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SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

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[NEW SERIES.]

NEW YORK, JULY 3, 1880.

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AGRICULTURAL INVENTIONS.

Mr. Sterling A. Millard, of Clayville, N. Y., has invented a scythe blade that contains much less weight of metal and possesses equal or greater strength than the ordinary scythe blades. It is made in the usual manner from what is termed by scythe makers a "scythe rod," and is wrought and shaped in such form that a proper thickness is left to serve as the back of the blade. A longitudinal auxiliary rib or supplementary back is formed on the blade, which stiffens the scythe without requiring the same weight of metal as those of the usual construction.

Mr. George C. Winslow, of Kalamazoo, Mich., has patented an improvement in spring harrow teeth, which consists generally in hinging the harrow tooth in the forward end of a rectangular frame bolted to the harrow bar, and combining therewith a spring, which at its back end is clamped to the harrow bar by the same bolts which secure the rectangular frame, and which spring then curves upward and forward, and then down through the slot or opening of the rectangular frame, and is jointed at its extremity, near the bottom of the harrow tooth, so that its tension serves to throw the harrow tooth forward, but allows it to yield to obstruction.

A Rare Specimen Lost.

Captain Ingalls, of the schooner *Chalcedony*, has let slip an opportunity to make a small fortune and at the same time settle the long vexed question as to the reality of the elusive and possibly mythical sea serpent. His story, as told in the *Argus*, of Portland, Maine, June 8, runs as follows:

"Last Saturday, about one o'clock in the afternoon, we were slowly sailing past Monhegan, there being very little wind, about twenty miles southwest of the island, when we caught sight of what looked like a large schooner floating bottom up. As the object lay almost dead ahead, we made directly for it, but before we got very close a Cape Ann schooner lay to and sent a boat's crew to inspect what now plainly appeared to be a monstrous carcass of some species or other. We finally hove to, about a ship's length off, and took a leisurely survey of the thing. It was dead, and floated on the water, with its belly, of a dirty brown color, up. Its head was at least twenty feet long, and about ten feet through at the thickest point. About midway of the body, which was, I should guess, about forty feet long, were two fins, of a clear white, each about twelve feet in length. The body seemed to taper from the back of the head down to the size of a small log, distinct from the whale tribe, as the end had nothing that looked like a fluke. The shape of the creature's head was more like a tierce than anything I can liken it to. I have seen almost all kinds of shapes that can be found in these waters, but never saw the like of this before.

Two years ago, off Seguin, I saw shooting through the water a thing which, I think, resembled this creature considerably, but I didn't get close enough to it to say for certain. The men from the Cape Ann schooner got on this dead creature, and one of

the boys cut a double shuffle on its belly, which for all the world looked like the bottom of a schooner covered with barnacles and seaweed by the weather. We should have towed the thing to Portland had there been any wind, but as there wasn't, we steered away and left it. What sort of a sea monster this was I can't say for sure, but in my opinion it was the original 'sea serpent,' which has been seen once in a while for years past, and which, when alive, was too swift a swimmer for any sailing vessel to get alongside of."

The report of the captain of the "Cape Ann schooner" will be in order now.

SIMPLE AND CHEAP PROCESS OF GAS MAKING.

When a current of air is passed over the surface of gasoline it becomes carbureted or charged with its vapors to saturation. Air thus charged is somewhat heavier than pure air, and when passed through an Argand or bat's wing burner, it burns with a brilliant white flame. Nothing would seem easier than to make a machine that would force a current of air through, over, or on some material saturated with gasoline, and this apparently simple process has led many into attempts to make a successful gas machine. Many fortunes have been spent by the unscientific in the chase after this, to them, *ignis fatuus*. The stumbling block which has wrecked so many enterprises in this line has been the cold produced by the evaporation of the gasoline. One pound of gasoline, in passing from a liquid to a vapor, requires

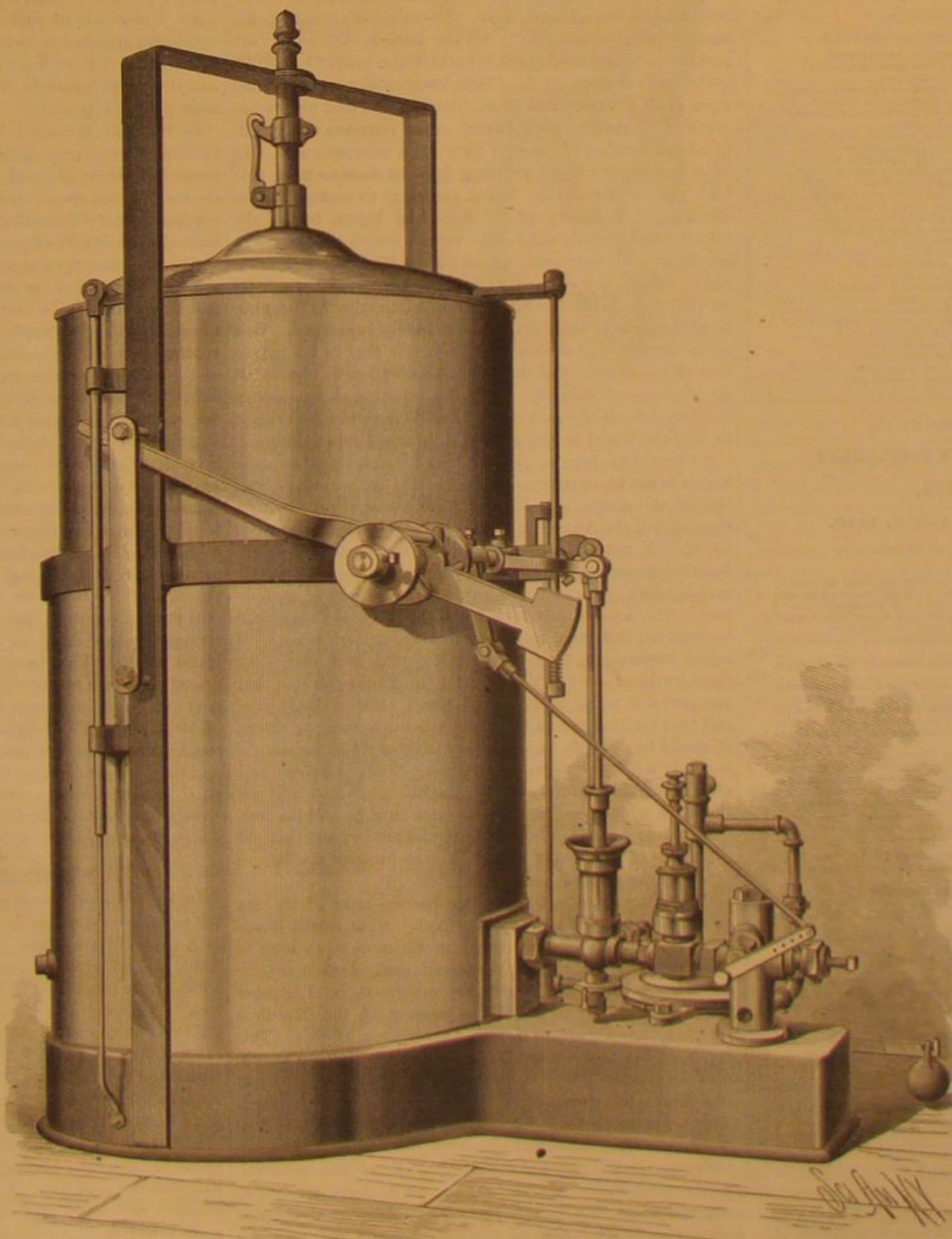
about as much heat as would be required to melt two pounds of cast iron. It is therefore obvious that where no heat is supplied, the gasoline, air, and machine must soon become very cold when any considerable quantity of gas is being made. The heat must come from somewhere, and as none is supplied, it is taken from the apparatus, air, and gasoline, making them very cold. A beautiful and simple experiment to illustrate this refrigeration can be made as follows: Place a gill of water in a common washbasin, then pour over it one pint of light gasoline; shake the basin, and blow the liquids vigorously, when very soon the basin will become intensely cold—the water will freeze, and may be taken out in the form of a snowball. If the water and basin are hot, and the experiment performed in a hot room or in the sun, it is much more striking.*

This refrigeration operates upon the gas as follows: Air will take up and hold in suspension any volatile liquid in proportion to the square of its temperature, so that when the temperature of the gasoline and air have fallen off one half, the quantity of gasoline in the air has fallen off three quarters, and the light is destroyed. The quality of the gas in such machines varies from a rich smoky flame to a pale blue and blowing flame in a short time. Every change of quality in the liquid, temperature of the apparatus, or number of burners used causes a vexatious change in the quality of the gas. If heat is applied at the right time and in the right quantity it is not so bad, but too much

heat, or neglecting to regulate it properly, converts the machine into a still, the condenser of which is the pipes of the building lighted, when danger is added to vexation. About ten years ago a machine was illustrated in these columns that obviated all these troubles; it was the invention of the well known mechanical engineer, Hiram S. Maxim, of this city. His machine was on an entirely new principle, and has since gone into general use. It was intricate and somewhat expensive, but it performed its work well. Messrs. A. T. Stewart & Co. use them largely in their mills and hotels. Mr. Maxim made one of six thousand burner capacity for the Grand Union Hotel, Saratoga Springs, it being the largest gas machine ever built. It has supplied gas of an unvarying quality for six years, and is as good as new to-day.

To reduce the cost as far as possible, Mr. Maxim has designed a new machine on another principle, which we herewith illustrate. Fig. 1 shows the machine in perspective, and Fig. 2 is a sectional view. The vertical cylinder is a common gas holder of sheet brass. It is 36 inches in diameter for a thousand burner machine. The operative parts of the machine are best shown in the sectional view, which represents the portion of the machine called the injector. A is a steam chamber supplied with four or more pounds of steam through the pipe, K. B is the gasoline supply pipe, and C the air supply. D is an index valve. The operation is as follows. Steam being in the chamber, A, the descent of the holder opens the valve, M, and allows the steam to

* This experiment should not be tried in the vicinity of a gaslight or fire.



MAXIM'S NEW GAS MACHINE.

[Continued on page 4.]

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NEW YORK, SATURDAY, JULY 3, 1880.

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THE SUPERIORITY OF AMERICAN WATCHES.

The extract from the report of the judges in horology, at the Sydney International Exhibition, with the diagrams showing the comparative merit of the watches tested, given on other pages of the current issue of the SCIENTIFIC AMERICAN, cannot fail to interest our readers. There were ten exhibitors, and the inherent and comparative merits of the various exhibits were rated under ten heads on the basis of 100 points "for the highest degree of excellence." There were British, German, French, Swiss, and American competitors; and while the scores of the nine European exhibitors footed up totals ranging from 76 to 686, their average being 389, the total of the Waltham Watch Company was 981. In detail this remarkable score stood thus: Originality, 98; invention and discovery, 95; utility and quality of material, 95; skill in workmanship, 93; fitness for purpose intended, 100; adaptation to public wants, 100; economy, 100; cost, 100; finish and elegance of cases, 100; time-keeping qualities, 100. Total, 981.

The timekeeping tests were made, as the report points out, by Prof. H. C. Russell, Astronomer Royal at the Sydney Observatory; and it is especially noted that while the majority of the watches tested had been made for exhibition purposes, and specially prepared for that end, the exhibit of the American company was the ordinary and regular product of the factory, such as is finished every day. Another evidence of the superiority of the American system, as emphasized in the report, is the fact that a sixth grade Waltham watch, one of the cheapest tested, showed a better performance than many very expensive and otherwise first class watches of other makes.

The moral of the victory is happily drawn in the following editorial review of the contest and its lessons, by the Sydney Morning Herald of April 14, last:

"The report of the judges in horology, which we published on Saturday last, was a document of more than ordinary interest. The slightest glance at it will show that the judges brought no small amount of ability and industry to their task. In many other classes of exhibits judging must, to no small extent, be a matter of opinion. There is no absolute test by which one photograph, for example, or one oil painting can be decided to be superior to another. In exhibits of this kind much must be left to the taste of the critic. Watches and chronometers, on the other hand, can be submitted to the minutest tests. The care and trouble which these require are not small, but the issue is sufficiently important to warrant all the labor which the judges in horology brought to their work. Time-keepers that can be relied upon in all weathers and in all climates, and that are within reach of all classes, are a luxury of no common order, but to a large number of persons they are a necessity also. In these fast days, when everything must be done to time, it is for a variety of purposes found necessary to make accurate divisions, not merely of the days and hours, but of the minutes and seconds also. The verdict which the judges in our Exhibition have pronounced on the Waltham watches is one of which any company might be proud; but the facts on which the verdict is based are as interesting to the public at large as to the parties immediately concerned. One of the secrets of American progress lies first in the invention of machinery, and then in its application to almost all descriptions of industry. It is the bringing of machinery to every branch of watchmaking that is enabling Americans to beat the world in this as well as in many other things.

"There has been a general belief that a machine-made watch is not to be compared to one that is hand-made, and that on this account the English watch must always hold its own against the American. This belief will have to be given up, if it is not given up already. It has now been established that machinery can be used for the purposes of watchmaking with quite as much success as for those of agriculture. The Americans are showing that they can make better watches than the Swiss or the English, but, what is of equal importance, they are showing that they can make them for less money. The boast of the Yankees is that they can turn out work cheaper and better than anybody else, and that for that reason the world must take their products. It would be difficult to prove that in some departments the boast is wholly without foundation. The American mechanic is paid better than the English mechanic, and yet the work which he turns out can, as a rule, be sold for less. The reason is, not only that he works harder, but that the assistance of machinery enables him to produce the largest result by the smallest amount of labor.

"Mr. Brassey, who believes that the workmen of his own country are equal if not superior to any in the world, maintains that an English mechanic can do more work than an American mechanic. The American really does more, because the inducements to industry are greater, and because he has better machinery. The success of the Waltham Company has furnished a striking instance of this. This company has now not only well-nigh driven foreign watch-making companies out of America, but it has shown that it can more than compete with them on their own ground. This arises partly from the fact that it can turn out the best work on a large scale, but also from the fact that the principle on which it operates enables it to do all this economically. The Waltham Company claims to have arrived at simplicity, uniformity, and precision in the manufacture of watches, and the report of our judges shows that its claim is well founded. One of its discoveries was that a simple instrument, where simplicity is possible, will cost less and be worth more than a complicated one. Another was that

the making of all instruments of the same grade exactly alike, so that the part which belongs to one belongs to the whole, will not only facilitate manufacture, but will greatly economize it. A third was, that these properties of simplicity and interchangeability are the best guarantees of perfect exactitude. The success which the Americans have reached in this as well as in other branches of industry, ought to excite the gratitude rather than the jealousy of the world. Any company or nation that shows how a "maximum of efficiency can be reached by a minimum of labor confers a benefit on mankind. This our American cousins have done in other spheres besides that of watchmaking. There are branches of the prosperity of the Americans that are traceable to the extent of their territory and the fertility of their soil; but the triumph of their machinery has been the result of their inventiveness and of their enterprise, and for that reason it points a moral that Australians might profitably observe."

A REMARKABLE LITTLE STEAMER.

There is soon to set sail from London for New York a new and remarkable little steamer of 70 tons gross burden, named the Anthracite, designed to exhibit the advanced engineering ideas of Mr. Loftus Perkins, of England. The distinctive peculiarities of this steamer are the very high steam pressure that she carries—350 to 500 lb. to the square inch, and the small consumption of fuel—one pound of coal per hour per horse power. A trial trip of this new little boat was lately made of 46 miles, during which 350 lb. steam pressure was steadily maintained, 132 revolutions per minute of propeller, and a speed of eight knots per hour. Other vessels, some of larger size than the above, have been built on the Perkins system, and are running in England. One of them, the yacht Emily, carries 500 lb. boiler pressure. Most of our readers are familiar with Mr. Perkins' system, which has been fully described in our columns. Those who may wish to refer thereto are directed to an interesting article by Mr. Perkins, with engravings, published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 81, July 21, 1877; also to the description of the steam ferry boat, run on this principle, given with three pages of engravings in our SUPPLEMENT No. 217.

Engineering theory and practice have for a long time plainly pointed to high steam pressures as one of the surest ways to economy of fuel. Twenty five years ago our ocean steamers carried only 16 lb. pressure to the inch, and burned 5 to 6 lb. of coal per hour per horse power. To-day they are carrying 75 lb. pressure, and burning 2½ to 3 lb. of coal per hour per horse power.

In 1840 the Britannia, one of the finest steamers of the Cunard line plying between this country and England, burned 5,291 lb. of coal for each ton of paying freight she carried, her speed, then considered fast, being 8½ knots per hour. In 1877 the Britannic, speed 15½ knots per hour, burned only 551 lb. of coal per ton of freight carried.

Although our present steamers are making fast time and are very economical as compared with the earlier vessels, still it is a lamentable fact that on the largest and finest of them, furnished with all the latest improvements and best appliances to secure economy, worked by the most careful and intelligent engineers, we succeed in putting into our steam only about one tenth of the heat realized in our boiler fire, the remaining nine tenths of the heat being lost. Only in proportion as we make our steam hotter, and expanding it more, shall we economize in fuel. In this respect the voyage of the Anthracite is designed by her owners, we presume, to be an eye-opener for steamboat owners, not only in this country but throughout the world. If a little bit of a boat like this, 84 feet long, 16 feet beam, and 10 feet deep, can carry its own coal and water across the Atlantic, with a pressure of 350 to 500 lb. to the inch, and on one pound of coal per horse power, the natural inference is that our great steamers, when fitted on the same system, will realize far better results. The change from three pounds of coal to one pound per horse power means a saving of two thirds in the coal bill, which is always an enormous item in the expenses of large boats. We ought to add that another peculiarity of the Anthracite is that she uses the same boiler water over and over, only a trifle of fresh water being supplied to make good the slight waste. Our New York steamboat men, who have to pay so dear for Croton water, will be likely to examine the water tank of the Anthracite with interest.

A STRANGE EPIDEMIC.

On the night of Tuesday, June 15, a remarkable epidemic fell upon several towns in western Massachusetts, the town of Adams suffering most severely. Out of a population of 6,000, several hundred—variously estimated from 600 to over 1,000—were prostrated by a disease resembling cholera morbus. The symptoms were first dizziness, then great nausea, followed by vomiting and prolonged purging, and in some cases delirium. A belt of country two or three miles in width and several miles long was thus afflicted, beginning at the west, the whole number of victims being estimated at from 1,200 to 1,500. No deaths are reported.

The cause of the epidemic is not known, but seems most likely to have been atmospheric. For some time the weather had been dry and hot. A heavy local rain fell during the evening, and was followed by or attended with a sudden and great lowering of the temperature. A chilly fog hung over the belt of country invaded by the disease, and a heavy "swampy" odor and taste were in the air.

The malady reached its climax in about twenty-four

hours. It was first suspected that the water supply had been somehow poisoned, but many people who had not used the water were prostrated, while others who used it freely escaped. Adams has hitherto been regarded as an exceptionally healthy town, and the surrounding country is high and wholesome.

CANNONADING OF OIL TANKS.

On the morning of Friday, June 11, lightning struck an oil tank belonging to the Tidoute and Titusville Pipe Line, at Titusville, Pa. The fire thus kindled, raged until Sunday night, consuming 200,000 barrels of oil, crude and refined, and destroying property to the amount of \$1,500,000. The most appalling feature in this fire was the successive "boiling over" of oil from burning tanks of the liquid. To empty rapidly a tank containing 20,000 barrels of oil, while the latter is on fire, is no easy matter. The pipes connected with the tanks were utterly inadequate to remove the oil rapidly enough to rob the "boiling over" of its terrors. A happy thought suggested itself on Friday to Mr. D. R. Herron, of the Titusville Battery. Obtaining permission, Mr. Herron brought out one of the Parrott guns of the battery, loaded it with solid shot, and began firing against the three-eighths iron sheets of the distant blazing tank. The first shot glanced, but subsequent volleys pierced the shell of the tank, releasing a large quantity of oil that otherwise would have fed the flames. The battery then moved on to the Emery tank, also burning, and lastly to the Acme tank. Large rents were made in all these, and the liberated oil ran harmlessly down into a stream. This novel target practice greatly shortened the duration of the fire at these tanks, and so drained them that the flames died out for want of fuel, and no "boiling over" resulted.

The peculiar attraction for lightning which these iron oil tanks appear to possess has been several times referred to in our columns. Whenever a thunderstorm passes fairly over one of them it seems to be devoted to destruction. Millions of dollars' worth of property have thus been destroyed. No practical safeguard has yet been suggested.

Ordinary buildings, when properly provided with rods that are well grounded in the earth, are comparatively safe from lightning. Structures made of iron and simply resting upon the earth, without rods, are also exempt from electrical damage. Such structures always present a continuous body of conducting material for the free passage of electricity to earth. Why is it, then, that iron oil tanks form such conspicuous exceptions to our common experience with lightning? Rods put on other structures save them; but rods have been put on oil tanks, masts with rods have surrounded the tanks, but the tanks were exploded by lightning all the same.

We will repeat a possible explanation which we have heretofore given. From every oil tank, according to our theory, there is a constant escape of light hydrocarbon vapor, which forms a permanent cloud or column, rising to a great height above the tanks, far above any rod that could be erected. This vapor rod is a conductor, which the lightning naturally follows, sets on fire the vapor, and explodes the tank.

A column of heated air or vapor rising from a chimney is well known to be a conductor for lightning; the rise of hydrocarbon vapors is illustrated by the balloon.

If the theory we have outlined is correct, the remedy for the electrical explosion of oil tanks is to be found in such a treatment of the oil, or such a construction of tank, as shall prevent any escape of the light vapors.

NAVIGATION IN FOGS.

The disastrous collision of the Sound steamers Narragansett and Stonington was quickly followed by one at sea, by which two great passenger ships escaped instant destruction almost by a hair's breadth.

Shortly after noon, Monday, June 12, the National Line steamship Queen, bound from London to New York, and within 300 miles of her journey's end, ran into the Anchor Line steamship Anchoria, on the way from New York to Glasgow. The bow of the Queen struck the Anchoria on the port side, about twenty feet abaft the foremast, smashing a great hole through the iron hull. Two compartments of the Anchoria filled immediately, but the partitions stood firm, and the other compartments sufficed to keep the vessel afloat. The bow of the Queen was badly crushed, and her forward compartment was flooded. Fortunately the bulkhead proved staunch, and the ship was saved. The fog was very thick, and both ships were going at full speed. It is said that the captain of the Anchoria mistook the whistle of the Queen for that of the Anchoria's companion vessel, the Victoria, which left New York at the same time, and was probably not far away, and before the error was discovered the ships were too close to avoid the catastrophe. Had the sea been rough or the partitions less staunch, both ships must have gone to the bottom almost instantly.

The passengers of the Anchoria were transferred to the Queen, which was least hurt, and the two ships sailed together for New York, arriving Tuesday noon.

These two collisions, coming in such quick succession and imperiling so many lives, give terrible emphasis to the dangers attending navigation in foggy weather. They make very pertinent also the query whether the means now employed for discovering the position and nearness of unseen vessels are at all commensurate with the necessities of the case, or with the means already known, and known to be well calculated to prevent such dangers. In a dense fog

the ordinary ship's light is visible scarcely more than a ship's length; and as it proved in the case of the Narragansett and Stonington, the time between thus sighting an approaching vessel and the instant of collision is fatally brief. The recent test of electric headlights for ships in this harbor clearly demonstrated the possibility of projecting a beam of electric light through the densest fog for a thousand feet or more, and through ordinary fogs a distance several times as great.

Except in very rough weather the steam whistle can be heard a long distance, but it is liable to be a treacherous guide. It is not always possible to determine by the ear alone the direction from which a sound comes; and it would seem that a mistake of this nature was made on the Stonington, since the order intended to change her course away from that of the Narragansett only served to precipitate the collision. Had the whistle of the Queen signaled her course it could not have been mistaken for that of a ship sailing in the opposite direction, and the safety of two great floating hotels and their occupants would not have been imperiled thereby.

Means for the better penetration of fogs, for determining the direction of unseen sources of sounds, and for enabling steamers to announce to all within hearing the course they are pursuing, seem therefore to be imperative necessities on shipboard. The first is furnished by the electric headlight, with a system of projection similar to but more efficient than that used on locomotives. The last would be provided by an efficient code of whistle signals to indicate the several points of compass. The second need is supplied by the instrument figured in the accompanying illustration.



PROFESSOR MAYER'S TOPOPHONE.

The aim of the topophone, which was invented and patented by Professor A. M. Mayer, last winter, is to enable the user to determine quickly and surely the exact direction and position of any source of sound. Our figure shows a portable style of the instrument; for use on ship-board it would probably form one of the fixtures of the pilot-house or the "bridge," or both. In most cases arising in sailing through fogs, it would be enough for the captain or pilot to be sure of the exact direction of a fog horn, whistling buoy, or steam whistle; and for this a single aural observation suffices.

Every one has twirled a tuning fork before the ear, and listened to the alternate swelling and sinking of the sound, as the sound waves from one tine re-enforce or counteract those from the other tine. The topophone is based upon the same fact, namely, the power of any sound to augment or destroy another of the same pitch, when ranged so that the sound waves of each act in unison with or in opposition to those of the other.

Briefly described, the topophone consists of two resonators (or any other sound receivers) attached to a connecting bar or shoulder rest. The sound receivers are joined by flexible tubes, which unite for part of their length, and from which ear tubes proceed. One tube, it will be observed, carries a telescopic device by which its length can be varied. When the two resonators face the direction whence a sound comes, so as to receive simultaneously the same sonorous impulse, and are joined by tubes of equal length, the sound waves received from them will necessarily re-enforce each other and the sound will be augmented. If, on the contrary, the resonators being in the same position as regards the source of sound, the resonator tubes differ in length by half the wave length of the sound, the impulse from the one neutralizes that from the other, and the sound is obliterated.

Accordingly, in determining the direction of the source of any sound with this instrument, the observer, guided by the varying intensity of the sound transmitted by the resonators, turns until their openings touch the same sound waves simultaneously, which position he recognizes either by the great augmentation of the sound (when the tube lengths are equal), or by the cessation of sound, when the tubes vary so that

the interference of the sound waves is perfect. In either case the determination of the direction of the source of the sound is almost instantaneous, and the two methods may be successively employed as checks upon each other's report.

It is obvious that with such a help the pilot in a fog need never be long in doubt as to the direction of a warning signal; and if need be he can without much delay, by successive observations and a little calculation, determine, approximately at least, the distance of the sounding body.

EFFECT OF AGE ON THE QUALITY OF IRON.

Professor Bauschinger, in 1878, tested iron taken from a chain bridge built in 1829, and found that fifty years of use had not perceptibly altered its quality—either its strength or its elasticity—as reported at the time of its erection. He also examined metal from another bridge built in 1852, and found that the average quality remained as given by Von Pauli at the time of its erection.

Professor Thurston, testing pieces of the wire cable of the Fairmount Suspension Bridge, recently taken down at Philadelphia, after about forty years' use, found the iron to have a tenacity and elasticity and a ductility fully equal to the best wire of same size found in the market to-day.

He therefore concludes that iron subjected to strains such as are met with in properly designed bridges does not deteriorate with age.

A COLLISION BETWEEN LARGE PASSENGER STEAMERS.

During a fog near midnight, June 11, two of the large passenger steamers plying on Long Island Sound, Stonington line, between New York and Boston, came in collision, while running at considerable speed. One of the boats, the Narragansett, was struck near the middle, her side cut open, and a smoke-pipe knocked over, which made a down draught through the furnace, driving out a great sheet of burning gas into the cabins and between decks, by which the vessel was set on fire, at the same time the opening in her side caused her to begin to sink. Some three hundred passengers were on board, and a frightful scene of confusion followed. Happily there was a plentiful supply of life-preservers, some life-rafts, and a few life boats. There was delay in lowering the boats, but the rafts, life-preservers, chairs, and other floatables served to support most of the unfortunate people, who, to escape the flames, were obliged to leap quickly into the water. About fifty lives were lost; the remainder were rescued by boats from another steamer, the New York, also by help sent from the other damaged vessel, the Stonington.

It seems remarkable that so many were saved. This calamity illustrates the necessity for further effort on the part of inventors to discover new and improved means for fog signaling, saving life, preventing the spread of fires, and keeping vessels afloat. Most of the large local steamers that communicate with New York are veritable palaces, built regardless of expense, and supplied with every known reliable appliance for safety; but the occurrence of accidents like this and their disastrous results show that much remains to be done before navigation, even upon smooth waters, can be considered secure.

The life-rafts of the Narragansett seem to have proved more useful than the life-boats in rescuing the drowning people, the rafts being more quickly and easily launched, requiring less skill, etc.

