipe.

This pipe when required is placed obliquely with its upper curved end over the dirt car, and its lower end projecting through the lower edge of the shield head, and flush with its outer face; a hose is attached to the small tube, and compressed air is driven through it, blowing the sand or earth backward and upward into the car.

This plan is found of value in certain kinds of sand for giving greater ease of motion to arm, F, but in silt or clay it is unnecessary.

The ejector is also valuable when placed from two to six feet lower down—that is, through an oblique opening at the lower front of the shield cylinder—to excavate for sinking below line of progress any boulder or similar obstruction which might prove too great for the unaided power of the arm to force downward. While using the ejector, and, indeed, at all times, except when in hard silt or clay, the shield should be pressed forward with considerably more

need not be used, as the tunnel would be of considerable thickness.

Cost of excavating in silt or clay and putting sections in position and placing tightening bars, it is believed, need not exceed seven dollars per lineal foot. It is believed that silt can be excavated at least fifty times faster by this process than with the well-known Brunel shield, in which the earth was removed principally with the bare hand.

Before any reasonably accurate estimate of the cost of the entire tunnels can be made, it is, of course, necessary to determine the grade and the consequent length of the tunnels required. The originator of the above system, after considerable investigation, is convinced that the *inclined plane system* is far the most desirable for passing trains through most short subaqueous tunnels. In this system a long inclined plane is prepared, down which the train runs by its weight. It is then raised over a shorter incline by means of an endless wire rope, which passes over a large wheel with a grooved face, and thence to the foot of the incline, and around a small pulley, and it is moved like a belt by the large wheel at the head of the incline. This rope is supported by a number of small sheaves.

The propelling power is a stationary engine, which revolves the large wheel. For making the connection of the train with the rope, a special kind of truck with clutching device is used.

It is coupled with the ordinary cars, and is called a "pusher" or "puller," as it is used in front or at the rear of the train.

The problem being, for instance, to move a train from Jersey City to New York, it is believed best to have the mouth of the tunnel near the New Jersey bank of the river, and by one long inclined plane to run nearly three-fourths across the river, and then by a shorter and steeper

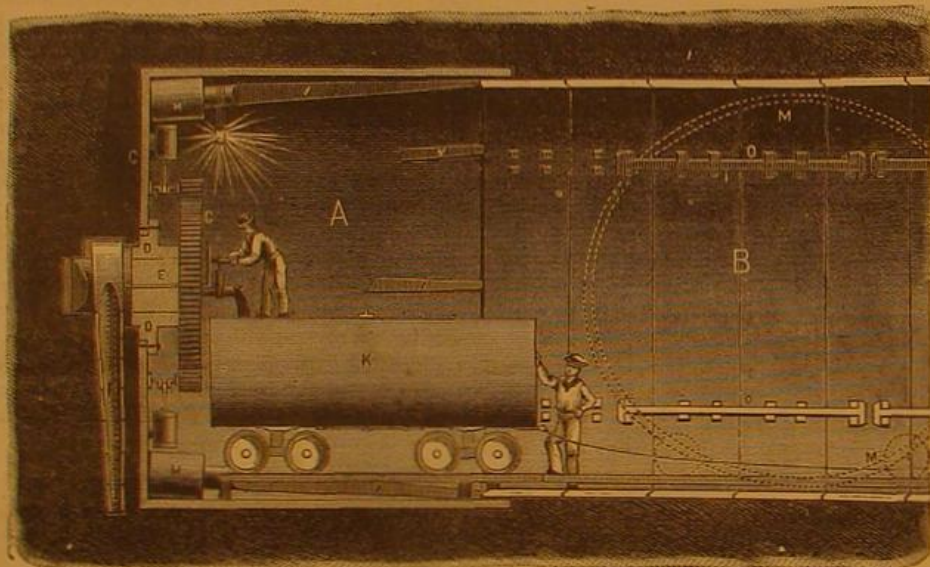


Fig. 1.

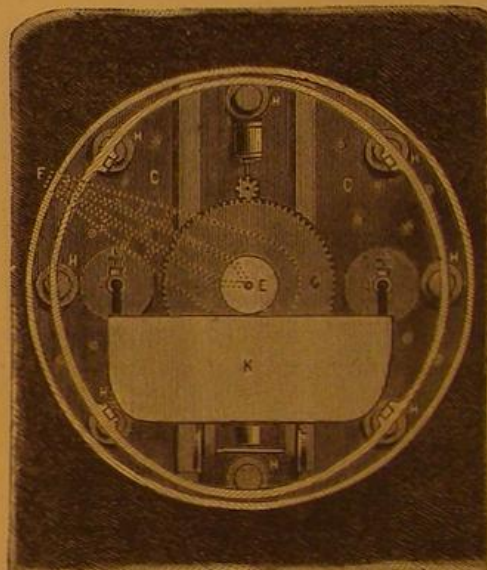


Fig. 2.

Fig. 3.

THE DOWD TUNNELING SYSTEM.

17½ feet high by 16 feet wide. This form allows the short sections of about four feet length to be carried through the completed portion by turning their greater diameter at right angles to the greater diameter of the completed tunnel, as shown by dotted lines at M. The tunnel section is fastened to two axles, thus forming a sort of car, and leaving only the axles to be thrown out of the way when the section reaches the interior of the shield, and is detached from them.

A wire rope hoisting gear is attached to the section, and it is raised by steam power and set in its permanent position. The pushing bars are then replaced against it, the pressure applied, and the car which has followed the section into the tunnel is filled, as before described.

After being cast, and before becoming quite cold, the sections are covered externally with a thick rust-proof bituminous preparation. This coating is applied by placing the section on its side with a hoop of sheet-iron of the same width as the section, but of size to leave about half or three-quarters of an inch space for the thickness of the coating. This space is filled with the composition while hot, so that it adheres to both the section and the hoop. While this is done the hoop is held by a frame coinciding with the form of the slightly elliptical opening in the rear of the shield through which it is to pass, so that, regardless of any irregularities in the rough casting of the section, the exterior of the hoop shall be suited to make a good joint in the shield packing, so that the rear of the shield may draw readily off from the hoop, which remains on the section, without allowing openings for irruption of water or mud.

A portion of the coating materials extends to the recess in the end of the section, to form a water tight joint.

force than the backward pressure of the earth heading incident to the weight of the superincumbent column of water and earth, to prevent excavating more material than requisite for the passage of the shield.

Collar, D, is arranged to allow of being taken into the shield with shaft and arm attached, if it is desired to renew the cutters, and means not shown are arranged to prevent silt, etc., pressing into the opening while this is done.

By the use of special cutters on arm, F, rock when not too hard may be tunneled; for instance, a rock known to exist below the Hudson river, and if this rock is as soft as believed by those claiming to know, the cutters would make very good progress through it; but if very hard, it would be desirable, after making a safe entrance within it, to remove parts of the shield head and go on by the usual methods, passing the shield through afterward and following with the iron tunnel.

When work is doing in ground filled with gas like that under the Detroit river, the car should have a tight cover, and its interior should be connected by tube with the ventilating pipe to convey the gas out of the tunnel.

As to the cost of this system, five among the best known expert authorities on a large foundry work agree in estimating the cost of casting the four-foot tunnel sections at less than thirty dollars each, or about seven dollars per lineal foot—this being in addition to the cost of the iron.

As the price of iron varies, no close estimate can be made of its cost. It is believed, however, it would be between \$700,000 and \$900,000 for the pig or scrap iron for two tunnels of length suited to the inclined plane system for the Hudson river. As weight is desirable, very expensive iron

grade to reach the surface not far from the river on the New York side.

A "pusher" or "puller" should be attached to the train at the last stopping place, and as the train approaches the tunnel the locomotive should be switched and the train allowed to enter the tunnel at full speed, running over the long plane to or past the lowest point. On commencing the ascent the motion will be checked, and the train may be stopped by the brakes, and the puller instantly attached to the wire rope, and the train be quickly drawn up into the passenger or freight depot.

A system is now used for lighter trains by which the ropes are attached while both the train and the ropes are running at full and nearly equal speed, and it is believed that this plan can be used for heavy trains by increasing the power of the machinery and the number of wire ropes, thus making the run through the tunnel without a stop. This would probably diminish the time of passage by more than a minute, thus allowing a much greater number of trains to pass daily. For outgoing trains the form of the tunnel should of course be simply reversed, the short incline and the stationary engines being placed at Jersey City. This system is much used, and is doubtless familiar to most readers, but slight modifications would be required.

The tunnels should be *entirely separate*, and at no point less than thirty to fifty feet apart. Fig. 3 indicates the form and approximately the grade of the tunnels for the inclined plane system under the Hudson. The south one represents the tunnel for incoming trains, and the north or upper one that for outgoing trains; the dotted lines simply indicate the horizontal.

HISTORY OF ELEVATED RAILWAYS.

The idea of using an elevated railroad for rapid transit is not of recent origin. In 1812, two years before George Stephenson built his first railroad engine, Col. John Stevens, father of the late millionaires of Hoboken, proposed to run a railroad train by steam in almost exactly the manner now adopted on the elevated railroads of New York. He made a proposition to the Commissioners for the Improvement of Inland Navigation, of which Gouverneur K. Morris was chairman, setting forth his plan in detail and giving facts and figures which showed him to be much further advanced in a practical knowledge of the possibilities attainable in railroad travel than any man of the day. He wrote, in February, 1812, as follows:

"Let a railway of timber be formed, by the nearest practicable route, between Lake Erie and Albany. The angle of elevation in no part to exceed one degree, or such an elevation, whatever it may be, as will admit of wheel carriages to remain stationary when no power is exerted to impel them forward. This railway, throughout its course, to be supported on pillars raised from three to five or six feet above the surface of the ground. The carriage wheels of cast iron, the rims flat with projecting flanges, to fit on the surface of the railways. The moving power to be a steam engine, nearly similar in construction to the one on board the Juliana, a ferryboat plying between this city and Hoboken."

The Juliana above-mentioned was built by Mr. Stevens in 1811. She afterward plied on the Connecticut River, having been the first steamboat to navigate the Sound.

It should be remembered that at that time railroad locomotion was little if any further advanced than aerial navigation is to-day. Both practical men and theorists laughed at the idea that an engine could draw a load heavier than its own weight, and the first locomotives were made with a cogged wheel to work in a cogged rail. Mr. Stevens' plan of an elevated road differs little in its general features from the rapid transit roads on Third and Sixth avenues, except that the height above the surface is greater.

Mr. Stevens' theory was a tremendous leap beyond the knowledge of that day. There were tramways in existence in England, but they were used almost without exception for coal transportation, and had never been thought of for passengers. There were steam road-engines also in use, but they were very heavy, clumsy, and slow machines, intended as traction engines over common highroads, and had nothing in them even to suggest the idea of the railroad locomotive of to-day. Nowhere had any attempt been made to run a locomotive on a line of rails. In the light of later progress in railroad construction, Mr. Stevens' calculations are interesting.

He supported his theory of the practicability of such a road by the following reasons: Its expense would be no greater than that of an ordinary turnpike road with a good coat of gravel on it; it could be built in one or two years; its elevation would remove the timber, of which it was composed, from danger of decay; and travel could never be impeded on it by even the deepest snows; it would be free from the casualties to which canals were liable; and the expense of transportation would be far less than on a canal.

The canal question was at that time the one toward which public attention was directed most forcibly, and therefore all of Mr. Stevens' calculations were comparative, the figures of the Commissioners for the Improvement of Inland Navigation being taken as a basis of comparison. The difference in elevation between Lake Erie and the Hudson at Albany being taken at 225 feet in a distance of more than 300 miles, Mr. Stevens treated it as practically a level road. Taking the capacity of one horse on a railway to be only eight tons, the angle of ascent being less than one degree, Mr. Stevens estimated the power of an engine having a cylinder of 10 inches diameter, with a steam pressure of 50 pounds, to be equal on a similar road to 20 horses, or a capacity to draw 160 tons. But Mr. Stevens, to be on the safe side, took 100 tons, at a speed of 4 miles an hour, as the work to be expected from his engine. Then allowing three cords of wood per day at two dollars a cord, and four men's labor at one dollar each per day, and supposing that full freight was carried only one way, he calculated that the round trip from Lake Erie to Albany and back would be made in five days, which at \$10 per day would make \$50 as the expense of transporting 100 tons the length of the road, or 50 cents per ton. The Commissioners' estimate of the cost by canal was \$3 per ton.

Speaking of the speed attainable, Mr. Stevens said: "I am by no means prepared to say what limits may be set to the rapidity with which a carriage may be driven on these rails."

Elsewhere, first referring to the speed obtained by the native boats, or proas, in the East Indies, Mr. Stevens wrote: "If, then, a proa can be driven by the wind . . . through so dense a fluid as water, at the rate of 20 miles an hour, I can see nothing to hinder a steam carriage from moving on these ways with a velocity of 100 miles an hour;" and in a foot-note: "This astonishing velocity is considered here as merely possible. It is probable that it may not in practice be convenient to exceed 20 or 30 miles an hour. Actual experiments, however, can alone determine this matter, and I should not be surprised at seeing steam carriages propelled at the rate of 40 or 50 miles an hour."

The Commissioners for the Improvement of Inland Navigation replied to Mr. Stevens' memorial, making the following objections: That the engine would not draw such a load for lack of a grip on the rails, for if there was sufficient friction for the engine to take hold, there would be so much more friction under each car, and one would overcome the other; there would also be great friction from the flanges used to keep the wheels on the track, which would be greatly increased if the logs should warp; it would be impossible to build a perfectly "true" railroad with ordinary workmen, and even if built it would easily be thrown out of line by frost and other causes; double tracks would be needed, since the same way would not serve for carriages going and returning, and the expense would thus be doubled; and finally, "it [did] not seem probable that a way could be made of sufficient strength."

Mr. Stevens replied to this highly scientific exposure of the Commissioners' ignorance by showing that an engine, theoretically, would draw such a load as he had estimated; that the roadway could be made true and maintained so at reasonable cost, and that if wood was deemed too perishable or insecure other materials could be used. He then made a detailed estimate of the cost of such a road, having brick pillars, 400 to the mile, with timber ways and iron bar rails four inches broad and one-half inch thick. He thus made the cost per mile as follows:

Bar iron plates.....	\$7,500
Brick pillars.....	1,000
Timber ways.....	1,500
	\$10,000
Or, for the whole 300 miles.....	3,000,000
For reducing elevations, etc.....	500,000
	\$3,500,000

Using stone instead of brick, he added \$800 per mile, or a total of \$3,950,000.

Mr. Stevens informed the Commissioners that the practicability of his plan could be satisfactorily tested for about \$3,000, but whether they thought it too visionary a scheme to deserve attention, or whether their minds were so devoted to the canal project as to be incapable of taking any other ideas into consideration, it is impossible to tell; at any rate they took no further steps and the matter dropped.

Pittsburg's 20-ton Hammer.

One of the largest castings ever made in this country was successfully poured at Pittsburg, October 5, being a solid block of metal weighing 161 tons. Its mission is to serve as the anvil block for a monster steam hammer in process of erection for the Black Diamond Steel Works, Park Brothers & Co., of Pittsburg. The growing demand for steel shafts for Western river steamers was one cause leading to the building of this hammer, whose cost, ready for work, will be \$52,000. The hammer frame will stand 34 feet high, the head, piston, etc., will have a dead weight of 17 tons, increased by steam pressure to 20 tons, and the fall is to be 9 feet.

To properly meet these Titanic blows the great casting was made, the dimensions of the anvil block being as follows: Height, 11 feet; at base, 8 by 10 feet, tapering upwardly to 4 by 6 feet. To secure the best results and toughest metal where this was most needed the block was cast with the smaller end down, and when cooled will be turned over by hydraulic jacks, trunnions forming a portion of the casting for this purpose. The foundations for this anvil necessitated the digging of a pit 27 feet in depth and measuring 30 by 50 feet. Cement piles, surmounted by successive layers of heavy timber, a ponderous cast iron plate, and finally by a section of oak timbers stood upright 11 feet high, form the support for the anvil block. The casting was accomplished in seven hours without accident of any kind, the metal pouring from five cupolas charged with 33 tons each of best charcoal iron. Previous to this work, as near as can be ascertained, no single casting of 100 tons had yet been poured in this country. The Rodman Columbiads, 20 inch bore, cast at Pittsburg in 1860, weighed 80 tons in the rough. As to hammers, the largest steam hammer at present in operation in this country is a 10 ton machine at Nashua, N. H. The Pittsburg hammer is being built by Wm. B. Bement & Sons, Philadelphia, and will be in operation early in the coming year. Western river men will no longer send their orders for steel shafts to Krupp, of Essen.

Balloon Photography.

An interesting experiment has recently been reported to the French Academy of Sciences by M. P. Desmarests. M. Desmarests has succeeded in taking two excellent photographic views from a balloon in mid air. Such views have hitherto been obtained by M. Nadar from a captive balloon, but these are the first from a balloon unattached to the earth. M. Desmarests used the instantaneous process of M. Janssen. The plates were very sensitive, specially prepared with gelatin-bromide, and the oxalate of iron was used in developing them. The views obtained are said to have shown a remarkable clearness. The time of exposure was one-fifteenth of a second.

The Distillation of Spirits.

The following statistics are furnished by the Commissioner of Internal Revenue. The figures indicate the number of gallons of distilled spirits produced, consumed, exported, etc., the fiscal years ending June 30. The marked increase of consumption the past year is attributable to the revival of manufacturing industries, the larger portion of the consumption of spirits in this country being—as is well known to all except prohibition lecturers—used in the arts.

	1880	1879
Production.....	90,355,370	71,892,621
Consumption.....	61,116,533	51,892,714
Exportation.....	16,765,963	14,837,581
Balance in bond.....	31,363,869	19,212,470

The Epidemic of Breakbone Fever in the South.

A painful but fortunately not fatal disease has been very prevalent the past summer along the south Atlantic and Gulf States, from North Carolina to Louisiana, extending into the interior as far as Augusta, Ga. At Charleston, Savannah, and New Orleans the epidemic has been especially severe, the victims being numbered by thousands. Both blacks and whites were affected about equally. For several weeks after the first cases appeared in June the real nature of the disease was not recognized, something like thirty years having elapsed since the last invasion. The symptoms of the disease, as described by Dr. F. P. Porcher, in a communication to the Bulletin of the National Board of Health, are as follows, not all of the symptoms, however, appearing in every case:

The disease generally begins with a feeling of coldness, or by a chill, followed by fever—this, with a temperature ranging from 100° to 105°, lasts generally from 24 to 48 hours, occasionally extending to four or five days, and even in rare cases to seven. Relapses occasional, specially in those who have gone out too early. Headache frequent, generally frontal, from the beginning. Miliary eruptions, sometimes elevated and red, like measles, and the occasional presence of *nodules* over the face, neck, and body; sometimes the eruptions were confined to the body, and endured for days after recovery. We have seen some examples of slight desquamation—furfuraceous or branny in character. Sweating profuse in many persons, though often absent. Hence, some physicians are inclined to consider the disease to be *ruette miliary* of a mild form. "Breakbone" is the best name, because pain in the bones and limbs is the most constant symptom. There is often great restlessness during the fever, and in some a feeling of tightness or congestion about the throat, with bleeding in a few cases known to us. Catarrhal symptoms are rarely present, although cough has occasionally existed. Bleeding from the nose not unusual in children, and also increase in the menstrual menses has been observed. Pain in the back and limbs markedly present, but no decided swelling of joints, no carbuncular enlargements or boils, as in the epidemic of Dengue, of 40 years since, or in that of "breakbone," which followed some years subsequently. Weakness and prostration have been very decided, but not nearly to such an extent as in previous epidemics. Some of the physicians consider that there has been a tendency to hepatic torpor or congestion, of no great severity, however. Dr. Porcher has heard of no cases of decided jaundice. Nausea and vomiting seldom occur.

Very little active treatment has been used: a mild laxative, saline or mercurial, hot teas, niter, pediluvia, synapisms, etc., and quinine during and after the attack, upon theoretical grounds, with occasionally mild stimulants. Several persons have recovered with no treatment whatever. No deaths are reported. The disease differed from the Dengue of 40 years ago, and also from the later breakbone fever, in that it seldom or never attacked all the members of a household, as was the case during previous epidemics.

A Successful Case of Transfusion of Blood.

The following case, which exhibits in a marked degree the beneficial effects of transfusion of blood when performed in cases of impending death from excessive hemorrhage, is reported in the *New York Medical Journal*, for August, 1880, by Joseph W. Howe, M.D.:

Mrs. B., aged twenty-two years, was delivered of a three months' fetus, November 7, 1879. From that date until November 11 she had repeated and profuse hemorrhages from the uterus. On the 10th the bleeding was continuous. Drs. Reynolds and Comstock, who were first called in, succeeded in controlling the hemorrhage, but not before the patient had reached the stage of collapse. They remained with her all night, endeavoring, with the ordinary means of stimulation, to rouse her, but without avail. She continued to sink in spite of everything.

On the morning of the 11th I was sent for. The patient was then completely pulseless and partially unconscious. The extremities were cold and clammy, and it was evident that unless some fresh blood were introduced death would soon supervene. She was so far gone that I made up my mind not to spend any time in defibrinating the blood. I opened the median basilic vein in the right arm of the patient and introduced the closed cannula of Collin's instrument, and after passing some warm water through the cylinder of the instrument, attached it to the cannula in the patient's arm. The median cephalic vein in the right arm of the donor was then opened, and the blood was allowed to flow directly into the cylinder without defibrination. When a sufficient quantity had been obtained, and while the blood was still flowing, I injected, without any difficulty, between seven and eight ounces. The whole operation did not occupy more than five minutes in its performance.

Within half an hour the pulse returned at the wrist, the voice became clear and distinct, and she asked for something to eat, saying that she felt stronger and better in every way. One of the medical gentlemen who had been with her all night assisting in the attempts at resuscitation, and who left in the morning, believing that there was no hope of her recovery, came in an hour after the operation, and said it was "a perfect transformation scene"—that he had no idea that a few ounces of blood could restore lost vitality so rapidly.

From that time on the patient continued to improve, and when I last heard from her she was in the enjoyment of good health and attending to her household duties without any discomfort whatever.

HOMICIDE IN THE UNITED STATES.

Some remarkable results have been arrived at by Mr. H. V. Redfield, who has been investigating the frequency of homicide and the treatment of murderers in different parts of the Union. Purposely avoiding years of political excitement, he has endeavored to discover the relative frequency of "ordinary homicide" in the North and the South. In the course of his studies he tabulated the homicides occurring in one or more years in Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, Pennsylvania, Ohio, Michigan, Minnesota, Kentucky, South Carolina, Texas, and other States; also the number of persons charged with murder and manslaughter, and the number of indictments for the various degrees of this crime, for several years, in the States of Maine, Pennsylvania, Michigan, and Minnesota, thus getting the annual average in all these States with a degree of accuracy not previously attained. He selected these States as containing a fairly average population of the Eastern, Middle, and Western States. The average number of indictments annually in all these States, taking a series of years together, was 154. This, however, included the period of the Molly Maguire murders in Pennsylvania.

In like manner he studied the records of the Southern States since the war, finding the homicides in that part of the country from five to ten times more frequent according to population than in the North. The treatment of such crimes in the South, however, was quite unlike that which prevails in the North. In this his statistics amply bear out those furnished recently by the Clerk of the Criminal District Court of New Orleans, in response to the Governor's request. The report is dated September 6, 1880, and was published at length in the *New Orleans Times*. The grand total of crimes of this nature in New Orleans during the ten years ending December 31, 1879, stands thus:

Total homicides.....	303
Guilty of murder and sentenced to death.....	11
Guilty without capital punishment.....	46
Guilty of manslaughter.....	44
Not guilty.....	110
Nolle prosequi.....	69
Not a true bill.....	9
Fugitives from justice.....	3
Transferred to dead docket.....	12
Mistrial.....	3
Total.....	303

In the ten years eleven persons were sentenced to be hung for homicide: of these but five were executed—two Italian sailors, entire strangers; one friendless Malay, and two negroes.

Homicide by native whites is not usually punished by death in the South. It is to this circumstance that Mr. Redfield attributes the fact that the murders in the Southern States are greatly in excess of the number elsewhere among English speaking peoples.

Homicide occurs less frequently in New England in proportion to population, and in no part of the country do man-slayers so rarely escape punishment. Fully half the murders in New England are by foreigners. Among the native-born the homicides do not exceed 1 to every 150,000 inhabitants annually. For a period of eleven years the homicides in Vermont averaged less than two a year. In many years not a single homicide has occurred in the State. In 1870 the vital statistics collected by the census showed but one homicide in Vermont and New Hampshire. In Florida, with less than one-third as many inhabitants, there were forty-four homicides. For the State of Massachusetts the annual average is twenty-three, half the murders occurring in Boston, and the larger portion there among foreign born residents.

In the Northern States generally the largest number of homicides occur in the cities: in the South the number is largest in the rural districts. During the two years 1877 and 1878 there were forty homicides in Massachusetts and over two hundred in South Carolina, with less than half the population of Massachusetts. Almost all the South Carolina cases were "personal difficulties," or chance fights from sudden quarrels. To a very great extent the Southern murders are due to the general habit of carrying pistols and using them at the slightest provocation. Touching the benefits that would result from the repression of the habit of carrying concealed weapons, Mr. Redfield cites the example of England, where the number of murders, in proportion to population, has been decreased in the ratio of 18 to 1 in the past four hundred years, and in consequence of a vigorous enforcement of law, at one period going to the extent of affixing capital punishment to the crime of stabbing a person or shooting at him, whether with fatal effect or not. The result was a wholesome diminution of this barbarism. Under the English system a murderer is not allowed to roam around on bail, and the chances of his escaping punishment are very rare indeed. As a consequence, in England and Wales, among the twenty-six millions of population, there are fewer murders and manslaughters than in the single State of Texas, in our own country.

Texas is a large State, but the homicides there are decidedly out of proportion either to its size or the number of its inhabitants. During the census year of 1870 there were more homicides in Texas than in all the Northwestern States combined, with three or four other States thrown in. The census vital statistics show one homicide annually in Texas to about every 2,500 population; in Iowa and Minnesota there is one annually to about every 50,000 population. In this fatal superiority Texas does not greatly lead the sister States of Louisiana, Arkansas, Mississippi, Kentucky, and South Carolina. In one rural county in Kentucky (Madison) the homicides during 1877 and 1878 were more than in all Massa-

chusetts. In Edgefield County, South Carolina, as many men were killed in street fights and personal difficulties in 1878 as there were homicides in Massachusetts, outside of Suffolk County. In the Northern States homicide is least frequent, in proportion to population, in New England and New York (outside New York city) than elsewhere; and probably most frequent in the southern counties of Indiana and Illinois. Homicide is quite frequent in New York city and in the coal and oil regions of Pennsylvania. In Ohio it is very much more frequent in the counties bordering on the Ohio River than in the Northern counties. It is least frequent in the farming counties of the "Western Reserve," where the proportion agrees with that of rural New England.

Open Air for Consumptives.

Dr. J. Henry Bennet, in a communication to the *British Medical Journal*, on the influence of mountain air in the treatment of pulmonary consumption, asserts that the temperature which exerts the most favorable influence in the treatment of phthisis is a day temperature ranging from 55° to 65° or 70° Fah., and a night temperature between 45° and 50°; in other words, that the climate and temperature which are the most conducive to the physiological well-being of the Caucasian race are also the most favorable to the treatment of phthisis. He draws attention to the fact that phthisis is rare among the people inhabiting the high plains of Central and South America, although common in the neighboring seacoast towns. Dr. Comes, with whom Dr. Bennet has lately been in correspondence, states that during a residence of four years in Quito, where he was one of the professors at the medical school, physician to the hospital, and engaged in active private practice, he only saw two or three cases of spontaneous phthisis among the natives, and in all the cases of imported phthisis from the seacoast that he met with the progress of the disease soon appeared to be arrested. He also states that in a large room, without fire, and with doors and windows open day and night, he found the temperature to oscillate all the year round between 57° and 65° Fah.

Dr. Bennet relates the case of a young married lady, aged 26, whom he attended for two winters at Mentone. She was a native of Guayaquil, but educated and married in France, where she became a consumptive; and finding that her recovery at Mentone was only a partial one, she returned to her native country. She has now been two years at Quito, and has become quite well and robust. But then, at Mentone, she lived shut up, while at Quito she has lived in the open air constantly. He therefore thinks that the immunity, or comparative immunity, from phthisis enjoyed by the inhabitants of the elevated mountain plains of tropical and sub-tropical America, from Mexico to the Argentine Republic, cannot be owing to mere elevation—to barometric conditions—inasmuch as phthisis reigns at all elevations, even above 5,000 feet, on the mountains of Switzerland. It cannot, either, be attributed to mere dry cold, as the mortality from phthisis is greater in Norway, Sweden, and Northern Russia than in London or Paris. It must, then, be owing to the ideal physiological climate, which enables the entire population to live, as it were, out doors, in the open air, night and day. Why should not the Andes, with a delightfully mild, dry, and equable climate, which is unequalled in any part of the world, become the health resort of the future?

Characteristics and Properties of Good Vinegar.

H. Krätzer says the quality of vinegar may be detected by its taste, by its color, and by its smell; for instance, good vinegar must have a sour taste, which is not altered by free alcohol or other foreign substances. As to the color, may it be that of the water-clear or of the wine-yellow vinegar, it must always be perfectly pellucid, and when rubbed between the fingers the odor must be acid without having any similarity to spoiled liquors; but before all, vinegar, if brought to the lips, must not produce either an itching or burning, nor give to the teeth a feeling of bluntness, for if this should be the case we can be sure that the vinegar is adulterated.

Adulterations are sometimes produced by the addition of mineral acids, sometimes by vegetable matters. Of the former, especially sulphuric acid, muriatic acid, and sometimes even nitric acid are used; of the latter we mention cayenne pepper, bertram root, common pepper, etc. The method of detecting these adulterations is the following:

If sulphuric acid is suspected of being present we should pour some of the vinegar into a small test tube, and add some chlorate or acetate of barium; if by the addition of this a white color is produced or after a time a white precipitate is formed, then the vinegar has been adulterated with sulphuric acid. If the vinegar only becomes slightly turbid, the reason may be accounted for by the fact that the water which was used for the fabrication of the vinegar contained sulphate of lime. To be certain that the vinegar contains free sulphuric acid the following method should be employed: A small portion of vinegar is put into an evaporation dish and there evaporated until it is condensed to about one-tenth of its weight; the remainder is dissolved in alcohol, filtered, and diluted with water, and finally a solution of chlorate of barium is added. If now the vinegar shows a turbid white color the adulteration by sulphuric acid may be assumed with certainty. Recently, for the detection of mineral acids a new reagent has been devised, which can be well recommended, viz., methyl-aniline-violet. A diluted solution of this substance does not change color at all with pure vinegar, while if the slightest quantity of mineral acids is present it takes a blue-green color.

If an adulteration of muriatic acid is suspected, some drops of a solution of nitrate of silver should be added to the vinegar; if a white, flaky precipitation is formed, which is blackened by the sunlight, and cannot be dissolved after an excess of nitric acid has been added, then the adulteration is proved.

To prove the presence of nitric acid a small quantity of potassium should be mixed with the vinegar, and after the liquid has been evaporated the remainder should be placed upon some glowing charcoal. If decrepitation takes place the adulteration may be taken for granted, otherwise the salt burns without noise and diffuses an odor similar to that of burnt sugar.

To detect the adulteration by sharp vegetable matters the following method may be employed:

A small quantity of the vinegar, having the weight of 150 grains, is slowly evaporated until some brown liquid remains. If it was adulterated, this liquid has a sharp stinging taste, while if this is not the case it will have only an acid taste.

A still more simple method is to moisten the upper lip with vinegar, the purity of which is acknowledged, while the under lip is moistened with the vinegar which is to be examined, and both are permitted to dry. If the vinegar has been adulterated in the manner mentioned a disagreeable itching or stinging is felt on the under lip, while the upper lip is not affected.

A third method for the same purpose is, to neutralize the vinegar by carbonate of soda; the acid taste of the vinegar is thus removed and the sharp taste of spices remains.

If vinegar is kept in copper vessels it is often dangerous to the health. In order to discover whether this has been the case sulphureted hydrogen is employed; if the vinegar first turns a brown color, and if finally a black precipitate is formed, the presence of copper is evident. Vinegar which has been kept in tin vessels gives a yellow precipitate when mixed with sulphureted hydrogen; such as has been kept in zinc vessels gives a white precipitate, and the presence of lead is indicated by a black precipitate.

If iron vessels have been used for the preservation of vinegar the latter loses its value for many industrial purposes. The presence of iron can be detected by the addition of ferrocyanide of potassium, which in this case produces a blue precipitate.

The strength of the vinegar is found in the usual way by means of an acetometer. That of Otto deserves to be recommended.

Recent Telegraphic Progress.

The laying of the new Atlantic cable for the Anglo-American Company gives occasion for a review of recent telegraphic undertakings in other parts of the world, not the least important of which is the laying of the cable between Hong Kong and Manila.

In Europe the most important work projected is, perhaps, the duplication of the Anglo-Danish means of communication by a cable from Newcastle to Arendal in Norway, and thence to Gothenburg in Sweden. Vienna is about to be supplied with underground telegraphic lines after the manner of London, Paris, and Berlin.

On this side the Atlantic several short cables are to be laid by the Canadian Government in the Gulf of St. Lawrence, so as to connect up the lighthouses on the Gulf Islands, notably Anticosti and Sable Island, with the villages of the mainland, and thus facilitate the salvage of shipwrecked vessels. These cables are being made by the Silvertown Company, and will probably be laid this fall. Canada is also bent on finishing her trans-dominion telegraph line, following the route of the Pacific Railroad, and Mr. Sandford Fleming, the engineer-in-chief of that work, has recommended the speedy erection of a line between Fort Edmonton and Cache Creek, so as to complete the communication between Winnipeg in Red River and British Columbia. He further advocates the extension of the Canadian system from Vancouver's Island to Japan by submarine cables via the Aleutian and Kurile Islands; and Mr. Gisborne, the superintendent of Canadian telegraphs, proposes to go still further and unite Japan to Hong Kong and Australia. In Australia itself there is a rapid spread of telegraph lines always going on. A new line is being built from Adelaide to Melbourne, and a cable is to be laid between Sturt's Lighthouse, Kangaroo Island, and Kingscote.

The Western Brazilian Telegraph Company intend to repair and put in working order their long inactive cables between Para, Cayenne, and Demerara. The latest projected work is the laying of a cable between Matamoros, in Texas, the southernmost point of the United States telegraphic system, to Vera Cruz, in Mexico. The line will consist of two sections, one from Matamoros to Tampico, and some two hundred and nine miles long, and the other from Tampico to Vera Cruz, a length of 256 miles. The core will be made of 107 pounds of copper and 166 pounds of gutta percha per mile. The main cable will be sheathed with 12 No. 6 galvanized iron wires and the shore end with 14 No. 1 wires. The insulation resistance of the cable, after five days' submersion, is specified to be 225 megohms per knot at 75° Fah. The temperature of the sea bottom will be tested every fifty miles of the route and one mile from shore at each terminus, the mean of these several observations being taken as the actual temperature throughout. The cable has been designed for the Mexican Telegraph Company, recently formed, by their engineer, Mr. J. B. Stearns, of duplex telegraph fame, and will be laid this year by the contractors, the India-rubber, Gutta Percha and Telegraph Works Company.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Eclipse Portable Engine. See illustrated adv., p. 252.

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Clark Rubber Wheels adv. See page 257.

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Peck's Patent Drop Press. See adv., page 258.

Blake "Lion and Eagle" Imp'd Crusher. See p. 259.

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Saw Mill Machinery. Stearns Mfg. Co. See p. 259.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 259. Totten & Co., Pittsburg.

Vacuum Cylinder Oils. See adv., page 259.

Lightning Screw Plates and Labor-saving Tools, p. 259.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. A. asks: How can I fix a mirror from which some of the quicksilver has been scratched? A. Remove the silvering from the glass around the scratch so that the clear space will be about a quarter of an inch wide. Thoroughly clean the clear space with a clean cloth and alcohol. Near the edge of a broken piece of looking glass mark out a piece of silvering a little larger than the clear space on the mirror to be repaired. Now place a very minute drop of mercury on the center of the patch and allow it to remain for a few minutes, clear away the silvering around the patch, and slide the latter from the glass. Place it over the clear spot on the mirror, and gently press it down with a tuft of cotton. This is a difficult operation, and we would advise a little practice before trying it on a large mirror.

English Patents Issued to Americans.

From September 23 to October 1, 1880, inclusive.

Blacking brush, E. L. Wood, Eastland City, Texas.
Compound for preventing pain, H. E. Dennett, Boston, Mass.

Electricity, apparatus for generating, E. Thomson, New Britain, Conn.

Electricity, conductors for, T. A. Edison, Menlo Park, N. J.

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Engines for locomotives, F. M. Stevens et al., Concord, N. H.

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Magneto-electric machine, T. A. Edison, Menlo Park, N. J.
Mail bag, C. J. Becktel et al., Muncie, Ind.
Planoforte, A. Heilig, Little Ferry, N. J.
Rail for railway, E. Rider, New York city.
Soap, manufacture of, A. Bastei, Brooklyn, N. Y.
Telephone, A. G. Bell, Washington, D. C.
Type setting machine, J. Thorne, Port Richmond, N. J.
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August 12, 1880.
"I cheerfully testify to the merits of Dr. Scott's Electric Hair Brush. It cures my headaches within a few minutes. I am so pleased with it I purchased another for my wife. It is an excellent Hair Brush, well worth the price, aside from its curative powers."
JAS. B. CHAPMAN.

[From Rev. Dr. Bridgeman.]

Brooklyn.

June 1st, 1880.

"Gentle—I have

never before given a

testimonial, but am willing

to encourage the use

of an honest remedy. I am

so pleased with your Hair

Brush that I deem it my duty

to write you recommending it

most cordially. My hair, about a

year since, commenced falling out,

and I was rapidly becoming bald; but

since using the Brush a thick growth of

hair has made its appearance, quite equal

to that which I had previous to its falling

out. I have tried other remedies, but with no

success. After this remarkable result I pur-

chased one for my wife, who has been a great suf-

ferer from headache, and she finds it a prompt and

infallible remedy.

A. C. Bridgeman, D.D."

218 Fulton Street, New York, August 21, 1880.

"I would Not take \$1,000 for my Brush

If I could not replace it."

Mr. Smith is a gentleman well known in this City as a Law Publisher, and also as a Director in several

Public Institutions of New York.

DE. GEO. A. SCOTT—Dear Sir: Permit me to add the testimony of my wife to that of the many others who

have been benefited by the use of your Electric Brush. She has for years been a sufferer from Neuralgia in an

acute form, but since I obtained for her one of your Brushes, she has experienced entire relief. Please accept

her sincere thanks.