The upperworks of our river and Sound passenger steamers consist at present of a mass of light, dry woodwork, forming cabins that are very comfortable and commodious for travelers, but highly dangerous in case of fire.

The collision of river steamers above described was followed a few hours later by a collision between two great ocean steamers, accounts of which we give in another column.

Honors to an Aged Chemist.

The chemists of Germany are collecting money for the purpose of presenting a gold medal to Prof. Woehler on his eightieth birthday, which will be July 31, 1880. Prof. Woehler is one of the most distinguished as well as the oldest of living chemists. Himself a pupil of old Berzelius, a contemporary of Liebig, and the loved instructor of many of our best chemists, his name is equally respected on both sides of the Atlantic. Profs. Jay and Chandler, of Columbia College, New York city, two of his former pupils, are receiving contributions from those who wish to join in this well deserved memorial.

Perseverance under Difficulties.

A good lesson to young people inclined to exaggerate the hindrances to their success in life, and to think that their chances are too poor to justify honest exertion, is furnished by a young colored man of Columbus, Ohio, F. P. Williams by name, now serving in that city as census enumerator. Several years ago he was run over by a train of cars, his arms being so mutilated that both had to be taken off near the shoulder. Lacking hands he learned to write legibly by holding his pencil between his teeth. He writes quite rapidly, and in his work as enumerator takes an average of 200 names a day.

MAXIM'S NEW GAS MACHINE.

[Continued from first page.]

escape through the jet, L. This produces a partial vacuum at L, and draws air in at C. The air and steam pass with great rapidity through the tube, G. The action of the air and steam produces another partial vacuum at N, which draws gasoline in through the pipe, B. The adjustment of the opening is such that one pound of steam draws in air sufficient for two pounds of gasoline. The heat of the steam is taken up by the refrigeration caused by the evaporation of the gasoline, so that at E the compound is carbureted air and cold water. The tube, F, presents the curious phenomenon of being hot at a and cold at b. In one short piece of tube we have a hot retort and a cold condenser. The supply of gasoline is regulated by the valve, D. The dash pot, H, prevents a too rapid action of the valve, I. Gas of any desired density may be made, and when once adjusted the gas does not vary. The burner used with this machine is made to produce the very best results attainable, and then the gas is regulated to a density and pressure to suit the burner. The nuisance of an adjustable burner is thus obviated.

The holder closes off the supply when full, and lets on a supply when nearly empty. Gasoline has been much improved within a few years. It is now so very cheap that the equivalent of one thousand feet of coal gas of standard quality may be equalled for sixty cents. Where no steam is at hand these machines are run with a small oil burner. They are being made by the Pennsylvania Globe Gas Light Co., 131 Arch St., Philadelphia, Pa., of from 100 to 10,000 burner power. This machine was patented June 8, 1880.

PREVENTION OF BOILER EXPLOSIONS.

This vexed problem has occupied the minds of engineers and inventors since the introduction of steam as a motive power, and there are several theories of boiler explosions, each having its adherents. Of course there are conditions under which a boiler explosion is involved in no mystery; as, for example, when the water is dangerously low, when the safety valve is of insufficient capacity, or when it is unduly loaded; but there are other cases where an explosion cannot be rationally explained in the light of the well known theories.

Mr. Daniel T. Lawson, of Wellsville, Ohio, has recently patented, in this and several other countries, a device for preventing boiler explosions, which appears practical, and according to the testimony of scientific men the claims of the inventor are well founded.

The inventor, in explaining his invention, says that when water is superheated it becomes as explosive as gunpowder, exploding by bursting into steam from a reduction of pressure. When the engineer opens the throttle valve the cylinder is instantly filled with steam, creating a vacuum to that extent in the boiler. The superheated water then immediately rises to fill the vacuum, and is met by the valve, instantly cutting off the escape into the cylinder; this causes a concussion on every square inch in the boiler much greater than the regular pressure of the steam. There is abundant reason to believe that it is this concussive action which causes the numerous and mysterious boiler explosions, and which cause is wholly independent of the amount of water in the boiler; in fact, the greater the amount of water in the boiler the more terrific the explosion.

This invention, which is based upon this theory, consists in reducing the concussive strain produced by the impulsive and intermittent escape of steam to the cylinders to an approximately uniform pressure, by rendering the evolution or passage of steam from the water to the steam space approximately constant and independent of the intermittent discharges from the steam space to the cylinder. The means for accomplishing this consist in a boiler constructed with a partition, A, intervening between the water space and the space from which the steam is taken to supply the cylinder, and feeding the steam as it is generated through valves or

moved from the water immediately under it, consequently the water rises through the valve. A number of small openings for the liberation of steam from the superheated water will remedy this difficulty.

MISCELLANEOUS INVENTIONS.

Mr. Niels C. Larsen, of Sacramento, Cal., has patented a purse or satchel fastening which can be securely locked and present a smooth and unbroken surface without projections.

A combined dental speculum and shield has been patented by Mr. Alfred W. Edwards, of New York city. The object of this invention is to facilitate the performance of dental operations, such as the filling of teeth. It consists in a combined dental speculum, gag, and shield formed of a flaring or bonnet-shaped shell of metal, having a longitudinal slot in its lower side to receive the teeth, and an arched wire attached to its lower part, upon the opposite sides of the forward end of the slot, to rest upon the teeth and support the forward part of the shell.

An improved coupling for the shafts of a wagon, which can be readily fastened to or unfastened from the axle, has been patented by Mr. William W. French, of Stockbridge, Mass. The invention consists in the combination with the axle clip and knuckle joint of a sliding bearer and spring catch to facilitate the opening and closing of the coupling.

Mr. Joseph Kintz, of West Meriden, Conn., has patented an improved process for bronzing iron surfaces, which consists in cleaning and buffing the iron surfaces, then electro-

plating with copper, then dipping in acid solution, then again buffing, then boiling in a salt of tin solution, and then finishing by subjecting the article to heat until the copper and spelter coatings are fused into bronze.

A simple device for extending the steps of passenger cars, for the convenience of passengers getting in and out of the car, and for protecting at the same time the treads of the permanent steps from sparks, cinders, snow, etc., during the passage of the car from one station to another, has been patented by Mr. Benjamin F. Shelabarger, of Hannibal, Mo.

Mr. Luther C. Baldwin, of Manchester, N. H., has patented a new and improved automatic heat regulator, simple in construction and so arranged as to operate, under the small changes of temperature, upon the valves of the source of heat.

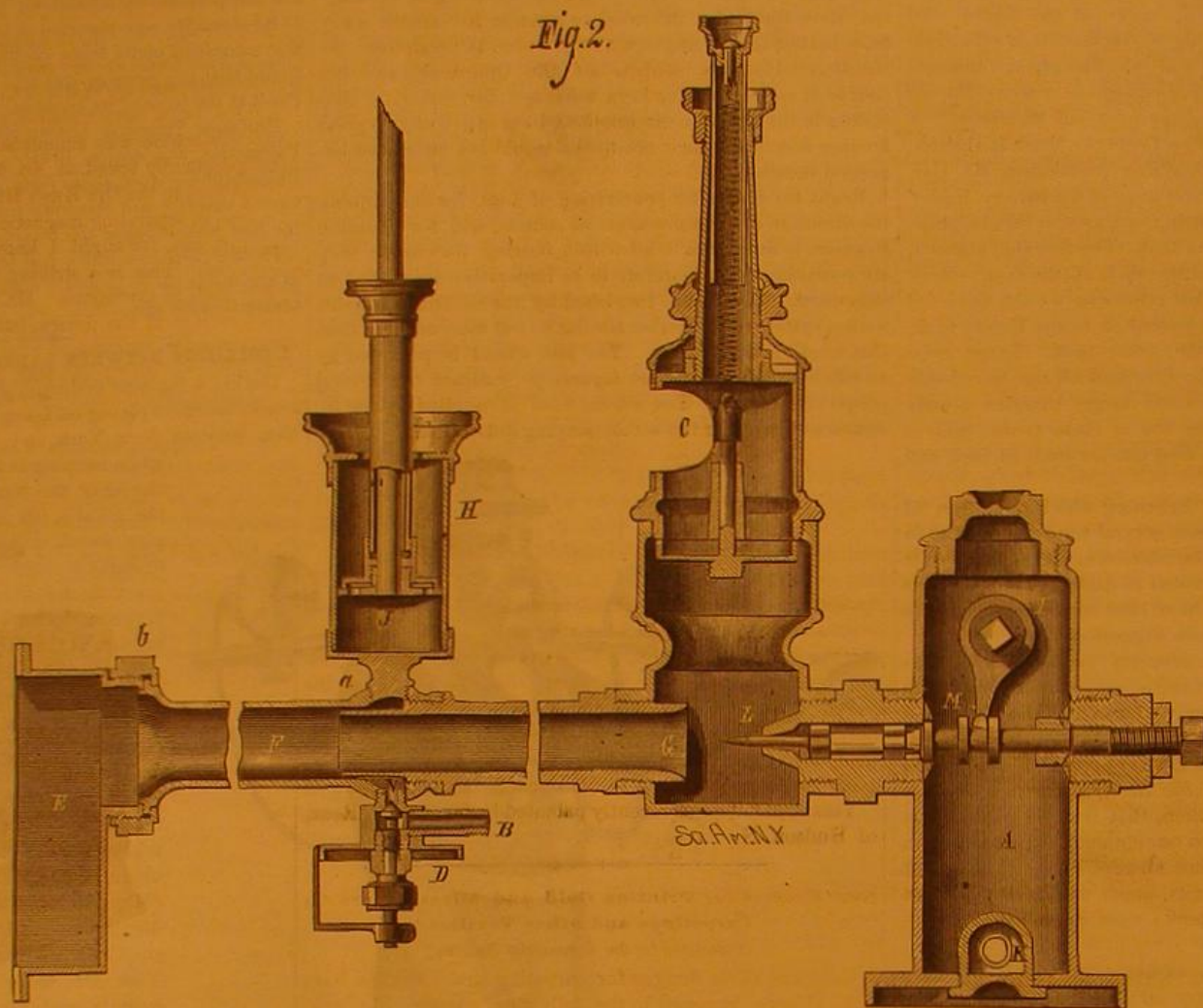
An improved cigar lighting stand has been patented by Mr. Joseph Kintz, of West Meriden, Conn. This improvement relates to lamp stands for cigar lighting, and has for

its object the production of a stand of ornamental character which may be packed closely for transportation and readily put together for use.

A simple, safe, and efficient device in which light oils may be used as fuel for heating sad irons for domestic use, or for the use of tailors, dress-makers, etc., has been patented by Mr. Harvey L. Wells, of Evansville, Ind. It consists essentially of an iron box divided longitudinally into two chambers, the lower being the combustion chamber and the upper the heating chamber.

An improvement in electric light has been patented by Mr. Charles J. Van Depoele, of Detroit, Mich. The object of

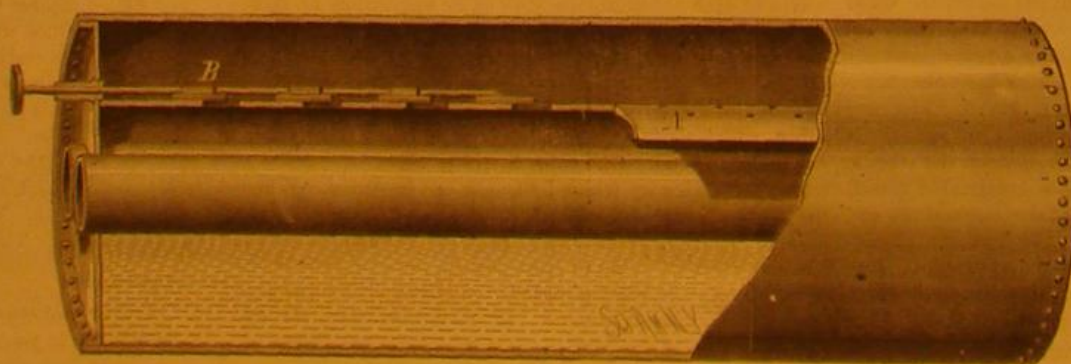
this invention is to automatically regulate the feed of the carbon in electric lights according to the changes of resistance in the current caused by the consumption of the carbon points, so as to prevent flickering and variations in intensity of the light.



MAXIM'S GAS MACHINE—SECTION OF INJECTOR.

orifices, B, in the partition, of a smaller size than the port or opening through which the steam passes into the cylinder. By this means the normal steam pressure or steam supply, when thus intermittently or alternately reduced, is restored gradually by reducing the flow from the water space to the steam space, so that the transformation of water into steam is made approximately uniform in spite of the intermittent escape of steam through the cylinders, and the boiler is thus relieved of the constant wear and strain of the concussion.

In supplying steam from the water compartment to the steam compartment, the inventor intends using a number of small perforations, not amounting in the aggregate to more than about one twentieth the size of the cylinder port, in connection with a number of small valves to be under control of the engineer, so that the amount of steam required can be readily regulated, yet carefully avoiding the possibility of all, when opened to their utmost capacity, forming as large an opening as the valve through which the cylinder is supplied. A number of small valves and perforations in



LAWSON'S IMPROVED STEAM BOILER.

the partition sheet between the water and steam compartments, will remedy that hitherto very general annoyance of water rising to and through the valves, which is occasioned by pressure of steam upon the surface of the water, and when one large valve is opened, the pressure is partly re-

Chloroforming during sleep.

The possibility of chloroforming a person in sleep, without waking him, having been disputed in a recent murder trial, Dr. J. V. Quimby, of Jersey City, was led to test the question experimentally. The results were presented in a paper before the section of medical jurisprudence at the meeting of the American Medical Association a few days ago. Dr. Quimby made arrangements with a gentleman to enter his room when he was asleep and apply chloroform to him. He did this with entire success, transferring the person from natural to artificial sleep without arousing him. He used about three drachms of Squibb's chloroform, and occupied about seven minutes in the operation. The second case was a boy of thirteen who had refused to take ether for a minor operation. Dr. Quimby advised the mother to give the boy a light supper and put him to bed. She did so, and Dr. Quimby, calling when the boy was asleep, administered the chloroform and performed the operation without awakening the boy. The third case was a boy of ten years suffering from an abscess, and the same course was pursued with equal success. Two important inferences may be drawn from these cases, Dr. Quimby said. Minor surgical operations may be done with perfect safety and much more pleasantly than in the ordinary way, and, secondly, a person somewhat skilled in the use of chloroform may enter a sleeping apartment and administer chloroform with evil intentions while a person is asleep. Hence the use of this drug in the hands of a criminal may become an effective instrument in the accomplishment of his nefarious designs.

IMPROVED WATERING DIPPER.

A convenient vessel for watering plants, sprinkling floors, and for other similar purposes is shown in the annexed engraving. It is simply a dipper of the usual form, partly covered at the top by a shield, at the center of which is fixed a sprinkler spout. The utility of this improvement will be

**HARRISON'S WATERING DIPPER.**

recognized without further description. It was recently patented by Mr. R. Harrison, of Columbus, Miss.

IMPROVED ELECTRIC LAMP.

The lamp shown in the engraving will be recognized as an Edison lamp, the vacuum globe and the carbon horseshoe being the principal elements. Mr. John H. Guest, a well known electrical inventor of Brooklyn, N. Y., judging from his own experience in fusing platinum with glass in the manufacture of thermostatic fire alarms, concluded that the principal trouble with the Edison lamp would be the entrance of air around the wires passing through the glass of the vacuum globe, devised a simple plan of sealing the joint between the wires and the glass by means of mercury, thus interposing an effectual barrier to the entrance of air at that point.

The invention is so clearly shown in the engraving that scarcely a word of explanation is necessary. In the lamp shown in Fig. 1, the wires that convey the current to the carbon horseshoe are sealed in the ends of curved glass tubes communicating with the globe, and these joints are inclosed in small globes formed on the ends of the glass tubes and filled with mercury.

In this lamp Mr. Guest has made provision partially or wholly preventing the circulation of air, should any remain in the globe after exhaustion with the air pump. The device by which this is accomplished is simply a small globe connected with the lower portion of the lamp globe by a contracted passage, the theory being that the cooler and heavier portion of the air will be drawn into the auxiliary globe by its own gravity.

Fig. 2 shows a lamp in which the tubes that support the wires extend downward into the lamp globe. These tubes at their junction with the vacuum globe are fused to the platinum conducting wires, and the tubes act simply as lateral supports to the wires inside the globe, allowing the wires to expand freely lengthwise. The tubes are sealed outside the globe in the manner shown in Fig. 1.

Another improvement made by Mr. Guest consists in inclosing the ends of the platinum wire conductors in the ends of the material of the carbon before it is carbonized, the wire being formed into a loop to increase the conducting surface and to insure a good connection with the carbon,

**Fig. 1.****Fig. 2.****GUEST'S IMPROVED ELECTRIC LAMP.**

oilcloth, and woods and metals. The bronze thus printed dries very rapidly, and cannot be taken off by oil or water, unless they are boiling. It bears light and heat equally well, and especially sulphureted hydrogen, which has such a destructive effect on bronzes put on in the form of powder. It is recommended to thin the mass by an addition of warm water, 10 to 20 per cent, so as to keep it from becoming too hard during the process of printing. An addition of glycerine or sirup, of 5 to 10 per cent, will be even preferable. The bronze color remaining on the printing forms can be taken off by warm water.

APPARATUS FOR PRESERVING FRUIT.

The annexed engraving represents a simple apparatus for preserving fruit in its natural state, by means of a partial vacuum. The vessel is especially designed for the purpose, and is provided with an absorbent which takes up whatever moisture may emanate from the fruit. The vessel is pre-

**FRUIT-PRESERVING APPARATUS.**

ferably made of glass or earthenware, and is provided with a cover having a packing ring and a device for receiving the stems of the fruit. The cover is secured to the vessel by an adjustable screw clamp. In the bottom of the vessel there is an absorbing ring made of burnt or dried clay, which absorbs the moisture escaping from the fruit. The air in the vessel is rarefied either by heat or by the application of an air pump to the opening in the bottom.

This apparatus was recently patented by Mr. Carl J. Renz, of Hudson, N. Y.

New Process for Printing Gold and Silver Colors on Carpetings and other Textiles.

(Translated for the *Commercial Bulletin*.)

Gold and silver designs for carpeting and oilcloths have been hitherto prepared in the following manner: The gold or silver were put in leaves or bronze powder on the designs, which were printed with a varnish of linseed oil, or similar adhesive. The bronze thus attached did not possess much firmness, and the method was necessarily expensive. The method recently adopted by Wohlforth is as follows: The bronze powder is united at once to printing material. The liquid silicate of potash, or of oxide of sodium, answers this purpose. One part, by weight, of gold, silver, or bronze powder, along with two parts of the silicate, will give a print color, which is easily transferable by rollers to paper,

The Edison Ore Separator Not New.

To the Editor of the *Scientific American*:

In your issue of June 19, 1880, I notice an illustration of an electro-magnetic ore separator invented by Mr. Edison, and patented June 1, 1880.

A device absolutely identical with this has been in use for the past ten or fifteen years at the emery works at Chester, Hampden county, Mass. I there saw it in use myself in November, 1876, and was informed, I think by Mr. Ames, that it was not patented, and that no valid patent could be granted upon it by reason of its long continued public use.

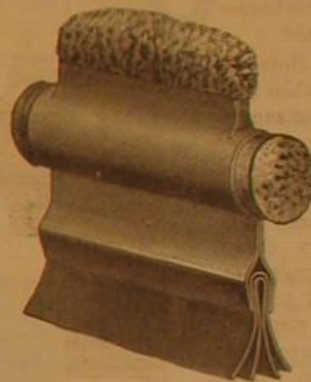
My uncle, John S. Williams, of this city, president of the Ore Knob Copper Company, had heard of the machine, and sent me to Chester with a view to purchasing the right to use it at the Ore Knob Copper Works, in Ashe county, North Carolina. On my return to Baltimore I had the magnets constructed by Watts & Co., electricians, on November 24, 1876, for a large machine, similar to the one at Chester, which machine was completed about December 10, 1876, and practically tested at No. 52 Commerce St., Baltimore. It was sent to the Ore Knob Mine about Christmas, 1876, to be used in separating magnetic oxide of iron from the copper ore, and, for aught I know to the contrary, is in use there yet. This is a striking instance of how history repeats itself in inventions. Mr. Edison is doubtless an original inventor of the device, but he most certainly is not the first inventor.

R. D. WILLIAMS.

Baltimore, Md., June, 1880.

NOVEL SLATE WASHER.

Few articles meet with a readier sale or more promptly remunerate the inventor than the class of inventions adapted to the use of children either in their school life or in their amusements. One of these useful little novelties is shown in our engraving. It is a slate washer, consisting of two

**SMITH'S SLATE WASHER.**

pieces of metal stamped up so as to form a holder for the sponge at the top and the cloth drier at the bottom. They also form a tubular receptacle containing a supply sponge, which is moistened by removing the corks at the ends.

This invention was recently patented by Mr. Jacob A. Smith, of Salem, Ohio.

The Utilization of Genesee Falls.

The plan to furnish Rochester, N. Y., with power for manufacturing and for running street cars through the utilization of the falls of the Genesee in compressing air, was described in this paper some weeks ago. All the power of the lower falls, save what is needed to run two wheels for factories already in operation, has been purchased by the inventor of the system, and a promising beginning has been made. According to the *Rochester Union*, a large gang of men are at work building the crib just below the falls on the east side of the river in a cove which seems to have been made by nature for this purpose. This foundation is 100 feet long by 75 feet wide, and will have an average depth of 13 feet. It is being constructed of solid logs of oak timber bolted together, and the center will be filled with stone. On the top of the crib will be erected the derrick, 125 feet high, and the water will pour into it from the top of the falls through the bulkheads at one end of the dam. The stand pipes will run from the top of the derrick to the cylinders on the crib, which will be in the neighborhood of 500 feet long. The whole machinery will be roofed in. The difficulty in the way of getting the materials to the place, they all having to be lowered over the falls, makes the work of construction somewhat slow. It is expected,

however, that the first application of the system to the propulsion of street cars will be possible in September next.

Stevens Institute of Technology.

The commencement exercises took place on June 16 and 17, and were of a very interesting nature. On the 16th President Henry Morton delivered an able address before the graduating class on "Popular Fallacies in Engineering." We intend to publish the address in full in our next week's SUPPLEMENT.

NEW PORTABLE SHOWER BATH.

We give herewith perspective and sectional views of an improved portable shower bath, recently patented by Mr. James E. Vansant, of Covington, Ky. It consists of a spherical vessel, having at the bottom a supporting rim which admits of setting it on the floor when occasion requires. The top is provided with a screw cap, perforated with numerous small holes for discharging water in fine streams. In the center of the cover there is a filling tube, which extends nearly to the bottom of the vessel. A float is provided to indicate when the vessel is filled, and shot contained in the two side tubes serves as ballast to keep the device either in an upright or inverted position.



Fig. 1.—VANSANT'S PORTABLE SHOWER BATH.

The vessel is pivoted in a light jointed frame that admits of hanging it up or setting it down. In use it is tipped by means of the cords attached.

Mines and Railroads of Leadville.

To the Editor of the Scientific American:

Nearly every person interested in geology sets up a theory of his own with regard to the carbonate deposits of Leadville, immediately on arriving in this famous district. There is, however, but one theory which has been generally adopted by scientific men, formulated by W. S. Keyes, General Manager of the Chrysolite Iron and Little Chief Mines, and substantiated by the mute testimony of the fossil remains that fix the geologic data. The theory is substantially as follows:

A shallow sea overspread this entire region. An even bed of limestone, dolomitic, was formed by the myriads of shell-fish that subsisted in this shallow sea. From some natural convulsion the waters flowed off, leaving the sedimentary deposits. Subsequently the porphyritic rock flowed over the surface in a pasty mass, covering the limestone. There then followed two processes of ore making. The first was through the mineralizing action of heated and ore depositing waters, coming up out of the depths, and impregnating and permeating the hanging and foot walls of the contact. No free oxygen was contained in these waters; neither did they carry any chlorides or chlorobromides,

wherein consists the present richness of Leadville's ores; but in the first process the ore was entirely in the form of sulphurets.

The second process was initiated by the uplifting of the mountain ranges to their present height, at which time the diorites, those ore indicators of the globe, uprose through the sedimentary strata. Thus was the original surface of deposit bent and folded, and not unfrequently entirely broken. The surface waters carrying free oxygen and free carbonic acid now penetrated along the contact, and oxidized the sulphurets, which formed free sulphuric acid, giving rise to the sulphates and sulpho-carbonates. The irresistible law of gravity distributed these sulphates, these oxides, and these carbonates in vast bonanzas, that have been the wonder of the world. The fossil trilobites of this region identify it with the silver lead districts of Nevada, Utah, and Mexico. It is not anomalous, but simply richer than its sister regions to the West and South.

The output of ore from the Leadville mines last year (1879) aggregated 122,483 tons, which represents a value of \$11,477,046. That is to say, there was an average yield at \$90 per ton, or just \$31,443.96 each day. On the first day of May of the present year (1880), the returns from thirty-seven of the leading mines gave a total daily output of 899½ tons of ore, yielding, at the low average of \$90 per ton, something like \$80,955 per day. The world's history of silver mining in the past shows nothing like this for so young a camp. Scarcely a month passes without opening up some new and vast carbonate deposits. The territory has not even been thoroughly prospected; and the future yield of the royal metal will far eclipse its past production.

It might not be uninteresting in this connection to give something regarding the sampling and milling of ores. One of the most complete concerns engaged in this business anywhere in the country is that of Augustus R. Meyer & Co. This establishment has grown with the growth and development of this carbonate district. The business was first established as long ago as the year 1877 (before Little Pittsburg was dreamed of). A little log-house, a relic of seventeen years previous, was found sufficiently ample for the needs of the business of that period. However, it was not long before additions had to be made and new buildings erected. In the year 1879 the present company was incorporated with a capital stock of \$50,000, and every preparation that money and business sagacity could effect was made to meet the demands of the prosperous era, that has built a mining metropolis 10,240 feet above the sea level, at the base of the great continental divide. As at present constituted the premises of the company comprise seven and one-half acres of ground, upon which six buildings have been erected, including ore houses and crushing and sampling buildings. During the busy season of summer from thirty-five to forty men are employed, who alternate their work in two shifts, day and night. At this season it frequently happens that the ore houses, which hold 1,500 tons, are insufficient for the accommodation of the mineral sent from the mines to be crushed, and large quantities have to be stored outside. In sampling ores from the various mines about Leadville this establishment pursues the most careful methods. The different ores are first deposited in large bins holding from 25 to 100 tons. One-tenth of each load is taken and run through a Dodge crusher, which well adapts it for the furnaces. A fifth of the tenth already indicated is put through heavy rollers, and one half of this finely crushed ore is subjected to the Bucking hammer and powdered to an eighty-sieve grade. One sample of this powder, consisting of a fourth, is given to the miner, two samples are kept for reference, and the other is sent to the assayer, who takes his "assay ton," upon which the company buys and sells. The capacity of the works are all the way from 80 to 150 tons

per day. For samples, \$7.50 is charged for silver and lead per ton, and \$10 per ton for gold; but in large quantities a less charge is made. In job crushing, the market value of silver is allowed, with from five to ten per cent deducted. The Meyer works enjoy an excellent patronage from the best mines of the camp, including such as the Chrysolite, Carbonate, Vulture, Duncan, Matchless, Climax, Morning Star, Crescent, and J. D. Dana, some of which have all their crushing done at these sampling works.

RAILROADS.

In order to furnish better transportation facilities for the mineral of this district, and to emancipate it from the freight embargo that has virtually fettered its commerce, citizens of



Fig. 2.—SECTION OF SHOWER BATH.

Leadville have determined to construct a broad gauge railway down the Arkansas Valley to Pueblo. This will enable Leadville merchants to ship goods through from the East without breaking bulk, and lay them down in their warehouses as cheaply as the same commodities could be laid down in Denver. This will insure Leadville the control of the business of the Gunnison country, whose mineral developments are spoken of in the highest terms. Propositions from Eastern railroad contractors have already been received, preliminary surveys have been made, and \$200,000 guaranteed to the stock subscription. It now seems to be only a question of what method to pursue in constructing the road.

Growing out of the broad gauge movement, to some extent, two or three narrow gauge enterprises have been organized. One is projected from Leadville to Salt Lake City, following the carbonate belt, as shown in Hayden's Geological Map, around through the Eagle River, Roaring Fork, and White River Agency districts, into Utah. Such men as H. A. W. Tabor and C. B. Rustin stand at the head of this project. Another narrow gauge road is organized to be built into the "Ten-Mile" and Breckenridge districts, where the famous Robinson Mine is located. Should the broad gauge be built this summer to Pueblo, there is little doubt but that narrow gauges would ramify out from Leadville into every mineral bearing gulch that was found accessible. W. Leadville, May 6, 1880.