Round Lake Camp-Meeting Grounds, Saratoga Co., N. Y., June 8, 1880.

"Your Brush is certainly a remarkable cure. I am highly pleased with it. Its effect is most wonderful, and you

may be sure I shall recommend it heartily among my friends. It is also a splendid Hair Brush, well worth the money,

and will last me for years.

Mention this Paper.

Over 7,000 similar Testimonials can be seen at our office.

Remember that this

is NOT a "metallic"

wire brush, but made

of PURE BRISTLES.

As soon as you receive the Brush, if not well satisfied with your bargain, write us, and we will return the money. What can be fairer?

This paper will not knowingly publish any humbug, and I have placed a Brush in the hands of Mayor Cooper and Postmaster

James of New York, as a guarantee of my good faith.

Remittances should be made payable to GEO. A. SCOTT, 842 1/2 Broadway, New York. Agents wanted in every town.

They can be made in checks, drafts, post office orders, or currency. Inclose 10 cents for registration, and we guarantee safe delivery of Brush.

218 Fulton Street, New York, August 21, 1880.

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"Domestic" Sewing Machine Co., New York, August 15, 1880.

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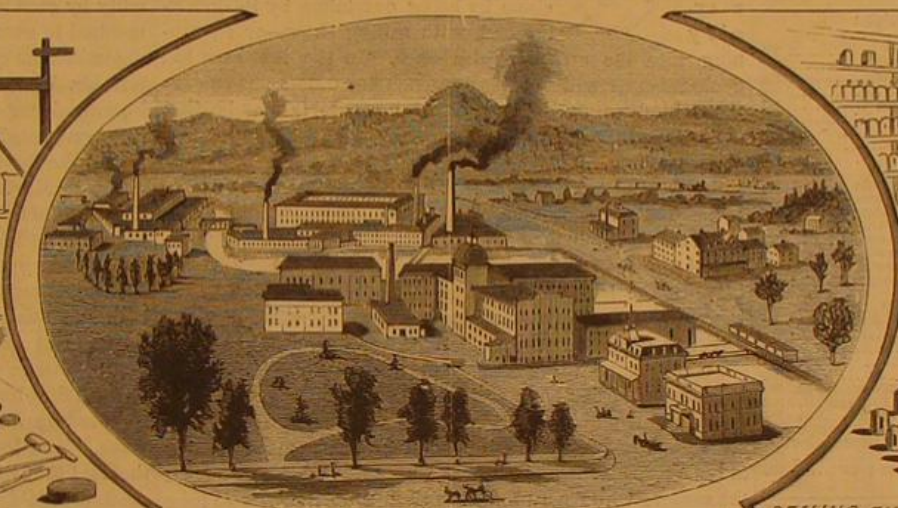
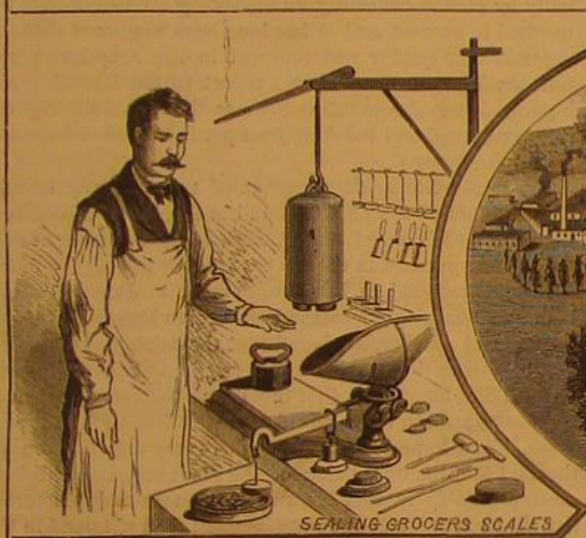
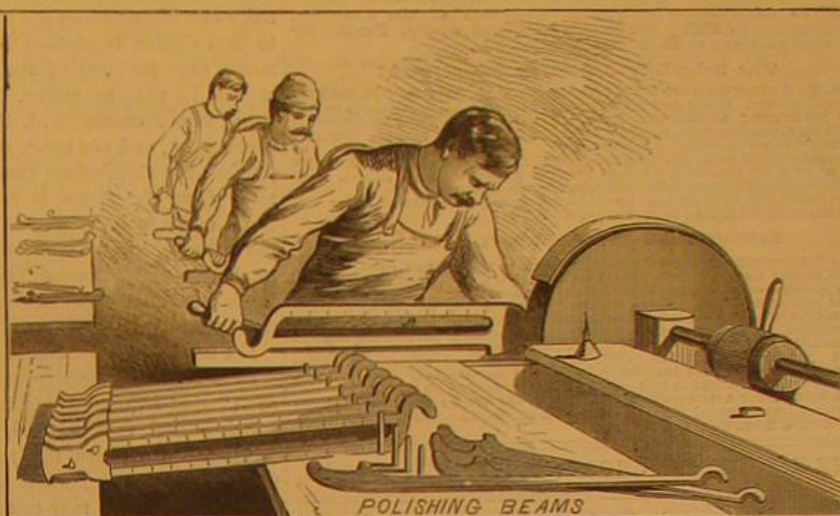
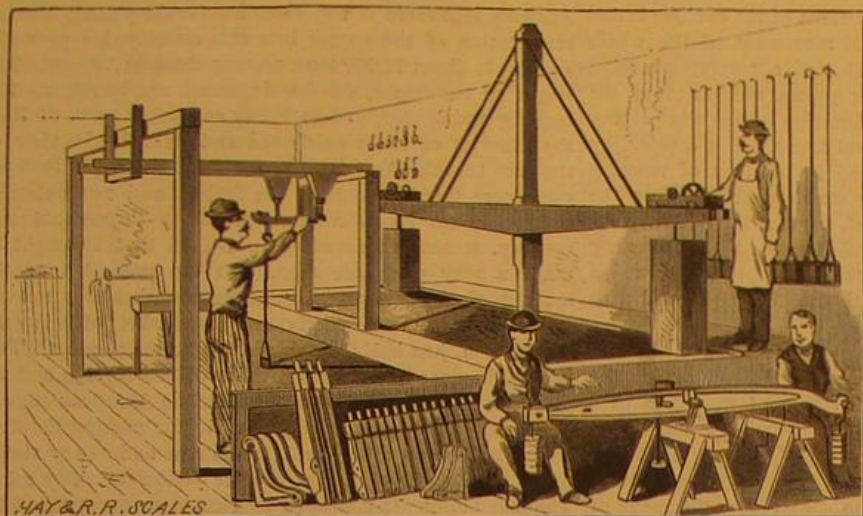
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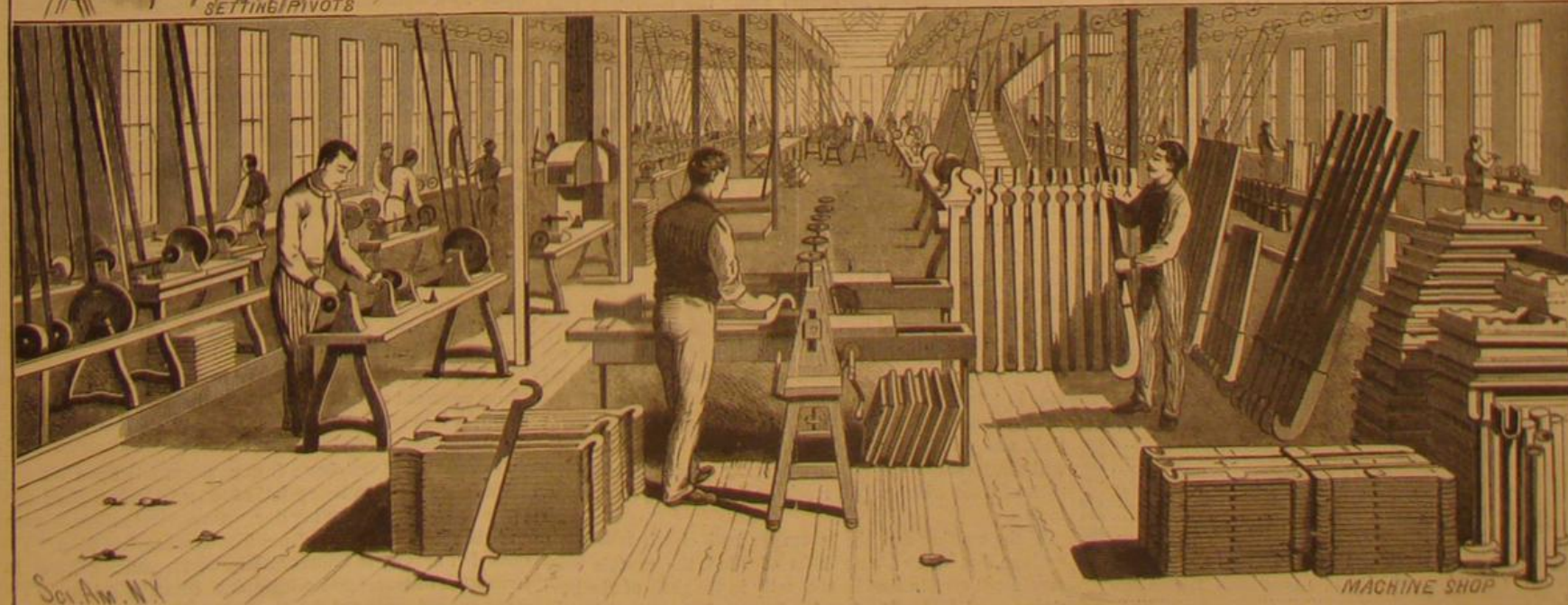
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NEW YORK, SATURDAY, NOVEMBER 6, 1880.

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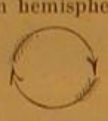
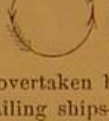
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THE LAWS OF CYCLONES.

There seems to be no subject of equal importance so little understood as the laws governing the revolving storms of wind known as cyclones. That this should be the case among landmen who rarely encounter them is not strange; but that sailors and *soi-disant* scientists should fall into gross errors in treating so simple a subject is not only unpardonable, but incomprehensible. The cyclone, as it is called in the northern hemisphere, or the typhoon, by which name it is known in the southern seas, is a revolving storm of wind, having a diameter of from 100 to 800 miles, and a spot of actual calm in the center. This storm revolves at a velocity increasing from the edges toward the center, where it sometimes attains a rate estimated at five miles a minute. The whole disturbance also moves forward at a speed varying from five to forty miles an hour. The great difficulty in understanding the phenomena of the cyclone is due to this double motion—a lateral movement of the whole storm over the face of the earth, and a revolving motion around its axis, or center. The general movement of the storm is confounded with the direction of the wind at any given point, and *vice versa*, so that oftentimes a captain, by putting his ship before the wind, in the idea of running away from the storm, is really steering straight into the track of its most dangerous part, namely, the center. Yet the means of knowing how to avoid this danger are so easily attainable that no captain nor mate ought to be allowed a berth on shipboard unless he is thoroughly acquainted with these simple rules.

Let us examine the conditions of the problem.

In the northern hemisphere the wind rotates "against the sun;" that is, opposite to the direction of the hands of a watch placed face upward, thus, ; and in the southern hemisphere the motion is reversed, thus, . Now it is evident that a vessel may come into the range of a cyclone by being overtaken by it—generally the case with sailing ships—or by running into the area of disturbance. In the first case the cyclone center will steadily approach her unless she runs in the right direction, while in the latter case it may be that she will feel the influence of the cyclone less and less as it draws away from her. The vessel must come into its influence in one of the quadrants indicated by the letters A, B, C, and D, in the figure, the direction of the forward motion being shown by the arrow.

So long as a ship was anywhere in either quadrant, A or B, she would feel a constantly increasing power of the wind, and would be in a steadily increasing danger. If a steamer should run into either of these quadrants she ought at once to take such a course as would carry her away from the center; while a sailing ship should do likewise so long as the wind and sea were not too heavy, and then "lie to" on the proper tack. If a steamer entered either C or D quadrants she would be obliged to change her course very little, if at all, and a sailing ship could actually derive a benefit from the cyclone by keeping in its edge as long as the wind and sea permitted her to do so.

Now the great question to be determined is: How can a captain tell which quadrant he is in when he enters a cyclone? First of all, he must always observe the weather and the barometer so closely as to know at the earliest possible moment when a cyclone is coming. Having assured himself that the approach of a cyclone is certain, he should carefully watch the wind and notice in which direction the shifts occur. These gradual changes in the wind's direction constitute the most marked features of the cyclone, since there is only one position in which they will not be immediately observed, namely, if the ship lies exactly in the path of the center of the hurricane in its onward course. When these changes in the direction of the wind have become clearly marked, he should apply the following rule, which is invariable in both hemispheres: When the shifts of wind occur from right to left, that is, say from north to west, west to south, south to east, or east to north, the observer is in quadrant A or quadrant D, that is, on the left hand side of the cyclone's advance facing in the direction in which it is moving; but if the shifts come from north to east, east to south, south to west, or west to north, the observer is in quadrant B or quadrant C, on the right of the storm's track. Knowing on which side the storm center will pass, it is an easy matter to avoid it. The difference between quadrants A and B and quadrants C and D will soon be discovered by the fact that in the first pair the storm will steadily increase, while in the two latter the strength of the wind will diminish. When a sailing ship has run away from the center as long as the wind and sea will permit her to do so, she must invariably follow this rule in "lying to." If she is on the right hand side of the storm center's track she must "lie to" on the starboard tack, and on the port tack if on the left hand side. She will thus escape the danger of being caught aback by a shift of wind which might result in her sinking stern foremost.

If the weather and the barometer both clearly indicate a cyclone, but there are no shifts of wind, the captain may consider it certain that he is exactly in the path of the hurricane; and during the first few hours of the storm there is a direct relation between the rapidity with which the wind

changes its direction and the proximity of the vessel to the cyclone's track: the slower that the shifts occur the nearer the vessel is to the path of the center, especially if the increase in the wind's strength is great; but if the shifts occur rapidly and steadily without a very great increase in force, the center will not pass very near. A careful seaman, consulting his experience and his barometer to discover the approach of a cyclone, observing carefully the foregoing rules to determine on which side of and how near him it is going to pass, and using a prudent discretion in avoiding its center, ought never to lose his ship.

THE CULTIVATION OF THE SUMAC.

There are thousands of people who wander through the woods in autumn picking the beautiful scarlet and yellow leaves of the sumac bush to decorate their rooms, without knowing that there is any other use for the plant. Yet the importation of the sumac into this country this year will amount to about 11,000 tons, costing about \$1,100,000. The leaves of the sumac, dried and ground, are largely used in tanning and dyeing, and in Sicily and other parts of Italy the plant is carefully cultivated and treated. In view of the fact that the American sumac contains from 6 to 8 per cent more tannic acid than the Italian, and remembering that the plant grows wild in profusion throughout this country, it seems reasonable to believe that it might be made a very profitable crop. At the present time the amount of native sumac brought into market does not exceed about 8,000 tons yearly, and its market price is only \$50 per ton, just half the price of the Italian product. This large difference in the market value of the foreign and the domestic article is due to the fact that the American sumac, as at present prepared, is not suitable for making the finer white leathers so much used for gloves and fancy shoes, owing to its giving a disagreeable yellow or dirty color. The many attempts that have been made to avoid this difficulty by care in collecting and grinding the leaves have not resulted in success, and it has long been supposed that this objectionable quality was inherent in the American plant; but Mr. Wm. McMurtrie, in a report to the United States Commissioner of Agriculture, shows that this difficulty can be surmounted and the American product made even superior to the foreign.

Mr. McMurtrie made a number of tests to learn the relative amounts of tannic acid found in the leaves at different periods of their development, and while the amount was found to be greatest in the leaves gathered in July, he found that those gathered in full development in June were even then more than equal to the best foreign leaves in this respect. But further, he found that the deleterious coloring matter (due to the presence of quercitrin and quercetin) was not yet developed, and that therefore the American leaves gathered in June were superior to the Italian for all purposes. The importance of this discovery may be seen by the fact that the cultivation of the plant may be carried on most profitably in this country as soon as manufacturers and dealers recognize the improvement thus obtained in the domestic article, and by classifying it according to its percentage of tannic acid and its relative freedom from coloring matter, advance the price of that which is early picked and carefully treated.

In Italy the sumac is planted in shoots in the spring in rows, and is cultivated in the same way and to about the same extent as corn. It gives a crop the second year after setting out, and regularly thereafter. The sumac gathered in this country is taken mostly from wild plants growing on waste land, but there is no reason why it should not be utilized and cultivated on land not valuable for other crops.

THE COLOR OF OZONE.

A paper recently read before the French Academy of Sciences contains some interesting facts relative to the liquefaction of ozone. A reservoir containing oxygen, at a temperature of 9.4° below zero (Fahr.), is charged with ozone, and pressure applied by a column of mercury acted upon by a hydraulic press. Immediately the gas begins to turn to an azure blue color, deepening the shade as the pressure increases. The liquefaction of ozone was obtained by applying a pressure to the ozonized oxygen of 75 atmospheres, while 300 atmospheres of pressure would have been required for pure oxygen. The fact was also established that ozone is an explosive gas, since, unless compressed slowly and at a low temperature, it exploded with a yellow flame. Its heavenly blue color was rendered manifest not only under heavy pressure, but under all circumstances.

UNTIMELY SNOWS.

The retreating winter of the southern hemisphere goes out like a lion, while the first showings of our coming winter are by no means lamb-like.

A dispatch from Buenos Ayres says that a terrific snow storm occurred in that province September 18, causing the death, it was estimated, of 700,000 cattle, 500,000 sheep, and 250,000 horses.

On the 15th of October a furious storm fell upon Western Iowa, attended by a heavy fall of snow, which drifted seriously during the following day. On several railroads trains were blocked by drifts from five to seven feet deep. The snow fell heavily in Southern Minnesota, causing great interruption of travel and telegraphic communication. The storm moved eastward slowly, raging with greatest fury over Lake Michigan, wrecking a number of vessels and causing a

serious loss of life. Even as far east as Western New York the snowfall was from twelve to fifteen inches, and badly drifted. Between Buffalo and Rochester several freight trains were stalled, and the passenger trains of the morning of October 18 had to be abandoned. So early and so severe a snowfall is quite unusual.

THE CAPE COD CANAL.

From time to time, for the past two hundred years, the merchants and shipmasters of Boston and New York have agitated the question of severing, by a ship canal, the narrow neck of land between Buzzard's Bay and Barnstable Bay (the inner portion of Cape Cod Bay), and thus saving the dangerous passage around Nantucket and Cape Cod. More than a century ago a committee, favored by Washington, examined and reported upon the feasibility of the project, and recommended its execution on commercial and military grounds. The need of such a channel of inshore communication was severely felt during the war of 1812, and in the years immediately succeeding the war the project was often brought up for public consideration. Between 1818 and 1824 the route of the proposed canal was re-examined by order of the State authorities of Massachusetts, and in 1825 a careful survey was made by Major Perault, U. S. Engineer, under the direction of the President of the United States.

The results of the survey, with plans, estimates, etc., were laid before Congress in 1826. Two years later the Board of Internal Improvement adopted a route for the canal, and there was every promise of its early execution. But a change of administration occurred, and with it a reversal of the policy of the general government touching the question of internal improvements, and the affair was dropped for thirty years or more.

In 1860 the State authorities of Massachusetts revived the project, obtained the assistance of the Coast Survey, and got together much information directly bearing upon the feasibility and probable benefit to flow from the work.

The exigencies of the war, however, prevented the carrying out of their plans at that time, and the years immediately following the war were not favorable for such enterprises. So the matter rested until a few months ago, when a merchant and shipbroker of this city took up the scheme, enlisted a number of New York capitalists in the enterprise, purchased, under an unexpired charter, a strip of ground a thousand feet wide across the neck of land to be severed, and set to work to dig the canal. The contract was given to Adam Driesbach and John Cameron, of New Jersey, and Mr. Geo. H. Titcomb was placed in charge as engineer.

The position of the proposed canal is shown in the accompanying map. The neck of land to be cut through is a little short of eight miles across. Two small rivers, the Monumet and the Scusset, make a shallow water way about seven-eighths of the distance, the narrow dividing ridge, five miles from Buzzard's Bay, rising only thirty-five feet above the average level of the bays on either side at low water. The earth to be removed consists mostly of gravel and is easy of excavation. The canal will be without locks, and owing to the difference in the times of high and low water in the two bays it is expected that a current of two miles or more an hour will traverse the canal four times a day. In width and depth the proposed canal compares with other ship canals as follows:

Canal.	Width at mean level. Feet.	Width at bottom. Feet.	Depth at mean level. Feet.
Cape Cod Canal	225	66	25
Caledonia Canal	110	50	20
North Holland Canal	123	31	20½
New Amsterdam Canal	191	87	25
Suez Canal	190	72	56

The direct advantages of the canal are the saving of ninety miles of distance and at least eight hours of time on the trip from New York to Boston. The incidental advantages are the avoidance of delays through fogs and rough weather while rounding Cape Cod; escape from the serious dangers attending the navigation of that dangerous coast, the present average loss by shipwreck on Cape Cod being something like 6,000 tons of vessel property a year, and from twenty to forty lives. In addition, the safe inshore route which the canal will provide will enable the popular Sound steamers, which cannot endure the outside passage, to run the entire distance to Boston. By this route steamers for freight and passengers will be able to leave New York in the evening and reach Boston early the next morning, making between the two cities one of the most inviting excursion routes imaginable. For general freight traffic between these ports—indeed for a large part of the coasting trade—the canal cannot fail to prove economical. It is estimated that not less than 40,000 vessels round the cape every year, carrying cargoes valued at \$600,000,000. The friends of the canal expect that fully 4,000,000 tons of shipping will use the canal the first year. The saving in

insurance, time, crew's expenses, etc., is estimated at \$1,500,000.

The subscribed capital of the company formed for digging the canal is reported at \$8,000,000, of which it is said that \$1,500,000 have been paid in. The work is to be completed in two years, if the plans of the company are carried out.

A Five Hundred Dollar Comet.

To the Editor of the Scientific American:

I hasten to say to the astronomical readers of the SCIENTIFIC AMERICAN that on the evening of the 10th instant, just before midnight, I discovered a new comet in about right ascension 21 hours 30 minutes, declination north 17° 30', or in the constellation Pegasus. It was very large, and its apparent motion so slow, and I have been so troubled to see it in the evening by moonlight and in the morning by haze and clouds, that I am yet uncertain regarding its direction and rate of motion. I can say, however, it is moving very slow, and probably west of north. Its slow apparent motion indicates that it is either moving nearly toward or from the earth.

It is so nearly in opposition to the sun (the earth being nearly between the two bodies) that its distance from the sun must be equal to the earth's distance (ninety-two and a half million miles) with the comet's distance from the earth added, whatever that may be, so that its distance from the sun must be very great.

It is, or was when discovered, apparently on the border land between brightness and faintness as applied to a telescopic comet. Its great apparent magnitude may be owing to proximity to the earth, but if, as is probable, it is at a very great distance from us, its real magnitude must be enormous.

As soon as the moon withdraws, observations of a reliable character will be made by such astronomers as have a clear sky, when the elements of its orbit will be approximately determined, and its magnitude, distance from both earth and sun, and many other interesting facts ascertained.



THE CAPE COD CANAL.

It is greatly to be hoped that it prove a bright one, that it may be satisfactorily subjected to spectroscopic analysis, for no large and bright comet has appeared since the invention of the spectroscope.

Whether science will be benefited or not, my pocket has been, for Mr. Warner, who is building for my use the "Warner Observatory," probably the finest private observatory in the world, has just handed me a check for \$500 for discovering it. This munificent gift, together with the gold medal I shall get from the Imperial Academy of Sciences of Vienna, makes it a comet which has some remunerative qualities about it which can be seen with the naked eye. During the whole history of astronomy, I think this is the highest price ever paid for a comet.

LEWIS SWIFT.

Rochester, N. Y., October 16, 1880.

Importance of Scientific Research.

The Philadelphia Ledger thinks that the scientists employed by the government have generally given a full return for the money expended upon them and their labors, and if Professor Riley has really found a means of putting an end to the ravages of the cotton worm, the editor adds, he will have paid in a single season for a whole decade of accumulated salary. So many scientists of our day turn speculative philosophers, and confound the public mind at least as to what is known and what is simply guessed at, that science, so far as they may represent it, is brought into disrepute, but the labors of real observers and experimentalists continue to be of immeasurable value to workers everywhere and in all kinds of occupations. The economic work of topographical and geological surveyors, of entomologists and meteorologists cannot be done effectively by private institutions or by individuals. The government must look to it "for the general welfare," and there is no danger that too much of it will be done. The discovery

of a means of stopping the ravages of a single pest like the grasshopper, or the army or cotton worm, or the potato bug, is worth more than has been expended by the government on purely scientific labors since the foundation of the government.

The Keeley Run Colliery Fire.

The failure of the attempt to stop the fire in the Keeley Run Colliery, Pennsylvania, by flooding the mine, was noticed some months ago. The attempt to suppress the fire by means of carbonic acid gas and nitrogen has been equally unsuccessful. That part of the mine in which the fire is has been closed up, and is estimated to have a capacity of 12,000,000 cubic feet. It is claimed that 6,000,000 cubic feet of gas has been forced into the mine daily for some weeks, but it has had no effect upon the fire.

Cresolene for Epizooty.

The following experiment in the treatment of a case of epizooty is reported to the Tribune by George Shepard Page, of Stanley, N. J. An ordinary stall containing a sick horse was lined and inclosed with sheets of carbolized paper. A vaporizer was set in operation, evaporating chemically pure cresolene (C₆H₄CH₃O). The horse had been coughing very frequently, the offensive discharge from the nostrils was profuse, and the eyes were dull and sunken. In ten minutes the inclosed space was charged with the vapor. In half an hour a copious discharge of mucus took place. The animal exhibited evident relief, holding its nose over the grating through which the vapor was issuing, the vaporizer being placed in the iron feed box, over which a perforated grating was arranged. He remained in the inclosure for six hours. The effect produced was marvelous. The cough ceased, the discharge from the nostrils was entirely checked, and the eyes regained their normal condition of brightness.

INCENDIARY SILKS.

Our readers will recall the interest that was awakened some months ago with regard to the spontaneous combustion of certain silks on shipboard and in warehouses in this city.

The burning of the storage warehouse in Leroy street, apparently from this cause, led to the appointment of a committee of investigation by the New York Board of Fire Underwriters. They have now completed their inquiries and issued their report, which conclusively establishes the fact that the fire in question and other fires in the same warehouse and elsewhere must have been caused by the spontaneous combustion of black silk yarn, thread, or twist, a class of fabrics often so loaded with dangerous dye-stuffs as to be at all times liable to burn of themselves. Five fires—four in this city and one in Philadelphia—are proved to have this origin, involving heavy losses and the peril of property valued at hundreds of thousands of dollars.

The evidence collected includes chemical analyses and the opinions of scientific experts, as well as the direct testimony of witnesses to the effect that in many if not all the cases examined the fires originated within the packages of incendiary silk. The committee refer also to fires occurring while packages of weighted silk were being transported by rail or water—for ex-

ample, that of the Mosel in mid-ocean a year ago, which fire began in and was confined to cases of heavy sewing silk so stored that fire could not have taken from without.

All this merely confirms the information long since brought out abroad in consequence of fires unmistakably traced to weighted silks. It was found that certain European silk manufacturers were able to "load" silk in dyeing to such an extent that the product would yield by analysis three or four pounds of chemicals for every pound of pure silk; and yet the thread would show no visible signs of adulteration. The animal, vegetable, and mineral substances thus united with the silk fiber forms a very unstable compound, liable to rapid oxidation with a consequent heating, which under favorable conditions results in active combustion or fire. Such goods have been known to smoulder and take fire not only while closely packed in cases, but also when lying in piles upon shelves freely exposed to the air; and so dangerous are they that certain European railways have been compelled to forbid their being carried as freight. Reporting upon the fire in the Leroy street warehouse, Fire Marshal Sheldon had no hesitation in pronouncing it due to spontaneous combustion of the silk twist therein stored, and he frankly suggested that the Board of Underwriters should take steps to prevent the storage of such materials in bonded warehouses within the city limits. The matter is evidently one that importers and dealers in silks will do well to consider carefully. The profits on weighted silks may be very large, but they will hardly justify the handling of them at the risk of burning one's entire establishment.

It would seem that nations prefer not their own thermometers, but other people's. It was Germany that invented the Fahrenheit scale, which we have appropriated, the Fahrenheit itself preferring to employ that of a Frenchman, Réaumur; while France will have none of Réaumur, but uses the Celsius or Centigrade, whose introduction is due to a Swede.

AMERICAN INDUSTRIES.—No. 59.

THE MANUFACTURE OF STANDARD SCALES.

When Thaddeus Fairbanks, in 1830, made the first application of his compound lever system in the construction of weighing apparatus, its simplicity and practical usefulness were not long in being appreciated. There was nothing essentially new, however, in the theory of their construction, except in the business-like perception with which he saw how previous well known mathematical and mechanical laws might be applied, in the combination of levers and fulcras, to fill a wide field of usefulness. Archimedes, more than 200 years before Christ, had shown a knowledge of the capabilities of the lever which has been nowhere better illustrated than in the saying imputed to him, "Give me a fulcrum on which to rest, and I will move the earth;" but the only application of the principle of the lever in this department previous to 1830 was in the old-fashioned steelyard, practically very limited in capacity, and exceedingly clumsy in operation. These steelyards and even-balance scales were then the only weighing machines in general use, and it was the obvious need of an improvement in this direction, first experienced in his own business, that led Mr. Fairbanks at the outset to make a scale for his own use, then to make others for his neighbors, and finally, with his brothers Erastus and Joseph, to make a business of this manufacture. The business in 1830 was conducted in a building 25 by 60 feet, employing 10 men. To what extent it has grown within a half century is much better set forth in the illustrations we to-day present relative to this industry than can be understood by the mere details in figures. Ten substantial brick buildings, with nearly ten acres of floor room, now take the place of the original shop; there is also a lumber yard covering ten acres, in which are constantly kept from two to three million feet of lumber; there are over 600 men employed, and 93 tenement houses for the employes; the capital invested now amounts to over \$2,000,000, and the annual product to considerably more than that, while in 1831 it was less than \$6,000.



MARKING THE BEAMS

As E. & T. Fairbanks & Co. cover all departments of the work which enters into their scales, their foundry is necessarily one of the principal buildings. It is 110 feet wide by 175 feet long, with a side extension, in which are three furnaces, one of 20 tons capacity, the others of 12 tons each; also a Sturtevant blower and a 35 horse power engine. These furnaces are worked alternately, one in the morning, a second in the afternoon, and the third on the following morning, their charges being always put in by weight, from the furnace charging scale perfected by the company. These scales are built of iron, so as not to be affected by the heat, and are so arranged that the weight of each portion of a charge may be exactly known without the knowledge of the workman. The pig iron used is about three-fourths American and one-fourth Scotch. The castings embrace a wide variety of sizes, from the large levers and framework of the great canal weigh lock and railway scales down to the small balances and tiny weights everywhere seen. A fine moulding sand is obtained near by, at Fort Ann, near Lake Champlain, and 500 tons of it come every year to the foundry. A railway track runs through the foundry, and all of each day's castings are loaded on cars and run to the "pickling" and milling room, where the larger pieces have a bath in a weak solution of sulphuric acid, and the smaller ones are revolved in a drum according to the usual plan with small castings. Should any imperfect pieces be found here they are sent back to the foundry,

and, if the fault be plainly due to careless or negligent workmanship, the workman is held accountable therefor. There is usually but little cause for complaint on this score, however, for the workmen have generally been many years in the employ of the company, and their theory in this, as in every other department of their business, has been to employ only the most competent and skillful hands to be had.

In addition to the business done in this foundry there is a



FIGURING BEAMS.

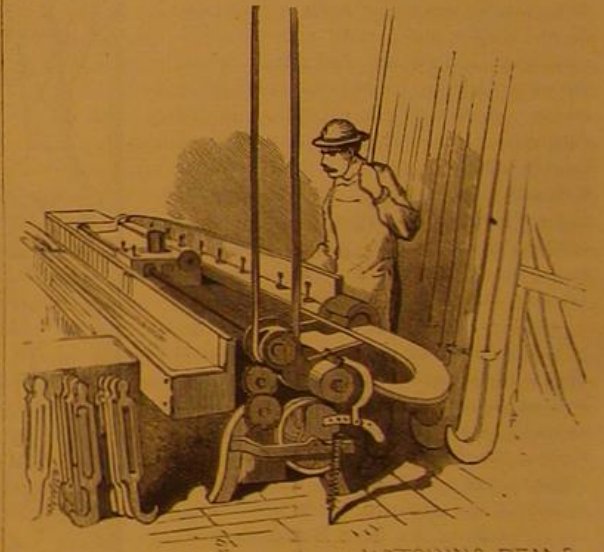
separate department for the brass castings, in which about 1,000 pounds are melted in the crucibles daily. Lake Superior copper is principally used, together with old brass, brass filings, etc., nothing being allowed to go to waste, but especial care is taken in tempering and in the alloy for the brass scale beams, so that the notches will remain sharp and not wear off.

The pattern department occupies a building by itself, 32 by 80 feet, and two stories high. It is crowded with models for castings, which are stored here when not in use, some of the patterns dating back more than forty years, and affording, by contrast with those now employed, a striking record of the progress which has been made in the furnishing of lighter, more convenient, and elegant scales than were known in the early history of the business. On the lower floor are the large scale patterns, including those for the great iron levers used in canal weigh locks, some of which weigh 1,650 pounds each, while eight of them are required for each scale. Here also are the great patterns for railway scales of 150 tons capacity, but which can be increased indefinitely by adding to the number of sections. The second story is also crowded with patterns in shelves and trunks, for the firm are now making over 800 different styles or modifications of scales, some of the patterns for which take a good many pieces. The making of new patterns, however, goes on as regularly as though all this vast plant had not been accumulated. A draughting room is connected with the pattern shop, and here are constantly being made designs for scales of novel construction to meet new uses, to obviate some engineering difficulty, or to more completely serve their purpose than those already introduced. The drawings here show designs for railway scales for tracks of all widths from 30 inches to 7 feet; for railway suspension scales, in which the great levers are in a framework high enough for a locomotive to pass under them; for combination beams for mines; different devices for measuring grain, for testing machines, etc. Of the latter class of machines the largest the firm has made was for the city of New York, being of 108 tons capacity, to be used to test the strength of girders

and building materials. The blacksmithing and forging department has a special building for itself, 200 feet long, in which 75 workmen are employed. It is provided with large and small power hammers, and dies for such portion of the work as can be struck out. The bar iron consumed yearly amounts to 350 tons, besides 50 tons of steel and 20 tons of nuts and washers.

The machine shop is 180 feet long by 70 wide, and is fitted up with a great variety of costly machinery, a large portion of which has been especially designed for the scale manufacture. In all parts of the works there are over 1,600 feet of main shafting, besides counter-shafting, etc., and it requires more than six miles of steam and gas pipes to do the heating and lighting. Perhaps the most interesting machinery in this department is that for making the notches in the scale beams. This operation for all the small scale beams is done on two or three hundred at once, the beams being laid in a frame which travels backward and forward under a cutter until all the notches are made, and this is done so nicely that the edges are all left smooth, each beam being necessarily notched in perfect line with all the others, and thus, with the machine set carefully at the commencement, insuring entire accuracy. The large beams are cut by a heavier machine with a different movement. The marks on the sides of the beams are cut with a knife worked by a geared feeding arrangement, but the figures are stamped on by hand. The making of the scale pivots and loops with the requisite finish and temper is one of the most important portions of the work in the machine shop, for on the finish depends, in a great degree, the sensitiveness of the scales, as to the temper is to be at-

tributed much of their good wearing qualities. The company use only direct line levers in all their machines, with devices to prevent strain from torsion, adopting clevises and links in hanging main levers. Their pivots are made from sections of steel rods, one edge being cut down smooth and true to the sharpness of a knife by a ma-



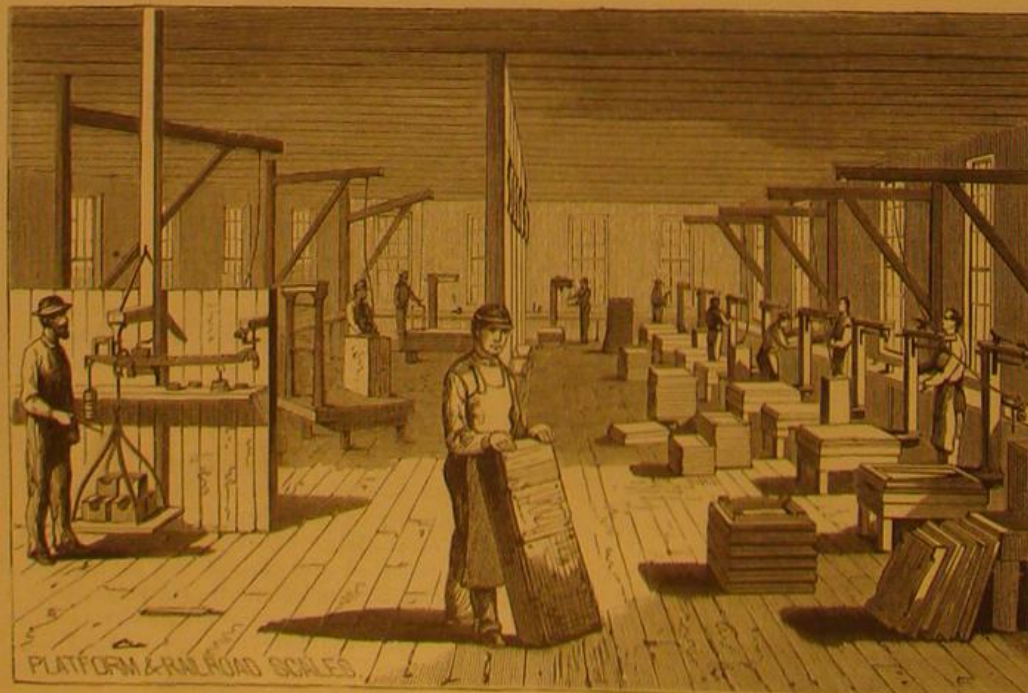
NOTCHING BEAMS

chine designed for this purpose. These pivot edges are cut and recut, gauged, and made smooth with the utmost care, and the loops on which they are to bear are lined with steel, made true and smooth. Both pivots and loops are then hardened by a process for which the company has obtained a patent, and which they claim will give the hardness of the best refined steel with the toughness of iron.

Notwithstanding the care, however, which is taken in all the previous parts of the work it is not until both scales and

weights have passed the testing room that they are considered ready for shipment. Here may be found, in safes provided therefor, standards of the weights of nearly every country in the world, a part of the machinery of weighing which was perfected long before we had any such thing as "standard" scales for general use. All the scales and weights which go out of the establishment must first be proved by these standards; if the weights are too heavy a shaving must be taken off by the rimmer, or if too light a little more metal must be added, while the scales must be equally true and positive, no matter what portion of the platform the load be placed upon. It often happens, therefore, with the great care which has been taken in every detail in order to secure the most perfect work, that a scale intended to weigh several thousand pounds does not show a variation of an ounce, and will be so sensitive that this weight will move the beam.

The japanning, painting, and ornamenting, which constitute



PLATFORM & RAILROAD SCALES

no small proportion of the work on small scales, each give employment here to a good many hands, although every facility has been provided to favor the work in these departments. The pieces of scales and weights to be japanned are piled on cars which run on tracks leading into huge ovens, thereby necessitating as little handling as possible. Some of the bronze ornaments are put on with powder, with rubber stamps and size, and others, as well as painted devices of various patterns, are transferred to the various parts by the decalcomanie process.

The tin shop, where also the sheet copper and brass are worked up into the different kinds of scoops and receivers, is provided with all the appurtenances which the inventions of the past few years have brought so prominently forward in this business. In this department 300 boxes of tin plate and 10 tons of sheet brass and copper are used annually.

The carpenter and joiner shop forms a large and important branch of the business, for here are made not only the wood-work of the scales, but the packing boxes in which they are shipped. Only the best seasoned wood is used in the scales, and to obtain a proper choice for this purpose from one to two million feet are always kept on hand. The company own large tracts of timber land convenient to their factory, and receive from their own sawmill over a million feet annually. Their platform scales with hard wood platforms have been decidedly preferred to other patterns with iron platforms, horses not being so likely to slip on them, and when the platform is worn or broken it can be easily repaired.

Of the large number of patents issued to the company for improvements made at their establishment in the scale manufacture over thirty are still in force, although the original invention on which the first Fairbanks patent was granted was made in 1830. Among the most important of their present patents are those on machines for milling knife edges, for weighing and distributing scales, for electro-magnetic weighing machines, automatic grain scales, track scales, registering and recording beams, letter balances, etc. They do not, however, lay so much stress on the value of their patent rights as they do on the perfect work they have always made it the rule of their establishment to turn out, to which end their long experience and ample capital are especially directed. Both at home and in foreign markets they have met with competition from cheap scales, but they hold, as they originally won, their position as the largest manufacturers of scales in the world by steadily adhering to the policy on which the business was commenced, of sending out only the best goods. Their exports include shipments to nearly every country on the globe, the weights and scales being often so provided as to give readings in two or three different languages, many of those now sent abroad being fitted up for weighing according to the French metric scale as well as that called for by the particular usage of the country where they are sent.

It has often been matter of comment that so large a manufacturing business has been thus successfully developed so far inland, away from water communication with other localities; but the explanation is readily found in the fact that the place has grown up with the industry, and now affords the large number of trained mechanics, drilled in this especial branch of business, without which it would be impossible to make it a success. The firm, while adhering strictly to the best business principles, have always been liberal with their workmen, anxious to promote faithful and skilled hands, and pensioning those who have become superannuated, so that, instead of having been troubled with strikes and disputes about wages, its members are regarded by their employes with more of that friendly feeling so often found in France and a few other localities in Europe, but which is seldom seen in so marked a degree here. With the growth of the town, too, have come the most liberal railroad facilities, so that, from tracks which run into the works, supplies may be received and goods shipped direct on trunk lines running to all points of the compass. A large proportion of the employes own their own houses, and different members of the firm have built and endowed various institutions for the benefit of the community in which their business has grown up, among which are a library, art gallery, lecture hall, and an academy.

The New York office of the firm is at No. 311 Broadway, but they have besides this fifteen other warehouses in different parts of the country, and established agencies in every quarter of the globe.

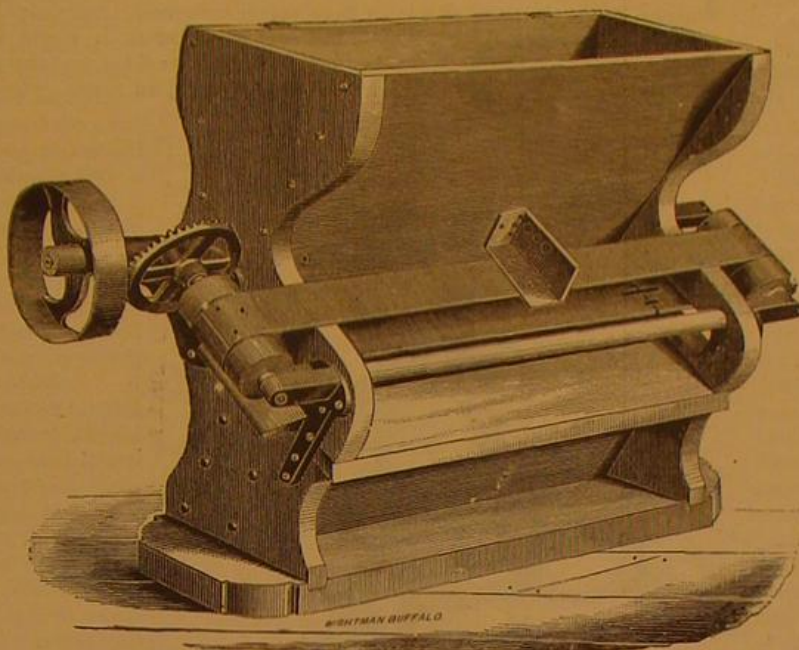
Repelling Flies.

I manage to keep flies out of my stable by removing the droppings se-

veral times a day, and sprinkling very slightly the floor of the stable with kerosene. I have a tin can with a cork in it, through which is pierced a small hole; through this I drop the kerosene. A pint will last over a week, and seems to be quite objectionable to flies of all kinds.—Wm. Horne, V. S., in *Country Gentleman*.

THE MAGNETIC SEPARATOR.

The engraving shows a magnetic separator for automatically removing metallic substances from grain. As the harvesting and thrashing of all kinds of grain are now done almost exclusively by machinery, and since the introduction of wire-binding attachments to the reaper, magnets in some form for removing pieces of wire and other metallic substances from the thrashed grain have become an absolute necessity. Heretofore gang magnets, placed in spouts through which the grain flows, have been used. With this method, however, after a certain amount of metal has been

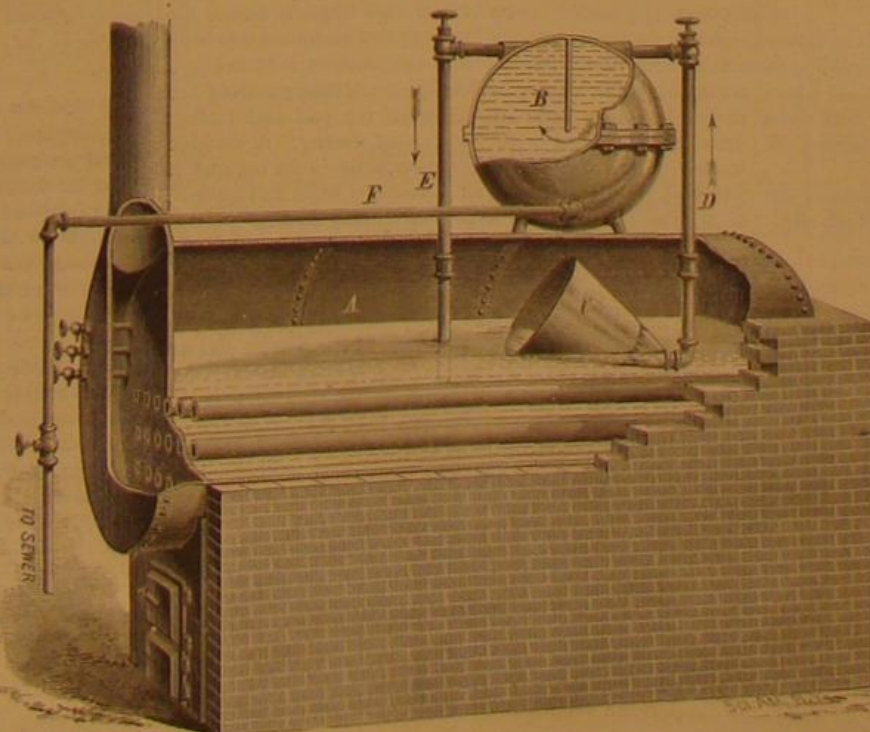


MAGNETIC SEPARATOR.

collected by the magnets, it is necessary to remove them and brush it off by hand, and unless the flow of wheat is stopped the material to be taken out passes on with the grain. If the magnets are left too long in the spouts without being cleaned, the metallic material is carried by with the grain, and the consequence is that more or less of the material sought to be removed is left in the grain.

The engraving shows a machine which does this work effectually as well as automatically. The grain is fed into the hopper, from which it passes over a zinc plate the entire width of the machine. As this zinc plate is placed on poles of magnets, any metallic substance in passing with the grain over the magnets is held by the attractive force of the magnets until removed by the wiper, which, being attached to an endless belt, passes once a minute over the magnetic field, carrying off the metallic substances, depositing them in a box at the side of the machine. This process relieves the miller from care, and prevents metallic substances from going with the grain to the burrs or rolls as the case may be, unless introduced after it has passed the machine. To prevent this, the separator should be placed as near the burrs or rolls as circumstances will admit.

For further information address Messrs. Howes, Babcock & Ewell, manufacturers, Silver Creek, Chautauqua Co., N. Y.



THE HOTCHKISS BOILER CLEANER

A NEW BOILER CLEANER.

The device represented in the accompanying engraving is designed to prevent the incrustation of steam boilers by removing all the scale-forming matter contained by the water used in them, whether vegetable or other matter in suspension, or salts in solution. The simplicity of the principles upon which the action of this ingenious invention depends, and their entire accord with natural laws, commands the approval of all practical engineers. The problem of preventing incrustation in steam boilers has proved to be one of the most difficult ones in the whole range of engineering science.

Millions of tons of coal have been wasted, vast amounts of property destroyed, and thousands of valuable lives sacrificed to the evil which this device, it is claimed, effectually removes. The most careful consideration has been given to this subject by scientific men, mainly in the direction of chemical analysis. How to render the solid sulphates, carbonates, and chlorides more soluble, and thus enable engineers to relieve their boilers by frequent blowing, has been the inquiry. But the results of these investigations have been only partially successful, and the owners of steam boilers have found only too often that the remedy proved worse than the disease.

Many mechanical devices have also been tried in this and other countries, but these have been crude and complicated, involving much trouble in manipulating them, and were finally discontinued.

The invention which we illustrate seems to mark a new era in the treatment of this subject. Since its first introduction, in 1876, it has been steadily growing into public favor, until it has secured the unqualified approval of many of the most practical and scientific mechanical engineers in this country.

The proprietor, Mr. James F. Hotchkiss, by a series of experiments and improvements, has reduced the question of the removal of sediment from, and the prevention of incrustation in, steam boilers to a certainty, and over six hundred times has this fact been demonstrated by trials in every part of the country and with all kinds of water.

The engraving represents the cleaner as attached to any ordinary boiler. The large iron bell mouth, C, is placed near the tubes or flues so as to bring the bottom of the mouth on a line with the lower gauge cock (low water). This mouth is usually connected by a right and left nipple and elbow to the vertical up-flow pipe, D, piercing the shell as far back as braces will allow, and connecting with one side of the improved reservoir, B, at the top. From the opposite side of the reservoir a return pipe, E, extends to a cooler stratum of water as near the bottom of the boiler as the tubes or flues will allow, the lower the better.

This system of pipes forms a siphon, which, together with the difference in temperature between the surface and the point where the water returns to the boiler, causes a constant circulation of water as long as any steam remains in the boiler. In all boilers heated at one of their extremities there is established a circular motion of the water, which not only raises the solid bodies and agitates them, but also keeps them in constant motion in such a way that the surface currents always set back from the fire, while those at the bottom travel in the opposite direction, so that all matters contained in the water, whether originally held in suspension or precipitated from solution, are carried by ebullition to the surface, and there float until they are finally deposited upon the heating surfaces, and attach themselves in the form of scale, and this continues until the accumulations cause a great increase in the amount of fuel required for evaporation and incur the danger of explosion from overheated plates.

The Hotchkiss mechanical boiler cleaner affords a complete remedy for these evils by removing all sediment as soon as it rises to the surface. As the suspended matters are thrown upward by ebullition the surface current carries them toward and into the large mouth-piece, whence they are carried by the circulation to the reservoir, where the water being cooler and in a quiescent state, all solids are precipitated. The solid matter may be blown out from time to time through a blow-off pipe, F, provided for that purpose. The spherical form of the reservoir permits of blowing out the mud which accumulates in it, without wasting the water.

Although the general principle of this invention has not been changed, it has been greatly improved in detail, and cheapened and simplified, so that it may be readily applied to any boiler by an engineer or ordinary mechanic.

Further information in regard to this invention may be obtained by addressing Mr. James F. Hotchkiss, 84 John street, New York city.

MECHANICAL INVENTIONS.

Mr. Robert P. Dake, of Colby, Wis., has patented a hand power for driving light machinery, such as straw cutters, pumps, churns, grindstones, sawing machines, lathes, boats, and other light machines where other power is not attainable.

Mr. James B. Carlin, of Carthage, Mo., has patented a grain mill for grinding corn, oats, and other grains for feed for stock, and for other purposes where a coarse meal is required.

Mr. Benjamin C. Senton, of Whitehall, N. Y., has patented a propelling device especially adapted for propelling vessels in shallow waters and canals. The invention consists in reversing mechanism by which the paddle shaft may be turned, so that the paddles reverse their action.

Mr. John F. Mathews, of Stamford, Conn., has patented an improved dumping car for coal and other substances, so constructed that it can be dumped with ease and certainty, and readily readjusted to receive another load.

NEW PROTECTIVE SUIT FOR FIREMEN.

Several years ago a fireman's suit, invented by Oestberg, a Swede, was the object of considerable attention. It was made of felt, which was continually soaked with water, thus protecting the wearer from the effects of the flames and heat. The wearer was protected from suffocation by a supply of fresh air conducted to him through a flexible tube connected with an air pump.

The disadvantage of this suit was that the water and air had to be conducted to it through flexible tubes, and if the wearer was compelled to operate some distance from the pumps the dangers arising from entanglement or rupture of the tubes was so great as to render the apparatus impracticable in the majority of cases.

Mr. August Beyer, of New York city, recently obtained a patent for an improved fireman's suit, which is devoid of the imperfections of Oestberg's device. His suit is made of some thick fabric, serving as a non-conductor of heat, and has a lining of oil cloth, which is covered on the inner side with a layer of compressed wool impregnated with coal dust, mineral wool, or like material, and is protected on the outer side by a thick woolen fabric having a thick coating of a mixture of red ochre, glue, and sulphur. The metal helmet has a projecting part with a thick bullseye glass in front; from this projection a flexible tube, resembling an elephant's trunk, hangs down. The lower end of this trunk is provided with a perforated plate, which retains a quantity of small pieces of sponge, that cool the air as it passes through them and frees it from smoke. A spiral spring gives the trunk the required strength and prevents it from collapsing. A collar is attached to the bottom of the helmet, as is shown in dotted lines, and serves to connect the jacket and the helmet.

The heat of the fire evaporates the moisture of the wool in the inner lining and thus cools the body. The outer coating of the suit is fire and water proof, and blisters under the effects of the heat, but protects the inner layers.

The fresh coat of the ochre, glue, and sulphur paint is applied to the suit after use. A fireman provided with one of these suits can enter into the midst of the fire without suffering from the effects of the heat or smoke.

This device will be of great service in hotels and public buildings, and it is very valuable for private use, enabling its possessor to escape from a burning building in cases where it would otherwise be impossible. The inventor informs us that it has been subjected to severe tests and has proved efficient in every case.

Further information may be obtained by addressing the inventor, Mr. Aug. Beyer, 149 Avenue B, New York city.

A Blind Man Climbs Mont Blanc.

That a blind man should undertake to climb the highest peak in Europe would seem at first sight to be about as useless and foolhardy an undertaking as could well be conceived. It appears, however, from the mountain climber's own account to have been a fair climb, pluckily undertaken and manfully carried out for a reasonable purpose. The climber, Mr. F. J. Campbell, of the Royal Normal College for the Blind, has devoted his life to the elevation of the condition of his sightless countrymen, and he finds that in order to carry on his work it is necessary to keep up his pluck, energy, and determination by all sorts of athletic efforts. Skating, swimming, rowing, riding, have contributed their share to this end, and last year he went to Switzerland to try mountain climbing. He went again this year, ending with the ascent of Mont Blanc, a task that taxes the capacity and all the powers of those who have no lack of human faculties and can enjoy by sight the grand views which the mountain summit offers as a reward for the hazardous undertaking.

Practical Suggestions on Stuffing.

If hair is confined, and the curl taken out of it by the use of the stuffing stick or wire, it has no power to act, as curled hair is intended to do; the life is twisted out of it with the stuffing stick; it lies dead, and we have to keep pushing more in to fill up the space between the tufts, so when the square or diamond is finished, it contains one-third more hair than it would if the stuffing stick had not been used. The job also is lumpy and heavy, and in a short time the cloth becomes loose by the settling of the hair, for the power to act has been taken out of it. If the tuft cords were cut and the cloth removed, the little ball of hair would scatter over the bench like so many walnuts. Now, if the hair had been laid, and the cloth tufted down through it, it would not do this, for the hair would be just as lively as when taken from the bag. We here give two practical ways to stuff a cushion.

A good cushion can be stuffed up in this way: Make the top up on a frame—lay the hair—and in sewing it to the facings, leave the back part open from corner to corner. Take sheeting or muslin, and make a pad one inch larger all round than the cushion facing and one inch thicker; fill the pad full of good hair—not with the stuffing stick, but



BEYER'S PROTECTIVE SUIT FOR FIREMEN.

with the hand—in the same manner that a mattress is filled; sew up the mouth, and quilt edge, bottom, and top, and also through the middle, with coarse shoe thread; fasten the cushion on the bench and fill the two front corners with cotton, and force the pad into the cushion. If not full enough, lay hair on top of the pad, and while sewing the mouth up, lay a little hair between the pad and facing; draw in tufts level with the top of facing. A cushion stuffed in this way must be comfortable to sit on, and it will keep its shape if the pad is properly filled and quilted; all with no thanks to our venerable stuffing stick.

Another way, and one that is quick for stuffing a cushion, is: Make the cushion with plain top, and when ready to stuff, fasten it on the bench, leaving mouth large enough to get the arm in. Commence filling the top first, using the hand. When a few layers are in, go to the bottom and fill that in the same way, but keep the top stuffing ahead. Continue this until the cushion is filled. It may be that the stuffing wire will be needed at the back corners, but only there. This is a much quicker and smoother way of filling a cushion than the old method. — *The Carriage Monthly*.

The Oregon Salmon Fisheries.

From the annual report of the Oregon Board of Trade we learn that the salmon catch of the past spring and summer has exceeded anticipations, yielding 530,000 cases. In 1875 a catch of 231,500 cases was considered enormous; 1877 yielded 400,000 cases, and 1879 as many as 435,000 cases. This rapid increase shows the vast extent and financial value of the Oregon salmon fisheries. Of the half million and more cases packed this year, 211,522 cases were sent to San Francisco, and 239,241 cases were shipped direct to Great Britain.

Growth of Inventions.

"Confound those ancients, they always get hold of one's best ideas." As it has been found in literature so in science, and the disappointed inventor, tumbling for the twentieth time over an anticipation of his cherished scheme, is tempted to redeclare that there is "nothing new under the sun," and that all is vanity and vexation of spirit. We give a few interesting examples of clear theoretical, if unpracticable, anticipations of a notable modern discovery.

Professor Stanley Jevons, ten years ago, found allusions to a magnetic telegraph running through many scientific or quasi-scientific works of the sixteenth and seventeenth centuries. The poet Addison speaks of "a chimerical correspondence between two friends by the help of a loadstone." Sir Thomas Browne, in his "Pseudodoxia Epidemica," says: "The conceit is excellent, and if the effect would follow, somewhat divine;" and he speaks of it as a conceit "whispered thorow the world with some attention, credulous and vulgar auditors readily believing it, and more judicious and distinctive heads not altogether rejecting it." Sir Thomas, it would seem, submitted the matter to experiment, but found that although the needles were separated but half a span, when one was moved the other would stand like

Hercules' pillars. Joseph Granville, in his "Scepia Scientifica" (1695), discusses the objections of Sir Thomas Browne, and concludes that "there are some hints in natural operation that give us probability that is feasible." Glanvill, more than 300 years ago, said: "Though this pretty contrivance possibly may not yet answer the expectation of inquisitive experiment, yet 'tis no despicable item that by some other such way of magnetic efficiency it may hereafter with success be attempted, when magical history shall be enlarged by riper inspections; and 'tis not unlikely but that present discoveries might be improved to the performance." The earliest book in which Mr. Jevons found allusions to a magnetic telegraph is the "Natural Magic" of Baptista Porta, published in 1589. In the seventh book he describes the "wonders of the magnet," saying in the preface, "I do not fear that with a long absent friend, even though he be confined by prison walls, we can communicate what we wish by means of two compass needles circumscribed with an alphabet." In the eighteenth chapter of the same book he describes the experiment of putting a magnet under a table, and moving thereby a needle above the table. This experiment, as Porta remarks, was known to St. Augustine, and an exact description will be found in his "De Civitate Dei," a work believed to have been begun A.D. 413. It seems probable that this passage in St. Augustine suggested the notion either to Porta, Bembo, or some early Italian writer, and that thus it came to be, as Sir Thomas Browne says, "whispered thorow the world." Mr. William E. A. Axon refers to the passage in Strada, in which he supposes the loadstone to have such virtue that "if two needles be touched with it, and then balanced on separate pivots, and the one be turned in a particular direction, the other will sympathetically move parallel to it. He then directs each of these needles to be poised and mounted on a dial having the letters of the alphabet arranged around it. Accordingly, if one

person has one of the dials, and another the other, by a little prearrangement as to details, a correspondence can be maintained between them at any distance by simply pointing the needles to the letters of the required words." — *Design and Work*.

An Automatic Fire Extinguisher.

An engineer in the Brooklyn Fire Department has invented an automatic fire extinguisher, which was recently tested as follows: An experimental shed was half filled with barrels of shavings and chips. Near the roof was an iron pipe for the conveyance of water, to the end of which was attached a bulb perforated with numerous holes. In the center of the bulb was a cartridge, held in position inside a plug, to prevent the water from flowing, and on the outer side was a telegraphic attachment. The inflammable material having been lighted, in thirty-five seconds the fuse of the cartridge became ignited, resulting in the explosion of the cartridge. This released the plug in the bulb, allowing the water free course, and at the same time released the telegraphic attachment and sounded an alarm on an instrument at a distance. The experiment was in every way satisfactory, as the fire was extinguished without damage to the shed.

The Baking Powder Controversy.

Shortly after the publication in this paper of the valuable report on alum in baking powders, by Dr. Henry A. Mott, Jr., a bitter attack upon Dr. Mott's professional character was made by the editor of the *Spice Mill*. Suit for damages for libel was brought by Dr. Mott, in the Superior Court of this city, and a verdict in his favor was given October 16. The damages awarded were \$8,000, to which the court added an allowance of \$150.

Improvements in Fire Hose.

In nothing connected with the fire service has there been greater improvement during the past ten years than in the manufacture of fire hose. In the old days of hand engines, there was scarcely anything but leather hose used. Occasionally a department would buy sewed canvas or linen hose, but nearly all those used was made of leather. With the advent of the steam engine and higher water pressures, came a demand for hose of greater strength than leather. Out of this demand grew rubber hose, which is made of cotton fabric, coated with rubber. By using several plies of cotton, hose of sufficient strength was obtained. Then some one conceived the idea of dispensing with the rubber, and making fire hose entirely of cotton, woven in a cylindrical form, having no seam, either sewed or riveted. The old leather hose was equal to the pressure obtained with hand engines, but, when new, the manufacturers would not guarantee it to stand 200 pounds pressure, and by constant use its power of resistance rapidly decreased. The rubber and cotton hose now made for fire service is usually warranted to stand a pressure of 400 pounds, and is guaranteed to last three years. Often the water pressure at tests is run up much beyond 400 pounds, and the term of serviceability far exceeds the guarantee. We have seen sewed cotton hose now in service that was purchased twenty years ago, and rubber hose that has seen over ten years' service, and is still in use. But it is not the capacity to resist pressure that is evidence of enduring quality. Hose may be constructed to resist 700 or 800 pounds pressure, yet be so deficient in wearing surface as to last but a short time. What is required in hose is lightness, strength, and durability. Hose that will stand a pressure of 200 pounds, having a surface that is well protected and durable, is better than hose that will stand 700 pounds pressure, yet having a surface that is not likely to resist the wear and tear of street service.

Few persons comparatively have an adequate idea of what it has cost manufacturers to bring the construction of hose to its present point of perfection. We were recently shown a piece of cotton hose about one foot long, woven cylindrical, which, we were informed, had cost \$15,000. That is to say, an inventor had spent years of his time and the sum named in perfecting a loom that would weave cylindrical seamless fabric suitable for fire hose. When he had produced the piece alluded to, he discovered that it would not do, but he had found the right way to do it at last, and his time and money had not been wasted. Many thousands of dollars have been expended in perfecting rubber hose and the machinery for its production. The manufacture of fire hose now constitutes an important American industry, requiring millions of dollars to conduct it, and giving employment to thousands of persons. It is an industry that is not adequately appreciated, even by those identified with the fire service. Firemen are wont to regard their apparatus with feelings of pride, and to boast of the achievements of their engines, while scarcely giving a thought to the hose, without which the engine would be valueless. Hose is not only a necessary part of the equipment of a fire department, but is usually the most costly. A steam fire engine will last for fifteen or twenty years, or longer, if carefully cared for, while hose necessarily wears out. The purchase of new hose year by year soon involves a city in an expenditure greater than the cost of apparatus. It is safe to say that if the hose in use in the fire service receives as good care as the apparatus, it would last much longer than it does. But the fact is, hose is regarded as rather an insignificant article: very necessary at a fire, but scarcely worth caring for afterwards. Even at a fire, it is generally treated with great roughness, trampled on by men and horses, and driven over by wagons and apparatus, and kicked about in a reckless manner. It is an easy matter to injure hose when under pressure, filled with flowing water, and strained to its full capacity. A slight blow will sometimes make an abrasion that results in a leak and a burst, destroying a length of hose worth in the neighborhood of \$50. A little care and thoughtfulness on the part of the firemen would prevent such accidents. After hose has been used, it should be carefully dried and cleaned. To dry it, the best way is to suspend it at full length in a tower. It should never be hung up by the middle, as is too often done. Where it is bent over and allowed to hang, it is apt to develop a weakness afterward. Leather hose should be cared for as carefully as rubber, cotton, or linen. It is a common remark that leather hose requires no care. While it is true that leather hose will stand neglect better than any other kind, it is also true that it will repay care and attention quite as well as any other.

While there is a great diversity of opinion as to which hose is the best, and leather, rubber, cotton, and linen each has its champions, we, certainly, shall not extol one above another. Each has its place, and each has made a record for itself. Our purpose is to call the attention of officers of fire departments to the necessity of taking the best of care of their hose. First, always buy the best; examine and test all kinds, and, having decided which kind is best suited to your requirements, purchase the best quality of that kind that you can find; having secured your hose, take care of it as carefully as you would of a new steamer or hook and ladder truck. By so doing you will not only save yourselves much anxiety of mind when you are fighting fires, but you will save many a dollar to the taxpayers who support your departments. But, of all things, beware of cheap hose, and do not trust your reputations as firemen upon a line of hose that you have no confidence in. The bursting of hose at a

fire may result in a serious calamity. If fire committees will persist in forcing cheap hose into the departments, the chief engineers should publicly protest against it and warn their fellow citizens of the danger to which they are exposed in consequence. With the abundance of good substantial hose that is now made, there is no excuse for any department being short of that article or having an inferior quality thrust upon them.—*Fireman's Journal*.

Jupiter's Satellite Seen Without a Glass.

Since the English shepherd reported to his master the curious sight wherein "a big star swallowed a little one," the larger satellites of Jupiter have more than once been seen with the unaided eye. Quite recently a lady of our acquaintance thus saw two of the great planet's moons and correctly described their positions with reference to their primary, the accuracy of the observation being verified by means of a telescope. The night was exceptionally clear, and the "seeing," as the astronomers express it, unusually good. The point of observation was near New York, and not more than two hundred feet above sea level.

At a recent meeting of the California Academy of Sciences there was read a communication from the president of the Academy, Professor George Davidson, describing what he terms an unmistakable case of seeing Jupiter's satellites with the unaided eye, the second case which he has reported, the first being from Mount Diablo, Cal., in 1876.

Professor Davidson writes from the station Monticello, of the United States Coast and Geodetic Survey, 3,125 feet above the sea, the highest point of a sharp ridge overlooking Berryessa Valley on the west and the Sacramento Valley on the east.

He says: "For nearly a month the Sacramento and Coast Range valleys have been filled with dense smoke, and the distant mountain ranges have all been hidden. Even the bold, dark, grand mass of Mount Helena, distant but twenty-four miles, was barely visible through the thick atmosphere. The upper limit of the smoke stratum was quite sharply defined to the eastward; above it the sky was generally clear, but upon the present occasion only moderately so. The weather for some time had been warm and pleasant, without clouds or wind. On the early evening of Monday, September 20, we were looking at the obscured moon struggling through the dense smoke; Jupiter, at an estimated elevation of about 8 degrees, was emerging from it, and for an elevation of 25 to 30 degrees the whole sky was hazy, and stars of the fifth magnitude, and even some of the larger ones, were not visible to the naked eye. There was not the least radiation to Jupiter, and the planet rose through the smoky but quiet atmosphere into the thinner smoke or haze without radiant points of light to blur his appearance. With the unaided eye Professor Davidson detected the third satellite of Jupiter, to the left and below the disk of the planet; but, lest he might be mistaken, he refrained from calling attention to it for some minutes, until there could be no possible mistake, when he announced the visibility of a satellite, but without stating its position in relation to the primary. All the officers immediately announced its visibility and position, but naturally wondered why it should be seen so unmistakably through such a thick, hazy atmosphere. A binocular, or good field glass, with magnifying power of seven diameters, revealed it, and also showed the other satellites on the side of the planet, but revealing the first and second satellites with difficulty, until the planet had risen somewhat higher. The third satellite continued visible to the naked eye for perhaps twenty minutes, when the moon rose above the smoke stratum, and the planet began to exhibit traces of radiation, when the satellite was lost to the naked eye, although all the satellites had become much brighter than before in the field of binocular. Upon subsequent nights, after the smoke had in great measure been blown away, with a remarkably clear sky and no moon, but with great radiation to the planet, no satellites have been surely made out with the unaided vision. The observers who distinctly saw the satellites were Messrs. Lawson, Gilbert, and Buckland, and also Mrs. Davidson."

The Earth's Magnetism.

The great physical problem of terrestrial magnetism has engaged the attention of numerous physicists lately, and it is well known that several ingenious solutions of it have been propounded. Professors Ayrton and Perry, for example, conceived the happy thought that the earth was charged with static electricity, which being carried round on the surface by the diurnal rotation, acted like a circulating current and magnetized the core. A severe blow was dealt to this hypothesis, however, by the mathematical criticism of Professor Rowland, who pointed out that the surface charge required was competent to send a spark from earth to moon. A theory based upon the existence of electric currents flowing in the atmosphere around the earth was promulgated later; and now we have another supposition, which has a better claim to serious attention than any of the rest, because it is supported by direct experiment. Starting from the idea of M. Edlund that an electric current is really an ether current flowing in the circuit, and that electrostatic effects are due to rarefactions and condensations of the ether, M. Selim Lemström considered that he might produce this ether current by mechanical action. He therefore made a paper tube having two concentric walls and mounted on an axle. A core of soft white iron was placed within the tube, and on rotating the latter the core

was found to be magnetic, as demonstrated by two fine astatic needles. Reversing the rotation, reversed the magnetic poles; and M. Lemström concludes that the relative motion of the ether in the revolving tube and the stationary core was the cause of the polarity. It follows that if the tube be stationary and the core revolved a similar effect will be produced; and hence if a magnetic body like the earth be rapidly rotated round its axis in an insulating medium like the air, it will exhibit magnetism. Pursuing this idea into mathematics, M. Lemström arrives at an expression for the magnetic moment of the earth which agrees very well with the formula of Gauss.

FISHING ON THE AMAZON.

Much attention has lately been given to the wonders of the great river Amazon, or "the Amazons," as the people there call it. Its whole valley abounds in streams that help to make up the entire volume of waters. These spread out into lakes, lagoons, and swamps, that extend over large regions of country. This is especially so in the rainy seasons or flood times.

The channels and lakes are abundantly supplied with fishes. Even large fishes are often left in the swamp lakes and streams when the water is low. A hundred different kinds of fish can be bought in the markets of Rio, many of which come from the Amazon.

Those most valued are *piranhas* and *pirarucus*. They are the largest, while there are numerous smaller varieties. The Indians catch the latter with hooks and lines or shoot them with arrows. But the larger fish are speared with a kind of trident. The men and even small boys acquire great skill in the use of these implements.

In the summer months the people come by hundreds to the lakes and channels to fish for the great *pirarucus*, and to prepare the fish much as codfish is prepared by the northern fishermen. Some of these fish are seven or eight feet in length. They are first dressed and cut into wide thin slices. These are well rubbed with salt and hung on poles to dry in the sun. The slices are taken under cover every night and carried out again in the morning. The stranger does not at once relish this dried fish, yet it is the standard flesh food of all the poorer classes throughout a large part of Brazil. During the fishing season the people build and live in little huts along the shores. Traders, in canoes, come with a stock of cheap wares to barter for the fish. Thus a trading community is formed, which breaks up with the January floods. The *piranhas* are much prized and are easily caught, for they are greedy to bite at most anything, from a bit of salt meat to a bathers' toe. Boys thrash the water with poles to attract these fishes.

The Tupi word *piranha* is a contraction of *pira satinha*, meaning "toothed fish." The same word is used by the Indians to describe a pair of scissors. There are several species of these savage *piranhas*, some being more than two feet long. They make nothing of biting an ounce or so of flesh from a man's leg. People are sometimes killed by them. Hence Brazilians are shy of going into these lakes and streams if they suspect the presence of these fish. The fishermen claim that *piranhas* will gather in schools against the larger fish and attack them. If one of their own number is at all wounded by mistake he is mercilessly set upon and devoured by his companions.

It is useless to try to use nets where this fish is found. They would spoil a net in a few minutes.

Another dangerous fish of these waters is the *sting-ray*. He lies flat on the bottom, his dark upper surface being hardly seen through the muddy streams. If left undisturbed the creature is harmless enough. But a careless wader in the shallows may step on the flat body, and then the great barbed sting inflicts a wound that benumbs the whole body and makes the sufferer speechless with pain. Persons have been lamed for life by such a wound.

A curious fish called *Anableps tetraphthalmus* is often seen there. Its eyes are divided, so that each has two pupils; of these the upper pair are for the air and the lower for the water. This singular fish swims near the surface and near the shore, and if chased does not dive.

A large fish named *caruana* is mostly taken at night. Men go out in boats with lighted torches and spear the fish with great skill and rapidity.

It is said you may often see a native with his bow and arrow standing like a statue on some overhanging bank watching for a fish to pass. When a fish comes near the bow is drawn quick as light, and the arrow hardly leaves a ripple as it cuts through the water. It requires the keenest skill to obtain fish by this means, and the fisherman must also allow for the refraction of the water, or he will certainly miss his mark. Yet many of the large *piranhas* are procured in this way. Good fishing depends, first, upon the flooding of the river, which fills all the valley lakes and channels with water and entices the fish out of the greater streams; then, second, such a falling of the floods as leaves many of these channels and lakes separated from the river. Thus the fish are imprisoned in shoal water and narrow quarters and more easily taken. Otherwise the present contrivances for procuring good fish by these native fishermen would be entirely inadequate.

Wallace, Smith, and others who have made recent explorations of the Amazon all speak of its prospects as a future highway of commerce. They also dwell much upon the abundant and even luxuriant natural resources of the entire region with which this great river and its tributaries is connected.

NEW INVENTIONS.

Mr. Stephen S. Haight, of West Farms, New York city, has patented improvements in cars for transporting cattle on railroads, the object being to provide separate and quickly arranged stalls for the cattle to carry sufficient stores of food and water for their consumption during a long trip, and to provide most convenient devices for feeding and watering the cattle, and in other ways administering to their comfort and necessities. The invention consists of vertically adjustable gates or partitions of peculiar construction, of food and water receptacles or reservoirs upon and beneath the car roof, of feeding troughs of novel design, of improved devices for supplying food and water to the feeding troughs, and of other novel devices in combination with the above.

Mr. Chester F. Adams, of Toledo, O., has patented an improvement in the class of radiators which are connected with or form attachments of chimneys and flues, and are so constructed that the current of volatile products of combustion may be diverted through them at will for the purpose of bringing such products in contact with a larger conducting and radiating surface, and thereby utilizing the heat more completely.

Mr. Benjamin A. Taber, of North East, Pa., has patented an improvement in that class of bag holders in which the bags are clamped by hinged levers to the bottom of a hopper through which the grain or other substance is fed into the bag. A light frame, having legs, supports a hopper that receives the grain or feed and delivers it into the bag, which is secured to the contracted lower end of the hopper by means of clamping levers. These levers are hinged near the ends of the supporting frame, and have broad inner ends which are beveled correspondingly to angle or inclination of the end of the hopper for the purpose of adapting them to clamp the edge of the bag against the hopper. The clamping is effected when levers are in horizontal position and they are secured in this position by means of ratchet catches.

Mr. George Scott, of Montreal, Canada, has patented an improvement in that class of printers' material known as "quoins," which are used in various ways for the purpose of locking up forms for use in the press. It has more particular relation to that form of quoin in which two wedge-shaped pieces are provided with a straight series of teeth, which are geared together by a pinion key, and are projected over each other to expand the quoin by the rotary action of the key.

COMBINED HORSE POWER AND STABLE FLOOR.

The annexed engraving represents a device which enables a horse to clean his own stable, cut his own feed, run a thrasher, fanning mill, corn sheller, or corn mill, churn, saw, or pump, to wash buggies, clean windows, or wet down lawns, water stock, and put out fires. It is always ready, and can be instantly brought into action. It is adapted for a colt or horse, and may be worked by a bull or a cow. It is always stored, and forms an elastic, well-ventilated stable floor, which permits of the ready escape of liquid manure and is self-cleaning.

The engraving conveys a very perfect idea of the invention, a portion of the stable being broken away to show the construction of the parts below the floor level.