AUGUSTUS R. MEYER AND COMPANY'S ORE MILL.

MECHANICAL INVENTIONS.

Mr. William B. Hickman, of Sterling, Kan., has patented a swage to be used in welding the triangular bar which is to form the flange of a plow point or share to the body of the same.

Mr. Lucius S. Edleblute, of Cincinnati, O., has recently patented what he calls the rubber cushioned spoke and hub. This is an improvement in the class of vehicle wheel hubs having an elastic band or annular portion which surrounds the journal box and on which the butts of the spokes rest, so that the wheel is rendered elastic and more durable, also comparatively noiseless when running on stony pavements, roads, or streets.

Mr. George Richards, of Roxbury, Mass., has patented a steam muffler composed of two plates of a diameter very much greater than the diameter of the pipe through which the steam escapes from the boiler, so that the steam has room to expand before escaping to the outer air, its expansion effectually deadening the noise caused by the passage through the contracted escape pipe.

The Baby Elephant takes a Bath.

It is customary with traveling menageries in hot weather when convenient to a river to allow the elephants to take a bath. The London Circus passed through Woonsocket, R. I., the other day, when the keeper let loose all the elephants, including "Hebe" and her baby, for the above purpose. The mother and her offspring were permitted to approach a river for the first time since the baby was born, and they were, therefore, watched with great interest by their keeper. The mother cautiously approached the Blackstone River, which flows past the circus grounds, and waded in a short distance, carefully feeling her way; she then encouraged the baby to follow her, which the obedient little fellow did. When far enough in the mother caught the baby between her fore legs, and then lay down in the water and rolled over, giving the baby the first bath. The mother then felt perfectly satisfied with her job, and rising up approached the bank, bringing the little one with her. On reaching terra firma she drove the younger before her, and would not allow it to approach the water again, though it showed a disposition to do so.

PHYLLIRHOE BUCEPHALA.

This little animal belongs to the family of snails, class Heteropoda, is about an inch long, and is devoid of any shell or covering whatever. It is flat, and so absolutely transparent that a person can read through its body. It is provided with a pair of feelers. The little animal is very luminous if placed in fresh water or disturbed, but this phenomenon is most beautiful when an ammonia solution is poured over the animal. It will shine with a vivid blue light, which extinguishes with life. But even after death the nerve cells, which are directly below the skin and produce the light, can be irritated sufficiently to become luminous. It is a singular fact that electricity has no effect upon these nerve cells.

Care of Trees and Shrubs.

In view of the drought which prevails in many parts of the country and its unusual severity over extensive districts, the *Rural New Yorker* suggests to those who have planted trees or shrubs the past spring that there is one method, and so far as we know, says the writer, only one, by which they may be protected against injury or death from that cause. Surface watering has been shown to do more harm than good. The ground is made hard and compact, thus becoming a better conductor of heat while it becomes less pervious to air and moisture. A portion of the surface soil should be removed, and then pailful after pailful of water thrown in until the ground, to a depth of two feet and to a width about the stem of not less than three feet in diameter, has become saturated. Then, as soon as the water has disappeared from the surface, the removed soil should be well pulverized and returned. A covering of boards, straw, or hay, or even of sand or gravel, may then be applied, and the tree or shrub, thus treated, will pass through ten days of additional drought in safety.

As soon as rain comes to wet the earth thoroughly, we think it is better to remove the mulch. Nothing is then gained by permitting it to remain. Mellowing the surface soil about the trees, thus keeping it free from grass and weeds, is then the most that is needed. We would repeat that the present is the season when the female borer deposits her eggs on the stems of fruit trees, and the wash of lime,

potash, sulphur, etc. (darkened with lamp black), should now be applied and reapplied during June and July, as soon as washed off by rain.

THE FORCE OF TREE GROWTH.

The disruptive power of tree roots, growing in the crevices of rocks, is well known. Masses of stone weighing many



THE FORCE OF TREE GROWTH.

tons are often dislodged in this way from the faces of cliffs, and no one gives them more than a passing glance. When, however, the sanctity of the tomb is invaded, despite the graven warning of the occupant, the case is very different, and superstitious people are apt to think there must be some-

by country people, who come from great distances to examine it.

The monument, so unfeelingly disrupted, was erected in 1782, and bears on its base the following inscription: "This grave, which was bought for all eternity, must never be opened." A chance birch seed, lodging in a crevice of the monument, has displayed the irony of nature in slowly yet surely thwarting the desire of the person who designed it for a perpetual memorial. All the joints are separated, the strong iron clamps are broken, and the birch tree has embraced the upper large block, which weighs about one and a quarter tons, and the tree is driving its roots below, gradually but surely tilting the structure.

Perseverance with the Drowned.

In a recent communication to the French Academy, Professor Fort asserts that he was enabled to restore to life a child three years old, by practicing artificial respiration on it four hours, commencing three hours and a half after apparent death. He mentions also a case in which Dr. Fournol, of Billancourt, reanimated, in July, 1878, an apparently drowned person by four hours of artificial respiration begun one hour after the patient was taken from the water. At this season, when cases of drowning are apt to be frequent, the possible benefit that may come from a persevering effort to revive victims of drowning, should encourage friends not to despair of their resuscitation, even after several hours of seemingly fruitless labor.

Simple Test for Chloral Hydrate.

A new test for chloral hydrate has been devised by Frank Ogston, namely, yellow sulphide of ammonium. On adding this reagent to a solution of chloral of moderate strength there is at first no change noticed, but in a short time the colorless solution acquires an orange yellow color, and on longer standing turns brown and evolves a gas of very disagreeable odor. Ogston's experiments show that a solution containing ten milligrammes turns brown in six hours, and gives the peculiar odor. With one milligramme the orange-yellow color appears in twelve hours, but no odor. Croton chloral gives the same reactions, but chloroform, chloric ether, and formic acid do not.

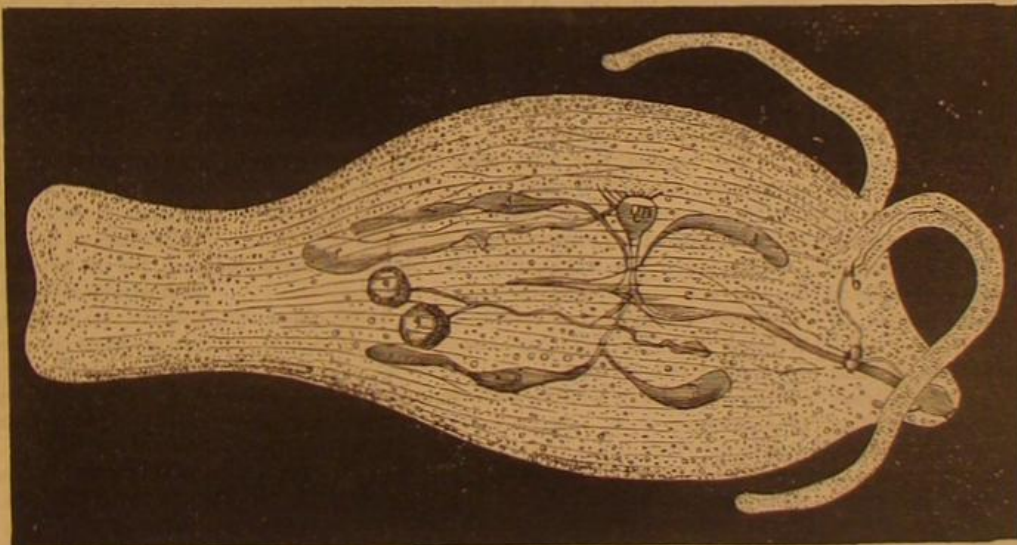
NATURAL HISTORY NOTES.

The Propagation of Oysters.—At the recent meeting in this city of the American Fish Cultural Association, a paper was read on the propagation of the oyster, by Dr. W.J. Brook, of the Johns Hopkins University. The manner in which this propagation takes place had never before, he said, been thoroughly understood. Through studies made by him last summer, however, great light was thrown on the subject. He found that the American oysters do not breed their young in the shell, as had been supposed, and that consequently the eggs can be impregnated artificially. An average oyster contains from six to nine million eggs, and one of large size may contain fifty millions. The plan pursued by him in fertilizing these eggs was to chop the male and female oyster up together; thus the fluids are mixed and the impregnation is made complete. The process of development immediately begins, and goes on so rapidly that a change may be noted every fifteen seconds. In a very few hours the embryo is sufficiently formed to swim in the water. The shells at first are very small, and are not adjacent to each other. They grow very rapidly, closing down over the sides, and finally unite and form the hinge. In the short space of twenty-four hours the young oyster is able to take food, and from three days to a week it attains perfect form. During its early life it is a swimming animal. The oyster is able to reproduce its species at the end of a year's growth, and it is marketable at the age of three years.

S. P. Ruggles.

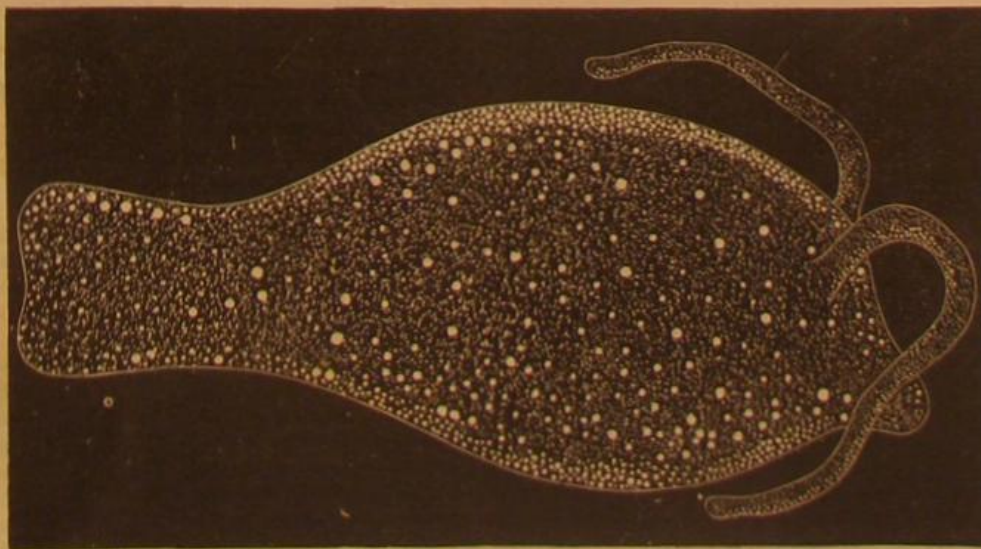
S. P. Ruggles died at Lisbon, N. H., May 28. He was principally known as the inventor of the Ruggles printing press, which was among the first of machine presses. His invention was what printers call an "upside-down press," the type being upside down when in the bed. About twenty-five years ago Mr. Ruggles sold out his interest

for nearly \$200,000, and since then has not been in active business. He was the inventor of the raised alphabet for the blind, and always showed great interest in the amelioration of the condition of the sightless. He was also a great friend of mechanical education, and has written much on the subject.



PHYLLIRHOE BUCEPHALA—AS SEEN IN THE LIGHT.

a b, ganglion; c, intestines; d, liver; f, kidneys; g, generative organs.



PHYLLIRHOE BUCEPHALA—SHOWING IN THE DARK THE LUMINOUS SPOTS.

thing in it more than accident and the unconscious expression of the resistless force of growing vegetation.

The engraving herewith is copied from a photograph sent to us by a European correspondent, of a grave in the Garten churchyard, in Hanover, Germany, the invasion of which by a birch tree has been the occasion of much wonderment

SYDNEY INTERNATIONAL EXHIBITION.—1879-1880.

Extracts from the Report of the Judges in Horology.

DEPARTMENT III.—EDUCATION AND SCIENCE.

Group—Scientific and Philosophical Instruments and Methods.

Class 310.—Chronometric Apparatus, Chronometers, Astronomical Clocks, Watches, Chronographs, etc., etc.

Judges.—John McGarvie Smith, New South Wales.

P. E. Bound, Switzerland.

H. C. Russell, B.A., F.R.A.S., Great Britain.

E. Beckmann, Germany.

Gregory P. Harte, United States.

To the Honorable Committee on Judging and Awards, Sydney International Exhibition.

GENTLEMEN: I have the honor to hand you herewith the report of the judges of Class 310, as above,

And remain, sirs, your obedient servant,

GREGORY P. HARTE, Chairman.

The following exhibits were submitted for examination:

U. S. Exhibit, 537, American Watch Company, Waltham, Mass., U. S. A.—Watches and Chronographs.

British Exhibit, 1,048, Victor Kullberg, London, England—Watches and Chronographs.

British Exhibit, 1,054, Nicole & Nielsen, London, England—Watches, Chronographs, etc.

British Exhibit, 1,060, T. Russell & Sons, London, England—Watches, Chronographs, etc.

British Exhibit, 1,041, Castleberg & Co., London, England—Watches, etc.

British Exhibit, 1,060a, S. Backschmid, Switzerland—Watches.

German Exhibit, 36, A. Lange & Sons, Dresden, Germany—Watches, etc.

Swiss Exhibit, L. Audemars, Brassus, Switzerland—Watches, etc.

French Exhibit, 146, A. H. Rodanet, Paris, France—Chronometers.

French Exhibit, 177, G. Tribandau, Besançon, France—Watches.

Swiss Exhibit, 14a, International Watch Company—Watches.

In presenting the following report, the judges desire to make some explanations, which, we trust, will excuse them in the minds of the impartial for any apparent neglect in the form of their report, and for the limited number of tests made of the horological exhibits.

The judges were appointed too late to do the full amount required, inasmuch as the number of exhibits was so much in excess of any reasonable allotment for examination and report before the closing of the Exhibition.

Commencing their labors, however, immediately after the first call, the examinations were not complete until March 3d, which only permitted a time test to be made of nine days in a single position. This single position was objected to by some of the exhibitors, but ill-advisedly, for the ratings observed in the watches of the objecting exhibitors were of such character as to establish in the minds of the judges the conclusion that their watches would not have made so good a comparative showing if there had been more time to observe the ratings in other positions.

Great care was taken by the individual judges in making up their note books during the examination of the watches, and scrutinizing the inherent and comparative merits of exhibits under the ten different heads unanimously agreed upon, as follows:

1. Originality.
2. Invention and discovery.
3. Utility and quality of material.
4. Skill in workmanship.
5. Fitness for purposes intended.
6. Adaptation to public wants.
7. Economy.
8. Cost.
9. Finish and elegance of cases.
10. Time-keeping qualities.

It was agreed the judges should use the number 100 as expressing the highest degree of excellence in each of these ten elements of inherent and comparative merit, and adjudge individually to each of the several exhibits such rating as their respective judgments would warrant after careful examination; each set of opinions being made a portion of this report, and in the *résumé* the mean average being taken as the unanimous verdict of the judges.

It was also decided we should take up each exhibit in the order originally examined, and, beginning with the first element of merit (originality), each judge should in numbers express his judgment of the inherent and comparative merit attaching to each exhibit in this one element; this being done, to proceed with each succeeding element in order and in the same manner. The five judgments being complete and in numbers, the aggregated verdict is arrived at simply by addition and division.

This is not only a verdict as to the inherent and comparative merits of each exhibit, but also a full analysis of each order of merit in any exhibit as compared with all the others.

In giving this verdict it was absolutely necessary to ascertain to the fullest extent the time-keeping qualities of the exhibits. The judges were led to this conclusion from the fact that in some of the exhibits we were shown watches of equal finish containing every known application of horological science in practically the same construction, which should,

as far as they could determine by merely optical examination, keep quite as good time as watches of double and treble the costs in other exhibits, thus involving their judgment in doubt upon several elements of merit.

In justice to themselves and to the exhibitors the judges determined to make the test in only one position, and give the whole of the time at their disposal to testing the watches in what might be considered their normal position, if such term is allowable—that is, "pendent up," or hanging.

At the solicitations of the judges Prof. H. C. Russell, Astronomer Royal at the Sydney Observatory, kindly consented to make the tests, and each of the exhibitors was requested to send three watches of his own selection to the Observatory for this trial.

As will be seen by the report of Professor Russell, eight of the ten exhibitors availed themselves of this opportunity. It is proper, however, to state here that none of the exhibitors apparently anticipated this test, and that it is possible some of the watches might have made a better record if they had been differently attended to since the opening of the Exhibition; but they were in this respect all upon a par.

The majority of the watches had been made for exhibition purposes and specially prepared to that end; and some had been previously rated at observatories before sending.

Notably, however, to the contrary of the above, the exhibit of the American Watch Company was the ordinary and regular product of the factory, such as is finished every day.

Notwithstanding the possibility that these exhibits might have been better prepared for observatory time tests, some of the exhibits, as will be seen by the rating, demonstrate the wonderful advances made in the application of horological sciences to the manufacture of watches, and that their rating is being made equal to that of the best marine chronometers.

The following is the report of Professor Russell, and the accompanying diagram (see next page) will readily give an idea of the comparative performance of the different watches.

"Sydney Observatory, 26th February, 1880.

"GREGORY P. HARTE, Esq.,

"Chairman of the Judges in Horology.

"SIR: I have the honor to report that, in response to your circular, inviting exhibitors of watches each to send three watches to the Observatory to be tested, I received on Monday, February 16th:

"Three watches, Nos. 611, 669, 237, from Mr. Dolman, agent for Mr. Tribandau, Besançon.

"Three watches, Nos. 987271, 670068, 1221336, from Mr. Manson, agent for Waltham Watch Company.

"Three watches, Nos. 3171, 1935, 2526, from Mr. Allard, agent for Mr. Kullberg.

"And on the forenoon of February 17th:

"Three watches, Nos. 11527, 19967, 12629, from Mr. Hoffnagel, agent for Lange & Sons.

"Three watches, Nos. 1004, 8632, 8870, from Mr. Jacob, as agent for Nicole & Nielsen.

"Three watches, Nos. 70690, 23496, 113516, from Mr. Jacob, as agent for Thomas Russell & Sons.

"One watch, No. 47150, from Mr. Jacob, as agent for Castleberg.

"Three watches, Nos. 12731, 12483, 11680, from Mr. Wiesener, as agent for L. Audemars.

"And on 18th February:

"Two watches, Nos. 2724, 3528, from Mr. Jacob, as agent for Castleberg.

"On the 17th I began rating these watches, keeping them all in one position (hanging), and subject to the same conditions of temperature; in fact, they were all hung on one board, and kept in a compartment locked up so as to avoid change of temperature, except such changes as were due to changes in the weather.

"They were rated once a day by the standard clock, which affords special convenience for this work, and the error of which was found by daily astronomical observations giving the absolute time; great care was taken in rating so as to get the exact error of each watch every day, care being taken at the same time to avoid errors in the seconds dials, a fault sufficiently obvious in some of these exhibits.

"In presenting the result of this test in the form of a diagram (see diagram on the opposite page), it is necessary to explain that the curves show only the change of rate in each case, and nothing is shown here of the actual rate, which was large in several instances.

"In the diagram spaces between faint lines represent seconds; and the thicker faint lines represent the mean rate in each case: When the curve rises it shows that the watch was gaining on its previous rate, and when it falls the watch was losing on its previous rate. For example, in No. 4 curve the thicker line shows the position of a gaining rate of 3 sec. per day; on the 18th, watch No. 4 had a gaining rate of 2.7 sec., and is plotted below the thick line; on the 19th and 20th it was less than 3 sec., but on the 21st the rate increased to 4.8 sec., and the curve rises above the line. The same rule is followed with losing rates; and, therefore, each curve shows whether the watch was gaining or losing on its own rate.

"For convenient reference the barometer and temperature curves are plotted on the same sheet; although from the short time at command the watches could only be tested in one position, a glance at the diagram will show that in some degree at least the temperature adjustment and the isochronal properties of the balance springs were also tested; and I wish to call your attention to the fact that the whole of these watches show in a more or less degree a marked response to

the change in temperature, some being over and others under corrected.

"This fact is important, because it adds another proof that the old form of compensation balance—even when combined with chronometer spring and escapement and all the refinements which the best modern workman can add to it—fails to yield a complete correction for temperature; and I much regret that the American Watch Company, who claim to have overcome this fault by means of a balance involving a new arrangement of the metals, did not send to be tested any of their first-class watches containing this important improvement.

"Several of the rate curves, especially Nos. 4, 10, 13, 16, 21, and 24, respond to the change in the barometer in a way that shows the isochronal properties of their balance springs are not quite perfect. Looking down the curves it becomes at once evident that watch No. 5, which is No. 670068, second grade of the American Watch Company, is remarkably free from these defects, and presents the best rate of all the watches tested. No. 9, which is No. 2526, Kullberg, is the nearest approach to No. 5; indeed, the difference between its highest and lowest rates is 0.1 sec. less than No. 5, but it has not such a steady rate. The timekeeping of both these watches is remarkably good, and shows that we have entered upon a new era in the manufacture of pocket chronometers; for these rates are better than the majority of marine chronometers.

"Among the cheaper watches tested, No. 6, which is No. 1221336, of the American Watch Company, is worthy of notice; it is a watch of the sixth grade, yet its performance has been better than that of many very expensive and otherwise first-class watches among those tested; such a watch speaks volumes in favor of the system under which it was made, and is the best comment upon the accuracy of the machines that produced it.

"There are several watches among those tested which have kept wonderfully steady rates, but their comparative merit is shown in the diagrams much better than it could be by any description. The daily rate of each watch will be found in a table attached.

"The changes in Nos. 1, 2, 3, 17, and 19 were too great to plot.

"H. C. RUSSELL,

"Government Astronomer."

CONCLUSION OF THE REPORT.

In consideration of the facts developed in this examination, and the preponderance of elements of inherent and comparative merit adjudged by the judges (each in independent judgment) being equal to nearly 70 per cent more than the next highest exhibit, they have found it exceedingly difficult to make such a classification in degree as will give even-handed justice to all.

We adjudge to the

AMERICAN WATCH COMPANY, OF WALTHAM, MASS., U. S. A., a first-class award, and such other special distinction, diploma, medal, or award, as is consistent with the duties and obligations of the honorable Sydney International Commission, for the largest and most complete exhibit of horological instruments examined.

They also propose, as the only means by which their appreciation of the merits of the production of this company can be adequately or equitably recognized by the Committee on Judging and Awards, that a separate first-class award be given for the timekeeping qualities of all grades of these watches.

Also a separate first-class award for the perfection of this system of watchmaking and the improvements in the mechanical parts of the watch, being notably in the main spring and going barrel, the patent safety pinion, the perfect epicycloidal form of all the teeth of the train, in every grade of watch alike, and the isochronal adjustment of the balance spring.

Also to Charles V. Woerd, mechanical superintendent of the American Watch Company, Waltham, Mass., U. S. A., a first-class award for his new mode of compensating balances.

Also a separate first-class award for the improvements in cases, the number of artistic forms and designs used, the beauty and elegance of their finish, and for their new and indestructible method of enameling.

VICTOR KULLBERG

The display of marine chronometers by this maker, with the Observatory ratings, was of the very first order. Every part of those instruments was remarkably well made, and the modifications of some of the balance wheels worthy of special attention. Adjudged a first-class award.

The display of watches by the same maker, although small, commanded attention from their very nice finish in all parts. As will be seen from the report and diagram of Professor Russell, they are good timekeepers, especially the one having the chronometer escapement. This style of watch, however, is of too delicate construction and too costly to fully meet the requirements of any considerable public want. The same objection will hold good as to the lever escapements as far as cost or economy is concerned, they being comparatively too high priced. Representing a certain class of manufacture, they are of the first order of merit, and adjudged a first-class award.

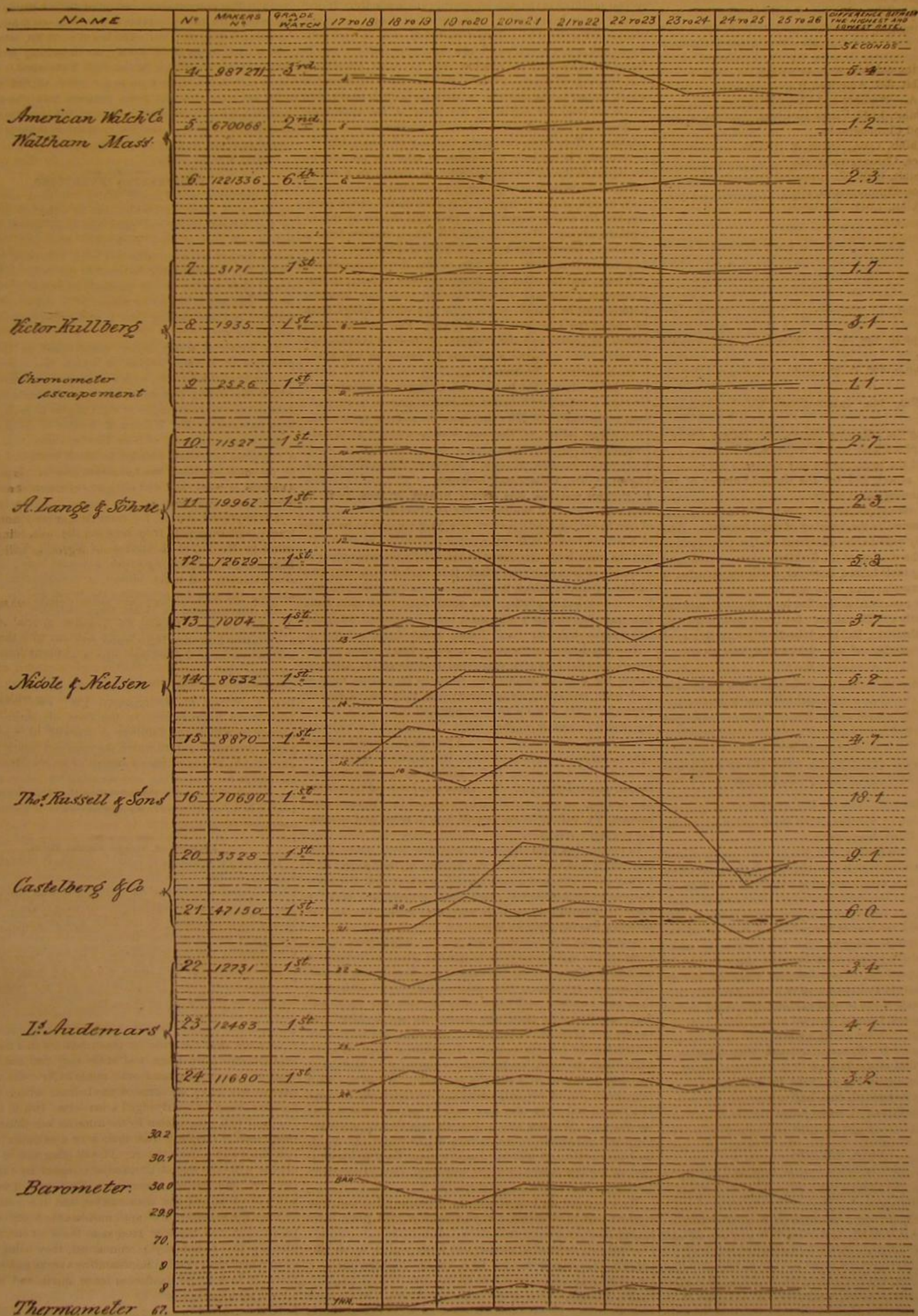
The "gas governor" exhibited by the same maker, as instrument for regulating the amount of heat in the testing of chronometers, is commended as a useful invention.

[Continued on page 10.]

RESUME OF THE JURY'S EXAMINATION.

NAMES OF EXHIBITORS.	Originality.	Invention and discovery.	Utility and quality of material.	Skill in workmanship.	Fitness for purposes intended.	Adaptation to public wants.	Economy.	Cost.	Finish and elegance of cases.	Timekeeping qualities.	Totals.
AMERICAN WATCH COMPANY, WALTHAM	98	95	95	93	100	100	100	100	100	100	981
Victor Kullberg	0	0	75	80	80	55	57	55	73	96	595
Nicole & Nielsen	28	23	47	58	70	60	48	38	76	80	527
Thos. Russell & Sons	8	0	25	30	36	34	22	26	42	44	267
Castelberg & Company	0	0	29	30	36	41	35	32	42	53	298
S. Backschmid	0	0	11	11	7	15	12	10	10	0	76
A. Lange & Sons	45	33	68	83	86	73	59	79	71	89	695
Louis Audemars	98	94	73	85	80	54	44	58	76	79	671
G. Tribandau	0	0	10	19	15	15	18	19	20	0	116
International Watch Company	0	0	32	31	37	49	41	63	34	0	287

FACSIMILE DIAGRAM SHOWING THE CHANGE IN RATE OF WATCHES TESTED AT THE OBSERVATORY, SYDNEY, FEBRUARY 17 TO 26, 1880.