The upright frame of the stable is constructed in the usual way. The floor of the stable has an opening of the full size of the stall. In this opening is placed an endless floor, A, composed of transverse slats and endless belts or chains supported by rollers, B C, which are journaled in a frame supported by a central pivot and capable of being inclined, as shown in the engraving, by means of a screw, D, which extends above the stall partition, and is provided with a wheel by which it may be turned.

A brush or broom is pressed against the under surface of the endless floor by counterweights, E, and serves to clean the slats as the floor is revolved in the operation of cleaning the stall.

The roller, B, carries a pulley which communicates with a pulley on a centrally located shaft from which power is taken for any purpose. When it becomes necessary to clean the stall all that is required is to release the shaft so that it may revolve, and to incline the stall floor, the manure is delivered to the cart below, and the floor is quickly and thoroughly cleaned.

The inventor suggests the use of this power for driving dynamo machines for electric lighting when the employment of engines or other powers would render it either inconvenient or impossible.

This device affords a ready means of exercising horses without removing them from the sta-

ble, and it admits of using younger horses than can be used in other horse powers. It is stated that it effects a cure of "cocked ankle" and knee spring.

The applications of this useful invention will be apparent without further explanation.

Further particulars may be obtained by addressing Mr. A. Herbert Crawford, patentee, Liverpool, N. Y.

IMPROVED MILK CAN.

The annexed engraving represents an improved milk can lately patented by Messrs. Brown and Rosa, of Wellsville,



IMPROVED MILK CAN.

N. Y. The novel feature is the form of the can, and in a peculiar cover, which closes the can when partly down, and seals it practically air-tight when pressed fully down. The can is furnished with a window to show the depth of the cream, and is made in what is considered the best proportions for the purpose for which it is intended. The form, as will be noticed, is oval. It is 16 inches long, 6 inches wide, and 19 inches deep. These cans are set in cabinets in the usual way, and surrounded with cold water taken from a spring, or cooled by means of ice. If the temperature is kept at 45° the cream will rise in 12 hours. If the temperature is higher the time will be longer.

By the use of this can the cream is prevented from drying, and dirt, flies, and bad odors are excluded from the milk, and good hard butter of a fine quality is secured.

The peculiar form of the cover insures a tight joint at the top, no rubber or other packing being used. The inventor

states that these cans prevent the milk contained by them from becoming sour during thunderstorms.

The cans occupy little space and may be readily removed from the cabinets and placed in the sun if desired. They are in use in dairies and in creameries conducted either on the Fairbank system or on the common plan. They are very simple and less expensive than other cans, and are certainly as durable as any other. The inventors of the can exhibit some very flattering testimonials from persons who have them in use and from experts who have examined them.

Further information in regard to this invention may be obtained by addressing Messrs. Brown & Rosa, as above.

The Sleep Disease.

M. Talmy has presented a note to the French Academy in which he calls attention to the analogy which exists between the "sleep disease" and chicken cholera. The sleep disease (*névrose*) is a rare affection, which, up to the present time, has been met with only among the negroes of the west coast of Africa. It was first made known by English physicians in 1819, but was not accurately observed till many years afterward (1862 *et seq.*) by the French physicians, Dugaix, Nicolas, Guerin, and very recently by Corre. In this curious affection the person attacked keeps his eyes half closed, as if he were unable to open them wide, and is frequently seized with a profound desire to sleep. Later on he sleeps continuously, and has to be awakened to take nourishment—which he does with pleasure if he is awakened sufficiently. Death approaches very gradually but surely, and the victim passes away at length without suffering any pain. The disease is always fatal, no cure yet being known for it. From the symptoms as given by the above-mentioned physicians, and from the symptoms of chicken cholera as studied by Moritz, Perroncito, Toussaint, and more recently by Pasteur, M. Talmy believes that the two diseases are of a similar character, and both due to a like cause.

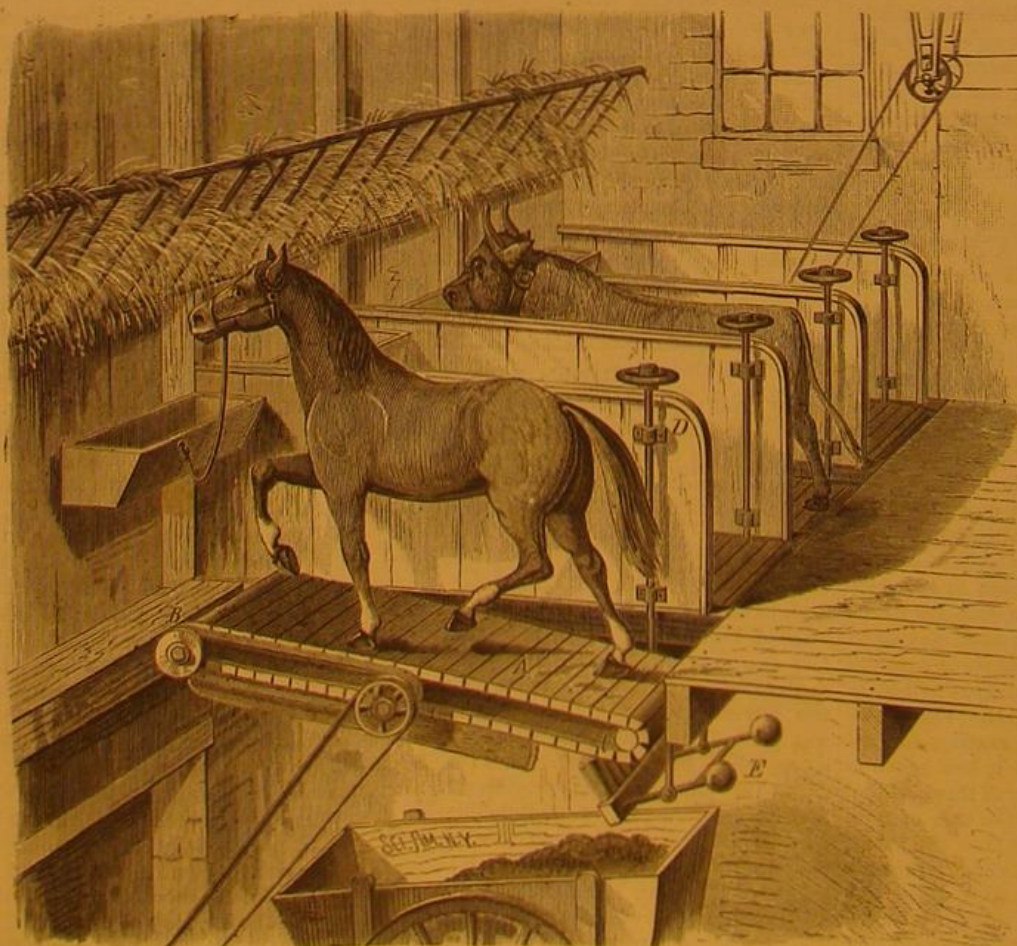
California Petroleum.

Great efforts have been made of late to bring about the fulfillment of Professor Silliman's prediction, that California would ultimately be the largest oil producing country in the world. The oil region consists of a section of coast range mountains covering 200,000 acres, and extending from Santa Cruz to Santa Barbara, a distance of 550 miles. During the past four years the Pacific Coast Oil Company have got control of the most of this territory under long leases, and within the past year they have sunk wells which yield good results, built pumping works and refineries, laid down pipe lines, and established factories for the production of casks and barrels. They have now about a score of wells, and hope soon to be able to supply not only the markets of Nevada, California, and Oregon, which require 3,500,000 gallons yearly, but Japan, China, Java, Australia, and Mexico, which require perhaps ten times as much oil.

American Sheep Sent to Australia.

The recent shipment from this port of picked sheep to be used in Australia for breeding purposes is explained as follows by Mr. William G. Markham, secretary of the National Wool Growers' Association: Some time ago Mr. Markham received from Mr. John L. Curry, one of the best known Australian sheep breeders, two entire fleeces, which he said had been taken from his best sheep, and sent here as a sample of what he could breed. These fleeces, and two fleeces taken from American merinos, were, by direction of the National Wool Growers' Association, taken to Boston and scoured. The scourers were given no information as to where the fleeces had come from, and they were all treated in the same manner. After scouring they were examined and appraised by competent and impartial judges. The American fleeces produced 8½ pounds of cleansed wool, while the Australian, when scoured, weighed less than 4½. The Australian fleeces were valued at \$4.80, while the price set upon the American was \$8.12.

Hearing of this comparison, Mr. Thomas McFarland, a prominent sheep breeder of Melbourne, Australia, who had come here to investigate the qualities of American merinos, visited the principal sheep raisers of New York and Vermont and satisfied himself that the showing was not remarkable. Finding that the American merino sheep combine the two desirable characteristics of large wool-yield and heavy carcasses, he ordered that two rams and two ewes be shipped to Melbourne for him,



CRAWFORD'S COMBINED HORSE POWER AND STABLE FLOOR.

These are not the first sheep sent from American to Pacific countries. Mr. Markham sent three car loads some time ago to Japan, where the government is striving to develop the best wool and carcass-producing animals.

THE ELEPHANT SEAL.

This animal differs from the crested seal by being furnished with a trunk-like extension of the nose of adult males, which has led to the adoption of one of its names, the "sea elephant." The number and arrangement of the teeth are the same as in the crested seal. A great difference is to be found in the claws of the fore feet, which in the elephant seal are merely rudimentary. The general appearance conforms with that of seals generally, but in size it is larger than any of its relations. Although the size has often been overstated, there is no doubt that it ranges from 15 to 21 feet in length. The females attain about one half the length of the males, but not over one third in weight of the male, the weight of the latter often exceeding 10,000 pounds. The head is large, broad, and somewhat elongated, the snout being greatly developed and terminating abruptly, as shown in the illustration. The upper lip has from 30 to 40 long dark-brown bristles arranged in six rows. The eye is rather large, round, and very prominent, the upper lid being destitute of lashes, the eyebrows having eight or ten bristle-like hairs. The ear is unusually small for so large an animal, and is situated not far to the rear and below the eye, and is not furnished with a flange, having the appearance of a hole.

Pitchblende in Colorado.

Some three years ago an intelligent mineralogist discovered specimens of pitchblende on the waste dumps of Denver City, Colorado, and, recognizing the value of the mineral, gathered a quantity and sent it to Swansea, where it brought five shillings a pound, or at the rate of \$2,500 a ton. To what extent the mineral occurs in that region does not appear, but the incident affords another illustration of the facility with which unscientific miners may throw away minerals of more value than those they are looking for.

Pitchblende, or uraninite, is an oxide of uranium, obtained in Saxony and Bohemia, and used in fine glass making. Glass colored with uranium has the peculiar property of showing green when looked at, although perfectly and purely yellow when looked through.

FIGHT BETWEEN A THRASHER, SWORDFISH, AND A WHALE.

A marine battle between a thrasher, swordfish, and a whale, as witnessed by Lord A. Campbell, of Belleisle, is graphically represented in the annexed engraving. The thrasher—over thirty feet long—attacked the whale from above, springing several yards into the air, descending with fearful violence, inflicting severe slaps with its long flexible tail, while the swordfish attacked the distressed whale from below.

Other authentic accounts are given of similar fights in which the sea around the wounded whale became dyed with blood, and we have an account of a whale taking refuge under a ship to avoid his enemies, much to the consternation of the crew, who hardly dared to step or move while the huge creature maintained its position under the vessel.

Are Sharks Viviparous?

Recently Mr. E. G. Blackford, of Fulton market, described the discovery of a number of small sharks alive in the body of an old one, and raised the question whether sharks may not be vivipa-

rous. Further evidence in the same direction is furnished by Mr. John F. Lovejoy, of this city, in a letter to the *World*. Mr. Lovejoy's shark—about three feet long—was caught last May on Nantucket Shoals. Mr. Lovejoy says:

"It flopped about considerably, and in order to get the hook out of its mouth we were obliged to strike it over the head with a small capstan bar. This must have put the shark to great pain, and at any rate caused spasmodic action of the stomach, for in a few minutes we saw the head of a small shark protruding from the vent of the large one. We pressed the stomach, and first one, then another, came out. Then we cut the large shark open, and to our great astonish-

grapes of the vine for eight days, and found them excellent, and he suggests that its culture ought to be attempted in all vine-growing countries, as a possible remedy against the phylloxera. He has sent home seeds for experiment, both in France and Algeria, and intends to bring home specimens of the plant at all stages of development.

Why the Glow-worms Glow.

The French scientist Jousset de Lielleme claims to have discovered that the glow of the glow-worm is a spontaneous action, and that the little insect has the same object in glowing that some Parisian ladies have in displaying certain ribbon streamers, which are very appropriately called "*suivez-moi*." It has long been known that the female glow-worm alone understands the art of glowing exceedingly well, though the male and even the larva possess some of this phosphorescence. Some earlier scientists expressed their belief that the glowing apparatus in the female served the purpose of favoring the fructification of the eggs, in so far as the male was attracted from the distance by the phosphorescent light of the female. But it was left to our prosaic age to discover that the light was produced by an essentially spontaneous action.

The above named French naturalist made an incision in the head of the female glow-worm (evidently supposing that in this animal, also, the organ of will is in the head), and the phosphorescent light at once ceased, but it returned—and this is the most important fact of the experiment—every time that the action of the brain or of the central nervous organ was irritated by artificial means, such as electricity.

NATURAL HISTORY NOTES.

Phosphorescence of very Young Fishes.—Mr. John A. Ryder, while investigating the development of the bay mackerel and porgy, under the auspices of the U. S. Fish Commission, in Mobjack Bay, Va., found that the latter fish, when three days old, was very decidedly phosphorescent at night, when sudden impulses were imparted to the water in which they were swimming about; acting in this regard like numerous other marine animals, such as medusae, polyps, infusoria, etc. The presence of an extraordinary development of amœbiform cells over certain portions of the bodies of these little fishes may be the cause of these phenomena. These cells change their form from time to time very considerably, but tend to aggregate in anastomosing clusters over the oil globule in the umbilical vesicle, over the ectoderm of the vesicle itself, and on certain parts of the body and tail. They are very different from pigment corpuscles. Besides these cells a peculiar homogeneously-distributed reddish tinge is acquired by the membranes of the umbilical vesicles of the porgy on the third day, and which is not due to the presence of blood globules. "To whichever of these structural causes the phenomenon of organic phosphorescence is attributable in this special case," says Mr. Ryder, "there seems to me to be little doubt that the prime element in the production of phosphorescence in the animal world in general is some kind of sudden molecular disturbance or impulse, disturbing the equilibrium of the molecules of the living protoplasm involved, so as to produce a kind of motion which makes itself apparent as momentary emissions of light. I have no doubt that the phenomenon in *Lampyris*, or the firefly, is connected with expiration and inspiration, and possibly, in the *Medusa*, with the rhythmical contraction of the umbrella. The application of experimental methods to verify the above suggestions would be very easy."

Relation of Algae to Flower-



THE ELEPHANT SEAL—(*Cystophora elephantina*.)

ment found four more. They were each seven inches long, with an umbilical sac hanging from them about four inches in length and looking very much like a spawn. Seeing that they worked themselves about on the deck, we wondered if they could swim, and dropped them into the water. They immediately commenced to swim, but gradually sank, the sacs seeming to carry them down. This, we think, goes to prove more fully that the shark is viviparous. The sac was not seen on the young taken from Mr. Blackford's shark, which in growing so large had absorbed it and were in a condition to take care of themselves."

A PROMISING VINE.

A French explorer in the valley of the Niger reports the discovery of a vine which promises to be of great economical value. Writing from Koumdian (Gangaran), July 25, he says that the fruit of the vine is excellent and abundant; its cultivation is very easy, its roots being tuberose and perennial, while its branches are annual. It can be cultivated as easily as the dahlia. He himself had been eating the large



WHALE ATTACKED BY ENEMIES IN THE ATLANTIC.

ing Plants.—Dr. Krause, in a recent number of *Koemos*, has discussed the relationship existing between the algae and phænogamous plants, taking as the special subject of his inquiry the *Podostemaceæ*, which, as well known, are aquatic plants growing on stones, some with the aspect of seaweeds and others of mosses or liverworts. The species of this order, he believes, combine characters of the algae and flowering plants, and show a direct transition between them. Indeed, the resemblance is so striking, and the forms of both so variable, that one would be excusable for inferring that the podostemes are algae with flowers. The flowers of the podostemes, moreover, are either apetalous or imperfect, and very simple. The plants are inhabitants of running water in Asia, Africa, and America—being represented in the latter country by a single genus and species, the river-weed (*Podostemon ceratophyllus*). The lower forms are composed of little else than parenchyma, while only the larger ones have vascular organs. The stem is either wanting or assumes a great diversity of shapes, and has scarcely any true roots. The leaves are mostly wanting in the thallus-like species, but are highly diversified in the stemmed species. The veins, when present, are dichotomous, seldom parallel. The buds, both of the stem and flowers, are folded convolutely. The cushion-like organs of attachment, which take the place of true roots, are found elsewhere only among the algae. The absence of vascular organs is common to algae and mosses among cryptogams, and also to a few phænogams, as the *Naiadaceæ*, *Ceratophyllaceæ*, and *Lemnaceæ*. Since the lower plants of these orders show no differentiation of stem and leaf, at least no more than the algae, it is suggested by Dr. Krause that they might be placed, with the *Podostemaceæ*, in a group representing a direct transition between the algae and phænogams, and for which he proposes the name *Anthophyceæ*. If the *Cytinaceæ*, which have no cotyledon, and the *Balanophoraceæ*, which have only a simple undivided embryo, be regarded as higher forms rising out of fungi, we may join them as *Anthomyceæ* with the *Anthophyceæ* representing the lowest phænogams, as *Anthothalloideæ*.

A Gluttonous Fish.—The Smithsonian Institution has received a curious specimen of fish, which was taken on the fishing banks of Gloucester, Mass. Scientifically it is known as *Chirocentrus niger*, and its peculiar and distinguishing feature is the fact that its rapacity leads it to swallow fishes which are twice as large and which weigh twice as much as itself. It is enabled to do this from the fact that its mouth is very deeply cleft, its teeth bent, and that its stomach has an elasticity resembling that of India-rubber. When it begins to swallow its food its jaws move alternately and seem to climb over the fish, which is gulped down and doubled up in this curious creature's inside. As the process of digestion and decomposition takes place and gases are originated, the distended stomach becomes lighter than the upper part of the body, so that the latter frequently turns under. In this condition the fish is utterly unable to help itself, and may easily be caught. This specimen, secured by the Smithsonian, is only the third known. The first was found a number of years ago floating in the sea off the Island of Madeira, and the second was discovered in the Dominican Sea. Careful drawings have been made of this particular specimen, which is ten inches in length. It has in its stomach a kind of codfish, eighteen inches long. It is only by contrasting the long and slender body of the fish in its normal state with its distended form after gorging, that a proper idea of the feat it so successfully attempts can be gained.

A New Harveeing Ant.—According to the Rev. G. K. Morris (in *American Naturalist*), we have a true harveeing ant at our very doors. In Vineland, at Island Heights, Ocean Grove, and Asbury Park, they are very numerous. It is a small ant, the worker being about a line long. It is of a reddish-brown color, and has a rather large head. The head of the soldier ant is a marvel for size, being many times larger than the abdomen. The soldiers appear to rule the community, and certainly furnish the brains of the family, in bulk, at least. They are ferocious, murderous warriors, and a battle between them is a terrible thing in a small way. They cut each other in two and yet continue to fight. Mr. Morris had the true character of these ants revealed to him by observing rejected husks of seed piled up by their doorways. They appear to do their house cleaning in the latter part of June, to be ready for harvesting the new crop of grass and other seed now ripening. Here and there, however, a careful eye may detect signs of some later work in husks just brought from below. Grass, clover, sorrel, or other seed put near them will be seized and carried below with eagerness. They have a violent antipathy to the little yellow ant—the pest of the pantry—and this fact may be used in recognizing them.

Experimental Transformation of a Living Organism.

The bulletins of the Academy of Science at Munich contain a report of a discovery which has the highest interest for the theory of evolution and will perhaps be also of practical value. Hans Büchner, well known as a skillful experimenter, has succeeded in transforming a microscopical kind of fungi, which is a dangerous agent of disease, into another kind of fungi which is perfectly harmless. He reached this result by a continuous treatment of the fungi for the space of six months, and by producing 1,500 generations. In this manner he was able to transform those bacteria that cause "milzbrand" (the dreaded inflammation of the spleen), into the so-called "heupilze" (fungi of hay), which are

harmless, and *vice versa*. And even more, he produced an organism that forms a connecting link between the above named fungi, and which was hitherto unknown. To give a detailed description of the experiment would take too long. We only mention two facts which will show with what organisms the experiment was made. The hay fungi, such as can be produced in an infusion of hay, have such an enormous vitality that their life cannot be destroyed even by boiling the liquid which contains them for hours, and each of these little beings is able to propagate itself and to produce ten generations per day.

MALIGNANT DISEASES OF PLANTS.

The study of vegetable nosology, or the diseases and injuries to which plants are liable, is a department of botanical science which hitherto has not received the attention which it deserves. Writings on the subject are comparatively few, many of them empirical, and but few throwing much light on the subject. Intimately connected with the prosperity of horticulture and agriculture, it is a matter of great importance, and this being recognized it is now beginning to receive the attention which its importance demands. Our intention in this article is not so much to advance theories on the subject as to direct intelligent observers, especially fruit growers, in the line of observation and experiment, and to throw out some hints which, if properly followed out, may help to clear up this hitherto obscure subject. We do not propose to treat of the injuries produced by accidents or the attacks of insects, but only of diseases producing disorganization of the tissues of the plant and ultimately resulting in great injury to it, and frequently its death and consequent pecuniary loss to the cultivator.

Plants in a high state of cultivation are more or less predisposed to disease. This is due to the unnatural and excessive development of particular structures or substances caused by high cultivation, and so producing a general morbid condition of the plant, predisposing it to disease whenever the conditions of cultivation are too strongly or too suddenly opposed to those of nature; making exciting causes act with great intensity whenever the predisposition exists.

Modern investigations in vegetable anatomy and physiology all point to a close analogy between vegetable and animal life, and to a similar analogy between many of the diseases which affect both of them, at least in so far as such diseases produce disorganization or destruction of the tissues. Mr. Meehan, of Philadelphia, in a recently published article, gives the results of some microscopical investigations which he has made upon pear blight, and suggests that it is analogous to melanotic or black cancer. The black knot in plum and cherry trees is certainly analogous to a gangrenous ulcer. The disease known as the "yellows" in peach trees is so similar in many of its symptoms to syphilis that it may be called vegetable syphilis. In the cacti family we have a form of anthrax or malignant pustule, in which the whole interior substance of the plant becomes black and rots away into an offensive black mass. The action of frost upon the succulent shoots of plants is almost identical with its action on animal structures in producing destruction of the parts exposed and their subsequent sloughing off. The deleterious effects of the gases escaping into the atmosphere from chemical works in manufacturing certain chemicals is as injurious to vegetable life as it is to animal life, and sometimes even more so; the liquid waste from other manufactures escaping into rivers or ponds is as destructive to the aquatic plants therein as it is to the fish.

While plants have not stomachs as animals have, they nevertheless have organs of nutrition, through which they take up their food in a soluble form. The process is similar in both animal and vegetable life; in the first, the food in the solid state is taken into the stomach, to be there rendered soluble before being absorbed into the system; in the latter, it is rendered soluble in the soil, whence it is taken into the plant. But in some so-called carnivorous or insectivorous plants we have, as in *dioncea*, an apparatus which catches insects, secretes a fluid similar to gastric juice to digest them, and then absorbs all the parts dissolved; just as is done by some of the lower forms of polypi or medusæ, which catch aquatic insects and folding their skin over them absorb all that is soluble of them. Similar action takes place in *pinguicula*, *drosera*, and other genera of plants. In others, such as *utricularia*, we find bladders attached to the plant; these are furnished at their mouth with peculiar hair-like processes or cilia, which have a vibratory motion, and in this and in their general appearance resemble many forms of polypi and medusæ. These bladders entrap minute aquatic insects, which being digested in them the soluble parts are absorbed by the plant. They are in reality outside stomachs. Again, we have in *sarracenia*, in *nepenthes*, and some other genera, large tubular leaves or outside stomachs, furnished with various appliances for catching insects and digesting the soluble parts. All this goes to prove the analogy of which we have spoken; we might extend it still farther into the processes of respiration and reproduction, and show similar striking points of resemblance. This being the case it is reasonable to infer that in so far as their difference of structure will admit, plants may be liable to diseases similar to those of animals. If these latter can be cured by medical skill, why should not the diseases of plants be likewise cured?

Many pathologists ascribe the cause of some of the cancerous affections in the human body to cachexia, or a condition in which the system of nutrition is depraved. This being the case, should we not in such diseases as pear blight

endeavor to ascertain the causes of such depravation, whether they are in the air or in the soil, and when in the latter endeavor to remedy the evil? Amputation is the general remedy, but where the disease attacks large numbers of trees in any section of country, it is reasonable to suppose that its cause must be in the soil. Perhaps introducing some antiseptic drug under and below the diseased parts so that it might be dissolved and carried up in the sap might destroy the destructive action, or even the introduction of some drug into the tree by means of small gimlet holes into the trunk or branches might be of service. What these drugs should be, or in what quantity they should be, we know not, our object being to draw attention to a certain line of experiment which we believe has not before been suggested.

The common idea is, that the class of diseases in fruit trees to which we refer is due either to injurious atmospheric or meteorological causes, to insects, or to fungoid growths. The first may no doubt have, in certain cases, much to do with it; as, for instance, an excess or a deficiency of ozone in the air, which by its remarkable oxidizing power may materially affect the various chemical changes going on in the organization of the plant. Lest some of our readers may not fully understand what this mysterious agent is, we will state, on the authority of Prof. Dunglison, that ozone is a powerfully odorous matter, produced when a current of ordinary electricity passes from pointed bodies into the air. It is generally presumed to be a peculiar modification of oxygen; and in varying quantity in the atmosphere is supposed to affect the health of man. By others, ozone is considered to be oxygen condensed to two-thirds its bulk, when it possesses remarkable oxidizing properties. It can be artificially produced by placing phosphorus in a flask filled with atmospheric air and partly covered with water, occasionally agitating the flask. So, too, an occasional change in the normal condition of the atmosphere by an excess or deficiency of its gaseous constituents, or the presence of other gases, may induce cachexia. In the full grown human being the lungs expose fourteen hundred square feet of surface to the action of the air inhaled. Large as this surface is, that of a good sized tree, through its leaves, is vastly greater; and just in such proportion must be the injurious effects of a vitiated atmosphere upon it.

The presence of insects in a degenerated tissue is not *prima facie* evidence of their being the cause of the degeneration. A neglected gangrene will become full of maggots, but they were not the inciting cause. The same may be said of fungi, particularly of such as the yeast plant, which develop whenever chemical changes incident to eremacausis or decay present themselves in any organic matter or living organization. The mildew on grape vines is well known to be caused by atmospheric influences; the mildew or fungi is not a cause, but only a secondary effect. Sulphur, or rather the sulphurous acid gas which it contains, is a specific cure for it, generally supposed to directly destroy the fungus; but it more probably destroys it by the gas being taken up by the leaves of the plant, thus absorbed into its sap, and so restoring the leaves to a healthy state, which in such a state do not afford the food necessary to the life of the fungus, and it therefore perishes. All these gangrenous diseases of plants are contagious if any portion of the diseased plant is introduced into a healthy one. If a knife used in pruning such a diseased plant be afterward used in pruning a healthy one without proper cleaning, it will communicate the disease from the first to the latter. As much care must be used in cleansing it as a surgeon would use in cleansing his instruments after an operation for cancer or gangrene, before again using them upon a healthy person in some other operation. In the "yellows" in peach trees the disease is no doubt mainly communicated through the organs of fertilization, the pollen of the diseased tree coming in contact with the stigma of a healthy one, and communicating the disease in the same way as syphilis is communicated to a healthy mother through the fetus derived from a father having a syphilitic taint. This disease is so virulent that the roots or branches of a diseased tree coming in contact with the roots or branches of a healthy one will communicate the virus.

In conducting such experiments as we have suggested, absorption of air and water by the roots and leaves, and also the processes of exhalation and respiration by the latter, should be studied as a means of detecting the causes of disease and indicating the methods by which remedies may be applied to restore them to health when diseased. There is a certainty, at least, of insentient life in plants, if not a close approach in some to sentient life. Some forms of it may be chemico-vital action, but others are different and of a higher character. Vegetable physiology and anatomy have received great attention from learned botanists; their researches have been of much practical service to cultivators, and have done much to advance the arts of agriculture and horticulture. To these two branches of botanical study we shall soon have to add that of nosology and therapeutics. Veterinary science has advanced from mere empiricism to a strictly medical science. Agriculture and horticulture are but arts as yet, in which there is much groping in the dark. We now have agricultural colleges in which are many learned professors, who can do much to elevate these arts to science. The elevation of veterinary art to science has been of great pecuniary value to many nations; a similar elevation of agricultural art to a similar scientific standpoint would be of equal value. When we look at the immense values of our crops and their vital importance to the people, we cannot but recognize the necessity of preserving them from disease and the consequent pecuniary loss it involves.

MISCELLANEOUS INVENTIONS.

Friction and percussion tubes have been made for insertion in the vent holes of cannon to fire them; but, as is well known, the vent becomes enlarged by use, so that the tubes fit loosely, and either blow out without igniting the charge in the cannon, or else the tubes break off below the firing wire, on account of not being firmly held. Mr. John B. Rodman, of Fort Brown, Texas, has patented a primer for cannon which holds the priming tubes securely, and thus insures their proper operation.

A device for removing old caps from and inserting new caps in cartridge shells which have been exploded, has been patented by Mr. Heber W. Harrington, of Fort Dodge, Ia. The invention is also adapted to be used in capping new shells. It consists in a novel construction and combination of a tubular plug and a punch or piston working therein, the details of which cannot be clearly described without engravings.

It is well known that in the burning of factories, hotels, and private dwellings serious injury to the person and loss of life are of frequent occurrence because of persons jumping from windows. Mr. Thomas Bickerton, of Lawrence, Kan., has patented a device designed to prevent the occurrence of such accidents. It consists of a frame lined on sides and ends with mattresses, and having a movable bottom consisting of a mattress suspended by elastic cords.

An improved vise that may be easily operated by the foot of the workman to forcibly clamp the jaws of the vise upon the work while the hands are free to hold the work has been patented by Mr. William S. Lord, of Brownsville, Tenn. It may be immediately adjusted to adapt the jaws to embrace the work before the clamping movement of the jaws is exerted.

An improved grate for stoves and furnaces has been patented by Mr. Isaac Hayes, of Philadelphia, Pa. The invention consists in a grate composed of cross bearers that are fitted for being rocked and support the grate bars. The bearers are moved by a rock lever and handle that is connected with two of the grate bars, whereby the bearers and grate bars are vibrated alternately in opposite directions.

Hygiene of Photography.

At a recent convention of Photographers at Chicago, Dr. Norman L. Briggs, of Rush Medical College, was announced to read a paper on "Poisons of Photography." He gave instead a brief practical address on the hygiene of photography, in which he said that photography, though not an ideal occupation, could not be an unhealthy one. An ideal occupation was one that required one to indulge in a variety of muscular motions. There were very few occupations ideal; one man labored with his hands, another with his legs; another was exposed to gases, and another to dust, the latter, by inhalation, producing lung diseases; still another class, such as people who work in gas works, was exposed to high temperatures, while yet another class, who work with their feet in the water, caught cold and were attacked with rheumatism, Bright's disease of the kidneys, etc. Photography was an occupation conducive to good health, as it required a great variety of motion, and was of the lighter occupations. It also dealt with the mind, being an artistic employment. There were certain chemicals photographers used that were detrimental to health, and there were a number of gases and solid substances that photographers were compelled to come in contact with. Among the fumes they inhaled were those of alcohol and ether. The latter was a stimulant to the animal body, and the effect was detrimental, many of the nervous disturbances being attributable to it. The vapor of alcohol was no more harmful than if taken in the stomach, and was as great. Acetic acid vapors were harmful if one was exposed to them a great deal, but the amount of fumes of that drug that photographers were exposed to was small. The fumes of hydrocyanic acid were exceedingly harmful, as well as those of iodine and bromide, these latter causing a sallowness of the complexion and producing eruptions of the skin. But those fumes were rare.

The solids that photographers came in contact with were exceedingly harmful, notably nitrate of silver, in the solution of which photographers put their hands. The absorption was slight, but they got some silver in their systems. Physicians found it valuable in some diseases. It produced symptoms of general debility; the patient looked sour, digestion was bad, the tongue coated, secretions sluggish, and the person was generally ill. They should avoid it as much as possible. Iodide of potassium solutions were slightly harmful, and bichromate of potassium was exceedingly harmful, producing irritation of the mucous membrane. Persons who manipulated that drug had eruptions of the skin and irritation of the mucous membrane—ulceration of the latter, etc. No person could work with it without ulceration of the bronchial tubes.

Another solid substance was cyanide of potassium, used for cosmetic effect—for the removal of stains from the hands. This drug would do more harm than the silver would.

The question was: How could they avoid injury? In acute poisoning something might be done in the direction of an antidote, but not generally as much as was supposed. Little could be done in the shape of antidotes in cases of chronic poisoning, which produced symptoms of nervous prostration, loss of sense of hearing, and fading of the sight.

Chloride of gold and sodium were harmless, and pyrogallie acid was harmful if it came in contact with certain

parts of the body. What were the measures that could be employed to remove the injuries caused by those poisons? The first thing to do was to avoid getting those poisons in the system. The gases might be rendered innocuous by dilution, which could be done by atmospheric air. It was possible to ventilate photographers' dark rooms well without interfering with their work. They should have several small openings in the apartments. A tallow candle or a small kerosene lamp, placed in a little flue so that it would cause the air to pass up would ventilate a room. By diluting the gases the photographer would cease to inhale them.

About the solids: He knew but one way to obviate their effects, and that was to avoid touching them, or, if they did it should be done with protected hands. The doctor thought tongs or forceps could be used to put the plates in solutions. He advised photographers to take less of stimulants while they were inhaling other stimulants. That brought forth laughter and applause from the delegates, and Dr. Briggs said he meant alcoholic stimulants to some degree. They should, he said, eschew tea, coffee, and tobacco; they could not take one stimulant to kill another, and should avoid as far as possible taking in the stomach all unnatural things. They should also avoid all strong stimulating condiments, such as cayenne pepper, etc. The photographer might indulge in athletic sports—play base ball, swing Indian clubs, or use the health lift. He should be out of doors as much as possible. He might indulge in a little free exercise, and a little medication might be allowed. He should avoid contact with and dilute the poisons; get good recreation and avoid the overuse of stimulants. The speaker believed the profession of photography ought to be as healthy as any in the land. He knew that photographers as a rule were chemists, and as years went by chemistry was being more and more studied by them. The danger from poisoning would grow less as years passed by.

Hunting for Submarine Treasure.

A schooner, owned by a Connecticut "Submarine Company," is being used in exploring a sunken wreck off Round Island, near Peekskill, on the Hudson. The wreck has been there many years, and is reputed to have been the ship of the famous pirate Capt. Kidd. A visitor found among the appliances of the schooner a great variety of machines, chains, pumps, rubber tubes, and other contrivances, for bringing treasure out of deep water. Chief among these was a large diving bell, of boiler iron, with little round windows on every side, so that the man inside can see out in every direction—up, down, and across. It is kept in a well in the hold, and when it is to be used, bolts at the top are unfastened, the man climbs in, and the bolts are again fastened, the top being put on so tight that the affair is both air and water proof. The sensation of being bolted into this narrow iron prison for the first time is said to be terrible, though the experienced divers do not mind it. There are two rubber tubes attached to the top, one to carry off the exhausted air, the other to supply fresh air. When the man is fastened in, the air pump is started, and the bell is hoisted out with an immense derrick and lowered over the side. This bell can operate in 300 feet of water, and is, of course, raised or lowered by steam. When all is ready it is lowered to the bottom. The man inside looks through his windows, and determines what must be done first. He has wires to pull to signal the men above. He can tell them to hoist, lower, give him more or less air, or any other signals that may have been agreed upon. Attached to the side of the diving bell, and operated by steam, from above, is what is called "the arm"—a heavy attachment, provided with so many joints and swivels that it is capable of making all the many motions of the human arm, with much greater strength than any human arm ever had. This arm has a hand, with fingers, that hold a saw, an axe, a crowbar, or any instrument desired. If the man in the bell desires to saw, he is drawn up, a saw is put in the steam hand, and he goes back and begins work. When he wants an axe or a hammer he is drawn up again, and the tool is changed. The iron bell is almost human in its capacity for work, and, with the brains of a man inside, it is a valuable laborer. When the work is in very deep or dark water, or at night, an electric light is attached to the bell, and the bottom for many yards around is made as bright as if the sun shone upon it. The effect upon the surface of the water of this bright light underneath is said to be dazzling and beautiful, and some of the Rip Van Winkles who live up yonder on the hills may well begin to wonder when they see the bottom of the Hudson bright with electric light and a steam-man digging for a pirate's treasures.

Energy Developed during Rains.

Professor Tait, of Edinburgh, thus illustrates the gigantic scale upon which nature performs some of the most ordinary of her operations: Suppose a mere tenth of an inch of rain to fall from the lowest mile of the atmosphere. An inch of rain is 5 pounds of water to the square foot, and gives out, on being condensed from vapor, approximately, 3,000 units of heat, on the Centigrade scale. The mass of the mile-high column of air, a square foot in section, is about 360 pounds, and its specific heat about a quarter that of water. Thus, its temperature throughout would be raised by about 33° Centigrade, or 60° Fahrenheit. For one-tenth of an inch of rain, therefore, we should have a rise of temperature of the lowest mile of the atmosphere amounting to 33° Centigrade—quite enough to produce a very powerful ascending current. As the air ascends and expands it cools,

and more vapor is precipitated, so that the ascending current is further accelerated. The heat developed over one square foot of the earth's surface under these conditions is equivalent to work at the rate of a horse power for 12 minutes. Over a square mile this would be 10,000,000 horse power for half an hour. A fall of one-tenth of an inch of rain over the whole of Great Britain gives heat equivalent to the work of a million millions of horses for half an hour! Numbers like these are altogether beyond our comprehension. They enable us, however, to see the full explanation of the energy of the most violent hurricanes in the simplest physical concomitants of the mere condensation of aqueous vapor.

Patents and Science.

A paper was read at the late meeting of the American Association by Mr. B. S. Hedrick, Examiner at the Patent Office, Washington, D. C., on "Patent Laws as a Means for the Advancement of Science." The proper aim of science was defined to be the making of discoveries. The discoverer of a new mineral, a new plant, a new law in nature, or a new world, has no proprietary right in his discovery. The honor and distinction he obtains is his reward. A discovery, then, cannot be the subject of a patent. The laws of nature, the properties of matter, the physical forces, and the laws of their generation and government, are, like the earth, the air, and the water, the common property of all. Property in the former, as in the latter, is created by enactments. But in civilized communities the reason for the law is that something has been added to what was given by nature. The land has been fenced, plowed, and planted, or buildings placed upon it that give the foundation for proprietary right. And public policy requires that this right be recognized; and civil, municipal, and common law does this in the case of the land, the air, and the water. Patent laws do the same when discoveries, the properties of matter, forces, the laws which govern them, are made to take the shape of useful invention. The invention which the inventor created is secured to him as his property for a period at least. But not the laws themselves. It is the reflex action of the invention that promotes the advancement of science. Illustrations were given by referring to Watt's steam engine in advancing our knowledge of the laws of heat; the telegraph, in giving a new development to the science of magnetism and electricity; and now the telephone and other kindred inventions serve to push our knowledge into the farthest and outermost borders. The protection given by patent laws enables the great host of investigators to carry on their researches, and, instead of becoming a tax and burden to the community, they help both themselves and others to bear a full share of the ordinary burdens of society. Reference was made to Wheatstone, Bessemer, the brothers Siemens, Perkin, Graebe, Sir William Thomson, and others in Europe, and to Morse, Page, Henry, Gale, Bell, Edison, and many others, members of the American Association—men who have greatly advanced science, and have received of the rewards which flow from the operation of patent laws.

Young Rats Tied by their Tails.

A correspondent writing from Richmond, Va., wants to know if it is the custom of rats to tie up their offspring by their tails. He lately found "four young rats, each one neatly tied around the left hind leg with his own or his sister's or brother's tail, and all tied together at a common center and neatly interwoven, on a fabric of downy feathers which composed their nest." Our correspondent will find an engraving of rats tied in this manner, with an explanation of the matter, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 234.

Subcutaneous Injection of Ether in Sciatica.

Dr. Comegys, in *L'Union Médicale*, recommends hypodermic injection of sulphuric ether for the treatment of sciatica. He cites two cases, one in detail, which he has cured by this plan. Three drops of ether are injected at intervals of twelve hours. The injection need not be a deep one; and though it causes a momentary sharp pain, it does not bring on any consecutive unpleasant effects. Dr. Comegys is inclined to think that the same injection might be successful in the case of tic-douloureux, for which Dr. Marino recommends hypodermic injection of ergotine.

Tasteless Cod Liver Oil.

Dr. Peuteves, in *La France Médicale*, recommends, in order to render cod liver oil tasteless, to mix a tablespoonful of it intimately with the yolk of an egg, add a few drops of essence of peppermint, and half a tumbler of sugared water, so as to obtain a *lait du poule*. By this means the taste and characteristic odor of the oil are entirely covered, and the patients take it without the slightest repugnance. Besides, the oil, being thus rendered miscible as the water in all its proportions, is in as complete state of emulsion as the fats at the moment they penetrate the chyle vessels, consequently absorption is better assured.

The Utilization of Saw Dust.

The saw dust, which has become such a nuisance at Minneapolis and along the river below that growing city, offers a promising field of enterprise for whoever will utilize it. Several applications have already been made of it, and now arrangements are being made by a French manufacturing chemist for the establishment, at Minneapolis, of a laboratory to make from the saw dust an acid, now imported from France, and largely used by dyers, chemists, and druggists. It is to be hoped that the enterprise will be successful.

THE CINCINNATI INDUSTRIAL EXPOSITION.

The machinery department of the Cincinnati Industrial Exposition contains enough to occupy a whole page of your paper. So I will give only a birdseye view of what is there to be seen.

A machine for making wire nails complete requires but little attention. Near it stands a nail-driving machine used for joining boxes. A large machine for making barbed wire fences is in operation.

A shoe manufacturer has a dozen or more employes at work making shoes. Most of the branches of labor are carried on in full view of the visitors, and usually attract a crowd.

A firm with emery wheels comes from Boston, another is from Detroit.

A thread spooler winds the cotton of John Clark, Jr., and a spool of cotton is presented to each passer by.

The Corticello Twist and Silk Company have a machine in operation for winding silk, and the exhibitors are almost lavish in their advertisement, which is not needed to those who have ever used their goods.

A sewing machine brought from Chicago stands in the vicinity. It is propelled by electricity. The attachment can be made to any machine, and costs \$25. The owner has one order for twenty-five machines to be used in a shoe factory in Massachusetts.

Weaving by the Jacquard loom draws crowds of people. Two of the looms are from Paterson, N. J. One is making handkerchiefs of various colors and patterns, the other book-marks. The one making book-marks is certainly a wonderful and complicated affair. Near the loom stands a machine for weaving gros grain dress silk. It is operated by the hands and feet, and made like those used in France.

A something novel to me was a machine from Boston for shearing sheep. It is to be moved by steam or water power. The machine is to be leased—not sold. It is suitable for the ranches of California, Kansas, and Colorado. It never cuts the sheep in shearing, which is one humane result that it effects.

A small but very useful contrivance is a clothes sprinkler. Laundry women should tender a vote of thanks to the inventor. A key hole guard, originated by a German of this city, is simple but ingenious. A new method of connecting the joints of stove pipes is likely to prove available. I observed from Boston a cordage that I think is unsurpassed for strength and durability. The manner in which it is woven is peculiar.

The Slater Woolen Company, of Webster, Mass., makes a large and handsome display of 52 pieces of broadcloths, doeskins, etc.

A fire escape is well worth the attention of hotel keepers and manufacturers.

An ice machine, said to be invented in Prussia, is much smaller than the American one exhibited last year.

A simple yet useful invention is a show case from New York containing the Waltham watches. The doors, by which salespeople take articles from the show case for examination by purchasers, slide down vertically, and so are not in the way of the clerks passing through the narrow space at the back of the counters. The Esterbrook pens have a large and varied display.

Van Duzen & Tift's bells range in size from a cow bell to a church bell. Evans' artificial legs seem to be preferable in some respects to natural ones. The motion of the ankle adjusts itself to whatever position the limb takes. The flesh tints are perfect. A patented flour chest is a treasure to housekeepers. Dentiphones modestly lie in a small case, unused and unexplained. Three telephone displays are in the main hall. A sponge in a glass, that serves as a reservoir for feeding it with water, is a good contrivance for book-keepers and bankers to moisten their fingers. The granite iron ware of St. Louis, now so much in vogue, is well represented. A water cut-off is to turn the water from a cistern, until the first water, which is not clear, has run off, and then convey the clean water to a cistern. It is also useful in cutting off the water supply when the cistern is full.

A wooden woman, dressed in fantastic style, is the operator at the Exposition, and occasions many a merry laugh.

Hamilton, Ohio, has much machinery on exhibition; also some mantels and marble statues. A lithographic press is exhibited by MacBriar. It is of English make, and cost \$950.

The usual large number of washboards, wringers, clothes driers, and knitting and sewing machines, are collected together. A wagon cover that can be folded or taken off entirely, and that can be moved so that a portion will project either forward or backward, seems to me a paragon of convenience for country people and expressmen. Folding and extension iron and steel gates are well worth the attention of storekeepers, livery stable men, and brewers. One is used in the rear of the Exposition building. Cincinnati is so noted for its musical talent and culture that many piano-forte manufacturers and dealers make an exhibit of their instruments and employ skillful musicians to play on them in the afternoon and evening, so that by auricular demonstration visitors may learn their comparative merits. A bookbinder's wire stitching machine comes from Boston, and may work a revolution in the old method of uniting the leaves of books. Caldwell's grain conveyor, of St. Louis, takes with the millers. Timmerman's furnaces for evaporating fruit can be used indoors or outdoors, and utilizes all

the heat generated. The fruit is bleached by the fumes of burning sulphur, but it is harmless.

Mrs. Short, of this city, exhibits five inventions of her own, namely, a cleansing powder for paint, a machine for washing blankets, a mangle and ironer, and a lace curtain stretcher.

The electric lights used in front of the Exposition building, in the vestibule, and the main hall, have the name as inventor of Maxim, New York. The *modus operandi* has been lately described in the SCIENTIFIC AMERICAN.

One of the most useful inventions is that of an arrangement placed under the boilers of the Exposition building. The inventor is Mr. Murphy, who hails from Detroit. He ought to take up his residence in Cincinnati, and get the city officials to pass an ordinance against manufacturers and others letting volumes of black, dirty smoke belch forth from their chimneys. In that way he could promote the comfort and health of the people and earn a fortune for himself. But a friend sagely remarks there is one great objection to its adoption by the city authorities for the water works, and that is that the steam stoker does not vote, while the twenty men that could be dispensed with do. Murphy's smokeless furnace is creating unusual interest in consequence of its remarkably successful operation. All coal fed to the furnace is passed through the hoppers, and dealt to the grate in a partially coked state and in small charges. The operation of the furnace may be stated as follows: The coal is pushed on the grate and remains there long enough to be coked. The gases then being released, the next charge forces the coke forward down the grates. This furnace is not, therefore, a "smoke consumer," for the smoke is never generated. It is, properly speaking, a smokeless furnace, or a smoke preventer.

The Union Electric Signal Company, of Boston, exhibit a practically successful system of operating railroad signals automatically. Each section of a mile of track is insulated from that preceding and following it. If a rail is anywhere displaced or broken, or a switch or drawbridge turned, there is no circuit, consequently no current, hence a "danger" signal must be displayed until the rail is relaid, the switch replaced, the bridge closed, or the destruction of the washout repaired. If the battery were neglected there would be no current, and a danger signal would be shown until it was attended to.

So it is with each section. The engineer sees by the signal just the state of the track for a mile ahead of him all the time, and the track and train themselves are made to announce their state automatically and positively. Thus it is impossible for the signal to give the train a signal of "safety" when there is danger ahead. If a track is single, and trains run both ways on the same track, it is required that signals be displayed not only at the end at which the train is entering, but also at the other end. That is to prevent a train entering a section, and so avoid meeting a train already started from the other end.

Secondary or cautionary signals are also used, which announce at a considerable distance before the section signal is reached, the state of affairs, and thus prevent danger from insufficient warning. VIRGINIA PENNY.
Cincinnati, Oct. 8.

THE AMERICAN INSTITUTE FAIR.

The fair of the American Institute is now at its best, all of the exhibits are in place, the patronage is large and well merited, and while we do not find anything as remarkable as the telephone, phonograph, and electric light were, on their first appearance in past years, the exhibition is very satisfactory.

The electric light, which was absent at the date of our last visit, is now supplied by two firms, the United States Electric Lighting Company, of this city, who light a portion of Machinery Hall, and the Fuller Electrical Company, also of this city, who light the main hall and also furnish lights at the front and rear of the exhibition buildings.

Among interesting objects in Machinery Hall we find Volkmar's apparatus for drying fruits, vegetables, fish, and meats by cold air, avoiding decomposition which accompanies high temperatures.

Mr. C. C. Clawson, of Raleigh, N. C., exhibits an automatic machine for packing tobacco and other articles. It weighs out the article, packs it in bags, and delivers the packages at the rate of thirty per minute.

Mr. William F. Gregg, of this city, exhibits some fine astronomical and engineering instruments, among which may be mentioned a thirty-inch time transit, a four-inch telescope, and a fine equatorial stand for a six-inch telescope. He also exhibits a new form of stereograph.

Several Holtz electrical machines are exhibited by Mr. Curt W. Meyer, of New York, who also shows some interesting apparatus for schools and amateurs.

EXPORTATION OF VULCANITE EMERY WHEELS.

The New York Belting and Packing Company have been receiving for some years large orders for their vulcanite emery wheels from England, where they are used in the government arms manufacturing works at Enfield, near London. They have also, for a considerable time back, been supplying these wheels for the use of both English and Continental manufacturers of fine cutlery, machine tools, and implements of precision, their superiority over English emery wheels for nearly every kind of grinding, cutting, and finishing being thus practically recognized. The success of

the company in this field, almost within the bailiwick, as it were, of a business in which England claims especial pre-eminence, is particularly creditable to its managers and to their goods, and cannot fail to be gratifying to American mechanics generally.

The solid emery vulcanite wheel is an American invention, to attain complete success in the manufacture of which the company devoted years of laborious application, making thousands of costly experiments, and constructing therefor elaborate and expensive machinery. It was a branch of the business which, starting with the most ample facilities, and using only the best rubber, presented peculiar difficulties, for the problem was far more complicated than any which came up in other departments of the vulcanizing process. Aside from the nice distinctions always necessary in the mixing and vulcanizing processes of the rubber manufacture, they had still more difficult points to overcome in making wheels which would be sufficiently strong to run at a circumferential velocity of from 5,000 to 7,000 feet per minute, and which would have only just enough rubber in them to bind the emery closely, so that the wheels would wear perfectly even without glazing, would not soften by heat nor become brittle from cold, and would be throughout of such uniform texture and density that their work could always be depended upon. How well they have succeeded in overcoming these difficulties, and also in perfecting the mechanical details for mounting, truing, and turning off wheels, the greatly increased demand affords the best proof.

There have been but few improvements which have within the past twenty years worked such important changes in the way of economizing work in the machine shop and finishing room as has been effected by the emery wheel. The many different grades in which it is made, each different from the preceding by the slightest variations, fit it alike for almost every kind of grinding and polishing. Its handiness and general adaptability have enabled it to drive out the use of the grindstone, to a great extent, in the saving files to the value of millions of dollars, and greatly reducing the amount of work for which lathe tools were formerly used, so that it is now generally employed by workers in wrought, cast, and chilled iron, hardened steel, slate, marble, glass, etc. In the marking of hardware, cutlery, and edge tools, it has become indispensable, while it has also effected a great saving of labor in the manufacture of plows, safes, stoves, agricultural implements, and small machinery of almost every description. It is, therefore, a matter of considerable credit to American inventive genius and mechanical skill that the rest of the world should be indebted to us for the introduction and continued manufacture of the best articles in so important a specialty.

DECISIONS RELATING TO PATENTS.

By the Commissioner of Patents.

(Appeal from the Board of Examiners-in-Chief.)

HOCKHAUSEN vs. WESTON.—DYNAMO-ELECTRIC MACHINE.—INTERFERENCE.

Application of William Hockhausen filed January 28, 1878. Application of Edward Weston filed December 13, 1877.

Marble, Commissioner:

1. A machine which embraces all the features called for by the issue in an interference in such a manner as to be capable of successful operation will serve to give date to an invention, although such machine fail to show additional features which give increased efficiency to the perfected machines.

2. Objections to the patentability of a claim constituting the issue in an interference should be urged by a motion for dissolution of the interference, and not by an attempt to restrict the scope given by the Examiner to such claim.

3. In both the courts and the Office abandonment is an ill-favored finding, and cannot be presumed, but must be conclusively proven.

4. The charge that an applicant is not an original inventor must be sustained by proof of a most conclusive character.

HOPKINS vs. LE ROY.—JOURNAL BEARING.

Application of D. A. Hopkins filed November 20, 1879. Application of T. V. Le Roy for reissue of patent No. 221,737, granted November 13, 1879, filed June 5, 1880.

Marble, Commissioner:

1. When a party files a preliminary statement it is to be presumed that he has fully canvassed all the facts in the case and has correctly stated the same, and unless a request to amend the statement is made before any testimony has been taken all parties have a right to proceed on the issue as made in the respective statements.

2. A party has no right to wait until his opponent has fully developed all the facts in his case, and then for the first time ask leave to correct errors in his statement; but if through carelessness or negligence he has failed to have such correction made he must suffer therefor.

WICKS vs. MCAVOY.—SHEET METAL CAN.—MOTION FOR REHEARING.

Marble, Commissioner:

1. The rules relative to the granting of rehearings in interference cases before this Office are those which govern the granting of new trials in the courts, and to motions for the same diligence is a prerequisite.

2. Misstatements in arguments of counsel will not warrant the granting of a new trial.

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 For Sale, ready for instant delivery, 16' x 42' Corliss Beam Engine, 16' x 2' wheel, thorough repair. Price, f. o. b. at tide water, in New England, \$1,250. S. C. Forsyth & Co., Manchester, N. H.

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Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

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Packing once tried always used. Phoenix Packing from 1-16 up in spools or on coils. Phoenix Packing Company, 108 Liberty St., N. Y.

Blake "Lion and Eagle" Imp'd Crusher. See p. 269.

Gas Machines.—Be sure that you never buy one until you have circulars from Terrell's Underground Meter Gas Machine, 39 Dey St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsburg, Pa. Peck's Patent Drop Press. See adv., page 268.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

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Green River Drilling Machines. See ad. p. 269.

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Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Eclipse Portable Engine. See Illustrated adv., p. 252.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Emery, Solid Walrus Wheels, Leather for Covering wood wheels. Greene, Tweed & Co., 118 Chambers St., N. Y. Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, 19'klyn, N. Y.

Clark Rubber Wheels adv. See page 237.

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4 to 40 H. P. Steam Engines. See adv. p. 252.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

For Separators, Farm & Vertical Engines, see adv. p. 220.

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For Yale Mills and Engines, see page 252.

Silent Injector, Blower, and Exhauster. See adv. p. 284.

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For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 284.

For Wood-Working Machinery, see illus. adv. p. 285.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 285.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see illus. adv. p. 284.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 285.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 284.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 284.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 284.

Catechism of the Locomotive, 635 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price \$2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 284.

For best low price Planer and Matchner, and latest Improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 284.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. M. asks: 1. What is the best method of washing a pair of common working pants that is tolerably greasy so as not to discharge the color? Is there any way of fastening the dye before washing? A. It is impossible to wholly prevent the washing out of such dyes; still, if treated in the following manner, and not allowed to remain too long in the water, the effect of the washing on the dyes will be less apparent: water 1 gallon, soap 1/2 lb.; boil to dissolve; add two oz. borax; dilute with about 8 gallons of water, work the goods through as quickly as possible, and rinse without wringing. An aqueous solution of 1 part copperas and 7 parts logwood extract may be used for reviving the faded color of cheap black goods. 2. How can I clean off the hard scale that has collected on the zinc of a medical battery? A. Try sulphuric acid diluted with two or three parts of water, and use a stiff wire brush. 3. What is the reason that copper is the only metal used for the apparatus in distilling spirits? A. Copper is a better conductor of heat, can be worked to better advantage, is less affected by the liquids, and less liable

to color or otherwise affect the distillate. 4. Would wrought iron pipe do for a worm for distilling whisky? A. Spirit could be distilled in such a vessel.

(2) G. G. G. writes: 1. In directions for making an induction coil in SUPPLEMENT, No. 160, it says the secondary coil is made of No. 36 copper wire. What gauge is understood? A. American. 2. In making coils of other dimensions, is wire of the same size used? A. Yes. 3. Can you tell me what kind of cement will fasten leather to metal, and will not be affected by bisulphide of carbon? A. Gelatine dissolved in acetic acid.

(3) F. R. R. asks (1) how to remove and replace the substance inside the porous cup of a Leclanché cell. What is the substance? A. Remove the cement at the top of the cell, take out the carbon and remove the filling of the cell, soak both carbon and cell in warm water. Replace the carbon and fill the cell with granulated black oxide of manganese. 2. What is the rule for the proportions of an electro-magnet to get the greatest power from a given current of electricity? A. The maximum magnetic force is developed when the resistance of the coils of the electro-magnets in circuit is equal to the resistance of the other parts of the circuit—that is, the conducting wires and battery.

(4) C. M. D. writes: I have about 600 feet No. 40 silk insulated wire and desire to make an induction coil. What size shall I make my spool, and how much wire shall I use for my primary, to get good results with one small bichromate cell? A. Use two layers of No. 16 silk covered copper wire. Make the core of your spool four inches long and five-eighths inch diameter. Your other query lacks data. Repeat, giving length of lines and diagram of connections.

(5) J. W. W. asks: 1. What is the cause of the heat produced in the armature core (iron) of a dynamo-electric machine? Is it not largely due to the rapid reversal of the magnetic polarity of the iron? A. Yes. 2. Supposing two dynamo machines alike in every respect with the exception that one armature is wound with No. 14 and one with the same length of No. 16, would not the one with No. 14 produce a current of greater quantity or more heating property than the 16? A. It depends on the construction of the machine. In a large machine, having strong field magnets, the larger wire would produce the most effective current; but with a very small machine the smaller wire would be best.

(6) W. S. asks: 1. Is the Siemens-Halske as strong as the chromic acid battery? A. No. 2. How long will either of the above batteries work without attention, if run constantly for eight hours per day on a circuit with a resistance of about two ohms? A. The S.-H. sulphate of copper battery will run for several months. The chromic acid battery will run two or three days only. 3. How many Smee batteries will be required to develop the same power as six of the above? A. Six Smee's are about equivalent to six S.-H. sulphate of copper batteries. Eight Smee's would be about the same as six chromic acid batteries.

(7) F. R. R. asks: Does the improved Prud'homme battery have the same substance in the porous cup as the Leclanché? A. We believe the porous cell contains granulated carbon.

(8) A. R. asks: 1. Will a magnet give more attractive force than its weight? If so, what are the proportions? A. A good magnet will lift several times its own weight; but the amount lifted depends on the form of the magnet, on the quality of steel from which it is made, and on the degree of magnetization. 2. Will a magnet lose its force by continual use? A. Yes, generally. It depends something on the manner in which it is used. If, as in some of the telephones, there is an armature constantly in contact with the poles, it will not lose its power.

COMMUNICATION RECEIVED.

On the Tin Mines of Maine. By C. W. H.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
 Granted in the Week Ending
 October 5, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.	
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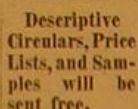
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Fig. 4.

MR. EADS' GREAT SHIP RAILWAY FOR THE AMERICAN ISTHMUS.—[See page 308.]

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THE PROSPECTS OF TRADE.

On all sides the business outlook is of the most cheering character. The statistics of the Treasury Department show that during the nine months ending with September the total exports of breadstuffs was in round numbers nearly \$200,000,000, or over \$30,000,000 more than during the corresponding period last year. The exports of domestic provisions during the same period approached \$104,000,000, against \$82,000,000 for the same months last year. The total exports of domestic manufactures and merchandise of all sorts during the first eight months of the current year exceed those of the same period last year by more than twenty per cent; and the general conditions of trade during the latter part of the year—for which the full statistics are not at hand—certainly indicate no falling off in the ratio of increase. The increase in the value of goods imported this year is greater than the increase in exports; while the steady inflow of gold from Europe is proof enough of the healthful condition of our foreign trade as a whole.

Our domestic trade was never being prosecuted with greater vigor, confidence, and profit. The great lines of communication are taxed to the uttermost to handle the merchandise now in motion. The trunk lines of railway report their western bound freights to be from 25 to 40 per cent greater than this time last year, while the eastward movement is fully 10 per cent above that of the corresponding period in 1879, with the heaviest parts of this year's crop yet to be moved. The coastwise trade is likewise reported as considerably in excess of last year's.

Not less cheering are the reports from manufacturing centers, East, West, and South. The mills and factories are running full time and full handed, and critical observers note as a source of special gratification that at no time since the war has there been so great a demand for tools and machinery required in extending old established works and for equipping new ones. The manufacturers of tools, machinery, and other appliances for manufacturing are crowded with orders, indicating not merely a present active demand for manufactured products for general consumption, but a confident expectation on the part of producers of increasing demands in future.

Even so conservative an authority as the United States Economist does not hesitate to say, what we had the pleasure of asserting more than a year ago, that the country has entered upon a period of productive energy and prosperity such as it has never seen before. In the words of our contemporary, the best ten years in all the history of this country are now before us. During the coming decade we shall enjoy a period unexampled prosperity, a prosperity whose foundations are as real and whose basis is as broad as the unequalled products of our fields, flocks, factories, and mines.

"With our currency on a specie basis, with our population steadily increasing through the active toilers of foreign immigration, with vast areas of rich virgin soil being constantly added to our productive growth, with all our vast industries in successful operation, with the balance of trade in our favor, with peace at home and abroad, with labor steadily employed and wages good, with the wealth of the nation rapidly augmenting, there is no bar in the way of our commercial advancement. All obstructions are happily removed, and taking care of home wants and developments, let the business men of this country reach out for the commerce of the world."

As we remarked in a recent issue of the SCIENTIFIC AMERICAN the closing years of this century should see, and certainly promise to see, as rapid a progress toward American commercial supremacy as the two decades just past have seen in the development of our agricultural and mechanical supremacy, with a collateral progress in our industrial affairs that the boldest scarcely dream of now.

PROPOSED PALM OIL INDUSTRY.

Mr. Edward S. Morris, of Philadelphia, suggests that something profitable might be done in this country in the extraction of palm oil by means of naphtha. While in Hamburg, Germany, lately, he found three factories running night and day extracting oil from palm kernels, and tried to gain admission to them. He was not admitted, the Germans thinking that Americans know quite enough, and that we will soon undersell them under every business head. He learned, however, that the oil was extracted from the kernels by naphtha, and not by hydraulic pressure. Most of the oil thus made goes to France, where it is refined and made into a fine table oil. Labor is so cheap in Germany that they can afford to throw the meal away after extracting the oil. If the oil was obtained by pressure, then the meal or cake would have the same market value as linseed cake, as food for cattle.

At Liverpool he learned that palm oil and palm kernels formed about two-fifths of the entire tonnage of more than twenty steamers trading along the African coast to and from Liverpool. The exportation of palm kernels from Africa began only a few years since. They now have a regular market value and a ready sale in England, where the oil is mostly purchased by soap makers and perfumers. There the oil is extracted by pressure, and the cake or meal finds a ready sale, being free from the odor of naphtha.

Believing that the industry might be profitably introduced here and the importation of palm kernels made a useful adjunct to the trade of American vessels visiting the African coast, Mr. Morris brought home three tons of the kernels purchased in Liverpool. He sent samples to several parties

likely to have facilities for extracting the oil, but found no one ready to undertake the work. He is still confident that the industry could easily be established here, and that it would pay. Seeing, however, that we have only begun to utilize the equally valuable oil of our enormous yield of cotton seed, there does not seem to be much probability of any rapid increase in the importation of African palm kernels for their oil. It might be a profitable thing to do, nevertheless. The objection to the naphtha process, that it leaves an odor of naphtha about the oil cake, is, we are inclined to think, unfounded in fact. At any rate, the taint must be rapidly dissipated on the exposure of the meal to free currents of air.

THE EFFECT OF FORESTS UPON RAINFALL.

The effect of clearing land of its trees, according to the opinion of many meteorologists, engineers, and other scientific students of the subject, is to diminish the average rainfall of the country thus cleared, to lessen the outflow of the rivers, and also to cause such concentration of the amount of rain and snow within short periods as to increase the danger of floods to a marked extent. This theory was formulated most fully in 1873 by Sir Gustav Wex, chief engineer of the improvements in the Danube River at Vienna, who supported his opinion by very ample calculations as to the decrease in the volume of water discharged by the five principal rivers of Central Europe. Since that time many opinions have been expressed by experts, some affirming, others denying, the correctness of Sir Gustav's theory; some have claimed that the fact of such a decrease in the discharge of the rivers cited has not been satisfactorily established; while others, admitting that the decrease has gone on, deny that this fact is sufficient to prove the accuracy of all, or even any of Sir Gustav's conclusions. The latter has, therefore, recently published a second treatise, in which he says that for six years he has shunned neither labor nor expense in obtaining as many and as reliable technical hydraulic measurements and data of different streams as possible; and he has come to the conclusion that his theory has been proven to be correct.

Sir Gustav gives voluminous tabular exhibits of observations taken on a number of large rivers extending over periods of more than 100 years in some cases, and in nearly every case it is found that the river surface has been lowered to a marked degree. The rivers cited are the Upper and Lower Rhine, the Danube, the Elbe, the Vistula, the Oder, the Moselle, the Main, the Theiss, the Tiber, the Po, the Seine, the Glommen (in Norway) and the Mississippi. In reply to the objection that the lowering of a river's surface may be due to the deepening of its channel, and not to the decrease in the volume of water discharged, Sir Gustav admits that the channel beds are sometimes raised and sometimes lowered; "but," he says, "if from the numerous gauge readings submitted by me are eliminated those which were taken on stretches of the stream in which changes in the bed of the river took place, we will still find some rivers or stretches of stream which lie either in a natural unchangeable bed, or which have been improved from time immemorial and are in permanent condition. The most scrupulous expert must admit that on such rivers and stretches we can justly assume that the decrease in their stages—i. e., the sinking of their surface, indicates a decrease in their volume of water, since it would be impossible to explain the phenomenon in any other way."

Sir Gustav claims that the destruction of forests, necessarily coincident with the advance of civilized habitations into new countries, not only diminishes the aggregate amount of rainfall, but it increases the tendency of floods. This is, of course, equivalent to saying that the rainfall (which word includes all atmospheric aqueous deposit, such as rain, snow, hail, dew, etc.) is concentrated into briefer spaces of time during the year, instead of being equally distributed; and as this concentration must have a detrimental influence upon agriculture, the importance of the subject extends beyond its effect upon rivers alone, which is the only point of view taken by Sir Gustav Wex. It therefore deserves double attention in this country, where droughts are so often such serious causes of crop failures.

The observations of the Mississippi recorded by Sir Gustav were made at Natchez, Miss., and extended over a period of 11½ years. They showed a mean annual fall of seventenths of an inch in the surface level of the water, while the highest stages averaged nine hundredths of an inch higher each year, and the lowest stages thirty-nine hundredths of an inch lower each year.

THE BRUNTON TUNNELING MACHINE.

The Society of Associated Coal Miners, of the Bouches du Rhône, in the south of France, have long had in view the cutting of a tunnel nearly ten miles long between their mines in the basin of Fuveau and the sea. During the last three years they have made many experiments with machinery intended for tunneling, at an aggregate expense of about \$40,000. There are serious objections to the use of explosives for removing the rock, and recently they have made some trials with the tunneling machine of J. Dickinson Brunton, invented for the purpose of cutting the tunnel beneath the Channel. The machine consists of revolving cutting disks placed at different angles, and so directed as to remove the rock in considerable quantities directly without the use of explosives. Mr. Brunton estimated that in a tunnel of 7½ feet in diameter, he could progress at the rate of about two feet an hour through calcareous rock.

The experiments by the French company were made in a mine at Gardanne, where a tunnel 800 meters (or half a mile) long had already been pierced. The motive power was at a distance of one-quarter of a mile from the mouth of the tunnel, and the power was conveyed to the Brunton machine by an endless chain.

The first trials were devoted to determining the best form for the cutting disks, and, although the life-time of those first used was only during one foot of advance, the form was so improved upon that they finally lasted during a progress of fifteen feet. It was then found that the machine did not work in a straight line, but would vary its direction and seriously strain the machinery. This was overcome by using the spirit level and other means of rectification. The improved machine was then tried for effectiveness, and, although its progress was satisfactory, it hardly came up to the sanguine anticipations of the inventor. In the best trials the progress made varied between $4\frac{3}{4}$ inches and $6\frac{1}{2}$ inches per hour. It was evident that the motive power transmitted was insufficient. Investigations upon this point brought out that of the 51 horse power of the original motor, only 12.4 horse power were transmitted to the tunneling machine, leaving a net loss of 38.6 horse power. Unquestionably if this large loss can be avoided the progress of the machine through the rock will even surpass the expectations of Mr. Brunton.

INFECTED CIGARS.

The occurrence of occasional cases of syphilitic sore mouth, among cigar smokers unwilling to admit any other source of contagion than the cigars they use, gives rise from time to time to sensational and possibly alarming newspaper reports of cigar smokers' perils. Several articles of this character are now before us. To one who does not smoke cigars the alleged perils from syphilitic taint seem to be grossly exaggerated, for two reasons: cigar smoking is extremely common among respectable people, on the one hand, and, on the other, the disease in question (syphilitic sore mouth) is by no means common among such people; while the probability that the relatively few victims who charge cigars with their misfortune may have been infected in some other way is certainly not small. The assertions of sensational reporters refute themselves by trying to prove too much.

Nevertheless it must be admitted that the indiscriminate smoking of cigars without the intervention of a holder is not a nice practice, especially when we take into account the large number of cigars made by untidy people in untidy tenement houses, and the disgusting practice which is said to prevail in them of finishing the cigar "with a lick."

It is asserted that over five hundred syphilitics are or lately were engaged in cigar making in this city; and the fact is notorious that the tenement houses in which cigar making is largely carried on shelter some of the lowest, filthiest, and most commonly tainted classes in the world. The thought of putting into one's mouth an article possibly handled by such people is certainly not a pleasant one. It is on the score of cleanliness, therefore, quite as much as on that of sanitary precaution, that the cigar holder should be used by all who smoke cigars, unless they know positively who made the cigars they smoke, and have confidence in the cleanly conditions of their manufacture.

The case reported in the London *Lancet* by Dr. Mannsell, of Liverpool, is enough to show that the danger of syphilitic infection by cigars is not wholly imaginary, although there is nothing in the report to show that such infection actually occurred. The case was that of a young girl with a syphilitic sore on her lip; and after describing it, Dr. Mannsell says:

"Independent altogether of the further progress of the case, or of the question as to how she became possessed of the sore, the interest of the case (and a melancholy one it is for smokers), centers in the occupation by means of which the girl got her living, for she had been pursuing it for a period of three weeks with this sore on her lip. She was employed in a cigar factory, where her work consisted in rolling the outer leaf around the bulk of the cigar, and when she came to finish off the end which is put into the mouth, the custom was to bite off the superfluous material with the teeth, making the ends to 'stick with a lick.' The girl naively supposed that some poison had got from the tobacco into a small crack of the lip. But how much poison is it possible got from the lip among the tobacco? She estimated the number of cigars got through in one day at twenty dozen."

There might not have been any serious peril in the act, still we doubt if any prudent person would choose to put into his mouth any one of the three or four hundred dozen cigars which this unfortunate girl had licked to a finish while her lip was sore.

The cases mentioned by Dr. L. D. Bulkley, of this city, in his paper on this subject read before the American Dermatological Association, seem to carry the possibility of syphilitic infection through cigars a long way toward positive proof; far enough, at any rate, to make the use of cigar holders not an unwise or unnecessary precaution on the part of cigar smokers. While we know that reputable American cigar makers are careful to prevent the untidy practice which seems to have been followed in the English factory mentioned by Dr. Mannsell, and require their finishers to follow more cleanly methods, there remains the unpleasant fact that tenement house workers are not under supervision, and are not by nature or habit inclined to be fastidious in

their own tastes or scrupulous with regard to the tastes of others.

Having no personal knowledge of the comfort to be derived from sucking the end of a roll of tobacco, we are obviously incompetent to advise smokers in this matter; nevertheless we may be allowed to submit the opinion that while the risk of syphilitic taint from infected cigars is extremely small there is still a risk, which the cigar holder is calculated to obviate. If we had to smoke cigars we should prefer to use a holder.

Transit Across the Brooklyn Bridge.

At a recent meeting of the trustees of the Brooklyn Bridge, a resolution was offered providing for the appointment of a committee to consider the question of the means of transportation over the bridge. This enormous and enormously costly structure being nothing more than the greatest railway bridge of its sort in the world, it is time, the editor of the *Sun* properly says, for its managers to begin the discussion of the methods of conveying freight and passengers across it.

We were promised last spring that the bridge should be completed by the next Fourth of July, but there have been delays which may put off its opening several months later. At any rate, the structure is now receiving its finishing touches, and we begin to get some idea of what it will be when it is done. Standing on the elevated railroad station on the east side of Chatham street, near the City Hall, a clear view from tower to tower and over the approaches may at last be obtained.

No one who takes the pains to look at that view can fail to be impressed with the magnitude of the work. It is indeed a stupendous structure as we see it, and yet much of its heaviest and most costly work, that spent on the foundations, is beyond the sight. And all this labor and expense have been laid out on the building of a single railway bridge between New York and Brooklyn; on what in all probability will practically prove to be only a connecting link between the elevated railway systems of the two cities.

The bridge will unquestionably be used by a large share of the people who travel to and from Brooklyn and New York, and for them will prove of great convenience; but it will be only one line of communication. If the wants of the people of Brooklyn were thoroughly satisfied, we should need not one bridge, but several. With but one existing, the ferries will continue to be used by a great proportion of the travelers, and perhaps very generally by the wagons going to and coming from Brooklyn. Loads drawn by horses are likely to cross chiefly by ferryboat as now, and people who live near the ferry landings on the other side and are employed near those in this city, will find it more convenient to use the old method of communication.

But for people living on the outskirts of Brooklyn, or who have occasion to use the rapid transit on the other side of the river, steam locomotion across the bridge will be a great gain. We may expect, therefore, that the opening of the bridge for use will be followed by the extension of the population of Brooklyn and the steady advance of the limits of that city. It will have an effect analogous to that produced on our upper wards by the establishment of rapid transit.

It is probable that large locomotives, traveling at a high rate of speed, will be used to carry over passengers. The project of drawing the cars with cables is not favorably received by engineers, and the superior advantages of employing locomotives are urged. The bridge can sustain them in entire safety, and greater speed will be obtained by their use.

How to Have Ice Next Summer.

A great many people do without ice in the summer—though the ponds and streams at their doors furnish an abundant supply every winter—simply because they imagine that an expensive icehouse is needed to hold the ice. A gentleman who once labored under the same delusion, describes in the *Tribune* the experience by which he was led to store his summer supply of ice successfully, without an icehouse, after paying dearly in disappointment, loss of ice, and loss of money, through having "too much icehouse." He was convinced of his error by the circumstance that the more pains he took with his icehouse the more rapidly his ice melted, while a neighbor who had no icehouse at all always had plenty of ice. The practice of the latter was simply to pile his ice in a square body under a cowshed having a northern exposure, the first layer of ice being raised above the ground so as to secure good drainage, and the whole covered thickly with sawdust. Boards set on end around the ice pile served to keep the sawdust in place. The gentleman referred to says:

A pile of ice six feet high, eight feet wide, and eight feet long will make three hundred and eighty-four cubic feet. And this is enough for the use of an ordinary family for the table and to cool the cream, etc. Six team loads fill an icehouse which contains about four hundred cubic feet. The blocks should be cut as smooth as possible and square, so they will fit closely, and then ice must be chopped up fine and crowded in between the pieces so as to make a solid mass. The closer the ice is packed, and the more solid the mass is united together, the better it will keep. When an icehouse is too close, there is a great deal of condensation, which makes the whole contents wet and dripping, and causes the ice to melt rapidly. The air must be kept as dry as possible, one secret of keeping ice being plenty of ventilation. The more ice there is in a pile the better it will keep. A small quantity must be covered deeper and

thicker than a large mass. A large mass will almost keep itself. It does not require the protection of sawdust, but straw or a double wall of boards will be ample. Every person who makes butter ought to have ice. It will more than pay for use in the dairy, and then for the family it is a luxury every provident man should supply.

Electric Light Wires.