Professor H.C. Russell, B.A., F.R.S.
Astronomer Royal, Sydney Observatory
New South Wales.

SYDNEY INTERNATIONAL EXHIBITION.

[Continued from page 8.]

NICOLE & NIELSEN.

This exhibit, made specially for the Exhibition, comprised a full line of plain levers, split seconds, chronographs, calendars, repeaters, etc., and was a representative display of their peculiar style of manufacture in all its details. The cost of these watches, compared with others of similar construction and finish, was excessive; and while they show good timekeeping qualities, they do not equal that of other exhibits.

As representing their own methods of construction they are of the first order of merit, and are adjudged a first-class award.

THOS. RUSSELL & SONS

exhibit a full line of their manufacture, which, upon comparison with other exhibits of the same general character and construction, places them in the third order of merit, and they are adjudged a third-class award.

S. BACKSCHMID

exhibits a class of cheap watches of very inferior workmanship and finish, of the last order of merit, and adjudged a fourth-class award.

N. CASTLEBERG & CO.

exhibit a meritorious line of watches in many respects, of good finish, and not excessively high priced for their performances; of the second order of merit, and adjudged a second-class award.

A. LANGE & SONS

exhibit a class of watches possessing many elements of merit, and of superior finish in many respects and at a cost which is quite reasonable. That the watches are constructed upon scientific principles and are intended as reliable timepieces, is shown from Observatory tests. The variations show that care has been taken to approximate a perfect adjustment, and that a partial success has been attained. A peculiarity in the construction of the balance wheel—having a horizontal split from the timing second holes each way—is noticeable, which we fail to understand. This exhibit was made expressly for this Exhibition, and Observatory rates sent with each watch, and, as a representative exhibit, although small, was the second best examined, and is, in its class, of the first order of merit, and adjudged a first-class award.

LOUIS AUDEMAIS

exhibits a wonderful class of complicated watches, calendars, repeaters, chronographs, etc., etc., combined in one watch, and elaborately cased and artistically finished. The great element of merit in this exhibit is in the combination of the great number of unusual functions for a watch, and by skill in workmanship and mechanical science securing a correct performance.

The enormous cost of these watches is an effectual embargo on their use to any except the very few, and their utility is, therefore, very limited. In their class they are, however, of the first order of merit, and adjudged a first-class award.

G. TRIBANDEAU

exhibits a considerable collection of watches in a great variety of cases, of a class of workmanship, finish, and performance calling for the fourth order of merit, and are adjudged a fourth-class award.

A. H. RODANET

exhibits two marine chronometers only, one of which was broken and the other out of order; commended.

INTERNATIONAL WATCH COMPANY

exhibit a collection of watches of the third order of merit, and adjudged a third-class award.

In concluding this report, the judges very much regret the limitation in time which has prevented them securing position tests of this very interesting exhibit in horology, as much on account of the exhibitors as on their own account. Such advances have in the last few years been made in this science that, in the interest of the public as well as of the manufacturers, a sufficiency of time is desirable to make tests in five or six positions, and fourteen days should be allowed to each position. Tests for heat and cold, and an opportunity to carefully note barometric and thermometric influences upon the various systems of adjustment, would be very valuable and interesting.

Respectfully, etc.,

GREGORY P. HARTE, Chairman, United States.

H. C. RUSSELL, B.A., F.R.A.S., Great Britain.

J. MCGARVE SMITH, New South Wales.

P. E. BOUND, Switzerland.

E. BECKMANN, Germany.

Corn Magnets.

Every kind of salve or lotion that is supposed to remove or relieve corns meets with a large sale. Corn files and pencils are getting stale, and an enterprising inhabitant of Dresden has lately brought out what he calls a "corn magnet." It is evident that it is as unlike a magnet as possible, for an examination shows that it is made of sulphur colored with graphite. The directions are to set fire to one end, and let a drop of the melted sulphur fall upon the corn. A convenient and agreeable operation, especially if the corn is on the bottom of the foot. It is needless to say that the corn usually survives the slight burn and lives to torment the owner again. All burns, whether by caustic or otherwise, should be avoided.

Experiments on the Resistance of Materials.

Prof. J. Burkitt Webb, C.E., now in Europe, writes as follows:

On the invitation of Prof. Spangenberg we visited the "Versuchstation," at the Gewerbe-Akademie, where the important experiments upon materials for engineering purposes are being made. These tests are of two kinds—trials of strength and trials of endurance. The first are made by means of very heavy and accurate machinery, mostly new within the last two or three years; the latter are the celebrated "Dauer-Versuche," a description of which we will reserve for another letter.

The main machine, of which there are three or four duplicates at work at various points in Germany, is housed in a special building in the interior court of the academy. It consists of heavy iron "ways," some fifty feet long, accurately planed and secured to a stone foundation, with a hydraulic pump and scales at one end, and a number of massive attachments for subjecting the piece of iron or other material to various kinds of strains. There are also other instruments which belong to the machine as delicate as it is heavy, and which are used for adjusting the parts of the apparatus, reading the results of a test, or making calculations. This machine differs from others in the way of measuring the force used. It has been the custom to take the pressure on the liquid in the hydraulic cylinder, as shown by a manometer, as the basis of calculation. This introduces an inaccuracy, as part of this is due to the friction on the piston packing, and the true pressure is less than that shown by this irregular quantity. To avoid this difficulty a massive lever is introduced between the hydraulic press and the point where its pressure is applied. One arm of this lever is one-eighth inch long, and the other five hundred times as long, so that to measure a pressure of one hundred tons, four hundred pounds must be placed on the scale pan which hangs from the end of the long end of the lever. The fulcrum rests against the piston, and the short end of the lever is connected by heavy links with the apparatus by means of which the strain is applied. Technically speaking the fulcrum of scales are "knife edges," but to convey a pressure of one hundred tons and remain free to move, these edges must be very obtuse, perhaps 160° to 170°; they must be as long as possible, some fifteen inches, of the best hardened steel, accurately ground, and must rest against a hardened plate of steel. Made with the greatest care the sharp edge under such a pressure will sometimes make a dent in the plate and the scales are clogged. As it is very difficult to measure the one-eighth inch with accuracy, another lever is provided with a ratio of one to ten, and with a short arm long enough to be made of a certain length with but a small percentage of error. To test the main lever this occupies essentially the same place as a sample of iron to be stretched; it is loaded with, say, two hundred pounds, which it multiplies to a ton; this pressure is then weighed by placing four pounds upon the main scale pan, and the fulcrum of the main lever is adjusted until the two weights balance.

The attachments consist of: I. Jaws for holding round, square, and flat bars to be submitted to tension. II. Arrangements for holding beams and columns in various ways at their ends, and compressing them until they are crushed or "buckle." III. Two massive graduated iron beams, which are placed crosswise on the "ways," and used for twisting shafts, railroad axles, etc. IV. A face plate, about four feet square, for holding plates of boiler iron nearly as large by the perimeter, and crushing in the middle by forcing various shaped pieces against it. V. Apparatus for bending a beam by crushing an angular piece into it; and in the same connection, VI. Shears for cutting off bars of metal and measuring the force required.

In connection with this main machine were some, quite old, which had been used in the infancy of the subject by a former professor, and a new special machine for the same purpose as attachment V., and which seemed to "kink" a piece of railroad iron as if it were only lead. In this the pressure was obtained by screws.

Among the instruments used for the adjustment of the parts of the main machine we saw the finest cathetometer we had ever seen. This instrument, by Breithaupt, in Cassel, has two telescopes, with micrometer screws with more than one hundred and twenty-five threads per inch, and scales graduated on glass with more than six hundred and twenty-five divisions to the inch. Another instrument for measuring the deflection, in two directions at once, of a column under pressure, has micrometer screws with more than two hundred and fifty threads per inch. We saw also a planimeter, which not only calculated mechanically the area of a figure, but gave also its center of gravity, moment of inertia, etc. We saw also a French calculating machine; the other apparatus is, we believe, all German. If one is, however, critical, it will be found in many lines of business that all the fine goods here are imported, though naturally the Germans are slow to acknowledge it.

We witnessed the experiments on a sample of round iron over an inch in diameter, and on a piece of iron plate three inches wide by half an inch thick. It is perhaps needless to say that they seemed to stretch like putty and to break like thread. The pressure is put on a few hundred pounds at a time, and the elongation is read by two telescopes and a scale, which multiply the distance five hundred times. At the same time the first "elastic limit" is watched for. Before this is arrived at the piece will return to its original length when the tension is removed; after this the stretching is in part permanent. One of the facts brought out is that there are

several elastic limits, in copper seven or eight. The appearance of the surface after the elastic limit is passed and the iron stretches is peculiar. A wavy appearance is seen, and longitudinal ridges begin to form, due to the changes going on in the crystals, by which they adapt themselves to the increased length. After a further general adaptation of structure becomes impossible, these appearances culminate in the weakest part. The apparatus for measuring the increase in length has long since been removed, and the places where it was attached have been filed smooth to avoid introducing the weak point artificially. The diameter of this part now reduces rapidly, and the surface becomes rough and the iron hot—you can see it stretch. When it has reduced twenty-five or more per cent it gives way suddenly with a sharp crack. The percentage of reduction before breaking is now recorded with the observations on the elasticity and the breaking strain, and the experiment is at an end. It suggested itself to see if the work done in pulling the iron apart was fully accounted for by the heat generated. We could easily calculate the work up to the point of maximum tension, but after this the force required was not measured; however, a rough calculation showed that the iron was as hot as required, or at least that the data would require to be quite complete if any residual was to be found.

Berlin, May 13, 1880.

ENGINEERING INVENTIONS.

An improved wheel guard, which will push any obstacles on the track aside, and which can be adjusted to a greater or less height above the rails, has been patented by Mr. Solomon Brisac, of New York city. It consists in a wheel guard formed of a metallic box with a beveled front side, which box is adjustably fastened to the front end of a recessed plate resting on and partially surrounding the grease box. The box is braced by means of a rod attached to its forward end and passing into a socket fastened to the bottom of the car.

An improved water motor, constructed on the general principle of a rotary engine, in which two compartments are arranged side by side, with a partition intervening, and in which the sliding pistons in the piston wheels in the two compartments are arranged at right angles to each other, has been patented by Mr. William E. Seelye, of Anoka, Minn.

Mr. Stephen Barnes, of New Haven, Conn., has invented a vibrating propeller, adapted to small boats and vessels to be operated by either hand or steam power. The floats are arranged so that they will offer no resistance on the return stroke.

An improved device for removing snow from railway tracks, and especially from between the rails, has been patented by Mr. David M. Horton, of Fishkill Village, N. Y. It consists of a revolving brush, a mould board in juxtaposition thereto, and a fan blower, in combination with suitable driving gear for propelling the brush and fan.

An improvement in steam traps, patented by Mr. Hugh O. Ames, of New Orleans, La., consists in combining with a vibratory arm carrying a water receiver, a side apertured hollow trunnion, a discharge pipe, a jacketed standard, and an outlet pipe.

An improved cotton press has been patented by Mr. Alfred A. Janney, of Montgomery, Ala. This invention relates to an improvement in the class of cotton and hay presses in which the follower is worked by a screw that passes through a nut, to which the required rotary motion is imparted by means of lateral sweeps or levers. It consists in the means for supporting and securing the levers and forming a vertical guide for the screw, so that the levers are prevented from rocking or swaying as power is applied in the operation of packing.

Improved Steam Canal Boat.

The late experiments in canal steamboats bid fair to be a complete success. The Baxter steamers were not sufficiently remunerative to continue the building of that kind of boat. They do not carry a sufficient load, owing to their build, and that is made necessary by the form and arrangement of the machinery and propelling power, the propeller being that form used by the tug in Buffalo. The new style, which bids to pay handsomely, is as full a bow and stern as the ordinary first-class canal boat. The propelling power is radically different from the tug propeller. The wheel is eight feet in diameter and placed close to the stern; the boiler is upright, with a single engine, very compact machinery, taking up no more room than the stable in many boats, and enabling the boat to carry 7,500 bushels of corn and coal for the trip. With this cargo they run from Buffalo to New York in seven days on five and a half gross tons of coal, saving river and harbor towing. One returned from New York to Buffalo in one hour less than seven days, bringing one hundred and thirty tons of freight. The outlook now promises to supersede mule and horse towing. The Belgian system of cable towing will take that large number of boats now relying on the mule, and deliver them promptly as consigned and in much less time and cost than can be done by the mule. Both systems are necessary for rapid movement on the canal, and to cheapen the transfer from the West to the seaboard. Steam is sure to supersede animal power on the canal, as everywhere else. The canal steamboats are at last so far perfected as to insure a handsome profit in running them, and a large number will soon be at work on the canal. Two are to be constructed in Lockport as speedily as possible by one of our most enterprising boat builders, and the machinery is contracted for, thus opening up a new industry for our numerous and worthy mechanics.—Lockport (N. Y.) Journal.

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 ordinary observer to find the planets.

M. M.

POSITIONS OF PLANETS FOR JULY, 1880.

Mercury.

On July 1 Mercury sets a few minutes after 9 in the evening.

Mercury can be readily found, early in July, a few degrees south of the point of sunset; the planet moves rapidly southward, but can be followed, and may be seen as late as the 20th. On July 18 Mercury has nearly the declination of Regulus.

Venus.

Venus keeps nearly the path of the sun, setting after the sun late in July, but so nearly with it that the planet is not likely to be seen.

Mars.

Mars has moved from its position nearly in line with Castor and Pollux toward Leo. It sets on July 1 at 9h. 44m. P.M. On the 31st Mars sets at 8h. 32m.

On the 31st, at meridian passage, Mars and Uranus are nearly together. Uranus is east of Mars and half a degree south.

Jupiter.

Jupiter is coming into the evening hours.

On July 1 Jupiter rises a few minutes after midnight. On July 31 Jupiter rises a few minutes after 10 P.M. It will be known at once by its brilliancy.

Besides the ordinary belts of Jupiter the planet still shows at this time (June 10) the large ruddy spot spoken of by many persons some weeks since. This spot is elliptical in shape; its longest diameter is about one-fifth that of Jupiter. A small glass will show it, and the ordinary observer can, by watching its appearance and disappearance and reappearance, determine the time of rotation of Jupiter on its axis, or the length of the planet's day.

The best evenings for looking at Jupiter are those of July 23, when the satellite nearest to Jupiter goes across its face, preceded by its shadow; July 28, when the first and second satellites will make similar transits; and July 29, when Jupiter will rise without the presence of its third satellite, which will be in eclipse, and will come out of the shadow after midnight.

Saturn.

Saturn follows close upon Jupiter, but keeps further north in declination by about $2\frac{1}{2}^\circ$.

On July 1 Saturn rises 36m. after midnight. On the 31st Saturn rises at 10h. 38m. P.M.

The waning moon will pass north of Jupiter and Saturn on the 27th to 28th.

Any one who has a glass sufficient to show the ring of Saturn and the largest satellite, Titan, will find this planet intensely interesting, and the movements of the satellite will show the time of its revolution in its orbit around Saturn.

Uranus.

Uranus rises after the sun, and sets too nearly with the sun to be seen.

Neptune.

Neptune may be seen, with a good telescope, in the early morning hour. Neptune is $2\frac{1}{4}^\circ$ west of Alpha Ceti, and 11° north. It approaches Alpha Ceti during the month, and if it can be found, may be known to be a planet by that movement.

Fires in New York.

The report of the Board of Fire Commissioners, just printed, shows that during the year 1879 there were in this city 1,551 fires, of which 1,029 were discovered by persons not connected with the Fire or Police Department. In 1,456 cases the fires were confined to the buildings in which they originated. Twenty-five buildings were totally destroyed, and 69 were greatly damaged. Of all the fires, 1,061 were extinguished by buckets of water and fire extinguishers. The total estimated loss by fire during the year was \$900,280 on buildings and \$4,771,300 on stock, making a total of \$5,671,580. The estimated insurances on the buildings were \$7,276,446, and on stock, \$14,525,264, making a total of \$21,801,710. The estimated uninsured loss was \$180,060. In three cases the loss was between \$100,000 and \$115,000; in one case \$168,908; in one case \$352,185; in one case \$333,900; and in one case \$1,978,991. In 1,066 cases the loss was less than \$100.

Nearly a quarter of all the fires were caused by carelessness, and 100 are attributed to children playing with matches and fire. Forty fires were caused by the spontaneous combustion of oily rags and other materials, and 93 by exploding kerosene lamps. Four members of the department and 12 citizens died of injuries received at fires during the year, and 139 firemen and 54 citizens were more or less injured.

There are 729 uniformed members of the department. The pay roll of the whole department for 1879 was \$1,030,822.14, and the appropriation for all expenses was \$1,254,970. The appropriation for the present year is \$1,307,670. The department now possesses 233 horses, 1 marine steam fire engine, 58 steam fire engines, of which 5 are self-propelling, 10 chemical engines, 24 hook and ladder trucks, 108 chemical fire extinguishers, and 4 aerial ladders, together with other fire apparatus.

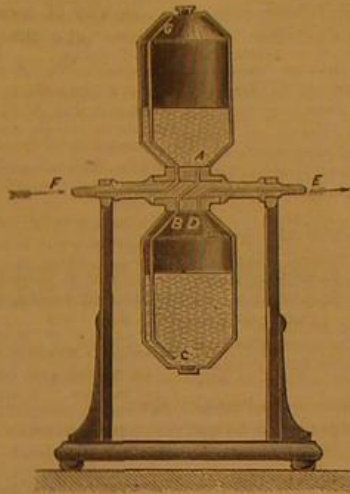
The annual inspection of the department showed that the quickest average time in hitching a team was 3.17 seconds, and in hitching a single horse, 5.66 seconds. The general

average in hitching all apparatus was, in 1879, 9.54 seconds; in 1878, 10.26 seconds; and in 1877, 13.03 seconds.

During the year, \$30,300 was collected for licenses for the sale of kerosene oil, each license costing \$10. The Fire Department Relief Fund now amounts to \$422,569.07, and the insurance fund to \$12,780.

ASPIRATOR AND COMPRESSOR.

Professor Marangoni, of Pavia, has invented an aspirator for measuring gases which is much simpler than many now in use in laboratories, which latter have the defect that the air or gas ascends through the descending liquid and makes thus the measuring of the former uncertain. The improved apparatus is shown in our illustration. It consists of two vessels attached to a fixed horizontal shaft, F E, which is placed upon two upright supports. This shaft has several ways or passages made in it which performs the functions of the taps. The water of the upper receptacle passes into the lower one by the passage, A, and thence through the tube, B C, issuing at its lowest extremity at C. The air contained in the lower vessel is thus emitted by the channel



D E, cut into the shaft, while the air or gas is aspirated in the same ratio by the passage and tube, F G. The apparatus acts thus at the same time as aspirator and compressor. It is simple, and will be a useful addition to the laboratory.

New Photoglyphic Process.*

WALTER B. WOODBURY.

It is now thirteen years since I had the honor of introducing in France my new photoglyphic process, which, up to the present time, has remained in the hands of very few, owing to the great expense hitherto necessary to start the working of it. For some time I have been engaged in making experiments with a view to discover a system which should be at the same time simple and inexpensive; and the process which I have this evening the honor to bring before your notice is the result of my researches.

The summary of the new system is as follows:

To obtain from negatives reliefs on glass similar to transparencies by the carbon process, but modified in the quantity of materials used.

To attach, and keep in absolute contact with the relief so obtained, a sheet of tin foil.

To solidify this sheet of tin foil by coating it with copper; then backing it up with another sheet of plate glass covered with a composition; and then to detach the whole from the first relief—the result being a mould ready to place in the press and print one thousand or more proofs.

I commence by showing you the relief made from the negative, and explaining how this is obtained.

I take a sheet of plate glass of a convenient size, and place it in hot water, together with a sheet of paper a little smaller; then, having driven out the excess of water by means of a squeegee, I place it on a leveling stand. Having prepared a solution composed of gelatine 200 parts, water 1,000 parts, glycerine 20 parts, white sugar 30 parts, with a little Indian ink, and filtered the same, I pour a sufficient quantity on the paper and spread it up to the corners with the finger. These plates are then dried in a dry place and can be kept until wanted.

To sensitize the plates I employ a bath of bichromate of potash of six per cent, and again dry them. Without doubt this method is rather long; but one should consider that each proof made is capable of giving five or ten thousand prints if necessary, as the same relief will make many printing moulds. I tried, with the aid of the Autotype Company, of London, to get a suitable tissue; but as this requires a uniform thickness of half a millimeter the ordinary system did not succeed. When the sensitized plate is dry the edges are cut with a knife, the glasses serving over and over again. I show you a piece of this prepared paper.

As in the carbon process, it is necessary to place a border of black paper at the back of the negative, and to cut the sensitized tissue a little larger than the opening.

After the exposure the gelatine is fixed on a collodionized glass by placing them both in water and squeegeeing the surface; but in dry weather it is as well to use albumen in place of collodion, as used by M. Ferrier for his transparencies in carbon. The glass holding the gelatine is now placed in a hot water bath heated to 43° Centigrade, and

* A communication to the Photographic Society of France.

left till the paper comes away from the gelatine, when it is placed in this apparatus by the frame holding the grooves.

By means of this small gas regulator the temperature is kept always the same, namely, 50° Centigrade. The water should be now and then agitated by lifting up and down the frame holding the glasses.

After a space of three or four hours the reliefs will be sufficiently washed, and can be taken out and placed in alcohol to dry quickly and sharp at the same time. In this stage of the process all spots or scratches that may have been on the negative can be removed (being in relief on the gelatine) by means of a piece of glass. The relief is now ready to be covered with the tin. You will observe that up to the present the operations have been almost the same as those necessary to produce a transparency in carbon.

As it is of the first necessity that the tin should be kept in absolute contact with the gelatine relief, I prepare the latter by rubbing it over with a piece of flannel charged with a greasy matter (pomatum answers as well as anything). I then make a border of India-rubber in benzine round the glass. The effect of this is to prevent any air from returning between the tin and the relief when once it has been driven out.

Taking care that the back of the glass is perfectly clean, it is now placed on the steel or glass bed of a rolling-press. A sheet of tin foil (without holes) that has been smoothed on a sheet of glass by a soft brush is now laid on it, and then three or four thicknesses of blotting paper. The whole is then passed under the cylinder several times, each time increasing the pressure. The surface of the tin is now ready to place in the electrotyping cell, but must first be cleaned with a solution of caustic potash to remove any grease, and bordered with shellac varnish to prevent the copper from depositing where not required.

Electric contact is made by means of the small apparatus, on removing a small proportion of the lac varnish. After two or three hours sufficient copper will have been deposited, and after drying can be then attached to another glass, on which it will remain.

This glass is covered while hot with a composition of shellac, resin, and Venice turpentine, and can be prepared in advance, using an iron plate heated direct by the gas flame. The same iron plate is employed to again soften the composition and attach it to the copper; but this time heated only by boiling water, this temperature being sufficient to soften it until it enters into all the hollows of the copper. On placing a weight on the two glasses the excess of the composition is forced out at the edges. When cold the glass plate on which the copper and tin are now attached can be separated from the relief, which can then be used over and over again to produce fresh matrices.

The matrix or intaglio is now ready to place in the printing press, and the remaining operations of printing are exactly the same as those used in the old process of photoglyphic printing.

In placing the mould in the press it is advisable to place one or two thicknesses of stout blotting paper, previously wetted, under the mould to give to it a slight amount of elasticity and, at the same time, to keep it in place.

As in all other mechanical processes a reversed or pellicle negative is required; but it is very simple to print upon a specially prepared transfer paper, and, instead of mounting the print with the face uppermost, to attach it under water to the mount, and when dry to detach the paper on which the print has been made. By this means there remains only one thickness of paper instead of two, thus doing away with an objection which has often been found in mounted photographs for book illustration.

NEW INVENTIONS.

An improved combined cutting and clinching tool has been patented by Mr. Peter D. Graham, of Black Hawk, Col. The object of this invention is to provide a new, useful, and convenient tool for cutting and clinching horse-hoe nails.

Mr. John J. Berger, of Brooklyn, N. Y., has patented an improved hand perforating or check stamp of the class which are used to cut or perforate the paper with figures and letters as a safeguard against alterations of the check; and the object of this improvement is to perforate the check with needle points, and at the same time ink the perforations, whereby the numbers may be clearly marked without cutting large openings in the paper.

An improved apparatus for the manufacture of nitric acid has been patented by Mr. Paul Marcellin, of Black Rock, Conn. The object of this invention is to furnish apparatus for manufacturing nitric acid so constructed that the stronger acid may be separated from the weaker acid as the acid passes from the retort to the receiving bottles, to obtain a strong acid suitable for use in manufacturing nitro-glycerine.

Mr. Max Rubin, of New York city, has patented an improved shawl strap, so constructed that either strap may be wound up alone, or both may be wound up together, or one may be wound up tighter than the other, by adjusting the handle.

Mr. Ambrose Madden, of Asbury Park, N. J., has patented an attachment for use with halters for preventing horses from cribbing and to cure them of that pernicious habit; and the invention consists in a combination of rigid arms and straps hung upon the halter and carrying a spiked plate, which is retained beneath the animal's under lip in such manner that the motions of the horse in the act of cribbing cause the spikes to prick.

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We keep a full assortment of Esterbrook's, Gillott's, Spencerian, Perry's, and Lamar's Pens. Send for price list to J. Leach, 86 Nassau St., New York.

For Sale.—A Baltimore City Fire Department Steam Fire Engine, in complete working order. Address P. O. Box 676, Baltimore, Md.

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

Asbestos Board on Chimneys prevents their heat from affecting the temperature of rooms through which they pass. Asbestos Pat. Fiber Co., Ltd., 134 Broadway, N. Y.

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.

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For Separators, Farm & Vertical Engines, see adv. p. 382.

Waxes, Leather, Emery, and Polishing Goods. Greene, Tweed & Co., 118 Chambers St., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna line, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

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Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p. 381.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

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For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings, see Frick's ad. p. 395.

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For Alcott's Improved Turbine, see adv. p. 397.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 434, Pottsville, Pa. See p. 381.

Robtine Mac. Co.'s Wood Working Mach'y ad. p. 380

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.

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Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

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Wanted.—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted.

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Eclipse Portable Engine. See illustrated adv., p. 413.

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THE MILLERS AND THE PATENT LAWS.

We doubt whether there has ever before been so large and complete an exhibition of the mechanical appliances of any trade, in practical operation, as that which was presented by the Millers' International Exhibition just closed at Cincinnati. The milling business has made great progress within a few years past—so great that a revolution may almost be said to have been effected therein—and old methods of making flour are everywhere being superseded by a radically different system, whereby the quality of the product is greatly improved. Nowhere else has the contrast between the old and the new method and their products been shown in such marked contrast, with such an extensive display of every kind of machinery, as in the Cincinnati Exhibition, and yet there is hardly a machine or an article for collateral use in the trade, which has materially contributed to its recent progress, that is not patented. It is our patent law, the protection it gives to inventors, the encouragement it offers to those who devote their time and means to improving old processes, that has chiefly made this splendid exhibition what it is.

And yet, strange as it may seem, with this practical proof before them of what the patent law has done for their business, the millers, in convention assembled, proceeded to make one of the most foolish and unreasonable attacks upon our patent system we ever remember to have seen formulated. The Millers' National Association of the United States have a standing committee on patents, and at their recent meeting in Cincinnati this committee made a report, which was adopted by the convention, avowedly to aid in "reforming" our patent laws and practice, and to "measurably free users of patented devices or processes from expensive litigation," etc. The "reforms" proposed include nearly every variety of objection to our patent laws which habitual infringers are in the habit of urging, and are as follows:

I. "More liberal appropriations by Congress to the Patent Department, enabling closer scrutiny of applications for patents, and consequent avoidance of the too frequent granting of patents on claims in which the essential features of novelty and usefulness are wanting." Is not the committee aware that the total expense of the Patent Office is paid by the inventors themselves, and that the examinations always involve a search through all like claims ever filed in the department? And if a patent be issued for anything that is not "useful," are not the millers aware that it is invalid and good for nothing, and is it any great hardship to ask the millers to let a thing alone if it is not useful?

II. "The abolition of the practice of reissue under new date or title, and sometimes for new things scarcely hinted at in original." If a miller obtains a defective title to real estate, through carelessness or error of his own, the courts will aid him to correct such title when it can be done without prejudice to the rights of others. Why should not a patentee, proceeding in good faith, have the like privilege? Further than this, a reissue is not valid if it covers "new things" involving different principles from what were set forth in the original patent.