We give below a letter from Mr. James Harrison, of the Board of Fire Underwriters, describing a singular accident occasioned by electricity from an electric light wire. In shifting this wire on the top of a building, it was accidentally brought into contact with a small telephone wire that led into an adjacent building, and the electrical charge inflamed the thread covering of the telephone magnets. This is a species of accident that can readily be prevented by covering the electric light wires or the telephone wires with insulating material, or using a return wire on the electric light circuit.

The rapid extension of both the telephone service and the electric light service in cities will probably put an end to any dangers like the above, as it is found that insulation of the wires is necessary to insure the best results, whether for lights or telephones, and covered wires are therefore taking the place of the uncovered wires.

Mining Operations in Great Britain.

The report of the Inspector General of Mines in Great Britain for 1879 has just been published. The number of persons engaged in mining operations in the United Kingdom was 523,870. The total number of serious accidents amounted to 843, and the number of deaths resulting, 1,037, a diminution as compared with 1878 of 39 in the number of accidents and 453 in the number of deaths. There was an average of one accident for every 621 persons employed, and a death for every 505 persons.

In the twelve districts under the Regulation Act of 1872, for the coal mines 476,810 persons were employed in or about the mines, of whom 385,179 were below the surface, and 91,631 above; of those above, 4,842 were women.

The products of the mines for the year were: 133,720,393 tons of coal; 9,387,766 tons of iron ore; 1,455,003 tons of potter's clay; and 803,207 tons of mica. The amount of coal produced was 1,108,330 tons more than in 1878, while the other items were less by the following amounts: iron ore, 1,359,461 tons; potter's clay, 170,583 tons; and mica, 10,055 tons.

Fire Caused by an Electric Light Wire.

To the Editor of the Scientific American:

I venture to call your attention to an occurrence which took place at No. 4 Maiden Lane very recently. In the office of Messrs. Silcox & Co., No. 4 Maiden Lane, is a telephone communicating with their factory, No. 14 Maiden Lane. One day, either Monday or Tuesday last, some person on the roof of one of the intervening buildings dropped an electric light wire upon that of the telephone wire of Messrs. Silcox, bringing the two wires in contact. The effect rather astonished the people in the office. Flames burst forth from the telephone instrument on the wall, producing such an intense heat as to entirely destroy the magnets. Can you, through your valuable journal, give us a possible reason for this?

Suppose the same thing should occur at Ridley's, or Lord & Taylor's, or any other establishment having telephones. In most of these establishments there is a large amount of open stock lying and hanging in every direction. It occurs to us that if there is a danger of similar accidents in these stores, it will be apt to throw the *show windows* fire traps into the shade.

JAS. HARRISON,

Superintendent Bureau of Surveys, New York Board of Fire Underwriters.
No. 115 Broadway, New York, October 21, 1880.

The Universal Grinder.

Messrs. Newell & Chapin have on exhibition at the Fair of the American Institute, their patent universal grinder. The grinder consists of hard iron or steel disks with beveled edges, locked together upon a shaft composing a cylinder with a series of angular grooves. Upon the sides of the disk are radial cutters or teeth. Another shaft with similar disks is so placed that the disks of one cylinder fit into the spaces between disks on the other. This machine will grind phosphates, barytes, lead plumbago, gold ore, quartz, plaster, shells, bone, wheat, corn, and other materials required by the manufacturer or farmer. The manufacturers exhibit an interesting collection of minerals and cereals ground by these mills, which shows that they are adapted to a wide range of uses.

POLICE TELEPHONES.

Chicago leads the way in adopting telephones for general police uses. Experimental telephonic stations have been established at various points in one important district, and relays of mounted officers are kept in waiting at a central station. Reliable citizens are furnished with keys to the telephone boxes nearest their residence. To prevent false alarms the keys are numbered, and cannot be withdrawn from the lock until released by a key carried by the police man on that beat. When anything goes wrong in a district, the alarm is sent to the central station, and explanations are given through the telephone. In case of serious disturbance a large bell is sounded, and every officer on post runs to the nearest box to receive orders.

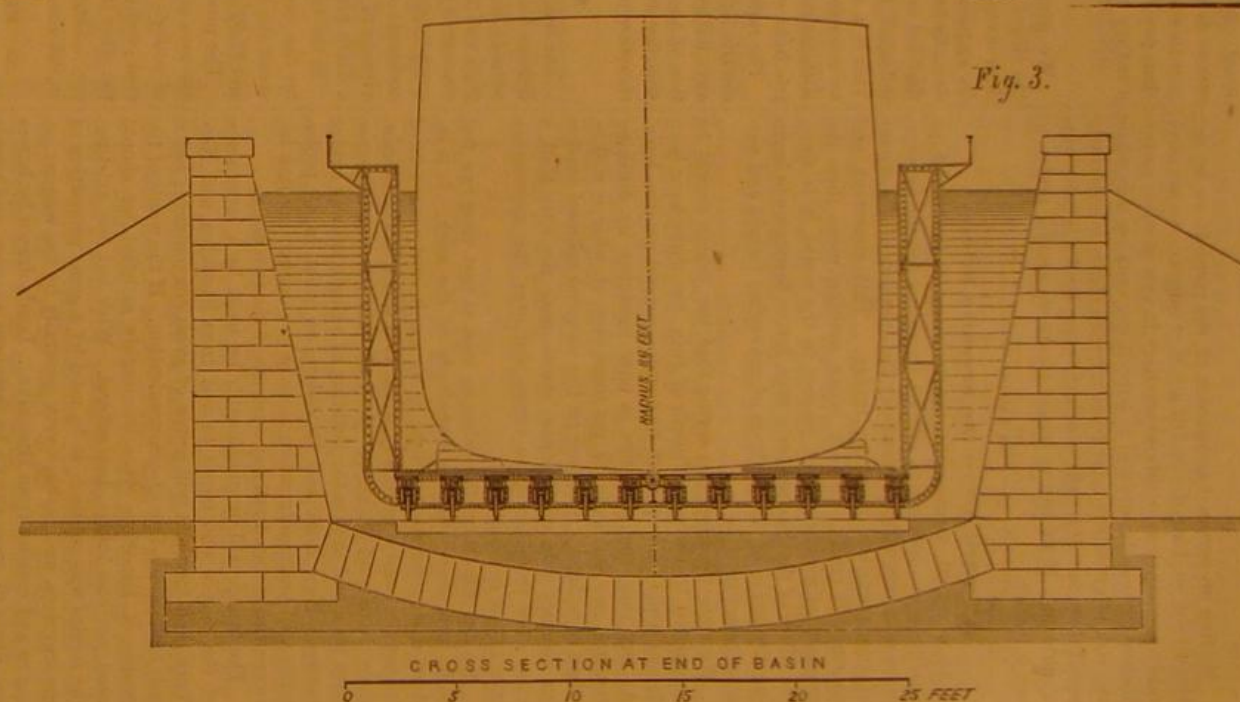
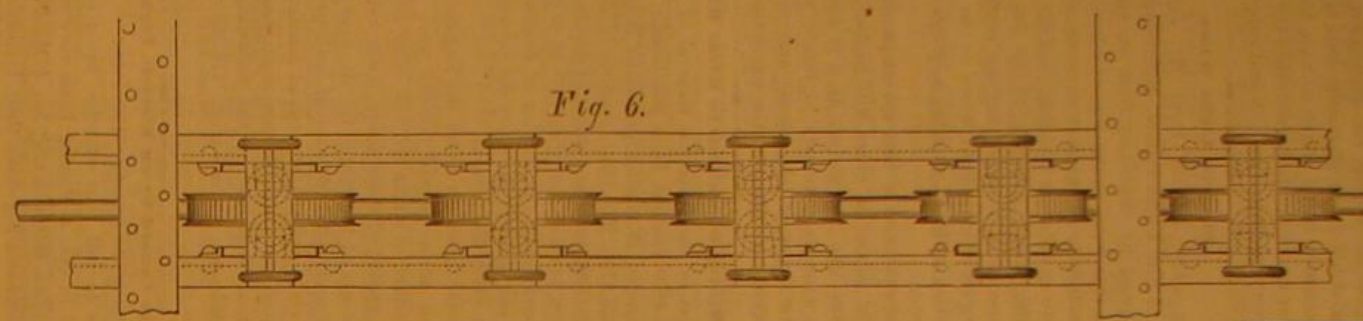
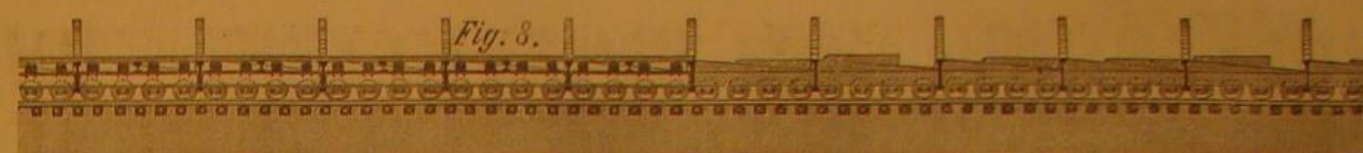
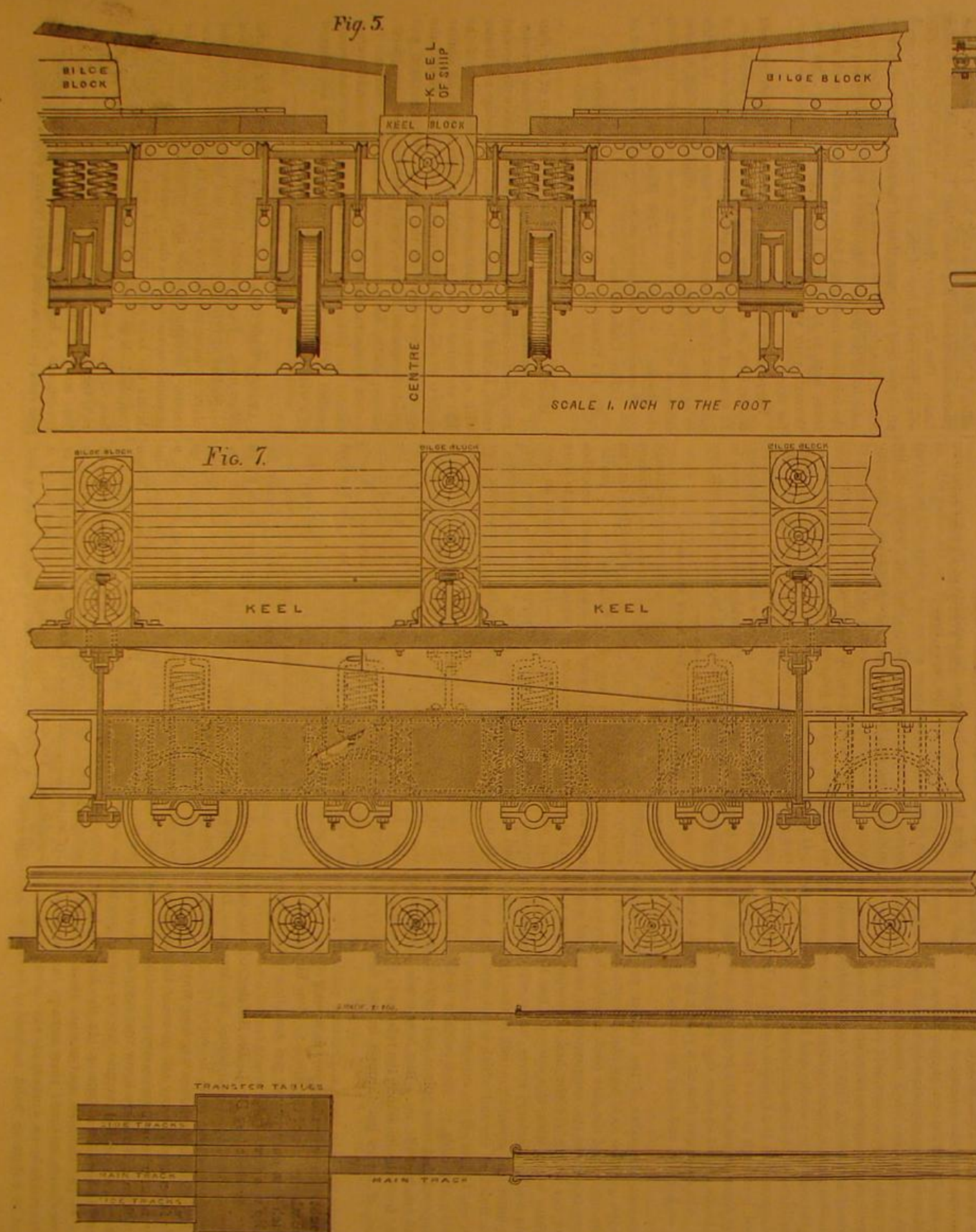


Fig. 2.

LONGITUDINAL SECTION OF BASIN
SCALE 100 FT. TO THE INCH

Fig. 1.

PLAN

The Cause of the Seawanhaka Disaster.

An important clue to the cause of the disastrous fire on the steamer Seawanhaka, last June, has been disclosed in the breaking up of the metallic skeleton of the wreck. What was left of the steamer, as it lay on the sunken meadow off Randall's Island, East River, was purchased by Mr. Matthew H. Gregory, of Red Bank, N. J., who is now engaged in recovering the iron and copper. In pursuance of this work the shell of the starboard boiler has been stripped off, disclosing the fact that the outermost of the eight large circular flues of the boiler had burst at the point where it joined the back flue sheet. A *Herald* reporter, who had visited the wreck in company with Mr. Gregory, says that the quality of the iron of that part of the boiler was evidently very poor.

"Originally the iron of the flue was three-sixteenths of an inch thick, but in some places near the break it is not now more than one sixteenth of an inch. The break gave every indication of an explosion. The force which broke it was evidently from the inside of the flue, since the jagged edges turn outward. A few inches from the place of the break the flue has at some time been patched, a fact which has not been developed by the official examinations. The patch is riveted to the flue, and covers a space of about half a foot. Until some better reason is put forward the presence of that patch will be taken as an argument for the weakness of the iron.

"The hole above described was not more than eight inches from the patch, and the wearing out process must have been going on for a considerable time. Mr. Gregory could not say how much the break had to do with the accident, but an expert could easily determine. If the break occurred before the fire, it certainly is large enough to have admitted the water and caused a back draught. That a back draught created the fire is the opinion of four-fifths of the experts who have testified since the catastrophe."

A New Military Telegraph Line.

The signal service has just completed a telegraph line across the northwestern territories from Bismarck, Dakota, to Dayton, Washington Territory, crossing the Rocky Mountains by the Sohon Pass. For the transaction of commercial business it has offices open at the following points: Bismarck, Rapid City, and Deadwood, Dakota; Bozeman, Helena, and Deer Lodge, Montana; Spokane Falls, Colfax, Almota, Pomeroy, and Dayton, Washington; and Lewiston, Idaho.

Chicago Manufactures.

Few people have any idea of the rapidity with which Chicago is becoming a great manufacturing center. The statistics gathered by the Secretary of the Board of Trade for the forthcoming census report show 3,752 manufactories in the city, giving employment to 113,507 operatives, and representing a capital of over \$80,000,000. The value of the output annually is \$249,000,000; value of material used \$178,000,000; wages paid, \$37,000,000.

NEW NURSING BOTTLE.

The body of the bottle shown in the annexed engraving is made in two parts, one fitting into the other at their junction, the external one being provided with an internal flange for receiving the packing ring, against which the edge of the inserted part rests. Upon one part of the bottle is formed a bead which runs around it spirally, forming a screw thread which is engaged by a metallic ring fitted over an external flange formed on the other part and capable of drawing the two parts firmly together against the packing ring.

The stopper through which the tube passes is inserted from the inside of the bottle and cannot therefore be drawn out accidentally. The nipple, as will be seen by reference to the small sectional view, is held in place by the shield which is slipped over the portion of the nipple bulged out by the bead formed around the end of the neck of the tube. This forms a very secure fastening for the nipple.

The body of the bottle has an inwardly projecting ridge which insures the greatest possible depth of milk for the inner end of the tube.

This bottle may be readily taken apart for cleaning, and avoids the imperfections found in other bottles.

For further information address the inventor and patentee, Mr. E. A. Barton, 348 Notre Dame street, Montreal, Canada.

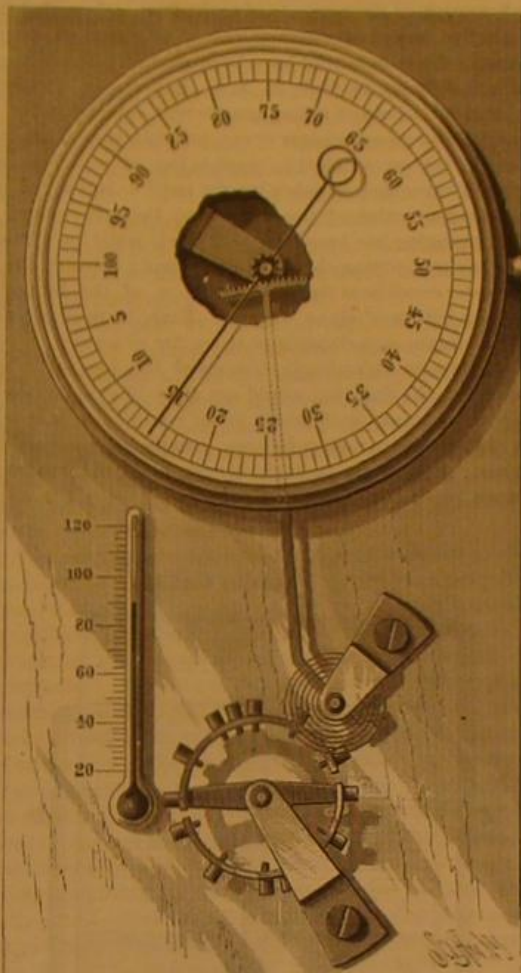
Plan for Catching the Express Trains.

M. Hanrez, of Paris, is the author of a method of taking up carriages by a train *en route*, in order to avoid stopping trains at stations to take passengers up. A "waiting carriage," fitted with a steam engine with special gear and space for passengers and luggage, is placed on a siding at the station, and picked up by the train as it goes past. The latter, by means of a hook on its last carriage, catches a ring supported on a post, and connected with a cable wound on a drum in the waiting carriage. Thereupon the drum

begins to unwind, and in doing so compresses a system of springs, while the carriage is moved at a rate gradually increasing to that of the train. The engine of the carriage then winds in the cable, the train and carriage are connected, passengers are transferred from the joined carriage to the train, and *vice versa*, then the two are disconnected, and the engine of the carriage working on the wheels brings it back to the station whence it was taken.

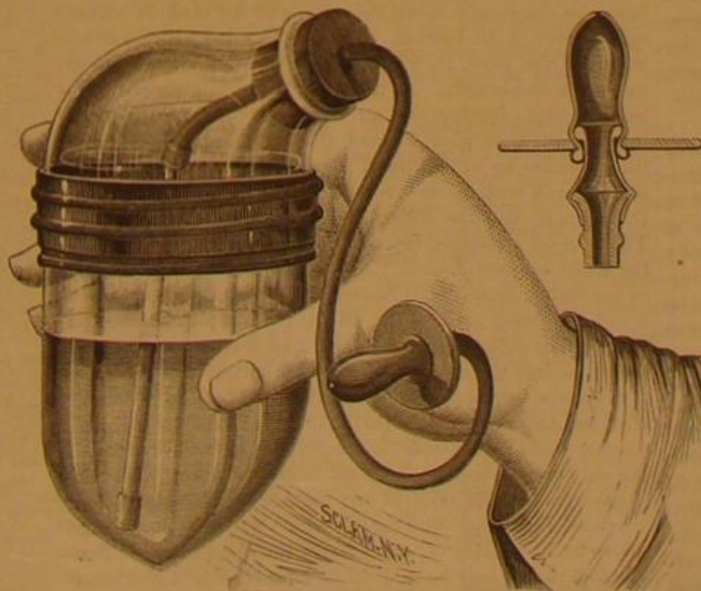
APPARATUS FOR ADJUSTING BALANCE WHEELS OF WATCHES.

The engraving shows a device for indicating any alteration

**IDE'S APPARATUS FOR ADJUSTING BALANCE WHEELS OF WATCHES.**

in the form of the balance wheels of watches, chronometers, and other horological instruments by changes of temperature. The invention consists of a holder for the balance wheel, a multiplying lever, and an index actuated by the lever. The short arm of the lever touches the periphery of the balance wheel, and the longer end carries a curved rack which engages a pinion on the arbor of the index.

By means of this mechanism the slightest change in the

**IMPROVED NURSING BOTTLE.**

form of the balance wheel is indicated by a movement of the index. A thermometer is mounted on the instrument, so that its indications may be readily compared with those of the index.

The inventor proposes to make the instrument double, so as to test both sides of the balance wheel simultaneously.

This invention was recently patented by Mr. F. F. Ide, of Springfield, Ill.

SOME one has said, what thousands have observed, that there is nothing keeps longer than a middling fortune, and nothing melts away sooner than a great one. Poverty treads upon the heels of great and unexpected riches.

The American Apple Crop.

It is gratifying to be able to record that, notwithstanding the failure of the crop of apples in this country, we are to have abundant supplies from America. Accounts from Boston report the crops to be the largest for many years, perhaps to the extent of 40 or 50 per cent. Up to June 30, 1880, the shipments from Boston to England amounted to 173,379 barrels, of a money value equal to over £70,000. It is expected that with the heavy crop this season the exports for the current year will nearly double those figures. Already large supplies are coming to hand from New York, the Anchor Line steamers arriving at Glasgow last week having over 5,000 barrels, which were sold at moderate prices for the early time of the year. The fruit, as a rule, is of excellent quality, and when it arrives in good sound condition will keep for a considerable time.

Many grocers consider it advantageous to add green fruit to their general stock, and the public begin to find out that they can purchase from the grocer at a cheaper rate than from the fruit merchant. In these times when the grocer is beset on every side by opposition from "stores" and "wholesale retailers," etc., it behooves them to look around for fresh articles for sale whereby they may recoup their loss. To those who have not already done so we would say: Add the green fruit business to your trade, and we are of opinion that you will not have any cause to regret it, provided the business be conducted with care and discrimination, and only such articles purchased as are found to be in demand in their respective localities.—*London Grocer.*

Fast Horses.

The standard trotter is one that can cover a mile in 2:30. It is said that less than 600 of all the horses raised and trained in the United States have this record. The number that can trot in 2:50 bear the ratio of 1 to 2,383 horses raised. As a business the breeding of fast horses is therefore very much of a lottery; and when we recall the fact that the high prices which famous colts have brought have rarely been received by the men who raised them, the prizes in breeding and training trotters are few and uncertain.

MECHANICAL INVENTIONS.

Mr. Eugene H. Angamar, of New Orleans, La., has patented a simple and effective apparatus for freeing railroad tracks from snow and ice by heat, more especially street railroads; and the invention consists in a truck fitted for running on the track and supported on hollow wheels, which are fitted with grates for burning fuel, and perforated so that the wheels may be highly heated.

Mr. Hilliard B. Smith, of Stephenville, Texas, has patented an improvement in wind wheels which consists in a novel arrangement and combination of wings or gates in a casing outside and independent of the wheel, whereby provision is made for adjusting the position of the wings, and consequently regulating the speed of the wheel, according to the force of the wind.

An improvement in rotary blowers has been patented by Mr. Charles A. Smith, of Philadelphia, Pa. This invention consists in certain novel details of construction and arrangement of parts which cannot be readily described without an engraving.

Messrs. Conrad Eimbeck and Fritz Wehrmann, of New Haven, Mo., have patented an improved coupling for connecting the forward axles and the bodies of buggies, buckboard wagons, and other vehicles, so constructed as to give the axle a free vertical and horizontal play, and thus better adapt the vehicles for use upon rough, uneven, and sideling roads.

An improved machine for framing timber has been patented by Mr. Richard H. Watson, of Leadville, Col. This machine is intended to accomplish by power the work of framing timber used in mines, shafts, tunnels, and similar underground works. The inventor makes use of a suspended carriage or frame fitted for movement in vertical guides and carrying two horizontal saw arbors fitted at right angles. This is combined with a bed carrying adjustable head and tail blocks for holding the timber and presenting it properly to the saws. A winding drum and friction pulleys feed the saws, and devices of novel character center and clamp the timber.

An improvement in that class of windmills in which the wheel is inclosed in a cowl, has been patented by Mr. Albert S. Dimock, of Hutchinson, Kan.

An improved lifting jack has been patented by Mr. John Paar, of New York city. The object of this invention is to construct a jack that can be made to press both upward and downward at the same time, or to operate either upward or downward, as may be desired.

Wintering Flower Roots.

The roots of many useful and ornamental plants, such as cannas, dahlias, and gladiolus, may be safely wintered in dry soil by means of external coverings. But as they do not require light during the winter it is safer to lift and store them in a dry cellar or building from which frost is excluded. We find them to keep best, says an agricultural writer, packed in a soil just moist enough to keep the roots from swelling.

Artisan and Artist.

A critical writer in an English magazine (the *Cornhill*) finds a potent cause for the separation between artistic and industrial work in the rapid growth of the manufacturing system in Northern Europe.

"During the Middle Ages the painter, the sculptor, and the wood carver were all higher handicraftsmen whose handicraft merged insensibly into that of the decorator, the joiner, the jeweler, and the potter. These lower trades still gave an opportunity for the display of individual taste, of artistic fancy, of that capricious quaintness which forms, perhaps, the greatest charm of mediæval workmanship. But with the employment of machinery the separation became broad and pronounced. Steam-woven patterns and calico prints have superseded the hand-made embroidery and rich brocades of earlier times. Cheap moulded crockery and stamped designs have taken the place of jars turned upon the wheel and painted decorations. Wall papers hang where tapestry hung before, and chintzes cover the chairs that were once covered by delicate needle work. Electroplate teapots, machine-made jewelry, and ungainly porcelain vases replace the handicraft of humbler Cellinis, unknown Ghibertis, or inglorious Palissies. Under the influence of this cause, industrialism became frankly cheap and ugly, while æstheticism retreated into the lofty upper region of the three recognized fine arts.

"In proportion as the industrial system was more or less developed in each European country did the divorce become absolute. In Italy and the south, where the manufacturing spirit never gained a firm footing, individual workmanship survived and still survives. Florentine mosaics, Roman cameos, Genoese filigree work, Venetian glass, are all of them relics of the old artistic handicraft which has lived on unmoved among the quiet Italian towns. In France, more manufacturing than Italy, but less so (at least during the eighteenth century) than England, we find a sort of intermediate stage in Sevres porcelain and Gobelins tapestry, in Louis Quinze marquetry and Dieppe ivory-carving. But in England the gap was truly a great gulf. Between the Royal Academy and the Birmingham or Manchester workshops there was no common term. Most of English manufactures were simply and unpretentiously utilitarian. They had no affectation of beauty in any way. Whatever art furniture existed in the country—mosaic tables or buhl cabinets in a few noble houses—was brought from those southern lands where industrialism had not yet killed out the native art faculties of the people. A piece or two of Chinese porcelain, a stray bit of Indian carving, an Oriental rug or embroidered cushion here and there carried the mind away to Eastern countries where steam and factories were yet wholly unknown. But in England the stereotyped uniformity of manufacturing ugliness bore undivided sway, and if a solitary Wedgwood at rare intervals had originality enough to set up some attempt at artistic industrial work his aspirations naturally cast themselves in the prevailing classical mould. From these tendencies two evil results inevitably flowed. In the first place, art came to be looked upon by the mass, even of the middle classes, as something wholly apart from everyday life. The æsthetic faculty was a sense to be gratified by an annual visit to the Academy, an occasional perambulation of the National Gallery, and perhaps a single pilgrimage during a lifetime to Rome and Florence. For the lower classes art ceased to exist at all. Their few sticks of furniture, their bits of glass and crockery were all turned out on the strictly manufacturing pattern, with the least possible expenditure of time and money. Only the extreme upper class, the landed aristocracy and very wealthy merchants, could afford to live in an atmosphere of pictures and statues, of Italian art furniture and Oriental porcelain."

The only fault to be found with our critic's statement of the case lies, we take it, in the assumption that "industrialism" is essentially and of necessity unartistic. It would be nearer the truth to say that when manufacturing began in the north of Europe the working people were grievously deficient in artistic taste, and so were the multitude who furnished a market for the manufacturer's wares. They had no "native art faculties" for manufacture to destroy. It was with them a step upward—from nothing to something—even though that something was cheap and ugly. The pottery and other wares turned out by English manufactories were not beautiful at first, not so much because of the necessary limitations of the scope of power machinery and large production, as because of the general lack of taste on the part of the makers and users of the wares. With the social and intellectual elevation of the masses the level of popular taste has risen, and our large factories have steadily improved the artistic character of their work to meet the rising demand. Meantime, while our artisans have been developing as artists, marrying beauty with utility, it has become the cant of the picture makers and their followers—artists *par excellence* in their own estimation—to associate æsthetics solely with utility, and to deny the artisan's right to consider himself an artist, except when he makes or imitates something that the world has no longer any use for.

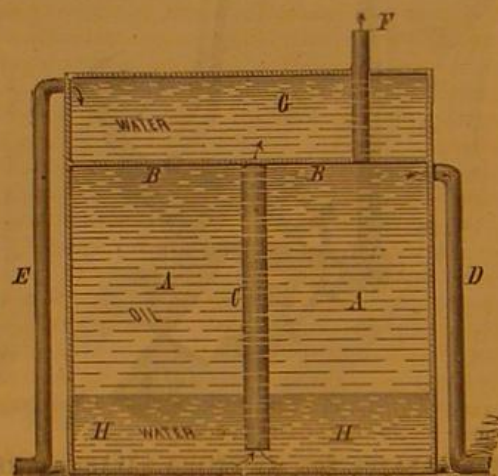
There is no portion of the community more pitifully destitute of genuine art sense than those who declaim most loudly about the necessary ugliness of modern manufactured products, and sipper over the "exquisite loveliness" of such bits of ancient or oriental stuff as it is the current fashion to call artistic. Next year the same things and styles may be out of fashion. Those who rave over them now will then pronounce them vulgar and ugly, and torture their æsthetic sensibilities over some other antique novelty; all the time

fondly imagining that the soul of art dwells exclusively with them. It never occurs to them that their followers a hundred years hence will rave in the same way over the works of the artistic artisans of to-day.

LIGHTNING-PROOF OIL TANK.

The enormous losses that have been incurred of late years from tank fires, the danger which threatens from the ignition of stored oil to whole towns and cities, have excited the attention not only of oil men, but scientists at large to the means of securing effectual protection. It is evident that the methods of storage ordinarily adopted have proved ineffectual; the precautions taken against lightning, or from conflagration of the contents of tanks from others that have caught fire, have proved worthless. The means of securing immunity from lightning have been studied philosophically and scientifically by Col. E. A. L. Roberts, of Titusville, Pa., and by the aid of a diagram we will explain it for the benefit of our many readers connected with the oil business. The principle on which it is based is that oil will not catch fire until vaporized, in other words, until it is blended with a certain proportion of the oxygen of the atmosphere. A ton of glycerine has been exploded in oil wells in Pennsylvania without setting them on fire, simply because the oil was under conditions that did not allow of the immediate blending with it of air or oxygen. Exclude these agencies and one might as well attempt to set fire to water.

Col. Roberts accordingly conceived the idea of so constructing tanks that they would not allow of evaporation; in other words, tanks with which no air could come in contact. His tanks, constructed as follows, completely compass this purpose: A A, space in tank for oil; B B, diaphragm; C, balance pipe; D, filling and drawing-off pipe for oil; E,



OIL TANK PROTECTOR.

overflow and inlet water pipe; F, vent pipe; G, water reserved on top of diaphragm; H, water in bottom of tank.

It is easy to show by reference to this diagram that there can be no possible liability to conflagration. Instead of the roofs now used the surface of the tank would be covered with a diaphragm. This diaphragm is of iron, and is so placed as to leave a space of a few feet between it and the top line of rivets. An eight inch pipe termed the balance pipe passes from this diaphragm down the middle of the tank to within eight inches of the bottom. The tank is filled with water by means of the pipe, D, which enters the tank immediately under the diaphragm. As the water fills up, it ascends the balance pipe, forcing the air completely out of the tank through the vent pipe, F, and the pumping is continued till it reaches up to the rim of the tank. The process of filling the tank with oil now commences by means of the pipe, D, which is also the filling and drawing off pipe for oil. Thus the oil is pumped through the same pipe through which the water has been forced. As the oil settles upon the top of the water, immediately under the diaphragm, the force which the pump gives to the oil then presses the water, as the heaviest substance, downward, and it passes up the balance pipe into the space marked G, the surplus passing away through the overflow pipe to the left of the tank in the above diagram, and marked E. On the space reserved for oil being evenly filled from under the diaphragm to the lower end of the pipe there remains about six inches of water, while the diaphragm and the sides of the tank being air-tight, no air whatever can mingle with the oil, which will also be protected above by its overlay of water above the diaphragm. Thus situated the oil may be said to be hermetically sealed when the top cock at the head of the vent pipe is turned off. It is obvious that in running the oil out no air can get access to the interior. To force it out by the pipe, D, water is pumped in by the overflow pipe, E, the water exerting the necessary pressure. In running down the balance pipe from the reserve tank above the diaphragm the water fills the exact place of the discharged oil.

Instruction in Industrial Art.

The American Carriage Builders' Association, in convention at Chicago, October 21, adopted a resolution for the establishment of a school of technology in this city, especially devoted to the art of carriage building.

The trustees of the New York Metropolitan Museum of Art had expressed a willingness to add a branch to the museum devoted to art instruction and original designing, in

connection with carriage building, if a fund of \$1,000 a year for three years were guaranteed. More than this sum was promptly subscribed. The aim of the trustees of the museum is, we believe, to establish industrial art schools for the benefit of American artisans in all the trades.

MR. EADS' SHIP RAILWAY FOR THE AMERICAN Isthmus.

For many years the popular idea has been that whenever the genius and energy of man should overcome the barrier to commerce which nature has placed at the American Isthmus, it would have to be accomplished by a ship canal. For many years exploring parties, supported by private munificence or by government appropriations, have been searching for the most favorable lines for transisthmian commercial routes, always contemplating the ultimate construction of a ship canal. And so persistently have the advantages and disadvantages of the different canal routes been insisted upon by their respective admirers and opponents, that there are few engineers of high rank, who have considered the question at all, who have not pronounced in favor of one or other of the several canal routes that have been surveyed.

Accordingly, when a new man enters the field with a novel plan, confidently offering to make a dry way for the world's commerce over the Cordilleras, in a quarter of the time and at a quarter of the cost of a ship canal such as Mons. De Lesseps proposes, the natural inquiry is, "Who is he? and what has he done to justify so bold a traversing of the opinions of the world's best known engineers?"

The world's best engineers do not need to have that question answered for them, though the general public may. The engineering world have already admitted Mr. Eads to an honorable place in the front rank of scientific and practical engineers. They know him as a man quite as remarkable for the soundness of his views, in great engineering emergencies, as for the boldness and originality of them. They know him, too, as a man whose professional career has been marked by grand successes as well as grand undertakings—successes achieved in more than one instance by methods as original as they were scientific and simple, accomplishing results of unequalled magnitude with the least delay and the greatest economy.

When the exigencies of civil war called for the immediate and speedy creation of a new order of war vessels, suitable for river navigation, yet capable of successfully assailing land batteries protected by earthworks, it fell to Mr. Eads to supply the need; and his fleet of "improvised ironclads" played a vital part in opening the Tennessee and the Mississippi.

When the requirements of peaceful commerce demanded an iron way across the Mississippi at St. Louis, a bridge which should offer no impediment to the commerce of that broad river, the same bold and practical spirit not only planned the structure, but saw it built, a work requiring the highest engineering and financial capacity, for the problems presented were in many respects not only novel in character, but involved operations of a magnitude never before undertaken.

Still more recently, when the general commerce of the great artery of the continent required a freer outlet below New Orleans, and when the government engineers were committed to a costly canal, Mr. Eads came forward with a solution of the problem directly contrary in its principles to that which had been proposed, and vastly less expensive in time and money. Still more, he was willing to stake his private fortune on the event, confidently undertaking to open the Mississippi in his own way at his own risk, asking no pay for his work until his scientific and official opponents should certify that the task had been successfully accomplished. Our readers do not need to be reminded of the magnitude of the work undertaken at the mouth of the Mississippi, the severity of the engineering problems it involved, the vast economy of the jetty system, or the marvelous celerity and certainty with which it overcame the barriers which nature had placed at the outlet of the great river.

In place of a doubtful channel admitting only vessels of less than eight feet draught, the Mississippi now offers a broad free entrance to the largest ocean steamers; and to emphasize the fact, which the commercial world is slow to realize, the merchants of New Orleans are arranging for a visit to their wharves by the Great Eastern.

These great achievements are referred to here simply as evidence that Mr. Eads is not a novice in engineering and finance, nor a speculative adventurer, but a scientific and notably practical man, whose large and varied experience in the planning and conduct of great enterprises gives pertinence and weight to any proposition which he may lay before the world. Whatever problems of engineering, mechanics, or finance may be involved in the planning and construction of a ship-railway across the Isthmus, and no one will question their multiplicity and magnitude, they have already been met and successfully overcome by him elsewhere, on a scale not out of comparison with those of the new undertaking. In laying before the world a plan of a ship railway, like that which we illustrate on our first and fourth pages, Mr. Eads offers no speculative project, but the well-considered design for a capable and experienced engineer, a working plan which can be carried out with absolute certainty.

At first thought most persons unfamiliar with the resources and practices of modern engineering are apt to look with incredulity, if not with amazement, upon a project

contemplating the hauling of great ships over land from one sea to another.

A ship, they say, is a structure made to float in the water, buoyed up by a mobile substance, the nature of which not only prevents unequal strains upon the ship from her general weight, but also helps her to resist the internal or bursting strain of her own cargo. Out of her proper element, they argue, all these conditions are reversed. The uniform support of the water is replaced by detached supports, subjecting the vessel to unequal and unpremeditated strains which she cannot safely endure. Accordingly, even if it were feasible to build a carriage strong enough to sustain a ship's huge bulk, or a roadbed firm enough to bear the weight of both ship and carriage, the proposed system of Isthmus transit must be a failure through the lack of adaptability of ships for that sort of handling.

In answer to these apprehensions it is enough to say that they are founded in a view of the case which every ship builder knows to be altogether inconsistent with fact. A ship afloat is not uniformly buoyed up by the water. On the contrary, especially where there are waves of any magnitude, a ship's support is not only unequal, but incessantly variable as to position. This fact is so well recognized by shipbuilders that every sea-going vessel is so built as to be able to bear her entire weight when supported only at the ends, or to withstand the strain of being held up wholly at the middle, with both ends unsupported in the air. If a ship is unable to endure these severe tests she is unfit to battle with the waves. As for the bursting strain of a cargo, with or without a counter pressure of water outside, every ship at sea has to withstand it, more or less completely, with the passage of every large wave; while at the same time she is buffeted with heavy seas, which strike with blows like those of a battering ram. Indeed it would hardly be possible to devise an apparatus capable of subjecting a ship to so frequent and severe horizontal, lateral, and torsional strains as a ship endures in every gale. In comparison with them the strains that would be put upon a ship in transit over a properly constructed railway would be as nothing. On the railway carriage the ship would rest on an even keel, uniformly supported from stem to stern, and as secure from lateral and twisting strains as when cradled in a dry dock; while the forward motion of transit over easy grades would be less trying even than that which ships are constantly subjected to in well-known marine railways connected with ship-yards.