III. "The establishment and maintenance of a special patent court at Washington to determine the validity of patents, before which court all parties directly or remotely interested in any case pending shall have ample time and opportunity to be legally and publicly heard." This is really a strange point to make in behalf of those who are now so vigorously protesting against the expense of patent litigation. It is proposed to have a new court, which cannot supersede, but must be auxiliary to the law machinery we now have, and to impose upon litigants in all parts of the country the necessity of a preliminary trial of their case at Washington, instead of having the trials take place as at present in the several districts where they reside.

IV. "The annual assessment of such a tax upon existing patents as can only be paid by owners of useful patents, and which, in default of payment of renewal tax, will free the records of worthless patents." It might just as rightfully be proposed that all flour mills making a low grade of flour should be taxed out of existence. The impositions of a tax on patents on such grounds would be nothing more nor less than direct robbery.

V. "A reasonable limit during which an inventor or patentee must successfully introduce his improvement to practical use and notice, in order to claim against any who may thereafter use the same." The present law makes seventeen years such reasonable limit, during which the inventor must not only introduce his improvement, but make therefrom all the profits which are to pay him for the time and means he has devoted to its development. This is the consideration which spurs him to effort, and the public, at the end of the seventeen years, becomes possessed of the free right to use his invention or discovery, whether or not they pay for its use before that time.

VI. "Some more reasonable measure of damages, with reference to actual benefits, in cases of established infringement." The courts always insist upon an accounting to show what gains or profits an infringer has made by his use, without permission, of the property of another. In this accounting the infringer has a right to show what other means were open to him whereby he might have avoided the use of the patent, and in this way it has often been shown that the patent he infringed upon was of no value at all to him. In many such accountings the damages for infringement have been placed at only six cents, and in all cases they are assessed by the court only after a full hearing of what both sides have to say. If a "reasonable measure" of damages cannot be arrived at on such investi-

gation, we fail to see how in this fallible world such object is even to be attained—that it should *never* be reached would probably be nearer what the committee would recommend.

VII. "Greater restrictions in the granting of injunctions, before the validity of a patent has been tried and established, and also preventing the fixing of excessive bonds in cases where temporary injunctions are granted." The general practice now is not to grant injunctions until the validity of a patent has been established, unless it is evident that the alleged infringer is deliberately endeavoring to avoid the consequences of his infringement and escape the jurisdiction of the court. The amount of the bonds which must be given are in each case regulated by the probable measure of damages, and are so fixed by the courts only after an examination in which the infringer has an equal right with the patentee to be heard.

VIII. "An amendment to the effect that, when new suits are begun under the same patent, in which a decision has already been made in a lower court, and appealed to a higher court, the defendant may demand a stay of proceedings pending decision in the higher court, and that he may become a party in the pending suit, avoiding the unnecessary expense of special defense, requiring the taking of testimony, and construction and explanation of models already on record." This is according to the general practice of our courts at the present time, except that the defendant has no right to this stay, and to be made a co-defendant in another suit, unless in accordance with the judgment of the court. When a stay of proceedings is granted in such case it would be a grave injustice to the patentee to allow his rights to go by default during the pendency of a long litigation, but by the giving of proper bonds by the defendant the court will generally grant the stay.

Finally, to "give force to these recommendations," as the committee say, it is urged that the association should make itself "financially strong," to prevent the granting of what they are pleased to style "fraudulent patents or reissues," for which they would have paid lawyers constantly "on the alert" in Washington, all the millers in the country contributing to funds for such a purpose. Is not this a direct proposal to attempt to circumvent laws passed in pursuance of an important provision of the Constitution? And are not the beneficent effects of those laws written in every leading feature of the great exhibition now just closing? If the millers, or representatives of any other industry, combine to obstruct the equitable administration of our patent laws, is it not just possible that inventors and patentees may, by like combinations, even more energetically defend their legal rights?

It is matter of astonishment to us that the millers of this country, supposing they are truly represented by the committee, have seen fit to take this view of our patent law. We should rather have thought that a system which has done so much for them would have met with nothing but kindly words, and that inventors would have received that encouragement from them which alone will induce them to put forth vigorous efforts to perfect that system of milling improvements which has already made such progress, but which is yet far from having attained perfection.

"THERE'S ROOM AT THE TOP."

The young man ambitious to succeed in any line of business should always bear this in mind. There are those in plenty of mediocre ability, superficial acquirements, and inadequate preparation, but the thoroughly trained and competent are scarce. The standard of modern professional requirements has been greatly elevated by the advances which the world has made within a few years past, and still higher demands are constantly being made. The demand for men who have a complete knowledge of every department of their business has always been felt. The extent of that knowledge widens every year, as improved methods and facilities are introduced. The ship captain, for instance, who a few years ago needed only to be acquainted with centuries old theories of navigation, with what more recent geographical explorations had added thereto, now finds himself, in this age of steam, working under totally different conditions. What he formerly knew is equally necessary now, but the successful management of a ship propelled by steam calls for an entirely new set of ideas and experiences, and the captain who would at present be a thorough master in his profession should not only know how to run a steam engine, but be a practical hydraulic engineer, with a good knowledge also of all the advantages which recent discoveries and inventions have placed at the disposal of navigators, whereby more efficient work may be done and a higher degree of safety attained. There are captains in plenty who are sailing masters only, but in proportion as they are also competent in these other departments, whereby they become in fact independent of their subordinates, do they attain the higher positions and greater responsibilities of their profession.

And what is true in this instance may be said of nearly every branch of business, as we find a like necessity for greater amplitude and thoroughness of preparation in all lines of professional activity. The discoveries in chemistry within a few years past have been of far reaching importance, and many of them have been such that a first-class doctor cannot remain ignorant of the advances made and retain his position in the front rank of his profession. With lawyers, also, a greater familiarity is expected with all departments of modern science, so that many members of the bar

at the present day may be really classed as experts in the technicalities of important industries. And with these demands for a higher standard of preparation the facilities for its attainment have been so multiplied that they are easily within the reach of all who have the disposition and the energy to avail themselves of the opportunities offered.

One peculiarity in the conduct of our leading industries, however, has operated rather to hinder the attainment of this higher standard of excellence among workmen in many cases. The "division of labor" now carried out in such detail in most branches of business has given us great numbers of workmen who know only a small portion of a trade, and, unless the mechanic be ambitious to rise in his avocation, he becomes little better than a machine. Blacksmiths, machinists, carpenters, masons, painters, shoemakers, etc., are now divided into separate classes of workmen who are masters only of some specialty in their trade, rather than the whole trade, and but seldom endeavor to reach a practical knowledge of all the other departments of their own business. To illustrate from what is certainly one of the least complicated of our trades, in a modern shoe factory we find, besides the cutters, fitters, and makers of the uppers, there are different sets of men employed for lasting, heeling, trimming, burnishing, finishing etc., the finished boot or shoe in most cases being the work of six to ten hands, each of whom knows only how to do his particular part. This division of labor undoubtedly gives the best results in the aggregate for the community, but the ease with which workmen attain proficiency in one small item of a whole trade undoubtedly tends to check that ambition to excel which has thus far been the most marked characteristic of American mechanics.

"I have taken all knowledge to be my province," wrote Lord Bacon, in 1592, when he was only thirty-one years of age. The expression often occurs to us when we consider what is now expected from first-class mechanics as well as from professional men. Bacon excelled all other men of his day in a "knowledge of the mutual relations of all departments of knowledge," and his philosophy, more than that of any one else of his time, taught "the art of inventing arts." Taking his meaning in this sense, there are many to-day who might fitly say what Bacon said of himself. But this is pre-eminently a practical age, and, while it shows the best possible development of the Baconian philosophy, it requires, of all who would stand at the head in any department of the world's activity, an amount of practical knowledge of which he had only a general conception. The multitudes which now crowd upon each other in the competitions of life are of those who do not meet the call for that better culture and more complete preparation of which society can never have enough, and which the diversified industries and great enterprises of modern times will always find ample employment for. "There is always room at the top," said Daniel Webster, in reply to the inquiry of a young lawyer as to the chances of success in his profession, and only those who pursue their avocations, of whatever nature, with this in mind, are certain to succeed.

PATENT PANTS.

As showing the importance of some of the minor patents the recent litigation of Strauss vs. King, reported in another column, presents a curious example. This is a patent for placing a metallic rivet at the pocket seam of the garment. The defense was that the use of rivets to strengthen seams was very old and well known; therefore a patent could not be sustained specially for securing pocket seams in that way. Issue was joined, 475 pages of lawyers' briefs were prepared, 528 witnesses were examined, and 3,361 pages of printed testimony were taken. Judge Blatchford, of the U. S. Court, sustained the patent. Let no man now rivet his pocket seams without first opening his wallet and paying toll.

ARE RIVER WATERS SAFE?

A very interesting discussion lately took place before the Chemical Society of London, concerning the comparative purity of river waters, into which town sewage was allowed to empty, and concerning the use of such waters for domestic purposes. The discussion was occasioned by the reading of a very able and exhaustive paper by Prof. Tidy, descriptive of his elaborate experiments showing the rapid oxidation of various deleterious substances when introduced into running waters. He also cited many examples of the rapidity of this oxidation in natural river waters, whereby immense quantities of sewage were, during a flow of only a few miles, rendered inert by oxidation, and such river water rendered fit for domestic use. Indeed, we have near New York an example of this. The city of Jersey City is supplied by water taken by pumps from the Passaic River, at Bellville, a few miles below the city of Paterson, N. J. The river receives a large part of the sewage of Paterson, also the refuse stuffs of many manufacturing establishments, but during its short flow to Bellville these bad matters, so eminent chemists have certified, are so rapidly oxidized as to become inert or changed, rendering the water pure enough for city people to swallow; and they are now drinking lots of it in Jersey City.

In the discussion alluded to, Dr. Frankland combated the views of Prof. Tidy, and claimed that the latter was wrong in his proposition about the rapidity of the oxidation; that sewage was not got rid of in that easy manner; and he adduced many proofs showing that no such purification and change in river water took place as had been alleged by Prof. Tidy. The discussion closed in the following interesting manner:

The president, Prof. Roscoe, said that all must compliment Dr. Frankland on the complete, clear, and withal, good natured criticism, to which they had listened with so much interest. He would ask Prof. Huxley to say something on the subject of bacteria.

Prof. Huxley did not wish to take part in the chemical controversy, but it had struck him on reading over Dr. Tidy's paper that there was a good deal of what he might venture to call "biological turbidity" in it. To this turbidity he would, as far as was in his power, act as a filter. He would state briefly only what were demonstrable facts. Diseases caused by what people, not wisely, call germs, *e. g.*, splenic fever, pig typhoid, etc., are caused invariably by bodies of the nature of bacteria; they could be cultivated through twenty to thirty generations, and then when given to the ox or the pig would invariably give rise to the characteristic disease. We have no reason even to imagine that any body capable of causing disease by such means could be anything but a body having the nature of a bacterium. Now, bacteria are just as much plants as mushrooms or cabbages, or the *Wellingtonia gigantea*, so that we know under what conditions bacteria can live and what they will do. Bacteria can be sown in Pasteur's solution just as mustard and cress can be sown in the soil; in it they thrive, and the liquid becomes milky, and he would ask the president whether there was any known method by which, if one drop of this Pasteur's solution were placed in a gallon of water, its constituents could be estimated. (The president having answered that he thought it was doubtful, the speaker continued.) Every cubic inch of such water would contain 50,000 to 100,000 bacteria, and one drop of it would be capable of exciting a putrefactive fermentation in any substance capable of undergoing that fermentation. For purposes of public health, the human body may be considered as such a substance, and we may conceive of a water containing such organisms, which may be as pure as can be as regards chemical analysis, and yet be as regards the human body as deadly as prussic acid. I am aware that chemists may consider this as a terrible conclusion, but it is true, and if the public are guided by percentages alone, they may often be led astray. The real value of a determination of the quantity of organic impurity in a water is, that by it a very shrewd notion can be obtained as to what has had access to that water. If it be proved that sewage has been mixed with it, there is a very great chance that the excreta of some diseased person may be there also. On the other hand, water may be chemically gross and yet do no harm to any one, the whole source of damage being, in the belief of the speaker, in the diseased germs. As to the bursting of the envelopes by endosmosis, it was a question whether they had any; bacteria would be large if one-twenty-thousandth of an inch in diameter; moreover, ordinary water was full of them, and in it they could be shaken for an indefinite period without harm. As long as bacteria had nutrition, there was no reason to suppose that oxidation or endosmosis would affect them. If, however, they were deprived of nourishment and exposed to sunlight the case might be very different.

The secretary then read a few remarks which had been sent by Dr. Mills. Dr. Mills has calculated the ratio of Oxygen consumed
Sum of organic C+N
and finds that it is not constant but varies in different streams. He does not think it possible to determine the peat in a water by its tint depth, owing to the difference of color. River water commonly contains a slimy or pectinous material, which tends to separate out on any substance which acts as a nucleus. This has, in the author's opinion, a most potent influence on the purification of river water. The oxygen theory of the natural purification of waters seems utterly untenable. The criticisms of the author coincide in several respects with those already advanced above by Dr. Frankland. In conclusion the author expresses his admiration of the patience with which Dr. Tidy has collected his facts, and of the meritorious accuracy of his analytical results.

Prof. Tidy, in his reply, relied mainly on the powerful testimony given in his behalf by the statistics of the last ten years. Notwithstanding the possible contamination of a large bulk of river water by a minute drop of a fluid containing germs, yet there were as many cases of fever in towns supplied solely by well water as in those supplied by river water; this holds good for towns all over England as well as in different districts of the same town. He took exception to the laboratory experiments of Dr. Frankland on oxidation; they were doubtless most interesting and satisfactory experiments as regards shaking fluids up in bottles, but they did not represent the flow of a river; there was no vegetation, no animal life. As regards the diminution of sodium chloride in the Severn, he contended that plants did cause a decrease in the quantity of sodium chloride in running water. As to the Shannon, he knew every inch of it, and perfect streams of black drainage entered into Loch Derg and elsewhere quite sufficient to account for the discrepancies noted by Dr. Frankland. He collected the samples of water himself, and did his utmost to collect them fairly. He had no interest whatever in commending any water. In conclusion, Prof. Tidy said, that although his paper might be considered in some respects an attack on Dr. Frankland, he wished to thank him for the freedom and the kind way in which he had met him at every turn, and expressed a hope that Dr. Frankland would join him in fighting the prevailing heresies on this question which tended so to upset the public mind.

ELECTRICAL PAVEMENTS FOR CITY LOCOMOTION.

The latest suggestion for the use of electricity as a motive power is to have the streets of cities paved with iron, either in blocks or so arranged that the pavement will form continuous electrical conductors, divided into suitable sections, each section to be charged with electricity by a stationary steam engine and dynamo machine of proper size. On the electrical pavements thus provided, wagons, carriages, fire engines, omnibuses and other vehicles, each provided with an electrical driving wheel, and taking electricity through the wheel from the pavement, may be run, in any desired direction, with more ease and certainty than by the present system of horse locomotion, although that system would not necessarily be interfered with, as those who preferred to use horses could of course do so. Iron pavements could doubtless be made that would be quite as serviceable as the present stone blocks. The subject presents a fine opportunity for students of electricity to exercise their head gear.

Skin Grafting from the Dead.

Dr. J. H. Girdner, house surgeon at Bellevue Hospital, has obtained some remarkable and valuable results in skin grafting during the past year. One patient who required such treatment refused to furnish grafts from his own arms or body, owing to the pain involved; and, unwilling to ask another to subject himself to a pain which the person to be benefited was unwilling to submit to, Dr. Girdner tried the experiment of taking skin grafts from a corpse. The doctor says:

"I cut a piece of skin from a patient who died in the wards a few hours before, first taking care to inquire whether the cause of death was due to a poisonous disease or not. I then cut the cuticle into small pieces, which I laid on the granulated surface of the ulcers, and bandaged the leg up very firmly. In three days the graft began to show signs of life, a perfect union having taken place, and in a week a splendid skin, smooth and elastic, had grown over the ulcerated part, making a complete cure and leaving no scar behind. Since that time I have treated upward of fifty cases with invariable success. I have grafted the skin of an Irishman on a negro, and I have grafted the skin of a negro on an Irishman with ease. In both cases the skin lost its original color and changed its hue to suit the wearer."

Slave-Making Ants.

It may interest such persons as take pride in physical prowess to know that on the battle field ants distinguish themselves quite as signally as do human beings. Mrs. Mary Treat, in the *American Naturalist*, thus describes a contest which she witnessed between slave-making ants and black ants: The former were the aggressors, and victorious. The two columns were one hundred and twenty feet apart. An idea of the numbers constituting the ranks of the slave-makers may be gathered from the fact that on the war path, one hundred and twenty feet in length and a foot wide, they "were not thinly scattered, but a vast moving phalanx." The blacks, a grand army on their own territory, would not flee. The battle field was about twenty-five feet in circumference. A roar, announcing the beginning of hostilities, lasted for five minutes, "whereas the battle lasted four or five hours before the reds gained possession of the vast nurseries of the blacks," and it took two days to carry the pupae and prisoners to their own dominions.

The Indestructibility of Matter.

This is capable of ready demonstration by preparing a couple of glass tubes of equal weight, each being filled with pure oxygen, and containing a few particles of carbon, free from appreciable amount of ash; that prepared from the fine loaf sugar gives very good results. The tubes are of precisely equal weight, and are hermetically sealed. By heating one of them the charcoal is caused to burn, and ultimately to disappear; the tube and contents, however, is of course found still to balance the other tube (which has not been heated), being of precisely the same weight as it was at first.

Earthquake Warnings.

In a recent lecture on the possibility of foretelling earthquakes, Professor Palmieri expressed the belief that by means of seismographic stations, telegraphically connected, for registering and reporting preliminary earth tremblings, it would be possible to foretell earthquakes just as tempests are now foretold, and to issue warnings to threatened districts about three days in advance. He did not expect to live to see such a system in operation, but he hoped and in a measure expected that posterity would be benefited by its universal and permanent establishment.

The Watch Trade of the United States.

The Watchmakers' and Jewelers' Guild of the United States held a convention in Chicago the second week in May. In his address, as President of the Guild, Col. R. E. P. Shurley said that the demands of the trade now amount to 3,000 watches a day. Of this number the large manufacturing of the United States produce 1,530 a day, as follows: The Waltham factory, 750; the Elgin, 500; Springfield, Ill., 80; Hampden Watch Company, 90; Howard, 20; Lancaster, 50; Rockford, 40. The number produced by smaller establishments was not estimated. The great body of American watchmakers are native born.

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MISCELLANEOUS INVENTIONS.

An improved apparatus for cooling cube sugar has been patented by Mr. John V. V. Booraem, of Brooklyn, N. Y. The object of this invention is to furnish an apparatus for cooling cube sugar after it has been dried, so constructed that the sugar may be thoroughly cooled quickly and before the cubes have had time to stick together.

Mr. Peter C. Freese, of Cayuga, N. Y., has patented an improvement in vehicle springs, which consists of two triangular frames, upon which the body of the carriage or wagon rests, and each of the frames has a ring at the point, and through these rings a stirrup passes, this stirrup being at the end of a rod adjustably secured to the under side of the seat, which rests on springs, so that the seat rests entirely upon the springs.

Mr. Hermann Wojan, of Golden's Bridge, N. Y., has patented an improved ox-bow fastener which is simple and convenient. The fastener is formed of two annular plates, between which an adjustable lever is pivoted eccentrically. It is acted upon by a cam lever, also pivoted between the two plates.

An improved hame tug, patented by Mr. Samuel R. Copeland, of Armstrong, Ill., consists in a novel construction and combination with the trace or tug of a metallic skeleton frame or keeper, provided with means for holding the trace securely in place and for adjusting it at pleasure to suit different animals.

An improved apparatus for drying fruit and vegetables by heated air, which has for its object to perform the drying rapidly, uniformly, and conveniently, has been patented by Mr. Jesse H. Burks, of San Luis Obispo, Cal.

Mr. Luke Davis, of Boston, Mass., has patented a fan attachment for elevators, which consists of a fan fixed in an elevator car having on one end a sheave, around which a turn is made of a rope that is stretched taut from the top to the bottom of the elevator shaft or well, so that as the car moves up or down the fan is revolved and creates a current of air to ventilate the car or shaft.

Mr. John F. McCoy, of Beverly, N. J., has patented a tire-upsetter, so constructed that it may be used upon an anvil. It is simple in construction and convenient and effective.

An improved cigar bunching machine has been patented by Mr. Moses Greensfelder, of Baltimore, Md. The invention is embodied in organized mechanism for laying a binder, filling in, rolling up the filler, depositing the bunch in the mould, and shifting the mould automatically. The details of construction and operation of parts cannot be clearly described without the aid of engravings.

ELECTRIC BRAKE FOR RAILWAY CARS.

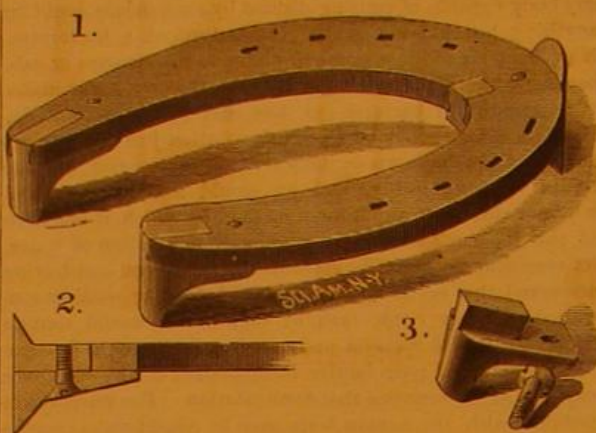
In view of the tremendous speed attained by railway trains, it is a matter of the greatest importance to procure safe, reliable, and powerful brakes, which can be controlled from the engine or any other part of the train. Mr. Achard has invented a new and very ingenious electric brake, which is illustrated in the annexed cut taken from *La Nature*. Two Planté secondary batteries, each charged by three Daniell elements, are arranged on the first car, and two like batteries are provided in the last car. In the engraving the four secondary piles are united, but that does not affect the working of the device.

The current of the secondary batteries is conducted to the brakes of each wheel, the two wires running parallel with the train, with which wires the electro-magnets of the brakes are connected in such a manner that the brake operates when the circuit is closed. The electro-magnet, A, is rigidly mounted on a shaft suspended opposite the axle, B. If the current passes through the electro-magnet it is with great force drawn toward a sleeve, rigidly mounted on the axle, B, and is held against it with sufficient force to cause it to rotate with the axle, thereby winding the brake chains upon the shaft of the electro-magnet. The long arms of the articulated levers, C C, are raised by the winding up of the brake chains, and the brake shoes, D D, connected with the short arms of the levers, C C, are pressed against the tires of the wheels with great force. A brake shoe is provided on each side of the wheel so as not to break the journal box by undue pressure. To release the brakes it is sufficient to break the circuit, upon which the electro-magnet is released from the axle, B, and the chains are unwound. The commutator, H, is used to close or break the circuit, and may be located in the caboose of the engine. The brake operates instantaneously, and sometimes produces such shocks that Mr. Achard has found it necessary to interpose resistances in the circuit to weaken the current proportionately. During the

experiments made with this brake, on the Northern Railway of France, a train of thirteen cars, with a speed of forty-five and a half miles per hour, was stopped in twenty-one seconds and within a distance of seven hundred and five feet.

IMPROVEMENT IN HORSESHOES.

Our engraving represents an improvement in horseshoes recently patented by Mr. Gelos L. Potvin, of Alpena, Mich. Lumbermen, contractors, horse-railway companies, and others who, in the prosecution of their various enterprises, employ large numbers of horses, are only too well aware of the great expense attending keeping their horses well shod under the present system of farriery, not



POTVIN'S IMPROVED HORSESHOE.

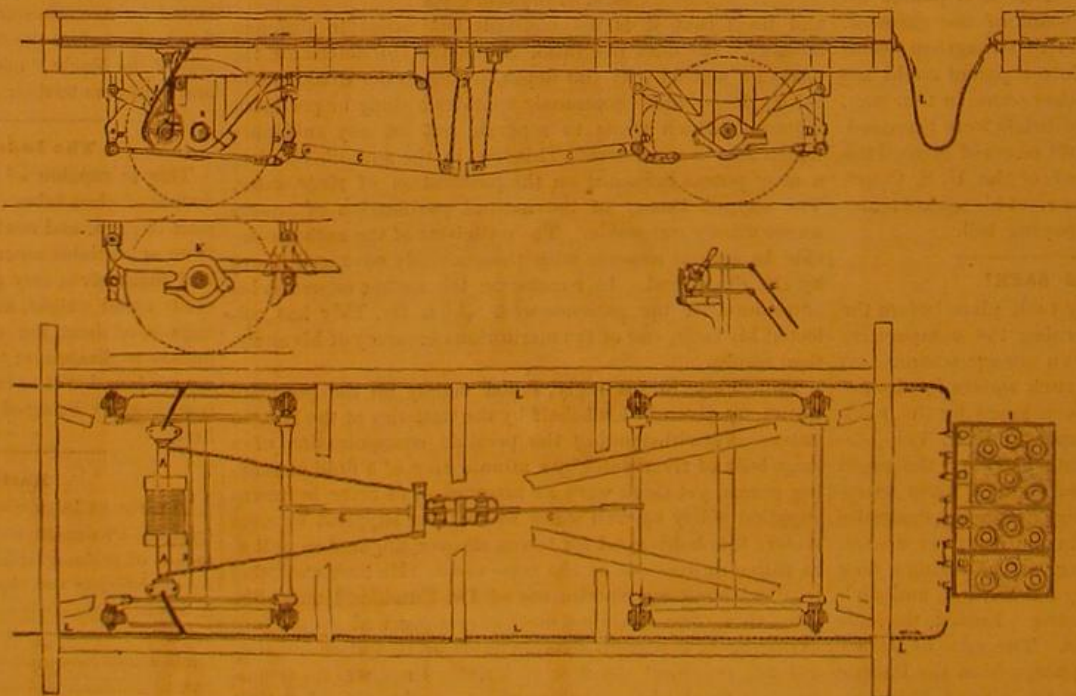
only in the amount of shoes used and the labor to reset them, but in the valuable time lost in having the animals shod, and the loss by laming many valuable animals caused by the necessity of taking off the shoes every time a calk becomes worn out or broken, thus requiring the hoof to be pared down till scarcely anything remains to nail the shoe to.

This invention is designed to obviate the necessity of taking the shoe from the horse's foot when it needs recalking. It will be admitted that if a teamster can recalk a set of shoes in ten minutes on the road, in the woods, or in the barn, he will have made a saving for his employer.

Fig. 1, which is a perspective of the shoe, shows the extreme simplicity of the improvement. In the heels of the shoe there are slots in which the dovetail studs of the heel calks fit snugly; the toe calk is set in a similar manner, and each calk is secured by a screw, as shown.

Fig. 2 and Fig. 3 represent the calks in detail, and the screw used in fastening is shown in Fig. 3.

These shoes can be manufactured as cheaply as the ordinary ones, as the calks can be made of malleable iron and



ELECTRIC BRAKE FOR RAILWAY CARS.

case-hardened. The plate will outwear a dozen shoes of the ordinary make, being almost entirely protected by the new calks that are put in from time to time.

The inventor states that a set of shoes can easily be recalked in ten minutes, and claims that it will save over fifty per cent of the horseshoeing bill to the owner every year.

For further particulars apply to Gelos L. Potvin, patentee and inventor, Alpena, Alpena county, Mich.

The Preservation of Fruit by Burial.

Last January a California fruit dealer took two hundred fresh lemons fresh from the tree and buried them in the

ground, to see how they would keep. Four months after he dug them up and found them in perfect preservation, as sound and fresh and nice as the day they were buried. Every one knows how well potatoes keep when properly covered by earth. Apples would doubtless do equally well; and possibly the same method may answer for grapes and other more perishable fruit. It would not cost much to try a few experiments in this direction, and success could not fail to be advantageous.

Silvering by Cold Rubbing.

Make paste by thoroughly grinding in a porcelain mortar, out of the light,

Water	3 to 5 oz.
Chloride of silver	7 oz.
Potassium oxalate	10 1/2 oz.
Salt (common table)	15 oz.
Salt ammoniac	3 1/2 oz.

Or,

Chloride of silver	3 1/2 oz.
Cream of tartar	7 oz.
Salt (common)	10 1/2 oz.
Water, to form a paste.	

Keep in a covered vessel away from the light. Apply with a cork or brush to the clean metallic (copper) surface, and allow the paste to dry. When rinsed in cold water the silver presents a fine frosted appearance, the brightness of which may be increased by a few seconds immersion in dilute sulphuric acid or solution of potassium cyanide. The silvering bears the action of the wire brush and of the burnishing tool very well, and may also be "oxidized." Should a first silvering not be found sufficiently durable after scratch brushing, a second or third coat may be applied. This silvering is not so adhering or white on pure copper as upon a gilt surface.

For the reflectors of lanterns the paste is rubbed upon the reflector with a fine linen pad; then, with another rag, a thin paste of Spanish white or similar substance is spread over the reflector and left to dry. Rubbing with a fine clean linen rag restores the luster and whiteness of the silvered surface.

The paste is sometimes mixed directly with the whiting and left to dry, or until nearly dry, then rubbed down as described.

Transplanting American Oysters.

Recently 1,250,000 American oysters were laid down on the coast of Little Celt, from Gravenhoved to Polkboved, and a company has been formed to lay down 15,000,000 more on the Schleswig Holstein coast. There have been several attempts to restock the exhausted British oyster beds with American oysters, but they have invariably failed through improper placing or bad handling. The Dutch oystermen may do better.

The Purification of Rivers.

The prize offered by the King of Saxony for the best practical scheme for rendering harmless to fish in rivers and lakes the refuse from factories and sewage of towns has brought before the public two precipitation processes, among others, in which lime is the chief agent. One of the schemes is that of Herr Wilhelm Knauer, in which the sewage is heated and then saturated with lime water, and precipitation being thus effected, the water enters another tank with chlorate of magnesia, and is ultimately filtered through gravel and earth. A remarkable scheme is that of Brigadier General W. Heine. Under this process the water, also sufficiently saturated with slaked lime, has to pass through several tanks and canals until it is pumped up to a tower, from which it descends in the form of rain, the sulphuric steam with which the interior of the tower is filled occasioning a crust of ammonia on the walls. This plan, it is said, is now being tried under the authority of the Saxon Minister of the Interior on the Elster, a river very much polluted by various factories on the Saxon frontier. The objection urged against these processes are that lime has a tendency hurtful to fish life, and leaves an offensive and worthless deposit, while the effluent water, being in an alkaline condition, is liable to putrefaction upon its introduction into the river. The effluent from the A B C process, as carried out at Aylesbury, with the help of sulphate of alumina, is, on the other hand, acid, and, therefore, not open to the same objection as the alkaline processes, while the deposit is a valuable and inoffensive manure.

An alloy of rhodium and lead, lately exhibited before the French Academy of Sciences, has the curious property of exploding on exposure to heat, as in being held before a gas flame. Its composition is one-third rhodium and two-thirds lead, fused together in a crucible, at a high temperature.

PNEUMATIC CLOCKS.

Compressed air, which has for some time past formed an important factor in mining, diving, marine engineering, locomotion, and analogous uses, has lately been utilized in a very ingenious manner in operating all the clocks of a city or district simultaneously. Some time since we gave an illustration and description of a pneumatic clock exhibited at the Paris Exhibition and in public use at Vienna. The entire mechanism of a pneumatic clock system, as in use at present at Paris, consists of three distinct parts: the central clock, the receiving clocks, and the tubes for conveying compressed air to the several receiving clocks. At the central station air is compressed to a pressure of about five atmospheres by means of a double piston compressor, and is stored in a large tank of about twenty-five cubic feet capacity. From this main reservoir the compressed air is conducted into a second reservoir, in which its pressure is regulated at seven tenths of an atmosphere by means of a very simple automatic contrivance. Every minute this distributing reservoir is placed in communication with the distributing tubes by means of a distributing clock, shown in Fig. 1.

In the annexed engravings, which we take from *La Nature*, the works on the left hand side are those of an ordinary clock, and the mechanism on the right hand side operates the distributing slide valve, R. The second dial of this clockwork is at D. At the beginning of every minute the compressed air from the distributing reservoir is admitted into the distributing box through the tube, J, and is conveyed to the distributing tubes by the tube, N. After about twenty seconds a movement of the lever, G, places the slide valve into its second position, and the tube, N, is in communication with the tube, K, which opens into the air, when the tube, J, is then neither in communication with the tube, R, nor with N. The slide valve, R, rests in this position for forty seconds, that is, until the minute is completed, when another displacement, as described above, establishes a communication between J and N. The compressed air is also used to wind up the weights of the clockwork, by means of the cylinders, C, and levers, A and B, as shown in Fig. 1. The slide valve, R, which may be replaced by a three-way cock, I, is actuated by the clockworks, which are adjusted and regulated every day or hour from the observatory. The central station is provided with duplicate apparatus, so that if one distributing clock is out of order or disturbed in any way the other can be set in operation in a few seconds. The tube, N, is connected with the several mains which convey the compressed air into the various districts or precincts into which the city is divided. The mains are made of wrought iron, are about one and one sixteenth of an inch in diameter, and are connected with lead tubes three fifths of an inch in diameter, for conveying the air into the houses. The tubes leading to the several stories are one quarter inch in diameter, and are connected with lead or rubber tubes one eighth inch in diameter, communicating with the several clocks and preferably colored the same as the wall paper or woodwork of the room, so as not to be easily perceptible. With a pressure of seven tenths of an atmosphere, and permitting the compressed air to pass through the tubes for twenty seconds, any number of clocks can be operated at a distance of one to two miles from the central station.

The mechanism of the receiving clocks, shown in Fig.

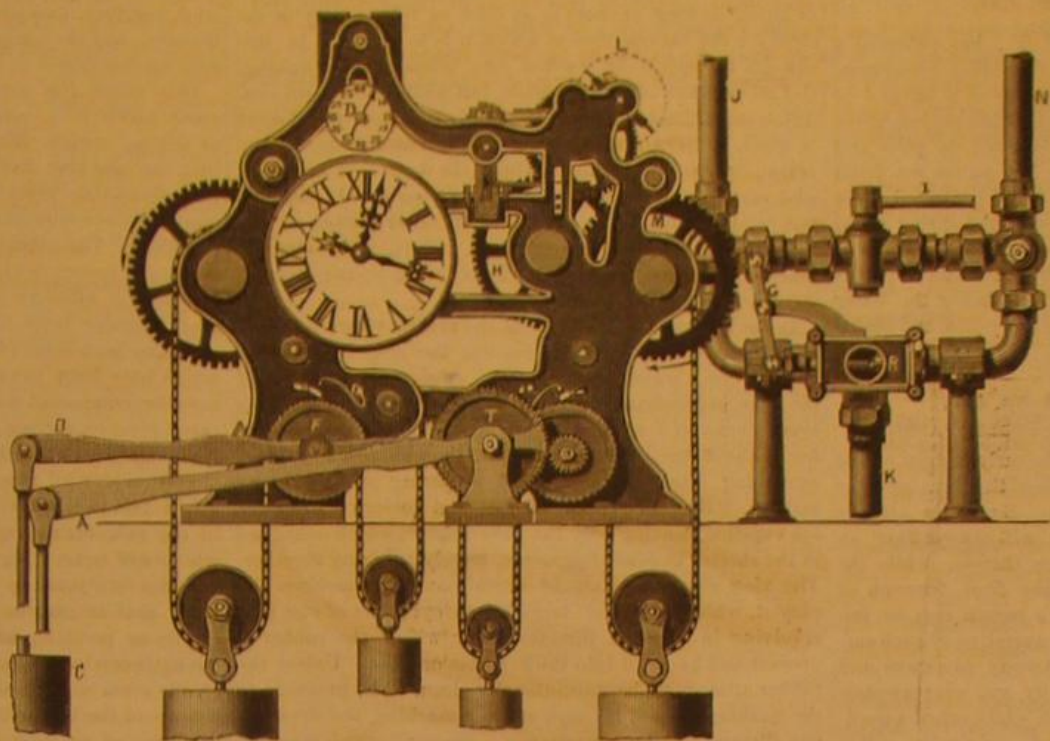


Fig. 1.—DISTRIBUTING CLOCK.

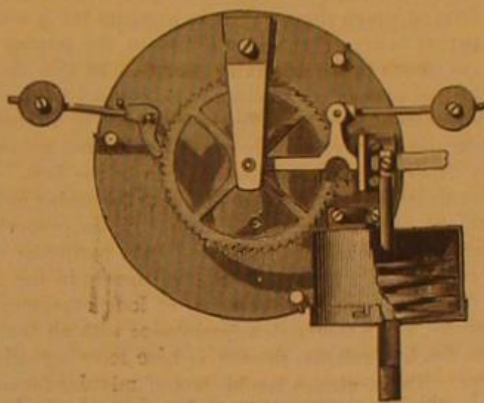


Fig. 2.—RECEIVING CLOCK.

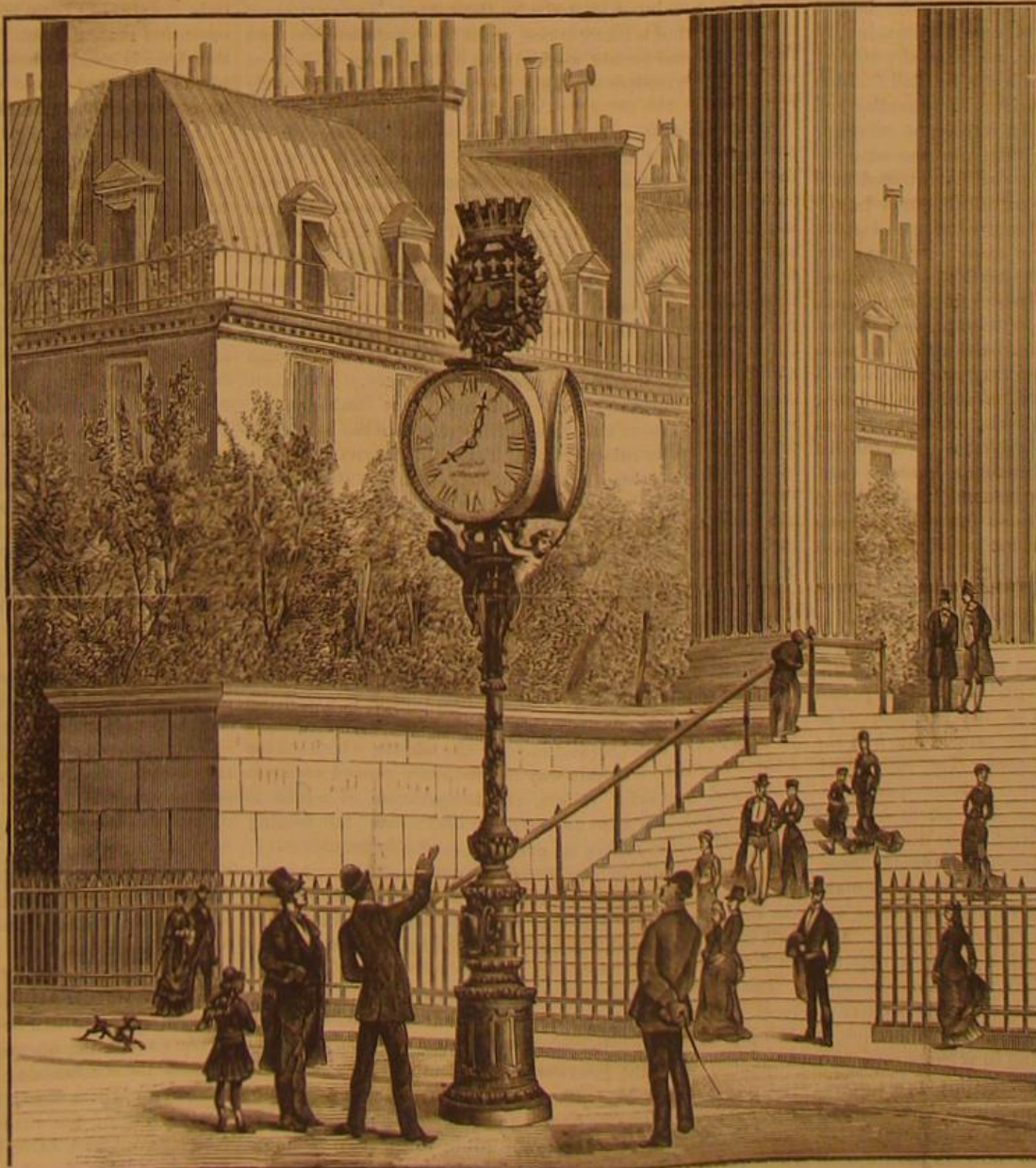


Fig. 3.—STREET CLOCK.

2, is alike in all cases, and is entirely independent of the size of the dial or the location of the clock. A small bellows, resembling that used in pneumatic call bells, is in communication with the tubes conducting the compressed air from the central office. Every minute the pressure of the air raises the bellows, and a rod attached to the upper bellows-head actuates a lever which engages with a wheel provided with 60 teeth, which is rigidly secured to the minute hand arbor. The wheel rotates the distance of one tooth every minute, and a weighted pawl on the other side of the dial checks this movement. The hour hand is rotated by means of the usual dial wheels. By means of a second bellows the clocks may be arranged to strike. The ordinary spring and weight clocks can be easily transformed into pneumatic receiving clocks.

Many of the principal hotels, railway stations, public offices, courts, etc., of Paris, are provided with the pneumatic clock; and public pillar or street clocks, which are illuminated at night, have been erected in several parts of the city. We are informed that a company has been organized in the city of New York for the purpose of introducing the pneumatic clocks into this and other cities.

ENGINEERING INVENTIONS.

Messrs. Youngblood & Holmes, of New Orleans, La., have patented a simple device for preventing the collection of scale on the crown sheet of a boiler. It consists of a pan arranged immediately over the grate bars on the bottom of boiler, and partly covered and provided with discharge pipe to prevent the deposit of scales on the boiler sheet and carry them into the mud drum.

Improvements in the construction and arrangement of the devices for opening and closing the lock gates and sluice gates of canal locks, have been patented by Mr. Thomas Millette, of Three Rivers, Quebec, Canada. The object of these improvements is to facilitate the working of the gates and to furnish a water way or sluice under the floor and lock gates for the entrance and emission of the water.

Mr. Charles A. Read, of Bridgeport, Conn., has patented an improved water meter and motor, which is so constructed as to run with little friction, to be sensitive to the least motion of the water, and to have very little leakage.

Mr. Henry Case, of Brooklyn, N. Y., has invented an improved apparatus for sinking and removing piles. It consists of one or more tubes with suitable couplings, by means of which forced currents of water may be made to create auxiliary currents to act directly upon the submarine bottom beneath and about piles or other objects, so that the sand, mud, gravel, etc., are washed away, allowing the pile or obstruction to sink or admitting of its being more readily raised.

Mr. Samuel L. Marsden, of New Haven, Conn., has patented an adjustable device for correcting and compensating the wear on the pitman bearings, toggle bearings, toggles, and movable jaw or jaws of stone breakers and crushers like that of Blake and others. The invention consists of an adjustable toggle block provided with a rounded convex or concave back, and of a toggle block wedge provided with a concave or convex face, in which concavity or convexity the back of the toggle block fits, the said toggle block being vertically adjustable by means of a screw or screws, and being capable of a laterally rocking motion because of its articulation with the toggle block wedge. This invention

is designed to compensate both for the direct and angular wear.

Mr. Henry Case, of Brooklyn, N. Y., has patented a breakwater that combines lightness, durability, cheapness, and effectiveness. The invention consists of a latticed or perforated sloping roof supported on piles that project above the water line, and of gratings fixed between the piles and extending above and below the water line on the sea front of the breakwater, the said structure being protected from injury from floating ice and other objects by spring piles, and further protected and secured by chains that, on the sea-front, are loosely stretched from the structure itself down to supplementary piles that are sunk entirely below the water line, the said spring piles and supplementary piles and chains forming part of the device.

AMERICAN INDUSTRIES—No. 48.

THE MANUFACTURE OF VULCANIZED RUBBER FABRICS.

Volumes have been written about the early history of the rubber manufacture, and the experiences of the great inventor who made its success his life's work. But those already familiar with this remarkable record will always have an appreciative ear for a brief reference thereto, while the generation which has arisen since the final triumph of Charles Goodyear was in everybody's mouth may be impelled thereby to study more closely a narrative of such surpassing interest to all mechanics. Among inventors and patentees especially, the thrilling story will ever awaken profound attention: how this yellowish white sap of a tropical tree, turned to gum by evaporation—originally called India rubber because it came from India and was used to rub out pencil marks—had baffled the efforts of the leading scientists of the world by its singular chemical properties, only to be at last worked up by an American mechanic into a substance adapted to a greater variety of uses than almost any other product of man's skill; with what untiring zeal and through what manifold difficulties he labored many years for what practical men deemed a chimera; the expensive litigation to which he was put to defend his patents when success had been fairly won, so that even the award of the gold medal at Paris, in 1855, accompanied by the Grand Cross of the Legion of Honor, found him in a debtor's prison—down to his final triumph in "the great India rubber case," when the legal declaration of his rights was finally reached through the last efforts in public life of Daniel Webster, but a few weeks before the death of the latter at Marshfield—all of these details, trite as may be the facts to many men now in middle life, can never fail to come home with touching eloquence to every American citizen, and to her mechanics and artisans especially.

The industry of which the manufacturing details are represented in our first page illustrations this week, from sketches taken at the works of the New York Belting and Packing Company, at Newtown, Conn., is one of the monuments of Charles Goodyear's success. This is the largest manufactory of the kind in the world, and the making of vulcanized rubber fabrics adapted to mechanical purposes is here carried on in a way which indicates the full fruition of his anticipations, whether we consider the quantity and variety of goods made, or the highly important relations which these productions hold to all industrial pursuits, for in many cases they meet wants never before satisfied, and fit needs for which no equally good substitute could be devised. The articles regularly manufactured at this factory include bands or belting for running machinery, from the largest belts ever made down to the smallest sizes in use; packing, to make tight joints in pumps, engines, etc., where the work is either in water, steam, or compressed air, together with a variety of valves, gaskets, and rings for similar use; hose for fire engines and watering gardens, besides heavy steam and brewers' hose; wagon and car springs, gas tubing, solid vulcanite emery wheels, corrugated matting and mats, cushions for billiard tables, etc. A full list of their productions would, indeed, make a formidable catalogue, but the interest therein to the general reader would be enhanced by the reflection that in so few years a comparatively unknown substance had come to play so important a part in our industries.

In giving a description of the process of manufacture, the first consideration is the condition of the crude material as it reaches the factory. Raw rubber comes from South and Central America, Africa, and the East Indies, but the principal supply for the United States, and the highest priced article, is from Para, at the mouth of the Amazon. The trees which furnish it are large, and are tapped much in the same way as we do the sugar maple here. The sap, which has a milky appearance, being collected in large quantities, flat wooden forms of various shapes, but about one foot across, are dipped into it, and then dried in the dense smoke made by a fire from a kind of nut found abundantly there. This operation is repeated until the successive layers make a coating about an inch thick, when they are cut from the wooden forms and the raw rubber is ready for market. Different kinds of cure are adopted in other places, so that the rubber is not so much discolored, but the impurities contained in raw rubber usually amount to about 20 per cent of its weight. The first operation at the factory, therefore, is to cut and tear it up, and, after soaking in warm water, carefully wash and clean it, when it must be thoroughly dried; it next goes to the mixing department, where, by repeatedly working it over, sulphur and the oxides of various metals are incorporated with it; the rubber, now in the form of rough and jagged sheets, passes to powerful calendaring

machines where it is pressed into smooth and regular strips or sheets as long or short or as thick or thin as may be desired for the various uses to which it is to be put. In this shape it is ready to be worked into belting, hose, packing, and all varieties of articles made, but while it is in this condition the ultimate shape of the fabric to be produced must be given it. The final operation is the vulcanizing, or tempering, in immense heaters, where the degree of heat and time employed must be very carefully regulated. In fact this principle has to be kept well in mind during all the preceding operations, the grinders, rollers, etc., being all hollow cylinders, steam heated according to the requirements of the special work in hand.

In our illustrations the titles of the several views will enable the reader to clearly distinguish the respective operations. The "washer and sheetor," as shown at the top of the page, represents a large vat where the rubber is cut into small pieces by a wheel with numerous sharp knives revolving in the water, which at the same time knead the rubber, something after the manner of preparing pulp in paper making. By this process all dirt and foreign substances are expelled, leaving only the pure rubber, which next goes to the sheetor in small fragments, loosely adhering together. The view shows only one of several powerful machines employed, which consist of large hollow cylinders of cast iron revolving in opposite directions, by which the rubber is pressed and kneaded into thick sheets or mats. Unless the rubber appears to be exceptionally clean, it is, previous to the washing, passed through another machine, not shown in our illustrations, and known as a "cracker." This machine has large, deeply-grooved iron cylinders, which revolve in pairs, slowly and heavily, grinding the tough rubber and driving out bark and dust, while they also stretch it so that other foreign substances drop out.

The rubber having been thus thoroughly cleaned and left in the form of rough sheets, must be hung up for a considerable period to dry, after which it goes to the mixing machines, as shown in the adjoining picture. In this department the character of the product to be produced is principally determined, for the different varieties of rubber for particular uses have each their several mixtures, according to what experience has demonstrated to be the best. The various substances here incorporated with the rubber include sulphur, the oxides of lead, zinc, iron, etc., the proportions differing for each class of goods, and each particular compound calling for a treatment adapted thereto in the after stages of manufacture. The value of long experience in the business, and a thorough acquaintance with all that science can teach in relation thereto, is here most signally appreciated. The workman has his box of mixture furnished him by weight, just so much for a given quantity of rubber, and then, taking the rough sheets as they come from the drying room, he passes them between the heated iron cylinders of the mixing machine, slowly feeding in, also, the mixture which is to be incorporated with the rubber. The same sheet is passed through many times, until the compound has been thoroughly and evenly worked into it, the degree of heat at which the cylinders are kept being all the while closely regulated.

After this process the rubber goes to the calendaring department, one of the large machines for which is shown to the left at the bottom of the page. These are heavier than calendaring machines generally, and the one represented is the largest ever made for this purpose. The rollers are hollow, and so fitted up for steam heating that the temperature can be kept as desired. The rubber is here rolled a great many times, some of it being passed through in sheets and strips, pure, and some with the rubber pressed upon a web of heavy cotton duck, previously coated with rubber driven through and through its meshes by powerful machinery. The fabric used for this purpose is made expressly for the establishment, so as to give it more than double the strength of the heavy cotton duck used for sails for ships. The cotton fabrics thus combined with the rubber give the belting and hose thus made their great tensile strength, which, in hose, where the tests can be most accurately made by gauging the exact pressure to the square inch, has been proven to be about twice that of leather.

For belt making, the rubber coated and impregnated duck is taken to a large department where this branch of the business is carried on, and unrolled upon tables one hundred feet long, where the workmen cut it accurately to the required width. One strip is cut so that, folded, it will make the width of belt, and another so that the wide strip will just fold over its edges and meet in the middle, which makes a three-ply belt. In this way the strips are passed between a series of powerful rollers, the temperature of which is evenly regulated, as in all the other operations; the folding over at the sides makes an even and perfectly regular edge, and at the middle, where the edges of the outside strip come together, a narrow ribbon of rubber is fed to cover exactly the line of meeting. In this way the entire outside of the belt is pressed by the heated rollers into an even, regular surface.

The thicknesses of the regular sizes of rubber belts for most machine work are three-ply and four-ply, although two-ply belts are also made. The three-ply is generally compared with the heaviest single leather belts, and the four-ply with double leather belts. In making four-ply rubber belts, or in heavier ones when ordered, the width of the outside strip is calculated according to the two or more thicknesses over which it must be folded, and the operation then proceeds as in making the three-ply.

As the rubber surfaces, before being vulcanized, would stick together, they are rolled up with a thickness of duck between, and the rolling machine has an attachment which rolls up this fabric as the machine is fed.

Our engraving gives but an incomplete idea of the room which these operations take up, for the long lengths of belting which have to be prepared previous to going into the machine have then to be carried forward into the vulcanizing heater, and this operation must be continuous from the commencement until the vulcanizing process is complete. The company is now making an elevator belt thirty-six inches wide and half a mile long, which will weigh over eighteen thousand pounds. All of the great grain elevator belts in the country are of rubber, and the company have some of their big belts in Chicago elevators which have been running perfectly for twelve years. The metallic compound with which the rubber for belts is prepared gives its surface a high degree of firmness, while there is yet sufficient elasticity to allow of its hugging the pulley closely, which all machinists understand is necessary to enable a belt to work well; in the compound, also, as well as in the vulcanizing, attention is directed to making a belt which will resist a high degree of heat, so that the surface may not be injured by friction. All mechanics will understand that in putting on belts they should be stretched as tightly as possible, and in large belts, where joints are strengthened by overlapping a thin piece of rubber or leather, the seam side should always be outside; the closer the contact of the belt with the pulley, and the more perfect the exclusion of air from between belt and pulley, the better the service.

For the hose-making department, the general features of which are represented in one of our views, the rubber has its different and particular compounds in the mixing machine, and in the calendaring is united with the fabrics suited to the different kinds of goods made here. The lengths and widths required are cut much the same way as in the preparation of belting, and then fitted over cylinders of 25 and 50 feet in length, which are rolled against other cylinders to press together and make solid the laps and joints under a powerful pressure and the requisite degree of heat. These forming cylinders remain in the lengths of hose until the vulcanizing is completed. A great many kinds of hose are made, two-ply being the thinnest, and the sizes from half inch to 10 inches internal diameter; hydrant hose is three-ply, and ordinary engine hose, to stand a pressure of 100 to 150 lb. to a square inch, is four-ply. Their "test" hose, made on carbolized duck for fire-engine service, will stand a pressure of 400 lb. per square inch. The advantage of rubber hose over that made of leather, aside from its much higher tensile strength, lies in the fact that it requires no care, only to be hung up to dry after use, while leather hose must frequently be "stuffed" with oil and tallow, etc., after the manner a currier finishes leather, only the stuffing must be forced inside the hose, making the operation more difficult. For these reasons the use of leather hose is steadily being relegated to the small country towns where only hand engines are used and where the volunteer firemen have ample time to devote to leather dressing.

In addition to the above, the New York Belting and Packing Company manufacture suction hose, and steamer and brewers' hose, on spiral wire, one variety of which has the wire entirely embedded in the rubber, so that the interior is perfectly smooth.

The illustration showing where the square packing is made ready for vulcanizing gives only one of many different operations connected with this branch. The rubber is furnished in sheets and plates of different sizes and shapes for regular articles, either pure or with cloth insertion, but where irregular shapes and forms are wanted, which cannot be cut out of the standard products, they must be made in moulds, not cast, as many suppose, and the rubber, after having been prepared by mixing and otherwise, as in the other operations, must be pressed into the moulds. In this way the corrugated matting, stair pads, car springs, etc., are made. The demand for this packing in steam work, to pack around piston rods, and wherever there is a joint where the metal is subjected to different degrees of temperature, in valves, etc., is enormous, and only an engineer who has had experience with the materials formerly used for this purpose can fully realize its value for such use.

The making of gas tubes, shown in one of the views, presents no substantial difference in principle from hose making. This tubing is made either pure or with cloth insertion.

An important specialty of the business of the company is the making of solid vulcanite emery wheels, in which just enough rubber is used to firmly hold together the particles of emery. It requires powerful machinery to thoroughly work the compound into a homogeneous mass, after which it is rolled into sheets, cut into wheels of the desired size and form, and pressed into iron moulds, when it is ready for vulcanizing. These wheels are of the nature of stone throughout, and nearly as hard as cast iron. They can be used either wet or dry, but by allowing water to drip on them while in use their cutting properties will sometimes be improved, and dust will be avoided.

The concluding operation of all the above processes, however, is the vulcanizing, a representation of two of the heaters for which is given in one of the views. To leave off this portion of the manufacture, and this was the point which gave Charles Goodyear the most of his trouble—all the preceding labor would be thrown away. Each article made must have just so much heat and no more, and be subjected

thereto for a certain definite time, the amount of heat and the time varying according to the mineral compound with which the rubber is incorporated. The heaters are, therefore, arranged with thermometers for gauging the temperature, and are made somewhat like steam boilers, some of them being 100 feet long; into these heaters run tracks on which long platforms, laden with articles to be vulcanized, are rolled in, and the steam is let on to raise and keep the required temperature. The great length of these heaters arises from the necessity of making long stretches of belting, and also from the amount of hose made in lengths of fifty feet.