In fact the ship railway proposed by Mr. Eads consists of nothing more novel than two marine railways of superior construction joined by a few miles of many-railed roadbed of easy grades. Every element of the system, as well as the ability of ships to endure out-of-water handling safely, has been practically familiar to engineers for half a century. The grades of the proposed railway, it will be remembered, need nowhere be steep, and the change at the summit is made by a tipping table, which prevents any lengthwise strain upon the vessel. At no other point of the road can such a strain occur except by the yielding of the road bed; a contingency which practical engineering is easily able to avoid.

If further assurance of the ability of ships to safely endure out-of-water handling were required, it might readily be found in the every-day handling of loaded canal boats at portages. In staunchness a sea-going vessel compares with a canal boat about as a well-made beef barrel does with a cracker box; and the capacity of canal boats to endure railway carriage was amply demonstrated forty years ago on the Portage Railroad of the Allegheny Mountains. To connect the canal systems of Eastern and Western Pennsylvania, a system of gravity railways with ten inclined planes was constructed between Hollidaysburg and Johnstown, thirty miles or more apart "as a bird flies"; and up and down these steep inclines the large boats of the "Pioneer Packet Line" made regular trips until the Pennsylvania Railroad was built.

In length of route and severity of grades, the Isthmus routes certainly offer nothing worse than was overcome on that Portage road; and it is absurd to say that modern engineering cannot do for ships what was then done for canal boats. Besides we have the direct evidence of some of the most experienced ship builders—among them the Hon. E. J. Reed, formerly Chief Constructor of the British Navy—to the effect that the transport of ships by rail is not only feasible, but that the plan is highly economical in comparison with a ship canal.

The essential features of his projected railway for transporting ships across the Isthmus were described and discussed by Mr. Eads before the Canal Committee of the House of Representatives last March. So many of the illustrative plans and drawings used by Mr. Eads on that occasion as are necessary for a clear understanding of his plan are reproduced in the engravings herewith. The large illustration on our front page gives a general view of one of the shore ends of the proposed road, with a large man-of-war just entering upon the transisthmian journey.

Fig. 1, at the bottom of the front page, shows a section of the basin, which constitutes the real terminus of the railway. To avoid extending the track out into the harbor, this narrow basin, 3,000 feet long, is excavated inland at right angles to the shore line of the harbor. At the harbor end the basin is deep enough to place the railway thirty feet below the surface level of the water. From that point the track rises one foot in the hundred, so as to reach the surface level at the shore end of the basin. This basin, and the corresponding one at the other end of the railway, will be lined

with substantial masonry. The outer end will be provided with a caisson gate, or lock gates, so that the basin can be pumped dry for repairing the track under water. At all other times the gates will be open.

Fig. 2 shows the basin railway with a ship on the cradle. In transferring a ship from the harbor to the upland track the cradle or ship-car will have to be backed down to the harbor end of the basin, under water, by means of a stationary engine. The ship will then be floated in from the harbor, so that her keel will rest over the cradle. Then the various supports on which the keel and bilges will rest will be moved into place.

Fig. 3 shows, in cross section, a ship resting on the cradle in deep water, and illustrates the manner of supporting her, substantially as is done in every dry-dock. Her weight rests mainly on the keel, a portion being sustained by the opposing bilge blocks, which also serve to keep her from toppling over. A similar cross section near the shore end of the basin is shown in Fig. 4. In the latter cut the vessel has been drawn nearly out of water. When entirely out the stationary engine will be detached and two powerful locomotives will be hitched on to haul the massive load to the opposite sea. It is expected that the transit will be made at the rate of ten or twelve miles an hour, and an additional hour will be consumed in placing the ship in cradle and in discharging her at the overland journey's end.

As will be seen in the engravings, the railway will be composed of twelve rails, spaced four or five feet apart. The locomotives will be five times as large and powerful as ordinary freight engines, and the whole twelve rails will be used by the two locomotives and their tenders. The ship cradles are intended to be of suitable lengths to receive all classes of vessels, and will have wheels about three feet apart on each rail, making a total for large steamers of from ten to twelve hundred wheels.

The maximum pressure allowed to a wheel capable of sustaining twenty tons will be five tons, or considerably less than the ordinary pressure upon the driving wheels of a large locomotive, which is usually six and a half tons. The weight of the largest merchant ships fully laden is about 6,000 tons. This weight distributed over 1,200 wheels—one hundred on each rail—will make the pressure on the rails and road-bed quite moderate. The proportion of the strength of one wheel to the strength of the whole number of wheels is so insignificant that the failure of any wheel could have no serious effect on the rest. Each wheel will be independent of the rest and readily removable. The possibility of derailment, as well as the pressure upon the tracks, is obviously diminished by the number of rails. Indeed, any six rails could carry the whole weight, so that any probable breakage or displacement of rails would not endanger the stability of the load upon the cradle.

As will be seen in the detail drawings, 5, 6, and 7, two strong steel springs surmount each wheel, so that the ship will in reality rest upon an elastic cushion, which still further lessens the liability to strain. Each spring is so fixed that it can be removed by unfastening two bolts, and the wheel under it can then be taken off with ease. Another advantage of the multiplicity of rails and wheels is the great reduction of the liability to jolting or oscillation. When a speed of twelve miles an hour is maintained on a railway so constructed the ship's motion would scarcely betray itself. To derail a car carrying a ship in this way would be an utter impossibility. To provide for the passage of ships going in opposite directions on the single line of track, there would have to be stationed at different points transfer or turn tables for moving cars sideways. By such means it is now common to shift trains of cars from one track to another.

The easiest grades for a ship railway across the Isthmus are found at Panama, Nicaragua, and Tehuantepec, and a mean grade, not exceeding thirty or forty feet to the mile, can probably be found at each place. The cheapest line could be built at Panama, where the distance as well as the grade is least. The harbor improvements there, however, would involve a great deal of cost. These would be less at Tehuantepec, and much less in the Chiriqui route, which presents steeper grades, but offers superb natural harbors. The maximum cost of a road at Panama, including harbors, is estimated by Capt. Eads at \$50,000,000.

Touching the relative economy of a ship railway compared with a ship canal, Mr. Eads is confident:

"That upon any route where it is possible to build a canal, it is equally possible to build and equip a substantial and durable ship railway for one-half the cost of a canal, if it be built with locks; and for one-quarter of its cost, if it be at tide level.

"That such a ship railway can be built in one-third or in one-quarter of the time needed for the construction of the canal.

"That when built, ships of maximum tonnage can be moved with safety at four or five times greater speed on the railway than in the canal.

"That a greater number of vessels per day can be transported on the railway than would be possible through the canal.

"That the capacity of the ship railway can be easily increased to meet the demands of commerce, without interruption to its business, whether it be to meet an increase in the size of the ships or in the number of them.

"That the cost of maintenance of the roadway and rolling stock will be much less than that of the maintenance of the canal.

"That the cost of maintaining and operating the railway, taken together, will be less than that of operating and maintaining the canal.

"That the railway can be located and successfully operated at localities where it is not practicable to construct a canal.

"That it is possible to estimate, with great accuracy, the cost of a ship railway, and the time needed to build it, because the work would be almost wholly upon the surface of the ground, whereas the canal is strictly a hydraulic construction, involving control of water and the execution of works under water, or liable to be submerged or interrupted by water, thus rendering anything like an accurate estimate of the time and cost of its construction an impossibility. Hence capitalists cannot know, with certainty, the amount of money and time required, or what the canal will probably pay when finally finished."

These are bold and significant assertions truly; the non-professional reader may pronounce them startling and extravagant. Coming from a speculative adventurer they would be; but Mr. Eads is no adventurer. He is an engineer who has shown his practical skill as a builder of ships of heavy tonnage, railway bridges of the boldest construction, waterways of the most extensive scope, and in every great undertaking he has demonstrated a financial ability not less remarkable than his engineering capacity. Not a few of the ablest and most experienced engineers and shipbuilders of the world have pronounced this plan of a ship-railway entirely practicable, and far more economical than a canal for the same work. Indeed, the cost of one canal such as Mons. De Lesseps proposes at Panama, would build a ship railway at four or five places along the Isthmus equal in capacity to the canal and several times more speedy in its operation. Again, the interest on the excess of capital required for the construction of a ship-railway for a given traffic, over the cost of a ship-railway of equal capacity, would duplicate the road every ten years. With capital supplied as fast as needed, the railway could be put in operation without difficulty in four years from the time of beginning its construction. The working expenses of the road need not exceed 40 per cent. of its revenue, against 50 or 60 per cent. on ordinary railways.

This superior economy would be due to the fact that the work would be more compact; there would be but one roadway to keep up, everything would be built in the most substantial manner, and all the freight would be handled in mass by steam-power. The liability to accident to shipping in transit would be less than on a canal. With the estimated traffic of 5,000,000 tons a year, a charge of two dollars a ton would yield a revenue of \$10,000,000. Allowing 50 per cent. for operating expenses, the net revenue would give 10 per cent. on the capital invested. A tariff of eight or ten dollars a ton would have to be charged to make a canal at water level pay as well, and such a tariff would be practically prohibitory.

MISCELLANEOUS INVENTIONS.

An improvement in the class of targets which are constructed of movable parts and connected in an electrical circuit with an instrument which is located at or near the place where the shots are fired, and is adapted to indicate the portions of the target struck by balls or bullets, has been patented by Mr. Morris Ullman, of Alexandria, Va.

A machine for bending shafts or thills for buggies and other vehicles, has been patented by Mr. John H. Smith, of Bluffton, Ind. The invention consists in a novel construction and arrangement of straps and formers, a screw, a cam lever, and a frame or table, whereby provision is made for simultaneously bending the heel and the point of both of the shafts of a pair.

An improved window and door screen has been patented by Mr. Albert F. Demorest, of Muscatine, Iowa. The object of this invention is to furnish window or door screens so constructed that they can be readily adjusted into and secured in place.

Mr. Henry Schlimme, of Wiconisco, Pa., has patented a simple and durable tuyere for blacksmith's forges and the like. It consists in a bored cylinder provided with water chambers, longitudinal blast opening, a blast pipe and sliding valve, and water feeding pipes.

An improvement in fences has been patented by Mr. Joel D. Olinger, of Water Valley, Miss. The object of this invention is to construct fences so that they can be readily moved from place to place, and to make them strong, durable and less expensive in construction than fences made in the ordinary manner.

An improved thill coupling has been patented by Mr. James S. Welch, of Dodge City, Kansas. In this invention the conical bolt which holds the thill iron is considerably longer than the width of the thill iron, and the latter is constantly pushed toward the larger end of the bolt by a U-shaped spring.

Mr. Isaiah A. Clippinger, of Plainfield, Ill., has patented an improved spring for bed bottoms, which will facilitate and cheapen their attachment to the supporting slats of the bed bottom and the attachment of the springs to each other, and effect continuity of the bearing surface.

An improvement in dynamo-electric machines, which Mr. Charles J. Van Depoele, of Detroit, Mich., has patented, consists in the peculiar construction of the revolving armature, and in the arrangement of the same in the magnetic field and the bearings carried by projections from the sides of the case.

Serviette Magique.

In France, a species of cloth for polishing metal ware is manufactured under the name of serviette magique. It consists of small pieces of woolen cloth which are saturated with soap and tripoli and colored with fuchsine. It is manufactured by dissolving 60 grains of Marseilles soap in 300 grains of water and adding 30 grains of tripoli. The mixture is colored red by means of fuchsine, and the pieces of cloth are saturated in it and afterwards dried.

IMPROVED BOTTLE STOPPER.

The bottle stopper represented in the engraving consists of a flanged tube provided with a perforated screw cap, A, and a larger spring actuated flanged tube set over the inner tube and connected with the rod, B, of the valve which closes the opening in the cap of the inner tube. It will be seen that whenever the flange, C, of the outer tube is pressed down the valve will be drawn from its seat, when the contents of the bottle may be discharged through the perforated cap.

This novel bottle stopper was recently patented by Mr. John Q. Houts, of Sioux Falls, Dakota Territory.

Guatemala's Exhibition.

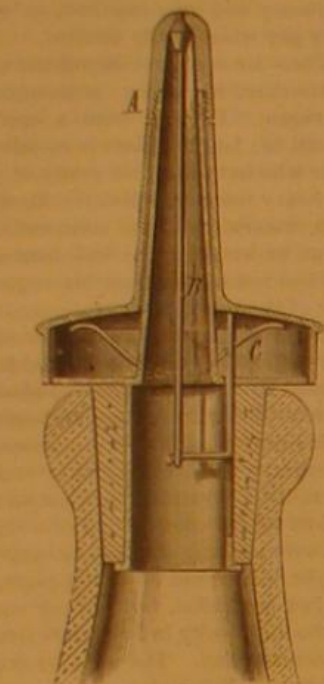
The largest and most enterprising of the Central American States, Guatemala, has entered the list of exhibitors, and announces the intention of holding an industrial exhibition in 1882. This is likely to furnish American manufacturers of articles suitable for the markets of that region a convenient opportunity for placing their products in a favorable way before the Guatemalan dealers and consumers.

IMPROVED BOLT FOR DOUBLE DOORS.

The engraving represents a novel bolt for double doors recently patented by Mr. William P. Brachmann, of 147 Walnut street, Philadelphia, Pa. This bolt is in the form of a right-angled lever pivoted at its angle, and provided with a spiral spring acting on its pivot, and having screws or spring pins for locking it in different positions. The bolts fit in appropriate sockets in the sill or jamb.

Fig. 1 shows the bolt applied to double doors with both doors fastened. Fig. 2 shows one door bolted and the other unfastened. Fig. 3 is an enlarged perspective view of the bolt, and Fig. 4 is a vertical section of the door and the bolts.

The bolt, A, is in the form of a right-angled lever, pivoted at its angle in a casing, B, attached to the door. Each arm of the bolt is provided with a recess for receiving the end of the spring pin, D, which serves to hold the bolt in either of its positions by engaging one or the other of the recesses. The pivot of the upper bolt is provided with a short arm to which is attached a chain for operating the bolt, and the pivot is provided with a spiral spring which tends to throw it into the position shown in Fig. 1, with one of its arms in the socket on the jamb and the other one in the socket on the other door. The chain is drawn down to throw the bolt into the position shown in Fig. 2, and to retain it in this position the ring at the end of the chain is placed on the pin projecting from the door.

**HOUTS' BOTTLE STOPPER.**

The lower bolt, A', has no spring, and is kept in place by the spring pin, D'. One arm of the bolt enters the socket attached to the door, and the other enters a slotted socket in the door sill, as in Fig. 1, when both doors are bolted. When only one door is bolted, the lower bolt is in the position shown in Fig. 2.

This bolt fastens both doors with a single operation, and to securely bolt the top and bottom of both doors requires only two bolts instead of four as in the ordinary method, and the shrinking or swelling of the doors makes no difference in the operation of the bolt, as it engages a simple, open, hooked socket which admits of the lateral movement of the bolt without interfering with its working.

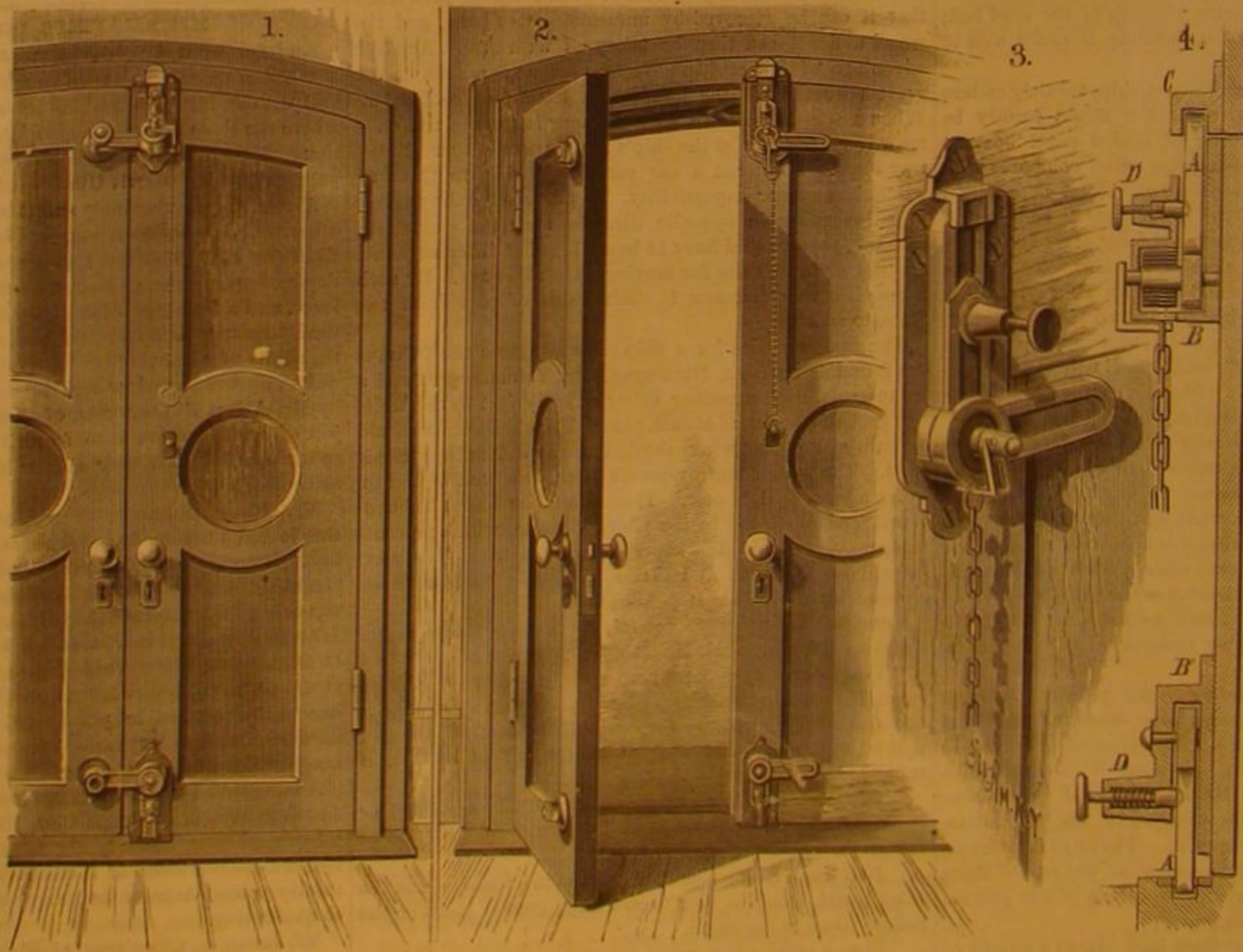
The bolt is made in very handsome shape, and is an ornament to the doors rather than otherwise.

The New Steamship City of Augusta.

The new iron steamship City of Augusta, of the Ocean Steamship Company, is described as the largest ship engaged in the coastwise trade. Her capacity is 6,000 bales of cotton, or 8,000 tons. She is 310 feet long at the water line, 323 feet over all, and is of 40 feet beam. Her cabin accommodations are for 100 first class passengers. She is equipped with a compound engine, with two inverted cylinders, 42½ and 82 inches respectively in diameter, and each of them with 54 inches length of stroke. These engines are capable of a speed of sixty revolutions per minute. The screw is 16 feet in diameter, with 23 feet pitch. The working pressure is 100 pounds of steam. In addition to this there is an auxiliary or independent engine, with force pumps attached and an air circulating pump. Steam is furnished by six tubular steel boilers, 12½ feet in diameter and 11 feet 5 inches long, with one superheater 12½ feet in diameter and 13 feet high. These boilers are ample to furnish all the steam required for a speed of sixteen knots. There are steam steering gear, steam capstans and windlass forward and steam capstan aft, with donkey engines for freight hoists at all the holds.

The City of Augusta was built by John Roach, of Chester, under the supervision of Captain Lefevre, marine superintendent of the Ocean Steamship Company.

The new dump car of the New England Car Company, which was illustrated in the SCIENTIFIC AMERICAN some time since, was recently tried at Brookline, Mass. The stockholders of the company and several railway men were present. The car, which was built by the Watson Manufacturing Company, is probably the longest and largest dump car in practical use in the country, and its size made the test of its workings all the stronger. It is thirty-two feet long, weighs 19,860 pounds, and contained 36,590 pounds, or over eighteen tons, of coal. All things being in readiness, a medium-sized man turned the crank, the machinery responded, the car tipped, the coal was

**BRACHMANN'S BOLT FOR DOUBLE DOORS.**

emptied out where desired, and the car body went back into place, the whole time consumed from "the start to the finish," as one might say, being less than two minutes. The car has been tested, with like results, with loads of gravel, both damp and dry. The gentlemen present at the trial expressed themselves well pleased with the workings of the car, as well as its simplicity, strength, and durability.

dle in such a way as to distribute and balance their weight, and at the same time make the saddle comfortable for the rider.

Mr. John S. Worth, of Coatesville, Pa., has patented an improvement in gearing for rolling mill rolls and other machinery. The invention consists in gear wheels, each of which is provided with several longitudinal rows of epicycloidal

DEEP SEA-SOUNDING APPARATUS.

The engraving shows an improved sounding apparatus recently patented by Paul C. Rousset, of St. Petersburg, Russia. The invention consists of a novel device for connecting the sinker with an ordinary registering log, and in the arrangement of a buoy of sufficient capacity to raise the log to the surface after the sinker has been detached.

The registering mechanism of the log is provided with a ratchet and pawl that prevents it from operating as the log descends, but allows the register to operate when the log ascends. A sinker is suspended from an eye on the lower end of the log by means of a hook which is weighted so that as soon as the sinker touches bottom the hook drops out of the eye, and the log being released is carried to the surface by the buoy, the screw meanwhile actuating the mechanism of the log, which records the distance through which the log passes.

This device renders a sounding wire or line unnecessary, and insures more accurate soundings than can be obtained in the ordinary way.

ROUSSET'S DEEP SEA-SOUNDING APPARATUS.**RECENT INVENTIONS.**

A ball and instep stretcher for boots and shoes, so constructed that it can be readily inserted into and removed from the boots and shoes, has been patented by Mr. Francis A. Fay, of Brooklyn, E. D., N. Y.

An improved milliner's steamer and presser has been patented by Mr. Thomas Hicks, Jr., of Gravesend, N. Y.

This invention relates to that class of devices designed for milliners' use for the purpose of raising the pile on velvets, etc.

An improved mechanism for changing and adjusting the height of revolving seats of stools and chairs has been patented by Mr. John M. J. Wernert, of Paw Paw, Mich. The invention consists of a spring-actuated rod enclosed in a slotted cylinder that projects downward from the under side of a chair or stool seat into a grooved socket which is fixed vertically in the central standard of the stool or chair, said rod being provided on its lower end with a laterally projecting lug, which is made to engage in the grooves of the socket and thereby hold the stool or chair seat at any desired elevation.

Mr. John R. Hastings, of Lampasas, Texas, has patented a military saddle so constructed that the valises and other equipments may be connected with the saddle

teeth set in echelon, the teeth of each row being in end contact or union with each other, and set so that the first tooth in any one row enters in gear with the opposite wheel while one or more teeth of the preceding row are yet in gear, whereby a majority of the sectional rows of teeth will always be engaged in the opposite wheel at one time, the precise number thus engaged depending on the number of sectional rows of teeth in the wheel, whether two, three, four, or more, also upon the height of the teeth and coarseness of the pitch.

Mr. John H. Holmes, of Charleston, Kan., has patented an improved rotary dasher or breaker for employment in vertical churns.

THE HUNTING FALCON.

Among falcons the hunting falcon is the most conspicuous on account of the great size and the striking power of its wing. This bird is a native of northern Europe, being mostly found in Iceland and Norway, and it also inhabits parts of both North and South America.

Some naturalists believe that the Norwegian and Icelandic birds ought to be reckoned as different species, but others think that any differences between them are occasioned by age and sex. The power of flight of these birds is marvelously great. When it comes within sight of its prey it bounds upward, every stroke of the wings producing a perpendicular leap, as if it were climbing a giant stairs. After having risen to the proper height it dashes itself upon its prey with a stroke that is as unerring as its motion is swift.

When at liberty it seems to prefer birds to any other kind of prey, and will resolutely attack birds of considerable size, such as herons or storks. It will also chase hares and rabbits, and in the pursuit of this swift game is so eager that after knocking over one hare it will leave the maimed animal struggling on the ground while it goes in chase of another.

Although its home is in the chilly wastes of the northern regions, the bird is in no want of food, finding ample supply in the sea birds which swarm around the tall cliffs that rise from the waves.

On account of the singular power, swiftness, and courage of this bird it was in former days held in the highest estimation, and could only be purchased at a most extravagant price. The training of this bird to fit it for the chase is a long and tedious process, requiring a longer time than the training any other bird.

The color of the adult bird is nearly white, being purely white on the under surface and flecked with grayish-brown spots on the upper side. The sharp claws are black, the beak of a bluish tint, increasing in darkness toward the point, and the cere, tarsus, and toes are yellow.

When young the bird presents a different aspect, and would hardly be recognized as belonging to the same species. In its earlier life it is almost wholly of a grayish-brown tint, the feathers being slightly marked with a little white upon their edges. As the bird grows older the white edges become wider by degrees until the entire feather is of a snowy whiteness.

Landscapes Changed by Animals.

All animals, says Professor Mivart in the *Contemporary Review*, are directly or indirectly supported by plants, and the range of plants and the very existence of species are often wonderfully affected by the appearance on the scene of even one new kind of animal. Thus a great grazing district at the Cape, called the "Midlands," was, in Burchell's time, covered with luxuriant greensward, with a few trees and bushes, with willows and acacias along the sides of its streams. The introduction of sheep first destroyed the grass and then most of the shrubs—a change which affected the rainfall, so that this region has been invaded by the hardy plants of the adjacent Karroo desert, and is fast becoming an extension of the desert itself. St. Helena, when discovered by the Portuguese, in the year 1502, was entirely covered with forests (the trees drooping over its high preci-

pices overhanging the sea) and with a rich flora of absolutely peculiar plants. In 1513 some goats were introduced, and in fifty years had multiplied into thousands. Yet in 1700 trees still abounded, and the peculiar native ebony tree was still so abundant that it was used to burn lime with. In another hundred years (1810), the goats had entirely destroyed the great forests, yet so rich was the soil that it was hoped, with the destruction of the goats (and they were destroyed) the island would regain its wood by a quarter of a century. But this was not to be, for the government of that day most unhappily planted the island with trees and shrubs from other countries, which have so grown and spread that now the old indigenous flora is almost confined to a few patches on the central ridge of the island, at a height of 2,700 feet. What has been lost may be judged by the fact that of the forty-five kinds of flowering plants and twenty-three species of ferns which yet survive, no less than



THE HUNTING FALCON.

forty of the former and thirteen of the latter are absolutely peculiar to the island.

Preserving Timber in Ground.

In speaking of the well known methods of preserving posts and wood which are partly embedded in the earth, by charring and coating with tar, it is said these methods are only effective when both are applied. Should the poles only be charred without the subsequent treatment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and, if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depths which the absorbing properties of the charcoal surface would insure. Wood that is exposed to the action of water or let into the ground should first be charred, and then, before it has entirely cooled, be treated with tar till the wood is thoroughly impregnated. The acetic acid and oils contained in the tar are evaporated by the heat, and only the resin left behind, which penetrates the pores of the wood and forms an air-tight and waterproof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay affects the wood first, and where the break always occurs when removed from the earth or strained in testing.

Taking Care of Fresh Meat.

The time for slaughtering beef and pork for home consumption is close at hand, and it is a busy time for housekeepers; and if the truth is told, it is not a very pleasant task to contemplate; but as the comfort and happiness of a family depend very much on the manner in which meats are prepared, it is an essential item in every farmhouse that it should be done in a judicious and proper manner.

It is to be hoped that the good man of the family is both competent and willing to cut up the meat when cool without the assistance of his wife, and also to pack and salt the pork in the barrels in the cellar. If he does not know how, it would be highly advisable for him to take a few lessons of an experienced teacher, for it is a job that no woman ever ought to attempt. She of course would see that the pork barrel was perfectly sweet and clean before it was used. The brine, if kept nicely, will answer to use year after year

by scalding and skimming and letting stand till cold before turning it over the pork. Pork must be cold before it is packed—all the animal heat entirely out of it—then, when packed down, an abundance of good coarse salt must be freely spread over every layer of the pork, then allow it to stand two or three days before turning on the brine. Place a heavy flat stone on the top of the barrel, so that the meat will be kept solid in its place. It is best to keep the stone on meat the year round, so that none of the pieces can float on the brine, as they are apt to do unless kept in place by a heavy weight. Have the brine cover the entire mass of pork, so as to exclude air. There is so much lean meat in the hams and shoulders of a hog, that they never ought to be salted with the solid pork. A pickle should be made expressly for their curing, as they can be made so much more palatable than when simply salted. The spare ribs of pork are better to be frozen and kept fresh until needed for cooking. The tenderloin can be frozen, too, and it is one of the most delicious parts of the whole, either broiled and buttered or fried. The head needs to be cleaned nicely, and soaked in a weak brine till the blood is all out. Some like it boiled, and others prefer it made into head-cheese and kept for cold meats. The feet and legs are to be scraped thoroughly, boiled till tender, and prepared as souse, or eaten hot, with turnip sauce for a relish. The trimmings of the pork—the neck pieces and the jowls—are nice made into sausages, and they keep all through the winter, to use at pleasure. The lard of course needs care immediately, but it is much better to let it soak in water over night before trying it out. Always keep the roundabout and leaf separate, and use the lard from the roundabout in cold weather, as it is liable to have a strong taste if kept till summer. The tongue and heart make good meat for mince pies, and the liver is pal-

atable and wholesome, either boiled or fried. Beef that is kept fresh for winter use ought to be frozen as soon as possible, and then packed in tight barrels and set in a cool place, where the changes of atmosphere will not reach it. Some bury the barrel in an oat bin; others cover it with snow or put it in the hay mow—the main object being to keep it from thawing out. Beef hams must be cured in a nice pickle for some six or eight weeks, and then taken out and drained, put into either cloth or paper bags, and hung near the kitchen stove to dry for summer use; the tongue can be pickled with the hams, and kept for any length of time. The neck pieces and heart are used for mince pies, and need a thorough soaking in water to extract the blood. The beef to corn must be soaked two or three days in a weak brine, then packed in a tight cask or barrel, with salt sprinkled freely between the layers, and held down by a stone, in a pickle made and poured over it. It should be kept in a cool place in the cellar during the summer, and a sprinkling of black pepper over the top of the brine will keep the flies at a distance.

There is a great amount of work and care required to keep a year's stock of meat in good, wholesome condition, but if it is properly cured to commence with, two thirds of the labor is saved, and all the worry. No farmer can afford to

patronize either the meat cart or the market for a supply of meat through the year. It is more convenient as well as more economical to lay in a store for family use that has been fattened at home, and then you are sure you have a good article, that is safe to use.—*Farmer's Wife in Country Gentleman*

THE NUTRITION OF ROOTS.

The microscope does not show openings in the cellular tissues of a root through which even the most minute particle of solid matter could pass, and there is no mechanical power that could pulverize any solid so fine that it could pass through those extremely small canals which enable the root to absorb nourishment in a liquid or gaseous form.

For a long time the absorbing power was supposed to be localized in a special organ at the end of the root. But this has been disproved, as the vegetable cone situated there is covered with a skin that possesses little or no power of absorption.

The maximum of absorption takes place directly above this cone, in a part of the root covered with peculiar fibers. In ascending the root these fibers gradually diminish and disappear, and higher still the skin itself exfoliates, and is replaced by a new tegument that grows less and less permeable with age. Both the anatomy of the plant and experiment prove that the absorbing power diminishes from the point to the base of the root.

The subterranean nutritive fluid of the soil is always very poor in plant building substances, of which it only contains from a few thousandths to one hundredth of its own weight. The plant soon exhausts the small amount of soluble matter contained in arable land, but this matter is daily renewed by the chemical action of sunlight, and the various natural agents cause a sort of digestion to take place in the soil, converting insoluble into soluble bodies. The fertility of the soil is not shown by the amount of nutritive matter that it can dissolve at a given moment in water, but by the amount of matter it contains that with time will become soluble. We should, therefore, remember in applying liquid fertilizers that they should be largely diluted if we would imitate the natural conditions of vegetation.

All roots possess an elective power of absorption, as they will only absorb those substances that are suitable to nourish them, and reject all others. Each plant, so to speak, follows a diet appropriate to its own organization and character, and generally when the soil does not contain the necessary elements the plant, instead of adapting its chemical condition to that of the soil, will suffer and prematurely die.

We do not yet fully understand the mechanism of this elective absorption, but we are sure that the force of endosmose enters largely into the phenomenon. This force is shown in the following experiment:

Take a glass bottle (see Fig. 1) from which the bottom has been removed and replaced by some vegetable or animal membrane, fill it with some uncrystallizable solution, such as gum arabic, and close it with a cork, in which is inserted a glass tube open at both ends. If this apparatus is placed in pure water the solution gradually mounts in the tube, proving that the water has penetrated through the membrane and augmented the volume of liquid in the bottle.

This property of membranous tissues, by which liquids of unequal densities are enabled to percolate through it and intermix, is called the force of endosmose, and was first observed by Durochet. The instrument that exhibits and measures the force is the endosmometer. The cells of the root act toward the soil and in regard to each other as minute endosmometers; and formerly it was assumed that the force of endosmose was the only power that introduced the water from the soil into the root, and caused its circulation through the plant. But this explanation is insufficient, because during the summer, when the circulation of the sap is the most rapid, the cells of the plant contain gas, and consequently are not perfect endosmometers.

But if the causes of absorption by the roots are obscure, its effect is well known, for we have observed that the power which forces the sap upward into the tree is very great, and can easily be measured by a "mercurial manometer."

This is a glass tube, in the form of a π (see Fig. 2), with unequal ends, both of which are open. The shorter end is enlarged in the middle so as to form a small reservoir, and is bent at right angles. If mercury is poured into the tube, until it half fills the reservoir, the mercury will remain at the same level on both sides.

If we wish to know the force of the sap as it rises from the root into the trunk, we cut the latter close to the ground and inclose the end of the stump in a glass cylinder, in one side of which is inserted the small end of the manometer. Fill the cylinder with water and lock it. When the instrument is thus arranged, the varying pressure of the sap is indicated by the rise of the mercury, and it is easy to calculate the exact force.

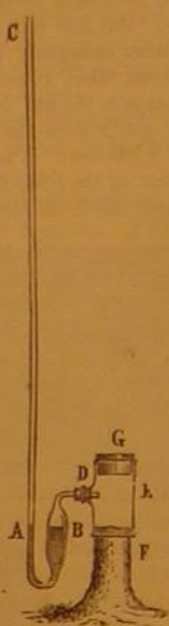
The pressure of the sap at different heights can be known by simply inserting the manometer in the side of the tree, as shown in Fig. 4.

Numerous observations have proved to us that the propulsive force of the roots, like all vital forces, is subject to variations produced either by external or internal causes.

Fig. 2.



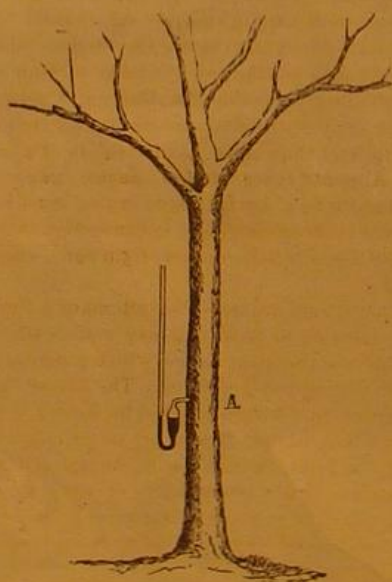
Fig. 3.



The strongest pressure observed by Hules (April, 1725) was equivalent to three-tenths of an atmospheric pressure. Since then still stronger pressures have been observed, in some instances to the pressure of one and a half atmospheres.

The propulsive force of the sap occasionally produces a curious phenomenon called the oozing sap. A little drop resembling pure water collects on the end of the leaf, and

Fig. 4.



gradually enlarges till it falls, and is replaced by another. This takes place intermittently, and generally during the night or after a copious rainfall.

This phenomenon of the oozing sap can be artificially produced by forcibly injecting water into the bark of the tree.

Fig. 5.

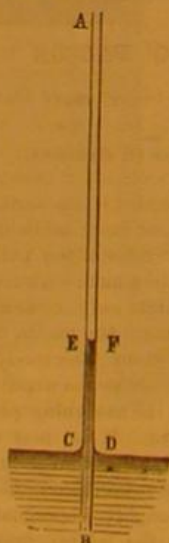
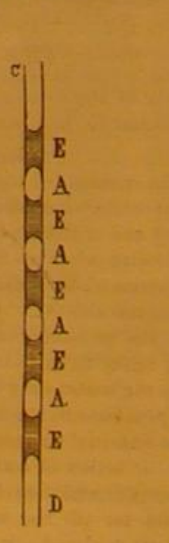


Fig. 6.



Soon after, drops of water will be seen issuing from the surface of the bark.

Sometimes this propulsive force suddenly disappears, and gives place to the opposite force of absorption, as may be seen in the following experiment. If, at the close of a

warm summer day, when its transference has been abundant, the plant is cut down to the ground, and a glass cylinder full of water fastened on the stump, the water will be seen to gradually diminish and disappear. The root will absorb it through the cut surface, just as a branch will absorb through its lower section when it is placed in water. In each case the cause is the same, the insufficiency of water in the tissues of the root or branch.

The varying operation of these two forces can be seen by a manometer inserted in the tree. In the morning the mercury descends in the longer side of the instrument, thus showing the absorbing force of the tree, and later, again changes its level and registers the opposite force, which increases during the day, especially if the rays of the sun fall on that side of the tree where the manometer is inserted.

Capillary attraction is another motive force in the circulation and movement of the sap. The most familiar illustration of this force is to take a very small glass tube and plunge one end of it in water. The liquid will immediately rise in the tube above the level of the surrounding water, to a height proportionate to the diameter of the tube, and the smaller the diameter the higher the liquid will mount.

It is generally admitted that capillary attraction is one of the principal causes of the ascension of the sap. Still it is necessary to recollect that during the period of the most rapid movement of the sap, the veins and fibers do not contain unbroken columns of water, but are filled alternately with drops of water and bubbles of air, and later in the season only with air, as shown in Fig. 6.