In this connection considerable interest attaches to an immense steam press, the largest of its kind in the world which the company have recently completed, and which is shown to the right at the bottom of the page. This press will take a belt 6 feet wide, and 15 feet of its length, at once; it weighs 85,000 pounds; the steam is let into the bed and platen so that the temperature can be readily regulated; the platen is stationary, and the bed is lifted by hydraulic pressure. The most novel feature of this great press, however, is that it is arranged with appliances at each end for stretching the belts, so that, while the belt is under the full tension of the heaviest strain it may be desired to put upon it, it may at the same time be compressed between the hot plates, and thus set its fibers as firmly as a bar of steel. It does not seem very likely that an engineer would ever be troubled with having to "take up" a belt whose "stretch" had been taken out in this way.

The N. Y. B. & P. Company own the patent for this stretcher in combination with the press, as they do many other patents of great importance in the business. The principal Goodyear patent on vulcanizing expired in 1865, but this company had then been many years manufacturing, and had obtained subsequent patents for improvements, some of which are of great value in their present manufactory.

The offices, salesroom, and warehouse of the Company are at 37 and 38 Park Row, New York. John H. Cheever is the treasurer of the company and general manager of the business.

RECENT DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Southern District of New York.
STRAUSS *et al.* vs. KING *et al.*—PATENT PANTALOONS.

The application of rivets to pockets for uniting and closing the end of the seam at the corners, as claimed in reissued patent No. 6,335, dated March 16, 1875, involves invention, is not a mere double use or aggregation, and is patentable.

Blatchford, J.:

This suit is brought on reissued letters patent granted March 16, 1875, to Jacob W. Davis and Levi Strauss & Co., for an "improvement in pantaloons," etc., the original patent having been granted to them May 20, 1873, on the invention of said Davis.

The claim of the reissued patent is as follows:

As a new article of manufacture, pantaloons or other garments having their pocket openings secured at the edges by means of rivets or their equivalents, substantially in the manner described and shown.

This case has been contested with great vigor. The bill was filed in November, 1876. Testimony was taken from May, 1877, to July, 1878. The plaintiffs examined two hundred and eighty-three witnesses, and the defendants one hundred and forty-five. The plaintiffs' proofs cover two thousand four hundred and sixty-five printed pages, and the defendants' one thousand one hundred and ninety-six. The plaintiffs' brief covers three hundred and twenty-three printed pages, and the defendants' one hundred and fifty-two. Infringement is not contested, but the defendants rely on want of patentability and want of novelty in the thing patented.

On the point that there is no invention in the thing patented the defendants contend that the want of patentability consists in the fact that the invention is nothing more than the employment at the corners of a pocket opening of the old and well known rivet, and that no new function is performed by the rivet in that place from what is performed by it in any other place. The invention is claimed as an improvement in the pocket opening of a garment which has a pocket opening. It does not extend to anything but a pocket opening. It requires that the seam which unites two pieces of cloth laterally shall terminate at the commencement of the pocket opening; that such seam shall be made by means of sewing the two pieces of cloth together laterally by thread; that the rivet shall be of metal; that it shall be placed in the seam at the edge of the pocket opening—that is, where the seam ends and the pocket opening begins, but still in the seam; that it shall be so located and fastened with reference to the two lateral pieces of cloth which the seam unites as to bind together such two lateral pieces of cloth by pressing tightly upon both of them; that this shall be effected by putting the rivet through a hole and heading it down on both of the two opposite faces where the hole begins and ends; that the operation of the rivet when so set shall be to receive the strain which results from pressure from within on the edge or end of the pocket opening and keep such strain from coming on the thread of the seam, and thus protect such thread from ripping or starting and allowing the seam to open, and that the practical advantage of the arrangement shall be to get rid of the frequent renewal by sewing of the thread in the seam at the edge of

the opening. In view of the testimony as to the state of the art prior to the invention of Davis, all the foregoing features are involved in such invention. They all appear on the face of the specification of the patent and are embraced in the claim. They amount to invention and they embody patentability. The result of them was new and useful. The case is not one of mere double use or of the use of an old rivet in a new place. It is not merely the usual through-and-through binding or uniting function of the rivet that is availed of.

It is argued for the defendants that there is no combination between the rivet and the sewed seam, but a mere aggregation; that the claim is not confined to the application of a rivet to a sewed seam; that a stay of sewed thread is the equivalent of a rivet; that in view of the prior use of a stay of sewed thread at the corner of a pocket opening there was no invention in the change to a metal rivet, and that a button had before been sewed on with thread at the upper end of the seam, at the edge of the pocket opening, to prevent the thread of the seam from being worn away, and the seam had been stayed by sewing in leather or other fabric, and there was no invention in passing from these arrangements to Davis's. It is sufficient to say that there is no force in any of these suggestions as against the validity of the patent, nor is it shown that the invention as before defined was known or in use before it was made by Davis. The defendants, to defeat the patent on the ground of want of novelty, must make out the defense by satisfactory and preponderating proof. This they have not done. In coming to this conclusion I have considered the Magee coat, the Nightingale coat, the evidence grouped in the defendants' brief under the heads "Nevada (C)" and "Nevada (D)," the evidence of Stanton, Ford, Wilson, Richville, and Hobbins, the Orr overalls, the patent to Bowker, and the patent to Bellford.

There must be the usual decree for the plaintiffs.

The Voyage of the Anthracite.

The experimental steamer Anthracite, described in our last issue, arrived at St. John's, Newfoundland, June 21, eighteen days from Liverpool. The weather was boisterous throughout the trip, making the speed of the little vessel somewhat less than was anticipated. Only 20 tons of coal were consumed on the voyage, and 436 gallons of water—a practical demonstration, it is thought, of the economy of the Perkins' system of high pressure engines which was on trial. The Anthracite is the smallest steamer that ever crossed the Atlantic. Her total length is 84 feet; beam, 16 feet; and depth, 10 feet, her engine and boiler room being 22 feet 6 inches. Her gross tonnage is 70.26 tons, and her registered tonnage 27.91 tons.

Correspondence.

The Temperature of the Sun.

To the Editor of the Scientific American:

On page 405 of your issue of June 26, 1880, in the article entitled "What is the Temperature of the Sun?" I discover a singular error. Mr. Sawyer estimates the diameter of the earth's orbit to be 190,000,000 miles, and the diameter of the sun at 800,000 miles, the diameter of the orbit being 237.5 times the sun's diameter. He thereupon computes the surface of the imaginary hollow sphere of 190,000,000 of miles diameter at 237.5 times that of the sun, instead of using the cube of 237.5 as the multiplier. Correcting this error, Mr. Sawyer's figures would make the temperature of the sun 1,339,648,437°, which will hardly corroborate his first estimate, in which all the sums on which he bases his calculations are assumed.

O. E. TOWNS.

Washington, D. C., June 21, 1880.

What is the Temperature of the Sun?

To the Editor of the Scientific American:

In your paper of June 26, 1880, there is an attempt to answer this question.

By a comparison with that of the voltaic arc, W. E. Sawyer finds the temperature of the sun to be "not less than 12,000°, nor more than 50,000° Fah.," and then in "another way," evidently peculiar to himself, he obtains a similar result. That other way, Mr. Editor, is unique! Look at it a little. Assuming the mean distance of the sun to be 95,000,000 miles, Mr. Sawyer proceeds to obtain the diameter of the earth's orbit by doubling its mean radius and adding 800,000. Why add the diameter of the sun? He evidently is not aware that the linear distances of heavenly bodies are calculated from center to center.

Again, imagining the diameter of the earth's orbit to be that of a hollow sphere concentric with the sun, he states that the surface of that sphere would be "237.5 times the surface of the sun," because, forsooth, "the diameter of the sun is contained in the diameter of the earth's orbit 237.5 times." Mathematics teaches that similar surfaces vary as the squares of their homologous lines; that is, the surface of the hollow sphere will be to that of the sun as the square of 237.5 is to the square of 1, as 56,406.25:1. Now the heat from 1 square foot of the sun's surface will be spread over 56,406.25 square feet of our assumed sphere, and its intensity on 1 square foot must be less than $\frac{1}{56,406.25}$ of what it is at the sun. If, then, we take the assumed mean of 100° at the earth, the temperature of the sun must be 5,640,625°, which corresponds more with the figures of "those who have estimated into the millions" than with what W. E. Sawyer has observed in electric temperatures.

T. ROBINSON.

Washington, D. C., June 21, 1880.

The Melbourne Exhibition.

All the space assigned to the United States at the approaching International Exhibition at Melbourne, Australia, has been taken, and a very creditable exhibition is promised. Our exhibits will occupy 48,500 square feet in the Main Hall, 14,500 square feet in Machinery Hall, and a small space near the main entrance. Commissioner Pickering sails from San Francisco about the middle of July. He reports that the exhibition of agricultural implements will be the best ever made. The United States is expected to make an especially good display in the following sections:

Silver-plated ware, watches and clocks, cotton goods, firearms, tobacco, glassware, musical instruments, particularly in organs, axes and edge tools, locks and household hardware, carriage material, printing presses and type foundry material, sewing machines, scales and weighing machines, carpenters' tools, dental manufactures, chilled iron car wheels, lamps, stamped tinware, and seamless metal goods, billiard tables, safes, steam pumps, saws, and portable farm engines.

The exhibits of Connecticut will be shown collectively. There will be between 400 and 500 American exhibitors, including a large number of our most prominent firms.

Gen. John A. Sutter.

The marvelous rate at which history is made nowadays is forcibly brought to mind by the death of General Sutter, in whose mill-race gold was first found in California, only thirty-two years ago. General Sutter (originally *Suter*) was born at Kandern, Baden, February 15, 1803. He was educated in Switzerland, and emigrated to this country in 1834. After many adventures in the Far West and along the Pacific coast, engaged in the fur trade, he settled on a grant of land which included the present site of Sacramento, Cal., calling his fort New Helvetia.

The Mexican authorities appointed him governor of the northern frontier country; and, subsequently, under the American authorities, he was justice of the peace and Indian agent. He acquired great influence and wealth, but was ruined in 1848, when gold was discovered on his property, near Coloma, El Dorado Co., in February. His laborers deserted him, and his lands were overrun by the gold diggers. During recent years he has received an annual allowance of \$3,000 from the State of California. In 1873 he removed to Litz, Lancaster county, Penn. He died at Washington, June 18.

The Pittsburg Exposition and Fair.

The Fourth Exhibition of the Pittsburg Exposition Society will be held next fall in the city of Allegheny, Pa., beginning September 2 and continuing until October 9. The success of the previous exhibitions has led the board of managers to add a fair to the Exhibition of this year, and to offer liberal premiums for live stock, farm and garden products. In furtherance of the latter project the area of the Exhibition grounds has been increased to twenty-five acres, and ample space has been allotted for the stabling and care of stock. The old buildings have been renovated, and a new and capacious machinery hall has been constructed, besides a boiler house and a large annex to the floral hall. New and powerful engines have been supplied, and every effort will be made to make the Exhibition profitable to exhibitors and enjoyable to the public. The allotment of space will begin July 26. Space is free; the entrance fee—Exhibition department, \$5; Fair department, \$2.

The Cincinnati Industrial Exposition.

The Eighth Industrial Exposition under the auspices of the Cincinnati Chamber of Commerce, Board of Trade, and Ohio Mechanics Institute will begin September 8 and close October 9. It will be open for the reception of Exhibits from August 18. From most exhibitors an entrance fee of two dollars is charged, but there is no charge for space or for motive power. Liberal preparations have been made for the exhibition of machinery in operation, and for the display of natural and industrial products, manufactures, and works of art. The exhibition last year represented twenty-four States, and was attended by 422,957 visitors. The coming exhibition promises to surpass in interest and value those which have preceded it. Over a thousand cash premiums and medals of gold, silver, and bronze are offered for competition.

The Cost of Keeping Soldiers.

The Paris *Constitutionnel* has been calculating the average cost of soldiers in the various European countries. It appears that the annual cost of each soldier in the English army is \$700. The soldiers of Austria-Hungary cost \$355 each a year. Those of France and Germany \$315 each. The Italian soldier costs a trifle less than \$200, and the Russian little over \$190. The maintenance of the army costs annually to each head of the population, 6s. 6d. in Italy; 7s. 4d. in Russia; 8s. 6d. in Germany; 12s. 4d. in France, and 12s. 6d. in Great Britain.

Winking Photographs.

Winking photographs are said to be produced in the following manner: One negative is taken with the sitter's eyes open; another without change of position, with the eyes shut. The two negatives are printed on opposite sides of the paper, "registering" exactly. Held before a flickering lamp, or other variable source of light, the combined photographs show rapid alternations of closed and open eyes, the effect being that of rapid winking.

IMPROVED FISHWAY.

The engraving shows an improvement in fishways lately patented by Mr. W. H. Rogers, of Amherst, Nova Scotia. It is built in with the dam or rests against it, and affords to the fish a ready means of ascending the stream without regard to the number or height of the dams. The fishway has an inclined flat bottom and vertical sides forming a channel or trunk. The bottom has a rise of about one foot in eight or ten, and the sides extend above high water. The lower portion of the channel is divided into a zig-zag passage way by diagonal partitions, which are attached in alternation to opposite sides of the fishway. These partitions retard the flow of water and afford an easy passage for fish. To the upper side of the upper edge of each partition a flange is attached for the purpose of checking the water so as to form pools of comparatively dead water in which the fish may rest on their course up the fishway.

The lower entrance to the fishway is formed in the lower part of the dam. The fish readily find this entrance, as the water flowing from it is comparatively sluggish.

The fishway is held together by a strong wooden framing, and in the sides there are openings provided with slides which may be opened whenever the water gets too low to flow over the upper end of the way.

This simple device admits of utilizing streams for power without interfering with the fish and without wasting an undue quantity of water.

California's Grain Product.

During the fiscal year just ended California has shipped about 580,000 tons of wheat (including flour) and 34,000 tons of other grain. As a larger area has been devoted to cereals this year, and good crops are now assured, the surplus for the coming year will doubtless be larger than last year's.

NOVEL CORN SLED.

The engraving represents a novel device for moving shocks of corn or other grain or fodder from one place to another without altering the form of the shock. The device is very simple, and can be easily and quickly operated. Two side frames, A, are supported in front upon pivoted runners, B, and at the rear on a folding runner, C, which may be operated by the lever, D, and link, E. The frames, A, are jointed together at the rear upon the pin, F, and are drawn together in front by a chain, G, attached to one frame and running over a pulley in the other frame. Each side frame is provided with a number of fingers or pins, H, which alternate in position with the pins of the other frame.

To use the apparatus, the chain, G, being unhooked, the side frames are spread apart and drawn forward on opposite sides of the shock to be moved. The chain, G, is then fastened, and draught being applied to it the two side frames are drawn toward each other, forcing the pins, H, into the base of the shock. During the operation the runner, C, is in the position shown in Fig. 3, and now by pressing down the lever, D, the shock is raised from the ground and the runner is placed in the position shown in Fig. 1, when the sled with its load may be drawn forward. The operation of unloading the sled is simply the reverse of what has just been described.

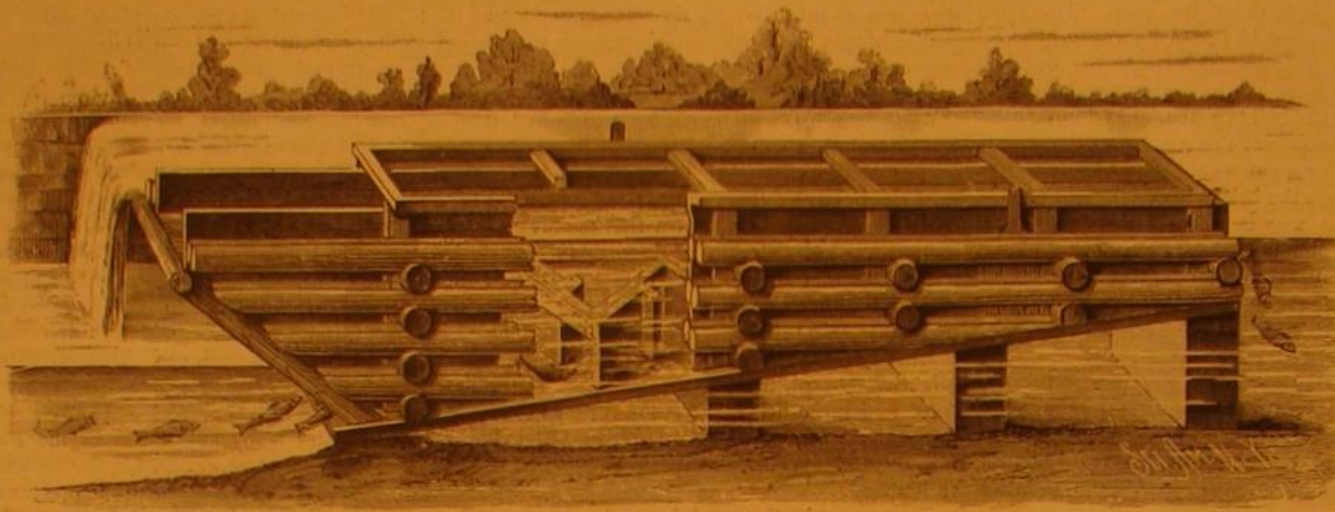
This invention was recently patented by Mr. William H. Wood, of Elizabeth, Allegheny County, Pa., who may be addressed for further information.

A LARGE CANAL BOAT.—The largest canal boat that ever passed through the Erie Canal, arrived at this city June 16, with a cargo of 8,500 bushels of corn. The boat—the Henry J. Robinson—is 96 feet in length, 18 feet breadth of beam, draws 9½ feet of water, cost \$5,500, and was built at Rochester, New York.

Government Fish Hatching.

At the hatching establishment of the U. S. Fish Commission at Washington about 20,000,000 shad have been hatched this year. Of these 15,000,000 have been turned into the Potomac River, and the remainder have been distributed mainly to the waters of California, Iowa, Kansas, Kentucky, the Carolinas, and Virginia. Yesterday 100,000 young shad two days old were shipped to Sandusky, Ohio, and the same number to Terre Haute, Ind., to stock the streams there.

During the year the Commission has distributed 25,000,000 fish. Carp have been sent to nearly every State in the Union, 3,000 applications for them having been received during the year.



ROGERS' FISHWAY.

The floating hatchery, Fish Hawk, soon starts on her first voyage to sea, to secure a supply of codfish eggs. * Thus far the experiments in hatching cod have been encouragingly successful.

At the establishment of the Fish Commission at Druid Hill Park, Baltimore, salmon eggs are now being hatched. Arrangements have been made for regular shipments of the eggs of that fish from California. Good results are expected. It has been demonstrated that salmon will thrive as well here as in the waters of California.

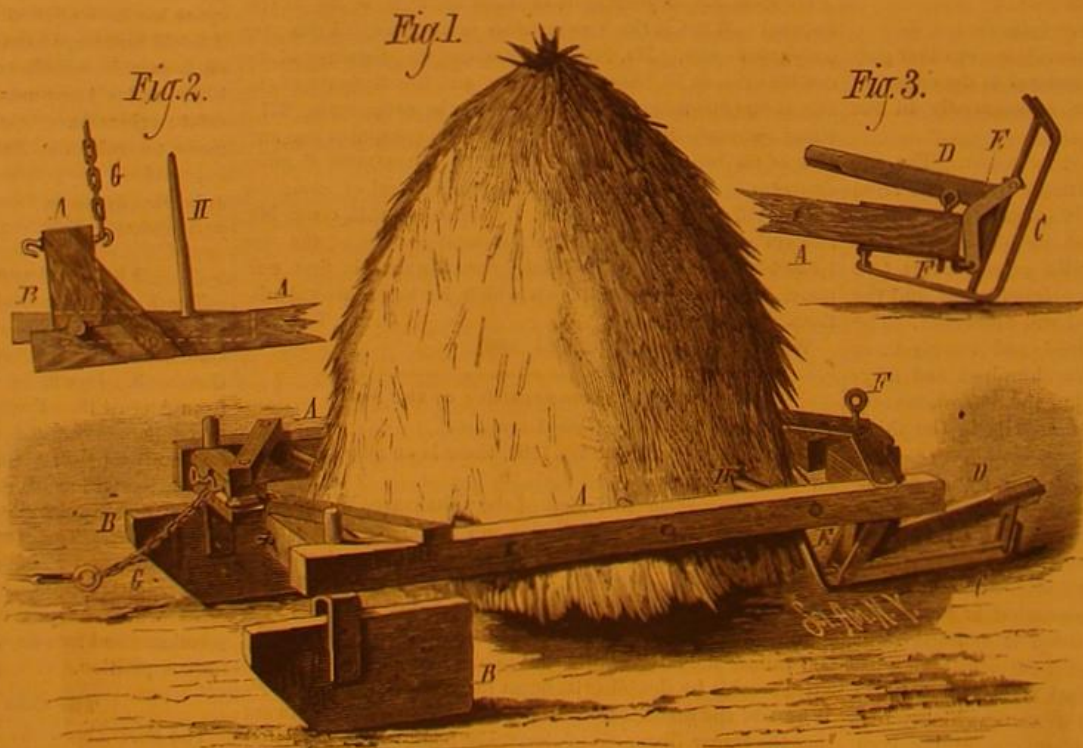
Wonderful Sensitiveness of Photo Plates.

Photo plates made by the new photo gelatino-bromide process have such a remarkable sensitiveness that soft harmonious negatives may be secured in one-sixtieth of a second. The opportunities for instantaneous pictures are thus greatly extended. At a recent meeting of the Society of

domestic work of the ship. The Admiralty, however, being desirous of extending the usefulness of these small craft, commissioned Mr. John Samuel White, of East Cowes, to build six sea-going life pinnaces of slightly larger dimensions, and which should realize a higher rate of speed than had yet been obtained from similar boats. The recent trials of these pinnaces at Portsmouth have been followed with great interest, and the results are in many respects remarkable. The boats measure 48 feet in length (or 3 feet more than the largest at present in use), 9 feet 3 inches in breadth, and 4 feet 9 inches in depth; and have a draught, when all their machinery and gear are on board, of 2 feet 8 inches forward and 3 feet 5 inches aft. They are built wholly of wood, and upon the diagonal principle, and are driven by compound engines, of which the high pressure cylinders are 7¼ inches, and the low pressure cylinders 11½ inches in diameter, having a stroke of 8 inches. The screws, which are

four-bladed, have a diameter of 3 feet 2½ inches, a mean pitch of 4 feet 7½ inches, and a length of 5¼ inches. The boiler is fitted with a closed stoke-hole, the furnace being supplied with air by means of fans exactly after the manner of a torpedo boat. The total weight of the fully-equipped pinnaces is 152 cwt., that is, 86 cwt. the machinery with steam up, and 66 cwt. the hull. When tried on the measured mile by the Dockyard authorities the engines developed 120 horses, with 340 revolutions per minute, and realized a mean speed of just over 13 knots, which is almost equal to the speed of the second class torpedo boats which, as a matter of course, can only be used for torpedo purposes. The steam pressure was at 120 lb., and the engines were worked expansively with the cut-off at 9-16ths of the stroke. The increase from 9½ to 13 knots at a bound has given great satisfaction, and, as the consumption of fuel has been reduced from 6 lb. to 3 lb. per unit of

indicated horse power per hour, the additional speed has been obtained without any additional cost of coal, seeing that the power developed in the 45 foot pinnaces was about 50. The question now arises whether these quick, light, and handy craft, which have had their fleetness greatly increased without injury to their special qualities as sea-going life pinnaces, could not be applied to purposes quite distinct from the ordinary work connected with a man-of-war, and thus help in freeing the decks and davits of an armor-clad from much of her present impedimenta. With a speed of 13 knots they will probably be found serviceable as patrol boats and for assisting in defeating a torpedo attack. Whether they may be adapted for offensive torpedo purposes, and thus compete with the steel boats, is a matter for consideration, but it is unquestionable that, while they possess the



WOOD'S CORN SLED.

Arts, London, Mr. Gale exhibited photographs in which was shown the picture of a swallow poising in the air over a pond, the shadow and reflection in the water being very perfect.

A Seal Caught in New York.

A young female seal was caught asleep on Holmes Reef, East River, June 18, by Captain J. H. Baxter, wreck master at Hell Gate. The little wanderer from the north was taken to the baths at the foot of East 86th street, where she has become a general favorite. She was from the first perfectly fearless and very gentle. She likes to be petted and never offers to bite. She is nearly three feet long, weighs about twenty pounds, and is thought to be about three months old.

Another step ahead has been made in the equipment of our men-of-war, says the *London Times*, though to casual observers the present improvement may appear less important than it really is. The advance, however, is highly significant, as showing the progressive development of steam propulsion and the multiplicity of uses to which a single boat may be applied. At the present time the fleet is provided with steam lifeboats varying from 42 feet to 45 feet in length, and which possess the prime quality that they will not capsize or sink if filled by a sea, there being more than sufficient buoyancy in the air-tight compartments to sustain the engines, crew, and weights. The air compartments, again, being built into and forming part of the structure of the boats, give great longitudinal and transverse strength, thereby enabling them to be hoisted up in davits, and rendering them available at all times. But, inasmuch as the speed realized by the largest of these twin-screw lifeboats has never exceeded 9½ knots—a very fair rate in the circumstances—they have been necessarily confined to the performance of what may be termed the

speed of a 60 foot torpedo craft in a straight line, their twin screws give them important advantages in respect of turning and going astern. With the rudder alone and with both engines going full speed ahead they can turn in from eight to ten times their length; but with one engine going ahead and the other astern they can go round in a distance equal to twice their length.

SEA OTTER, OR KALAN.

The kalan, or sea otter, says "Wood's Natural History," is very much larger than its fresh water relations, being rather more than twice the size of the common otter, and weighing as much as seventy or eighty pounds. During the colder months of the year, the kalan dwells by the sea shores, and can be found upon the icy coasts of the Northern Pacific, where it is extremely active in the capture of marine fish. When the warmer months begin to loosen the icy bonds of winter, the sea otter leaves the coasts, and in company with its mate proceeds up the rivers until it reaches the fresh water lakes of the interior. There it remains until the lessening warmth gives warning for it to make its retreat seawards, before the fierce frosts of those northern regions seal up the lakes and deprive it of its means of subsistence.

It is rather a scarce animal, and is not so prolific as many of its relations. The fur of the kalan is extremely beautiful, shining with a glossy velvet-like sheen, and very warm in character. It is in consequence valued at a very high price. The color of the fur is rather variable, but its general hue is a rich black, slightly tinged with brown on the upper portions of the body, while the under portions of the body and the limbs are of a lighter hue. In some specimens the head is nearly white, and in one or two instances the white tinge extends as far as the neck. Indeed, the proportions of dark and white fur differ in almost every individual. All the otters are long of body and short of limb, but in the kalan this peculiarity is more apparent than in the ordinary otters, on account of the curious setting on of the hinder limbs and the comparative shortness of the tail, which is barely more than seven inches long, while the head and body measure three feet in length. The food of the sea otter is not restricted to fish, but is composed of various animal productions, such as crustacea and mollusks. Some writers assert that, in default of its more legitimate food, it varies its diet by sea weeds and other vegetable substances.

NEMERTES, OR STRIPED POLIA.

The nemertes is somewhat like the leech, but it is not furnished with a sucker. It sometimes attains the extraordinary length of thirty to forty feet, and can extend or contract itself in a surprising manner. A specimen of twenty feet long is capable of suddenly contracting itself to the length of four or five feet. The exact length to which the nemertes can extend itself is not known. It is always writhing and coiling its long body into apparently inextricable knots, but never suffering any real entanglement. It will convert its body into a long and slender screw, and it is assumed that it moves from one place to another when coiled in this way. No accurate and reliable observations of the habits of this animal have yet been made.

Effects of Severe Cold on Insects.

A very general impression prevails that severe winters are prejudicial to insect life. It is, however, a quite erroneous impression, for nothing has struck us so forcibly in our experience with injurious insects, as the fact that in most cases they pass more safely through a steady, even if severe winter, than through a mild or changeable one. We have repeatedly called attention to this fact in our own writings, and Miss E. A. Ormerod, in her "Notes of Observations on Injurious Insects," for 1879, has some quite pointed remarks on this subject, in connection with the severity of the past winter in England.

Severe and steady cold is not only favorable to insect hibernation, by causing a continued state of torpor, but indirectly in preserving them from the attacks of birds and other animals, which, during such severe weather, cannot reach them in the frost-bound ground.

Mild winters, on the contrary, generally cause premature activity in insects, often followed by relapses into the torpid state, and such changes are prejudicial to their well being.