The capillary phenomena in the plant are of a complex nature, and vary according to the time of the year, and heat, especially solar, dilates the interior gases of the plant, and by increasing their elastic force exercises a great influence on these phenomena, for the sap always percolates more abundantly through the insertions made in the tree when the sun falls warmly upon it.

IMPROVED GAS BURNER.

The accompanying engraving represents a new form of gas burner invented by Dr. McGeorge. It is claimed that it is very economical in burning gas, and secures complete combustion. It is well known that ordinary burners, because of imperfect combustion, throw off a great deal of poisonous carbonic oxide and carbonic acid gas, which vitiates the atmosphere very rapidly. The burner shown in the annexed engraving secures a more perfect combustion of gas, and thus diminishes the formation of poisonous gases, and at the same time, as shown by careful tests, an increase of fifty per cent in illuminating power secured by perfecting combustion alone, the quantity of gas consumed remaining the same.

In this gas burner, which has been named the "focus gas burner," two small side jets are directed to a point at

the base of the flame, throwing heated gas mixed with air. By this means the gas is greatly rarefied and expanded, and an additional amount of oxygen is conveyed to the flame. The particles of carbon or blue portion of flame (the gas being superheated) are reduced so as to eliminate the greatest amount of light. This more perfect combustion also checks the outflow of carbonic acid gas.

Gas, like steam, admits of expansion by heat to almost any limit. The more the particles are heated and separated, the more perfect combustion is secured, and a larger proportion of light is produced.

If a regulator is used, a sufficient pressure is given through it to carry the burner to complete combustion. This pressure is offset in the "focus burner" by a novel check, which is very simple and effective. No complicated valves nor inside apparatus, which are liable to become smutty and fill up, are used.

The inventor gives the following photometric test, made in May last, at one inch pressure: A common burner, placed upon the test, gave an hourly consumption of 2 feet; light emitted equal to 6 star candles. The "focus burner," with the same amount of gas; light emitted equal to 11 1/4 candles.

Further information may be obtained from J. C. O. Redington, General Manager, 27 Park Place, New York.

Telegraphy Between Australia and London.

On the 1st of October last, a message of sixty-nine words was forwarded by the Governor of Victoria announcing the opening of the Melbourne Exhibition on that day. The message was dispatched from Melbourne at 1 P.M., and reached London at 3:43 A.M., on the same day, or 9 hours 17 minutes before the hour of its despatch. Allowing, however, for the difference of time between the two cities, it occupied only twenty-three minutes in transit. The route of the message was over the lines of the Victorian and South Australian colonies, the cables of the Eastern Extension, Australasia, and China Telegraph Company, the lines of the Indian Government, the cables of the Eastern Telegraph Company, and the lines of the Egyptian and French Governments, and the rapidity of its transmission shows the harmony with which these various administrations work together. The total distance traversed was 13,398 miles.

DECISIONS RELATING TO PATENTS AND TRADE MARKS.

By the Commissioner of Patents.

(Appeal from the Examiners-in-Chief.)

HARRISON *et al.* vs. HOGAN *et al.*—HEELING MACHINE.

Application of Hall and Harrison filed March 20, 1879. Application of R. M. Harrison filed February 8, 1879. Patent No. 206,237, to Hogan and Whitlock, granted July 23, 1878. Marble, Commissioner:

1. As between an employer and a party employed for a special purpose, features suggested by the employee which are merely tributary to the main invention can give to him no claim as an inventor, and in regard to such features as amount to independent inventions a presumption exists in favor of the employer.

2. An award of priority cannot be rendered in favor of joint inventors as to a part of a machine which is in itself a distinct improvement capable of supporting a separate patent, and in the conception and completion of which one of such joint inventors had no part.

It is a familiar doctrine that as between an employer and a party employed for a special purpose matters merely auxiliary or tributary to the main invention can give to the employee no claim as an inventor, and in regard to such features as amount to independent inventions a presumption exists in favor of the employer as the author of the same which can only be overcome by conclusive and unequivocal proof. The stop used in connection with the slide is a feature which, in my judgment, cannot be said to be more than tributary to the invention of the slide, the movement of which it is designed to regulate. The conception of the one naturally followed that of the other, and even if this feature was added by the workmen it is not such a distinct invention as would warrant them to make claim to the same. Were this otherwise, however—were the stop other than a tributary element—the weight of evidence satisfies me that the patentees are the parties rightfully entitled thereto.

By the Commissioner of Patents.—Trade Mark Decisions.

EX PARTE HEYMAN.

Marble, Commissioner.

1. The law is well settled that words merely descriptively used are not proper subjects for trade mark registration.

2. If the descriptive character that might attach to a word is so very remote as to be but secondary, so that the word will be understood by the public not as a descriptive but as a fanciful term, it may then constitute a valid trade mark.

Abstract.—The applicant in this case seeks to register the word "Invigorator" as a trade mark for spring bed bottoms. The registry is denied by the Examiner on the ground that "the word in question is, in a certain sense, descriptively used by the applicant; or the objection may be stated in another form, that the word is not distinctly an arbitrary designation, and hence would not serve the purpose of indicating the original ownership of the articles to which it is designed to be affixed."

It is undoubtedly a well settled rule of law that words that are merely descriptively used are not proper subjects for trade mark registration. If, however, the descriptive character that might attach to a word is so very remote as to be but secondary, so that the word will be understood by the public not as a descriptive but as a fanciful term, it will then accomplish the office of a trade mark, and to the use of a word which in connection with a particular article is primarily fanciful an exclusive right can exist. Indeed, it is common to find words, either newly coined or arbitrarily selected, the validity of which as trade marks has been sustained by the courts, which contain a suggestion more or less remote of some peculiarity, real or supposed, of the article to which they are attached. An example of this is afforded by the case of *Davis vs. Kendall* (American Trade Mark Cases, 112), where the term "Painkiller" was held to be a proper trade mark as applied to a medical compound.

I do not think that the word "Invigorator" stamped upon spring bed bottoms could be regarded as merely descriptive. It is true, perhaps, that by a process of logical deduction it may be resolved into a description in one sense, since a spring bed bottom may be conducive of sleep, and sleep invigorates; but, in my judgment, the primary significance which the public would attach to this term would be a fanciful one.

The decision of the Examiner is reversed.

EX PARTE OLIVER.

Application of R. W. Oliver and J. E. Robinson filed March 3, 1880.

Marble, Commissioner:

A geographical name, although also the name of a historical personage, is not a proper subject for trade mark registration.

Applicants in this case seek to register the word "Raleigh" as a trade mark for manufactured tobacco, whether such word be accompanied by a portrait of Sir Walter Raleigh or not. The Examiner holds the word alone to be geographically descriptive when used upon tobacco, it being a name of a leading city of a tobacco growing State, and he has accordingly refused the registration.

It is contended on behalf of the applicants that the word as here used is the name of an historical personage, and that it would be more likely to be associated with the person than with the place of that name. In this statement of counsel I cannot concur. Situated as the city of Raleigh is, in the con-

ter of a tobacco growing region, the vast majority of persons, and especially the inhabitants of that section of the country, as well as many elsewhere whose historical knowledge is defective, would, I think, regard this word as indicative of the place of manufacture. The mere circumstance that the name of a place is also the name of a person cannot alter the fact that any manufacturer of tobacco in Raleigh, and there are doubtless such there, would have a perfect right to use this mark upon his wares, thus destroying the exclusiveness of the right of user—an essential feature in a lawful trade mark—nor the fact that many, and I think most, persons would understand the mark as geographically descriptive. The authorities are numerous and conclusive upon the point that, as a rule, geographical names are not proper subjects of trade marks. (*Ex parte Knapp*, 16 O. G., 318; *Marching & Co.*, 15 O. G., 294; *Cornwall & Bros.*, 12 O. G., 312.) There have been, it is true, exceptions to this rule, where the geographical words employed were obviously fancifully used, and were of such a character that they could not be misunderstood as indicating the locality in which the goods were made; but this cannot, in my judgment, come under the excepted cases.

The decision of the Acting Examiner of Trade Marks is affirmed.

STRAITON & STORM.

Application of Straiton & Storm filed August 20, 1879.

Marble, Commissioner:

1. A band or ribbon of such shape and so attached to the wares of a manufacturer as to enable them to be readily distinguished in the market may properly be allowed registration as a trade mark.

2. The mere fact that such strip or ribbon may also be the vehicle of other matter cannot detract from its efficiency as a means of distinguishing the goods upon which it is placed.

Abstract.—Applicants in this case seek to register as a trade mark for cigars—

"A waved band or ribbon of rectilinear form longer than it is wide, which is fastened to the two ends of a cigar box, and so placed with reference to the cigars within the box as to be below some of said cigars and above the remaining cigars."

The Examiner denies the registration for the reason, as he states in answer to applicants' appeal, that—

"The matter sought to be registered does not amount to an arbitrary symbol, the band or label serving the office of a mere label, which, besides the descriptive matter contained thereupon, may also contain matter indicative of origin and ownership, and thus serve as the vehicle of a lawful trade mark. A contrivance, design, device, name, symbol, or other thing, to be a lawful trade mark, must be of such a character that its employment in connection with a particular commodity will indicate the origin and ownership of that commodity."

There have been numerous definitions of a trade mark, the difficulty seeming to be to find one sufficiently comprehensive to embrace the many means which a manufacturer may employ to distinguish his wares. The Acting Commissioner in the Gordon case before referred to, says:

"Thus a box, barrel, or wrapper containing merchandise, whatever its form, cannot, *per se*, be a trade mark, but a name, symbol, figure, letter, form, or device cut, stamped, cast, impressed, or engraved thereon, or in some other manner attached thereon or connected with the article itself, may be a proper trade mark."

This statement is fully sustained by the case of *Moorman vs. Hoge* (2 Sawyer, 78), to which reference is there made. Surely under so broad a definition applicants' mark must find some place. It is a "device" "attached to the box and connected with the article itself" for the purpose of indicating the origin of the goods. Will it serve this purpose? An inspection of the illustration at such a distance that the printed matter contained on the band cannot be read shows at a glance that applicants have attached to their wares a device by which it can be readily distinguished from the wares of another. This is the purpose of a trade mark, and this purpose applicants have, in my judgment, accomplished by a means which is clearly comprehended under all the authoritative definitions of a lawful trade mark. In the case of Gordon the following language occurs, which, although but a dictum, is here in point:

"Perhaps this objection (the useful functions of the mouth-piece of the cigarette) would not lie if, as in the case cited by applicants—that of Mommer, for which a trade mark was granted for a silk band around a champagne bottle—a silk band was attached to the cigarette, or a colored piece of paper or similar device connected therewith, for in such instance the device would answer no other purpose than that of a trade mark—perform no mechanical function."

This language would seem to recognize the propriety of granting registration for such marks as applicants'.

The mere fact that applicants' strip can be made the vehicle of other matter which may constitute a trade mark does not detract from the efficiency of the strip itself as a means or device for distinguishing the wares upon which it is placed. The same objection might be urged to a figure in the form of a star or crescent or other fanciful shape, for upon such, as upon applicants' strip, a trade mark might be stamped, and yet these fanciful figures without any matter marked thereon would certainly be understood as distinguishing marks in the trade as trade marks. The Office has re-

peatedly allowed the registration of strips, either of peculiar shape or attached in some distinctive manner to various articles, as appears by the numerous cases to which my attention has been drawn.

The decision of the Examiner is reversed.

Complaints about the Patent Laws.

There is a growing disposition in some branches of industry in this country to find fault with our patent laws, and the manner in which they are enforced. There is hardly a trade that has not at frequent periods its crop of harassing patent suits, which perplex the manufacturer, the dealer, and the consumer. It is not surprising, therefore, that the dissatisfaction thus created finds expression in complaints. Naturally, the subject comes up before the associations formed among those belonging to the various trades for their mutual protection and the advancement of common interests. A committee is appointed, and, if its members are in earnest, a report is drawn up suggesting possible measures of reform. Such has been the course pursued by the millers, and we learn that the brewers have taken the first steps in that direction.

All this is very well in its way, but it does not seem as though the agitation of the subject is conducted in the manner best calculated to secure the reforms desired. The reports of such committees are so evidently biased by the interests of the members, as defendants in patent suits, as to have, as the rule, little or no value. The one great and sole object of their effort seems to be to beat the particular patent or patents which menace them, and the fact is lost sight of that it is to the interest of every enterprising manufacturer to aid in sustaining patents. In many cases where complaint against the patent system is loudest, known rights have been infringed, and the protests of patentees disregarded, in the belief that it was cheaper to take the chances of infringing than to recognize the demands of those whose claims were disregarded. Patents thus ignored almost always acquire an unexpected value before they expire, and it is quite usual for them to be made the basis of expensive suits. Often they are sustained by the courts and become very valuable, for the simple reason that they have been infringed without regard to consequences. Manufacturers who find themselves figuring as defendants in suits of this character commonly have a great deal to say about the injustice of our patent laws.

Perhaps they are unjust in their requirements in some instances, but to modify them in any essential particular, in points touching the value of valid patents, would be to destroy an immense property right, and to make it extremely difficult for inventors or the owner of a patent acquired by purchase to protect himself in the enjoyment of the rights it is designed to secure to him. It may be vexatious to settle or defend frequent demands for royalties and damages; but it is still more so to know that you have valuable rights in patents which you are unable to enforce, and that which should belong to you alone has become common property. The only safe and honorable position for the manufacturer is one of justice and fair dealing. He should act advisedly with regard to the payment of royalties and the infringement of patents. If he manifests a fair and liberal disposition in this matter, and a willingness to recognize the rights of others as beginning where his own rights cease, he is not likely to have serious trouble. As the rule, it is cheaper to purchase a right under a patent than to defend an infringement; but when a manufacturer persistently disregards notices and warnings, and takes his chances as an infringer, he should stand by the consequences like a man, and not whine nor complain if called upon to pay for what he has taken without leave. He may, at least, have the satisfaction of knowing, under such circumstances, that every decision of the courts affirming the validity of patents increases the value of those he owns and controls, and that he has thus a direct interest in sustaining all good patents. But then we must make some allowance for human nature, and it certainly does make a great difference in a man's feelings whether he appears as plaintiff or defendant in a patent suit. He often does and says a great many things when he is defending an infringement suit which he would be very sorry to have quoted against him should he ever find it necessary to move for the protection of his own rights and interests. Our patent laws may be susceptible of improvement, but the men to improve them are not found on committees representing cliques of defendants interested in suits brought to recover damages for the wholesale infringement of valid patents. What they have to say may always be taken with some allowance. —*Iron Age.*

Shooting at Balloons.

English papers report some experiments, lately made at Dungeness, which show remarkable success in reducing the efficiency of military balloons. An ordinary service balloon was used, and after it had risen to a height of 800 feet was fired at with an 8 inch howitzer at a distance of 2,000 yards. The gunners were not instructed as to the precise range, but were required to find it for themselves. An 8-inch shell was accordingly fired into the air as a trial shot, and this, despite the novelty of the target, sufficed to supply the gunners with the necessary information. The next shot brought down the balloon. The projectile was a shrapnell shell, and the fuse had been so well timed that the shell burst just in front of the balloon, projecting something like 300 bullets through the fabric, and causing its immediate descent.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Chard's Extra Heavy Machinery Oil.
Chard's Anti-Corrosive Cylinder Oil.
Chard's Patent Lubricants and Gear Grease.
R. J. Chard, Sole Proprietor, 6 Baring St., New York.
Lead Speaking Telephones, \$5 a pair. Illus. circulars or stamp. Agents wanted. Wm. R. Brooks, Phelps, N. Y.
Price Focus Gas Burner (50 per cent. more light from same amount gas), 30 cts. Mailed everywhere. J. Redington, 27 Park Place, New York.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can sent C. O. D. for \$5. A. H. Downer, 17 Peck Slip, New York.

Now is the time to paint your roofs. The genuine Asbestos Roof Paints have proven the best and most economical protective coating for tin roofs, iron work, exposed brick walls, etc. Send for samples. H. W. Johns Mfg. Co., 87 Maiden Lane, sole manufacturers.

Wanted—A First-class, Second-hand Planer, 42" x 42", to plane 16" to 18". Give full description. Noble & Hall, Erie, Pa.

Wanted—Live Manufacturing Company to Manufacture my Patent Thread Case in the United States on Royalty. Address E. L. Fitch, 1417 Locust St., Des Moines, Iowa.

Wood Working Machinery of Improved Design and Workmanship. Cordeman, Egan & Co., Cincinnati, O.

The great advantage of the genuine Asbestos Coverings for Steam Pipes, Boilers, etc., over any other forms of non-conducting coverings, aside from their superior effectiveness and fireproof qualities, is that they are manufactured in convenient form, ready for use, and can be easily applied without the aid of skilled labor. The H. W. Johns Mfg. Co., 87 Maiden Lane, New York, are the patentees and sole manufacturers.

All infringements will be prosecuted to the full extent of the law.

We unhesitatingly pronounce Messrs. Boomer & Boomer's Cider Press the best one in daily use at Am. Inst. Fair. New York Office, 15 Park Row.

Rubber Hose and Linen Hose, all sizes in stock and to order. Greene, Tweed & Co., 118 Chambers St., N. Y.

Pays well on small investments.—Magic Lanterns and Stereoscopes of all kinds and prices. Views illustrating every subject for public exhibitions and parlor entertainments. Send stamp for 116 page catalogue to McAllister, Mfg. Optician, 49 Nassau St., New York.

Contractors Supplies Co. First hands, 8 Liberty St., N.Y.

Metal Pattern Letters for Foundrymen, at reduced rates, made by H. W. Knight, Seneca Falls, N. Y.

Jenkins' Patent Gauge Lock; best in use. Illustrated circular free. A. W. Cadman & Co., Pittsburg, Pa.

Mr. Ely, of Afton, N. J., cut thirteen acres of heavy grass in five hours, July 2, with the Eureka Mowing Machine. It is the best mower made. Farmers send for illustrated circular to Eureka Mower Co., Towanda, Pa.

Parties desiring of contracting for the construction of Wells of extra large capacity, may address P. O. Box 1150, New Haven, Conn.

For Sale, on account of increase of power, one 29 x 48 Corliss Engine, with three boilers and equipment complete. Now in use, but deliverable in November next. For particulars address Natchez Cotton Mills Company, Natchez, Miss.

The E. Stebbins Mfg. Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

Nickel Anodes, Nickel Salts, Pumice Stone, Rouge, & Composition for Polishes. Greene, Tweed & Co., N.Y.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 322 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 14 Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, borders, etc., sent on receipt of \$2. Palm & Fechteler, 433 Broadway, New York City.

Packing once tried always used. Phoenix Packing from 1-15 up in spoons or on coils. Phoenix Packing Company, 109 Liberty St., N. Y.

Bake "Lion and Eagle" Imp'd Crusher. See p. 269.

Rubber Packing, Soap Stone Packing, Empire Gum Core Packing; quantities to suit. Greene, Tweed & Co.

Gas Machines.—Be sure that you never buy one until you have circulars from Terri's Underground Meter Gas Machine, 30 Dey St., New York.

Experts in Patent Causes and Mechanical Counsel Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsburg, Pa. Peck's Patent Drop Press. See adv., page 268.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, Limited, Erie, Pa.

Skinner & Wood, Erie, Pa. Portable and Stationary Engines, are full of orders and withdraw their illustrated advertisement. Send for their new circulars.

Eagle Anvils, 10 cents per pound. Fully warranted.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 51 Dey St., N.Y. Wiley & Russell Mfg. Co. See adv., p. 269.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hoghead Machinery, address H. A. Cross, Jr., Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

For Sale, ready for instant delivery, 16" x 42" Corliss Beam Engine, 16" x 2" wheel, thorough repair. Price, f. o. b. at tide water, in New England, \$1,250. S. C. Forsyth & Co., Manchester, N. H.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Light and Fine Machinery to order. Foot Lathe catalogue for stamp. Chase & Woodman, Newark, N. J.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr. & Bros., 331 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hoghead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For Patent Shapers and Planers, see ill. adv. p. 284.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna Lume, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, N.Y.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

H. A. Lee's Moulding Machines, Worcester, Mass.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 284.

For Mill Mach'y & Mill Furnishing, see ill. adv. p. 284.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 284.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 424, Pottsville, Pa. See p. 284.

For Separators, Farm & Vertical Engines, see adv. p. 220.

Steam Engines, Boilers, Portable Railroads, Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Air Compressors. Clayton Stm. Pump Wks., Bklyn, N.Y.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 300.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 21 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 301.

Gear Wheels for Models (list free); experimental and model work, dies and punches, metal cutting, manufacturing, etc. D. Gilbert & Son, 213 Chester St., Phila., Pa.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Houston's Four-Sided Moulder. See adv., page 301.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 141.

New Economizer Portable Engine. See ill. adv. p. 301.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 301. Totten & Co., Pittsburg.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Solomon's Parallel Vise, Taylor, Stiles & Co., Hightstown, N.J.

Vacuum Cylinder Oils. See adv., page 301.

NEW BOOKS AND PUBLICATIONS.

ANALES DEL MINISTERIO DE FOMENTO DE LA REPUBLICA MEXICANA. Tomo III. Mexico, 1880.

The beautifully printed, large octavo volume of 500 pages before us, forms the second part of the third volume of the *Annals of the Minister of Public Works*, and contains the reports made to that officer by various officials in charge of different departments of national scientific work. About one-third of the volume is devoted to reports of the scientists who were appointed to co-operate with Captain Shufeldt, U. S. N., in his reconnaissance of the Isthmus of Tehuantepec to ascertain the feasibility of constructing across it an inter-oceanic canal, and gives a narrative of the expedition, an account of the geology and flora of the Isthmus, the astronomical and topographical operations, and a discussion of the probabilities as to the construction of the canal there; the reports being illustrated with numerous topographical and geological maps and sketches. The other papers are: A report of the Engineer of Mines on an alleged deposit of tin in the State of Guerrero; an exhaustive report of the same official on the mines of Guadalupe, in the State of San Luis Potosi; a voluminous memoir by the Director of the National Astronomical Observatory of Chapultepec, showing the scientific work accomplished in that institution from its inception in 1875 up to December, 1879; and a report of the Engineer of Mines on the results of a geological and mineralogical exploration of the Sierra Mojada, illustrated with maps and with plates of the fossils observed. The volume as a whole is of considerable scientific interest, and is in every way highly creditable to the government officials of our neighboring republic, who are encouraging and vigorously pushing forward these valuable researches.

considerable scientific interest, and is in every way highly creditable to the government officials of our neighboring republic, who are encouraging and vigorously pushing forward these valuable researches.

MANUAL OF CATTLE-FEEDING. By Henry P. Armsby, Ph.D. New York: John Wiley & Co.

A treatise on animal nutrition and the chemistry of food-stuffs in their application to the feeding of farm animals. The work is based on the researches of Wolff Köhn, and other recent German investigators; and is intended not only to give such practical information as to economical stock feeding as may be of value to American farmers, but also such scientific instruction as shall enable the intelligent student to make good use of the results of new investigations.

THE PRINCIPLES OF THERMODYNAMICS, WITH SPECIAL APPLICATIONS TO HOT AIR, GAS, AND STEAM ENGINES. By Robert Röntgen. Translated and enlarged by A. Jay Du Bois, Ph.D. New York: John Wiley & Son.

In using the work of Röntgen in his classes in the Sheffield Scientific School of Yale College, Professor Du Bois has had occasion to supplement it with matter drawn from other sources. Among these additions, which appear in this volume, are two lectures by Professor E. Verdet upon the Mechanical Theory of Heat, an abstract of Pernolet's work on Air Compressors and Compressed Air Engines, and Zeuner's Theory of Superheated Steam.

HYGIENE AND TREATMENT OF CATARRH. By Thomas F. Rumbold, M.D. St. Louis: Geo. O. Rumbold & Co.

Sets forth in a plain and practical way such hygienic and sanative measures for the prevention and cure of chronic catarrhal inflammation of the nose, throat, and ears as the author's professional experience has proved to be beneficial to his patients. Much space is given to the influence of tobacco in predisposing to catarrhal diseases and preventing the cure of such complaints.

THE AUTHORSHIP OF THE FOURTH GOSPEL: EXTERNAL EVIDENCES. By Ezra Abbot, D.D., LL.D. Boston: Geo. H. Ellis.

Reproduces in convenient form the series of articles on this subject in the *Unitarian Review* of February, March, and June, 1880.

AMERICAN NEWSPAPER DIRECTORY, 1880. New York: George P. Rowell & Co.

From this directory it appears that there are published in the United States and British America, 10,287 periodicals, divided as follows: Daily, 904; tri-weekly, 69; semi-weekly, 147; weekly, 7,997; bi-weekly, 46; semi-monthly, 129; monthly, 921; bi-monthly, 17; quarterly, 57.

THE MECHANICAL TREATMENT OF THE MORE COMMON ABNORMAL CONDITIONS OF THE FOOT. By C. F. Stillman, M.S., M.D. 8vo, paper, pp. 16. Reprinted from the *Transactions of the Medical Society of New Jersey*.

Describes the physiological conditions which should govern the construction of mechanical devices for the treatment of weak ankles, inverted feet, and the common forms of club foot.

LIGHT AND HEAT. THE MANIFESTATIONS TO OUR SENSE OF THE TWO OPPOSITE FORCES OF ATTRACTION AND REPULSION IN NATURE. By Captain W. Sedgwick, R.E. London: C. F. Hodgson & Co.

On the basis of two or three simple observations, the meaning of which he misunderstands, Captain Sedgwick tries to make out that light and heat are the two all-controlling opposite forces in nature.

CIRCULAR NO. 3. BUREAU OF EDUCATION, 1880. Washington: Government Printing Office.

A valuable summary of the legal rights of children; the first part treating the rights of children in general; the second part giving a comparative view of the system of education in the different States.

SPONS' ENCYCLOPEDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. London and New York: E. & F. N. Spon. In 30 parts, 75 cents each.

Parts 12, 13, and 14 of the encyclopedia contain articles on coffee, cork, cotton manufacture, drugs, dyeing, electro-metallurgy, and explosives.

THE LOCOMOTIVE ENGINEER'S TORCH. By Frank C. Smith. New York: George H. Frost. pp. 59.

A pocket book of practical instruction for engine drivers. The author frankly defines its province as "simply to discuss such points of interest to the locomotive engineer as the writer happens to be acquainted with."

MANUAL OF HYDRAULIC MINING. By T. F. Van Wagenen, E.M. New York: D. Van Nostrand.

A useful little handbook for practical miners having no knowledge of hydraulic engineering, describing the conditions and methods of placer mining, the properties of water, construction of water ways, flumes, ditches, piping, sluices, etc.

SILVER AND GOLD TABLES. New York: Mathey, Kustel & Riote.

A series of tables showing the value of silver and gold per ounce troy at any degree of fineness. Also tables of weight, and tables for the calculation of assay values, as used by the New York metallurgical works.

THE AMERICAN SYSTEM—LATIN CHARTS WITH TEXT. By C. C. Schaeffer. Philadelphia: Charles Brothers & Co.

The first part of a series of text books on languages. The author holds that from ten to twelve hours' study of these charts will enable the student to "take up the text of Caesar and Virgil so as to handle it with understanding." His English style is intensely German, and his work is as unintelligible as anything that has ever come to our table.

KREMER'S GRAPHIC RAILWAY GUIDE FOR GREAT BRITAIN AND THE CONTINENT. Price one shilling. Paris, London, and Nice.

Contains a large number of skeleton tours in Europe, with sketch maps, official time tables of railways, steamboats, etc., and a considerable amount of information of use to travelers.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the *SCIENTIFIC AMERICAN SUPPLEMENT* referred to in these columns may be had at this office. Price 10 cents each.

(1) A. D. T. writes: We are lubricating our engine cylinder with winter strained lard oil. We wish to use the exhaust from engine. Can we, after condensing and cooling the water, float off the oil in the condensed water so it will not be tainted to the taste; or will we be compelled to filter the water? A. You can either filter the water, or exhaust through a coil, so that the oil carried over will not mix with the water. We think the latter is the better plan.

(2) C. M. R. asks how to keep moisture and ice in winter from forming and accumulating on plate glass stove windows. The size of the glass is about 4x11½ feet. A. The only really successful method of accomplishing this is to place a row of very small gas jets at the base of the window near the glass.

(3) D. R. S. writes: 1. I wish a simple practical rule to determine the proper sizes to make foot wheel or band wheel of foot lathe (when the cones of lathe head are given), so that when the belt is changed it will be proper length on all of the sizes. A. If the two shafts are a good distance apart, it is sufficiently correct to make the sum of the diameters of the two opposite pulleys the same or a constant quantity. For a full explanation of the subject consult "Gooden's Elements of Mechanism." 2. What is the best book or books published for a common scholar to complete the science of land surveying, as practiced by our ordinary surveyors? A. Write the industrial publishers who advertise in our columns.

(4) F. W. asks: Why is it that I can plainly see in the reflected image of Jupiter in a looking glass two of his moons, which I cannot see with the naked eye when looking at the planet without the aid of the looking glass? A. You do not see the moons of Jupiter as you imagine. The extra images are produced by the internal reflection of the planet in the body of the glass.

(5) R. H. G. asks: Can you give me through your paper a remedy for red ants? I have a house in which they fairly swarm, and cannot find anything that will drive them out. Have tried insect powder, bug poison, etc., without any good result. A. Turpentine or benzine used in small quantities is one of the best remedies, we believe. A good way to exterminate these pests is to place a sponge filled with water sweetened with molasses in the infested spot. It will soon become filled with the insects which may be killed with hot water. This operation repeated daily will soon accomplish the desired result.

(6) F. P. N. asks: What sort of lime is used in combination with flour for making moulds? A. Use good quicklime, a sufficient quantity to give the requisite hardness.

(7) H. A. asks: What is the highest incline a common locomotive can climb? A. A grade of 1 in 10, or 528 feet to the mile, is the heaviest grade ever worked by a locomotive having no artificial "grip" to the rail, but depending upon gravity for adhesion.

(8) H. H. McC. writes: In *SCIENTIFIC AMERICAN* of April 26, 1879, in an article on falence manufacture, on first page, it is stated Wedgwood was the first to discern that siliceous clay bleached by calcination, and that calcined siliceous clay bleaches clay. Now, what I want to know is this: If clay bleaches oil, which it will, and siliceous bleaches clay, why will not siliceous bleach oil? Do you know if calcined siliceous contains any bleaching or decolorizing properties similar to animal charcoal? A. Try it. The bleaching action of such substances on oils is mechanical. They are not under the circumstances, bleaching agents in a chemical sense. 2. Can calcined siliceous be bought in the market? A. Yes. 3. Is it sometimes called hydrate silica? A. No. 4. And if calcined, would it be more costly than animal charcoal? A. Weight for weight calcined silica is much cheaper. 5. How would you calcine it—that is, siliceous? A. Reduce it to powder and heat to bright redness in contact with air. 6. Sulphate of soda is used in making a soft quality of soap hard. Can you tell me what the proportions are to use it? A. 3 to 5 per cent of the calculated weight of alkali. 7. In the present volume of *SCIENTIFIC AMERICAN*, page 55, you speak of ice without freezing for skating rink, by mixture of chemicals. Could you give any instructions for making an experimental skating rink? A. Dissolve equal parts of carbonate and sulphate of soda in the smallest possible quantity of boiling water. The solution becomes solid by contact with cold air.

(9) H. S. asks: 1. Please let me know through the SCIENTIFIC AMERICAN what mineral wax is used for and what it is worth? A. It is chiefly valued for the paraffine which it yields, and its value depends upon the per cent of this substance which it contains. Refined paraffine is quoted at 20 cents per lb. 2 and 3. And what does a machine for making pins cost? How many different sizes of machines are there in a pin factory? A. Address dealers in such machinery who advertise in the SCIENTIFIC AMERICAN. See Knight's New Mechanical Dictionary for descriptions, etc.

(10) A. P. R. asks: What is the horse power of a boiler of the following dimensions: fire box 4 feet long, 3 1/4 feet wide, and 3 1/4 feet high, with 113 tubes, 1 1/4 inch hole, and 11 feet 10 inches long? A. Your boiler is out of proportion, except for forced combustion; too little grate for the tube surface. It would be about 50 horse power.

(11) R. W. asks: 1. In making a cistern, is it necessary that the coat of cement should be permitted to get perfectly hard and dry before fitting the cistern? A. No, if the cement be a hydraulic cement. 2. If water be permitted to fill a cistern, with the cement still moist, will the water be pressed through the coat of cement, and thus spoil it; or will the cement grow hard and make a good cistern, notwithstanding the pressure of the water? A. Not if properly cemented. It will grow hard, but it is better to let it harden before the water is put in. 3. Can you give us the title of a book from which we could derive the necessary knowledge for building good cisterns? A. We know of no book which treats on the subject specially; "Beckwith's Hydraulic Lime and Test" will give you general information respecting the use of hydraulic limes.

(12) C. O. S. asks how to soften sheet cork so as to make it pliable and easily shaped in an oval shape. A. Steam it thoroughly, or boil it in water for an hour or so.

(13) F. N. asks how to make a gas that will inflate small balloons in country towns where there is no ordinary burning gas. A. Place a quantity of zinc scraps in a bottle, pour over them a mixture of sulphuric acid and water, and hydrogen gas will be rapidly evolved. Convey this gas through a wash bottle to your balloon. This experiment should not be performed in the vicinity of a light or fire.

(14) G. A. H. asks: 1. What is the most constant galvanic battery now made; how long will it remain active by one charging; and how many cells are required of such to produce the electric light (moderately powerful)? A. The gravity or Daniell. They remain in order from 6 to 9 months. It would require 100 cells to produce a small light. 2. Why is graphite not suitable for the carbons? A. Because of its inferior conductivity. 3. Can mica be colored like stained glass, and if so, by what process? A. Apply lacquer tinted with aniline or other transparent colors.

(15) W. S. D. says: This morning, as engine 265 on the B. & O. R. R. was about five miles from here, the fireman went out on the front to put the head light out; but when he opened the door of the head light the wind seemed to fan the flame, and in an instant the whole thing was afire. He returned to the car for water, which seemed to have no effect on the burning oil. The engineer was compelled to stop his train and open his cocks on it after they had taken it down. A. The body of the oil in some way, doubtless, became heated above the inflaming point.

(16) E. S. asks: 1. What is the difference between a cape and a chipping chisel in shape and average width of cutting edge? A. A cape chisel is a narrow edged chisel, the cutting edge being from one-eighth inch to three-eighths inch wide. A chipping chisel is for work on surfaces, and is generally from three-quarters of an inch to one and a quarter inch wide. 2. Are cold chisels and chipping chisels the same, or is there a difference? A. Same thing. 3. What is a good width for the cutting edge of a scraper? A. Depends upon the kind of work. 4. Is ten or eleven feet per minute a proper speed for drilling wrought and cast iron, both of good quality? A. Ten to fifteen feet, depending upon the kind of drill and character of the metal.

(17) C. D. A. asks: 1. Is it of any advantage to an engine to reverse it every six months or year; that is, let it run six months in one direction, then six months in the other? A. It would equalize the wear. 2. How do you tell the condition of boiler iron with a hammer, or by giving it what is called the hammer test? A. By the sound. 3. Where, in Michigan, can an engineer be examined to obtain a license? A. At Detroit, and, we believe, at Port Huron.

(18) "Student" asks: 1. If three pine logs, twenty-five feet long, fifteen inches diameter at small end, would have buoyant capacity enough to hold a boat's crew weighing about 700 lb? A. Yes, if white pine. 2. Would one inch iron bolts be heavy enough to hold them together, if bolted to heavy cross pieces? A. Yes.

(19) P. J. M. asks: 1. What power is required to work a Cornish pump, 20 inch stroke, 8 inch discharge pipe, situated in a mine the shaft of which is 70 feet deep? A. If the pump makes 12 strokes per minute, 6 horse power, and for any other speed in proportion. 2. What power is requisite to hoist 800 lb. 70 feet per minute, that is from the same shaft? A. 17 horse power. To these powers should be added at least 25 per cent for friction. 3. What size engine and boiler would be required to perform both these duties at the same time? A. An engine of 30 horse power.

(20) D. H. writes: 1. I have a hull, 35 feet long, 10 feet beam, draws 36 inches. Now, what size engine do I need? A. Engine 8 inches diameter by 8 inch stroke. 2. What size propeller? A. Propeller 42 inches diameter.

(21) G. H. C. asks: If a vessel is filled with steam at 60 lb. pressure per square inch, then placed in a furnace of 1,000° temperature; supposing that the vessel is absolutely steam tight, will the pressure in vessel rise as the temperature rises, and what will be

the pressure in said vessel per square inch when raised to 1,000°? A. Yes; it will increase in pressure about 1/10 for every degree of increased temperature; in other words, an increase of 400 degrees would double the pressure.

(22) C. W. S. writes: I have a telephone line 1,300 feet long, and have for alarm vibrating bells to be worked by six cells of Leclanche battery. What are the proper connections and switches? I wish to use one wire, with ground connections at each end. A. To use a single wire for your purpose you will have to divide your battery and place three cells at each end of the line. For calling use at each end of the line a key that grounds the line when raised, and connects the line with the battery when depressed. Now, your bells being in the ground wire outside of the keys, pressing the key at one end of the line will ring the bell at the other end of the line, and vice versa. Connect your telephone with the ground wire, and arrange a switch that will cut the battery and bell out of the line, and at the same time direct the battery current to the transmitter, and the secondary current of the induction coil to the line. The receiving telephone should be connected with the secondary wire of the induction coil, between the latter and the switch which connects it with the line.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. S.—Galena—lead sulphide.—G. W. K.—Sulphide of iron.

COMMUNICATIONS RECEIVED.

On Science and Revelation. By P. S. H.
On Cause of Diseases. By L. H. K.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
Granted in the Week Ending
October 12, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1836; but at increased cost, as the specifications not being printed, must be copied by hand.

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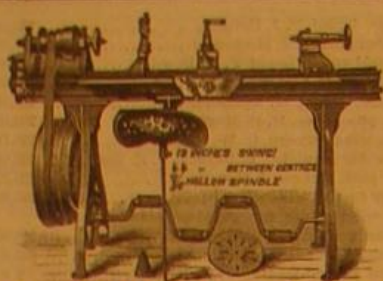


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As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of such locks and keys for the purposes of the mails, the Postmaster General prescribes no model or sample for bidders, but relies for a selection on the mechanical skill and ingenuity which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

Specifications of the conditions and requirements relating to proposals, samples, contract, etc., as well as forms of proposal, will be furnished on application by letter to the Second Assistant Postmaster General.

No proposal will be considered unless it shall have been submitted in accordance with such specification and forms.

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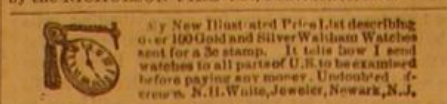
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