Insectivorous animals also fare better during such mild winters.—*American Entomologist.*

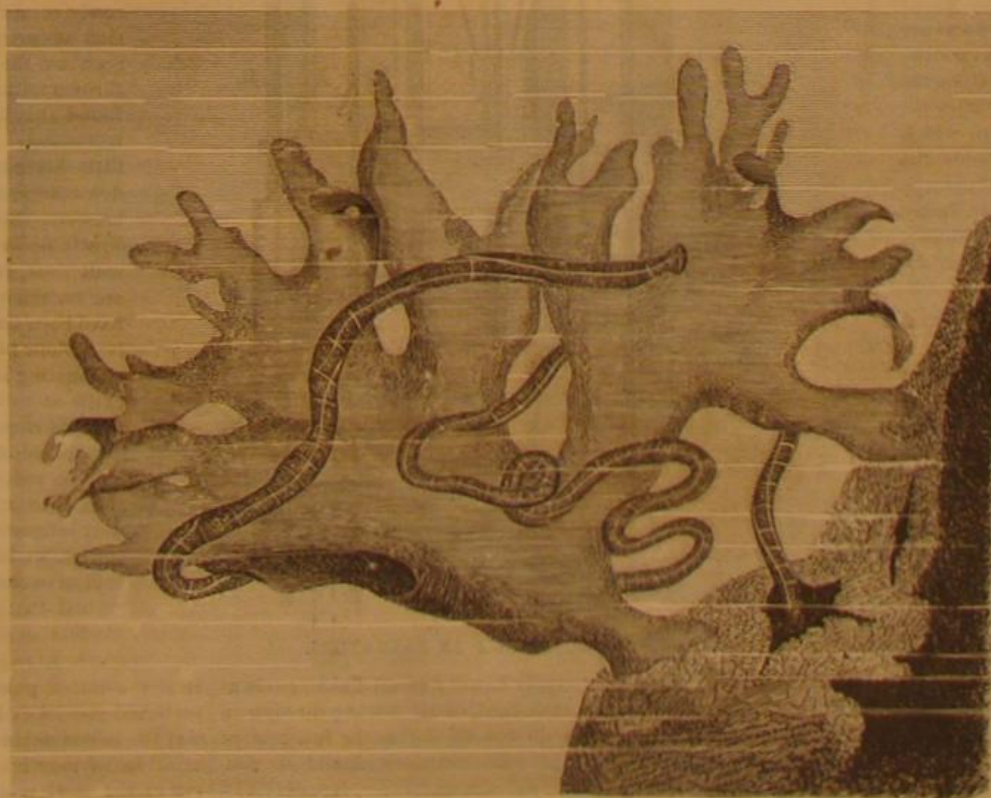
The Centrifugal Creamery.

The estimation of the quantity of cream contained in milk can now be made very accurately and rapidly, by means of centrifugal force. Attach the handle of a can, filled with milk, to a cord; hold the other extremity of the latter in the hand, and twirl as if for a sling; the cream, lighter than the rest of the milk, will accumulate on the surface free from all liquid, and more quickly than if in a state of repose; the time will even be lessened in proportion as the revolutions are rapid. When the milk has a temperature of 59° to 60° Fahr., the separation of the cream takes place in fifteen minutes, at the rate of six hundred revolutions per minute. At the same time the quantity of water added to the milk for adulterating purposes can be ascertained. M. Gemboux



SEA OTTER, OR KALAN.—(*Enhydra lutris*)

having tested that pure milk contains ten per cent of cream, added one, then a second tenth of water, and when whisked the cream represented but nine and eight per cent of the volume of milk. Further, when whirled in the cylindrical churn, the contents formed three distinct layers—cream, water, and skim milk. The same centrifugal test was applied to butter, maintained in the liquid state by means of hot water; the water separated into three states toward the circumference of the churn—fatty butter, caseine, and salt water; it was in the latter all the mineral adulterations lodged. It was at the Exhibition of Vienna that an apparatus for separating cream from milk by centrifugal action was first made known. It is to M. Lefeldt that the honor reverts for applying the system on a vast scale by means of a turbine cylinder making eight hundred rotations per minute, when the cream is formed round the axle of the machine, after which comes the skim milk, and then the impu-



NEMERTES OR STRIPED POLIA.

rities, forming, as it were, three rings or zones. Other skim milk is introduced, which forces up the cream to run over, and thus out of the cylinder. Mr. Lawal's Swedish skimmer is so constructed that, in proportion as the cream and skim milk are separated, they pass off by the entrance of fresh milk. In the co-operative dairy at Kiel, 4,000 quarts of milk, the produce of 550 cows, are centrifugally skimmed per day.

NATURAL HISTORY NOTES.

Effect of Thick Sowing on the Sex of Dioecious Plants.—At the meeting of German naturalists and physicians at Baden-Baden last September, Prof. Hoffmann, of Giessen, as reported in the Berlin *Monatsschrift*, sought to show that seeds of unisexual plants, when thickly sown, result in a preponderance of males. Thus he found that one hundred seeds of spinach, sown in a six-inch pot, yielded two males to every female, whereas the same sample of seed produced an equal number of males and females in the open ground where they had plenty of room. This observation would be important if of general application, and especially with hemp, but Haberland disputes it so far as this plant is concerned. According to Hoffmann, sex does not reside in the seed, but depends on the conditions of germination. Unripe seeds of *Lychnis viscaria*, he found, gave a larger proportion of males than fully ripe seed. Seed of *Mercurialis annua*, artificially impregnated in early summer, gave more males than autumn impregnated seed. Prof. Prantl, of Aschaffenburg, remarked that crowded prothallia of ferns produce a larger percentage of antheridia, and scattered ones more archegonia. Prof. Pfeffer, of Tübingen, stated that he had observed a similar phenomena in the case of equisetum.

Interdependence of Animals and Plants.

—The *Gardener's Chronicle* gives an engraving of a very remarkable pitcher plant, new to cultivation, but described by Dr. Hooker, a few years ago, from dried specimens collected in Borneo by Low and others. The large bag-shaped pitchers are, when fully developed, provided with two sharply toothed wings. The neck of the pitcher is thrown into ridges with intervening furrows, and is prolonged at the back into an erect, or slightly incurved process, terminating in two sharp recurved spurs, the whole reminding one of the head of a snake uplifted and ready to strike with its fangs.

At a recent meeting of the Linnean Society Mr. Burbridge, an observant naturalist, read a paper on the subject, which throws some light on the curious organization in question, and is of considerable interest as illustrating the solidarity of the organic world. It seems that the stalk of the lower bag or ampulla-shaped pitcher is swollen and hollow, and in their native country most of them are perforated by a species of black ant, which forms its colonies in the old and dry pitcher, and continually visits the fresh ones, so far as can be determined, for the purpose of obtaining food and water, since these fresh pitchers contain a miscellaneous collection of dead and decaying insects of many kinds. As these pitchers are perfect traps to creeping insects of ant-like character by reason of the incurved ridges round the throat of the pitcher, these black ants ingeniously perforate the stalk, and so obtain their supplies, and provide a means of exit in case of need. Now as to the

uses of the formidable spurs which lie concealed under the kidney-shaped lid of the pitchers: There is found in the Bornean forests, where this fine pitcher plant grows, a curious little animal called by the natives "Tampellic," and by the few Europeans who have ever seen it alive, the "Spectre Tarsier" (*Tarsier spectrum*). It is a most singular and interesting creature, about the size of a rat. An engraving of it is given on page 247 of the *SCIENTIFIC AMERICAN* for October 18, 1879. Its head is singularly like that of a small kitten; the eyes are large and full, the body is monkey-like, and the tail slender and as long as the body, but bushy at the tip like that of the lion. Its feet have curiously enlarged disk-like tips, reminding one of the enlarged ends of the climbing tendrils of the Virginia creeper. This little animal is an insect-eater, and knowing that the pitchers contain entrapped insects, visits them pretty regularly. In the case of some of the pitcher plants the insects imprisoned in their unarmed urms are readily removed, but not so in the species under consideration, as the sharp spurs are so placed that the tarsier is sure to be pricked by them, and

quite sharply too, if its head is inserted under the lid for getting at the interior. The main question, and the one yet to be solved, is, of what use are the living ants, and what end is this one species of *Nepenthes* made to serve as the nest of a peculiar species of these insects. To suit its requirements not only is its very structure modified, but especial precautions are taken to ward off the insect-eating tarsier. The use of the entrapped insects we already know, for it has

been demonstrated by Dr. Hooker that the pitchers of *Nepenthes* not only allure insects by a sweet secretion at the rim and upon the lid of the cup, but also that their capture, or the presence of other partly soluble animal matter, produces an increase and an acidulation of the contained watery liquid, which thereupon becomes capable of acting like gastric juice in dissolving flesh, albumen, and the like. In other words these pitchers seem to be stomachs. Borneo is indeed a land of many wonders. Dr. Beccari has found there a curious plant (*Myrmecodia*) which never fully develops until bitten by a large red ant. They make their nest in the swollen stem, and thence rush out to repel all invaders. Dr. Beccari asserts that the presence of these ants is absolutely essential to the plant's existence, for unless the young plants are thus attacked they soon perish.

IMPROVED ELEVATOR.

The frequency of accidents to elevators has suggested a practical field for invention, to which some of our inventors have turned their attention. By some safety is sought in pawls and ratchets, in a multiplicity of ropes, and in the hoisting machinery itself; but the inventor of the device which we illustrate secures safety by automatically opening and closing the hatches as the elevator approaches and recedes from them. This plan not only secures the elevator car from dangerous falls, but it also prevents persons from falling down the hatchway, and in case of fire prevents its spread through the hatchway.

The mechanism by which this very desirable end is accomplished is both novel and ingenious. The hatchway is closed at each floor by two doors, A B, which are connected by links, *a*, with a slide, *b*, moving in guides at the side of the hatchway, so that when one door is moved in one direction the other will be correspondingly moved in the opposite direction. The doors, A B, are each provided with two segmental racks, C D, which are engaged alternately by racks on the vertical rods, E F. These rods extend from the top to the bottom of the hatchway, and are provided with as many short sections of rack as there are segmental racks attached to the doors.

On the driving shaft of the elevator there is a loose spur wheel, G, engaging a rack on the lower end of each of the rods, E F, so that when one of the rods moves upward the other moves downward. Upon the rod, F, in addition to the rack already mentioned, there is another rack which is engaged by a wheel having cogs in a segment of its periphery, H, secured to the driving shaft. The car is hoisted in the usual way, and as the driving shaft revolves an intermittent vertical movement is imparted to the rack on the lower end of the rod, F, by engagement with the mutilated wheel, H. The rod, E, by virtue of its connection with the rod, F, through the spur wheel, G, is also moved vertically, but in the opposite direction.

When the car is ascending the rod, F, with its racks, is moved downward, and its movements are timed relatively with the movement of the car, so that just before the car reaches a pair of doors the rack segment, D, on the door is engaged by one of the racks on the descending rod, F, and the doors are opened, at the same time one of the racks on the rod, E, engages one of the rack segments, C, on the door below, closing the doors immediately after the passage of the elevator through the floor to which the doors belong. When the car descends the reverse of what has just been described occurs.

This invention was recently patented by Mr. James W. Evans, care Geo. F. Betts, Equitable Building, 120 Broadway, New York city, who may be addressed for further information.

A Great Towing Feat.

One of the longest towing feats on record was lately accomplished by the salvage steamer *Recovery*, of Liverpool, in towing from St. Vincent, W. I., to Flushing, Holland, the Italian screw steamer *Centro-America*, which had broken her propeller shaft. The *Recovery* left St. Vincent, with the steamer in tow, April 1, and arrived at Santa Cruz, Tenerife, April 11, where she was detained one day. The Lizard Signal station was passed April 24, the run from Tenerife, 1,383 miles, having been made at an average of 115 miles a day. Flushing was reached on the 27th, making the whole passage of 2,578 miles in 26 days, deducting the detention at Tenerife. Two heavy gales were encountered by the way. The best day's work was 144 miles. The *Centro-America* registered 1,384 tons.

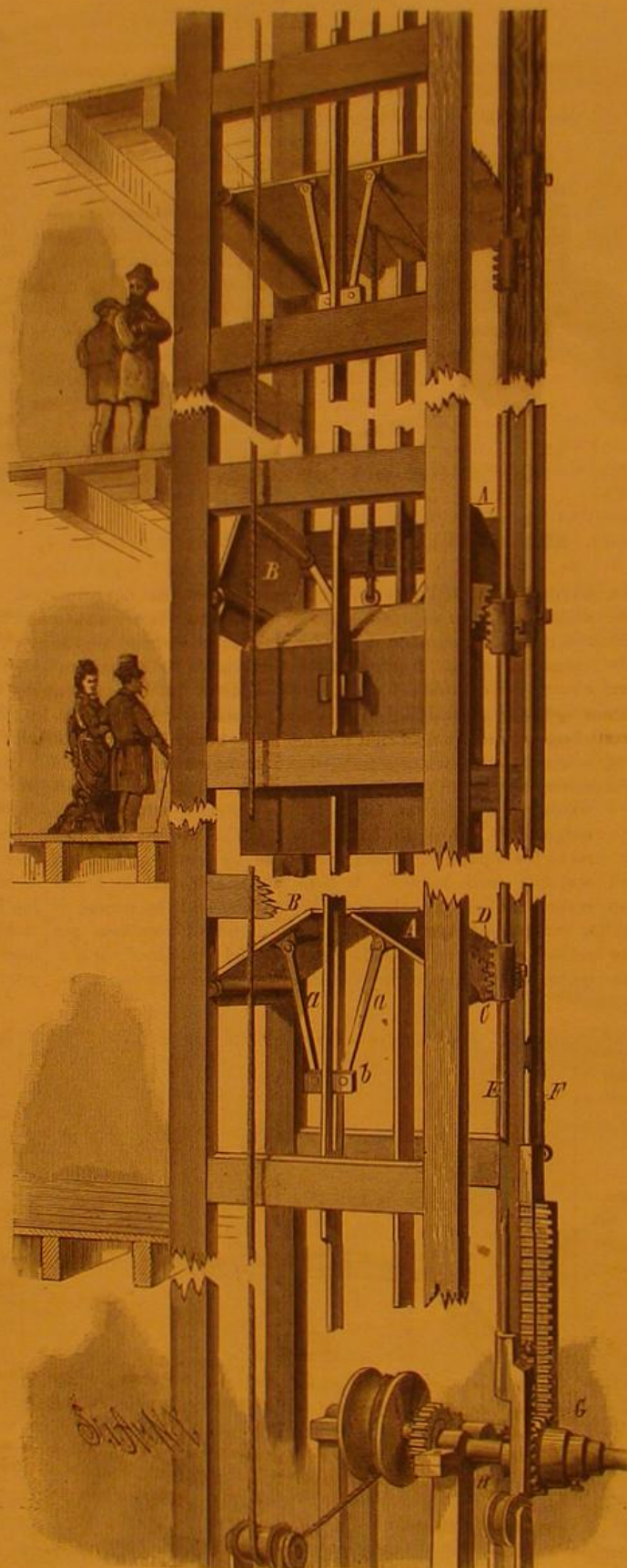
Preservation of Hops.

The principal feature in this new system consists in sprinkling the hops with alcohol prior to packing, and then pressing them tightly into air-tight vessels. In course of time the alcohol combines with some of the constituents of the hop, and certain volatile ethers are thus formed; these possess a strong and peculiar fruity smell, but being very volatile, they are all dissipated during the boiling. Dr. Lintner has experimented on these preserved hops at Weihenstephan, and speaks well of them; he says the fine color

is retained and there is a full development of aroma; the fermentation of worts made with these hops worked well, and the resulting beer possessed a fine bitter flavor. If this method of sprinkling with alcohol will stop the development of valeric acid, which takes place in hops when stored in the usual manner, it ought to come into general use.

Wind Pressure.

Does the wind, in passing through the open spaces left between the solid members of an articulated structure (such as a bridge), experience no further resistance than that offered by the net area of the solid surfaces of the members? We think it does. Air is a fluid equally with water, and it is well known that when water issues through an orifice in a flat surface, the issuing stream is very sensibly contracted to much less than the area of the orifice. This coefficient of discharge through holes in plates or flat surfaces is as low as 0.62. Or, in other words, only 62 per cent of the opening is truly effective for the passage of the liquid. Without



EVANS' IMPROVEMENT IN ELEVATORS.

doubt, these principles apply equally to all fluids, gases as well as liquids. In the case, then, of air flowing through an articulated structure, we do not think that the full area of the openings, between the solid members, should be considered as effective for the passage of the air, but only to a reduced extent of, perhaps, from 60 per cent to 70 per cent. This would have the effect of adding very largely to the gross resistance offered by any articulated structure to the wind—in fact, it would cause an addition of from 30 per cent to 40 per cent of the openings to be added to the solid members as representing the whole area offering a resistance to the passage of the wind. This additional amount of resistance may be found more than sufficient to occasion overturn, when otherwise it would be far from being anticipated by calculation.—*Iron*.

A Curious Phenomenon.

The *Plaindealer*, of East Kent, Ontario, states that a curious and inexplicable phenomenon was witnessed recently by Mr. David Muckle and Mr. W. R. McKay, two citizens of that town. The gentlemen were in a field on a farm of the former, when they heard a sudden loud report, like that of a cannon. They turned just in time to see a cloud of stones flying upward from a spot in the field. Surprised beyond measure they examined the spot, which was circular and about 16 feet across, but there was no sign of an eruption nor anything to indicate the fall of a heavy body there. The ground was simply swept clean. They are quite certain that it was not caused by a meteorite, an eruption of the earth, or a whirlwind.

The New Brooklyn Elevator.

A brick elevator, with stores, rivaling in capacity the great elevators of the Erie and the Pennsylvania Railroad Companies in Jersey City, has just been erected in Brooklyn by David Dows & Co., of this city. It is intended exclusively for handling and storing grain for the European trade.

The façade on Columbia street is 200 feet, and the sides reached to the Atlantic dock stores, of which it will form a part, are 175 feet on each side and three stories in height. The chimney is situated on Pacific street, about the middle of the building, and is 12 feet square at the base, rising to the height of 180 feet, which is also the height of the elevator. The upper part of the latter will be entirely of framework, extending the full width of the store on which it rests, and will contain five tiers of chutes leading to the wharves on either side, so as to be readily connected with the holds of vessels. A novel feature in connection with these chutes is that they form a continuous circuit with other chutes leading from the new building.

But the essential feature of the structure in which it differs from the other elevators in use is the erection of two elevators on the Columbia street side, corresponding in height and shape to the elevator proper at the wharves. These will be so connected with each other and with the main elevator, that any or all can be used simultaneously in loading from one to four vessels, or in unloading grain from canal boats or lighters at one point, and at the same time loading steamers at another. It is in the facility with which this process can be carried out that the great improvement in the elevator system consists. So great is the capacity of the stores that 20,000 tons of grain can be readily stored on any floor of either building. The machinery will be so adjusted that a double hoisting system can be employed with as little difficulty as the single hoisting system now employed on the railroad elevators. It is calculated that by this method two transatlantic steamers of the greatest capacity can be loaded with grain within eight hours by the simultaneous operation of the double hoisting apparatus.

Explosions of Malt Dust.

One of the Burton-on-Trent breweries has narrowly escaped destruction by fire. A violent explosion occurred in the malt grinding room, and as soon as the workman in charge, who had been thrown on to the ground, could recover himself, he found that the hopper above was in flames, which, fortunately, were soon suppressed. There is but little doubt that this explosion was caused by a sudden combustion of malt dust, and it is well that brewers should be warned against this danger. Finely divided combustible powders, such as flour, malt dust, coal dust, etc., will explode, and there are on record many serious conflagrations which have been traced to this cause; in America several large flour mills have been totally destroyed by fires originating in this way. Some difference of opinion exists as to the way in which these explosions are brought about; it is, however, easy to imagine that a combustible substance like malt, flour, or coal, may be reduced to such a fine state of division as almost to approach the gaseous state, and being thus intimately mixed with the oxygen of the atmosphere, we have all the materials for a sudden and explosive chemical combination. Some persons have argued that these explosions are spontaneous, but we incline to the opinion that either a flame or a spark is required to bring about the combination.

It is a common practice in some breweries to place an unprotected gas jet or lamp close to the malt mill, and in this way the inflammable dust may easily become ignited; or the same result may be produced by a small stone passing between the steel malt rolls, by which a spark is produced, and thus the dust is exploded. Precautions against these two sources of danger should be observed in every brewery.—*Brewers' Guardian*.

A BEEFSTEAK chopped up fine and baked with flour and yeast in the form of a "meat-bread" loaf is the latest dietetic sensation. It is asserted that meat thus treated entirely disappears during the process of purification, the nutritive principles becoming incorporated with the bread. M. Scheurer Kestner has just been explaining the process.

THE STRUCTURE OF MATTER.

Read before the New York Academy of Sciences by Prof. C. F. Kroch, of the Stevens Institute of Technology.

It is a well recognized fact that much of the progress in chemical and physical science is due to the increased attention given by investigators to the molecular structure of matter. The labors of Clausius in founding the mechanical theory of heat, of Tait, Sir William Thomson, and others in studying the motions of gases, the researches of Helmholtz in hydro-dynamics, of Clerk-Maxwell in electro-dynamics, of Julius Thomsen in thermo-chemistry, and of Crookes on residual gases, may all be attributed to this cause; while Graebe and Liebermann have shown by their discovery of a method for preparing artificial alizarine, that "mere theory," as the practical man of the past was wont to call it, may become of great industrial utility.

Seeing, then, the obvious importance of the results already reached, and believing that we are only upon the threshold of higher achievements in the same direction, it occurred to the writer that the interests of science might be promoted by bringing together precise information concerning the views held at present by the most prominent workers in this field, and the evidence upon which these views rest.

In a series of articles published in the SCIENTIFIC AMERICAN of May 17, June 7, June 14, July 19, and August 23, 1879, the arguments, from which the following results are derived, were presented:

1. That the elements and compounds combine in invariable simple or multiple proportions by weight.
2. That this fact is explicable by the assumption of ultimate particles having different weights.
3. That gaseous bodies combine in invariable proportions by volume.
4. That this fact, together with the behavior of gases under variations of temperature and pressure, enables us to ascertain the relative weights and volumes of the ultimate particles of gaseous bodies.
5. That the ultimate particles, whose relative weights are thus found, and which we may now call molecules, must themselves consist of still smaller particles or atoms, about which we have no definite information, except that the number of them contained in the molecule of one substance bears a simple numerical ratio to the number of them contained in the molecule of another substance.
6. That, until the absolute size of molecules is known, a molecular volume can be regarded only as the cubical space of which, at a given moment, the molecule forms the center.
7. That, starting with this conception, ingenious attempts have been made to determine the relative molecular volumes of elements in their compounds, and that different investigators have reached different results. To this I might add,
8. That finally considerable insight has been gained by this means into the properties of compounds.

These papers were preceded by a statement of a few facts warranting the assumption that matter is composed of exceedingly minute particles. It will be necessary in the following papers to give further evidence, after showing what opinions the master minds of the past held concerning the structure of matter. Impressed as I am with the consciousness that we are but too liable to be biased by prevailing hypotheses, and to accept them as demonstrated truth, simply because the erosive action of habitual use has worn channels in our minds from which our thoughts cannot escape without a great effort, it has seemed to me an imperative duty of scientific men to return, from time to time, to first principles, and to review the opinions of the past by the aid of the new light of modern thought.

THE EXISTENCE OF MATTER.

It seems to be a prevalent belief that no one but a metaphysician would take it into his head to doubt the existence of matter and the reality of the universe outside of ourselves. However, it was but a few years ago that a friend, standing on one of the balconies of Horticultural Hall at the Philadelphia Exhibition, and lost in admiration of the region of wonders before him, was accosted by a stranger who persisted in trying to prove that it was all unreal.

It was recognized early in the history of philosophy that the perceptions of our waking hours do not differ much from those of our dreams, and the question naturally arose: How do we know that life is not a continual dream? This and all similar questions have been long ago disposed of, however, by the recognition of the fact that our reason sits in judgment upon our perceptions and decides upon their validity. In other words, we know when we have been dreaming. Yet the fact remains that our senses do deceive us.

When we look at the starry heavens, science teaches us that there is no reality in what we see. Light, with its enormous velocity of 186,000 miles per second, takes $3\frac{1}{2}$ years to reach us from α Centauri, 23 years from Sirius, and 50 years from the Pole Star. It is evident, therefore, that what we see simultaneously is not simultaneous in reality. We see at the same moment one star at the place where it was $3\frac{1}{2}$ years ago, and another where it was 50 years ago. The sun himself has traveled onward for over eight minutes since the light started from the place where we see him at a given moment. Have we then ever really seen the sun?

If our senses so obviously deceive us in this as well as in many other experiences, what guarantee have we that they do not deceive us in all? Simply this, that we are not really deceived even in these experiences, but we have the power to make the necessary corrections. No argument in favor of the unreality of the material world based upon such con-

siderations can prevail against the universal experience of mankind. When many persons receive the same impression under the same conditions, there must be something external to them to produce that impression. According to the calculus of probabilities, the chances that they would all, each of his own accord, think the same thoughts or dream the same dreams, are infinitesimal.

Let us now inquire into the views held by the thinkers of the past concerning the structure of matter.

ARISTOTLE.

The first conception of matter that merits our attention, though not the most ancient, is that of Aristotle (384 to 321 B.C.).

Our daily experience teaches us that the properties of bodies continually change. The tints of the sky, the sea, and the mountains vary from hour to hour; water is at one time a liquid, at another a solid, or a vapor; the air is now at rest, then it assumes a gentle motion, or rushes onward with a frightful velocity.

It is a natural inference that in all these phenomena there is something that changes, something that moves, and that none of the properties, motions, or changes we observe are essential to it. Thus we arrive at Aristotle's conception, that matter is something without any properties whatever, yet capable of assuming all properties; something without power of its own to move, yet capable of receiving motion. It possesses nothing but quantity, and that quantity must be unlimited.

Aristotle recognizes a first cause through whom this matter received motion and properties, but assumes that matter is coeternal with God, *i. e.*, that it existed from all eternity.

According to this system the first act of the Deity upon matter was its endowment with properties and motion. This is equivalent to a creation, since the objects we now see are its results, and it is perhaps difficult to conceive why Aristotle did not represent God as creating these objects out and out, matter and properties together. The explanation lies in his conception of the Deity, a conception arrived at as follows:

Passive matter must be moved either by a cause that is itself in motion, or by a cause that is at rest. Now, a cause that is itself in motion would need to have its own motion explained by a cause yet more remote, and so on indefinitely. We have left only a cause that is itself at rest. Such a cause can be only a mind, a spirit. Accordingly the god of Aristotle is pure thought, a perfect mind, that is the object of its own contemplation. Now, a mind could think properties, but it could not think concrete, material objects.

The difficulty with Aristotle's world of uncreated matter without properties is, that motion must be imparted to it by mere thought, and that in such a world there must be a constant intervention of the Deity, a continuous miracle.

LEUKIPPOS AND DEMOKRITOS.

We pass in the next place to a system that has more affinity with modern thought, the system of Leukippos and Demokritos, who maintained, about 400 B.C., in opposition to Anaxagoras, the teacher of Sokrates, that bodies are not infinitely divisible. We finally reach particles infinitely small and indivisible, which are called atoms and are indivisible. By reason of their indivisibility they are indestructible and unchangeable, and they completely fill the space they occupy. All atoms are identical in substance and differ only in shape and size. Differences in substance are produced by different groupings of these atoms, which have only one physical property, weight.

All invisible bodies consist of atoms and empty spaces. Motion, it is argued, is a necessary result of this. The atoms have always been falling, like snowflakes, through empty space. The larger ones overtake the smaller and form still larger bodies. Thus accretion goes on, a whirling or vortex motion is produced, and worlds are formed. There is no evidence, according to these philosophers, that motion is the result of purpose or design.

Unfortunately for this system large bodies do not, as a matter of fact, fall faster in vacuo than smaller ones.

EPIKURO.

Epikuros (342 to 271 B.C.) endeavored to rectify the errors in the system of Leukippos and Demokritos. He reasoned thus:

Matter consists of indivisible atoms differing from each other only in size, shape, and weight. A finite body could not have an infinite number of parts; therefore its divisibility cannot be infinite.

Atoms have a limited number of shapes and sizes; but of each kind there exists an infinite number.

Space and the number of atoms that exist in it must both be infinite. Finite space could not contain an infinite number of atoms, and on the other hand, a finite number of atoms would be lost in infinite space.

Now for motion. From all eternity atoms have been falling through space by reason of their weight. There being no resistance in a vacuum they must all have had the same velocity, and they could never have met and combined to form bodies and worlds, if their fall had always been vertical. So Epikuros invented a lateral deviation that he ascribed entirely to accident. Granting this, we may have collisions and repulsions, whirling motions and aggregations that spring into being and pass away again without law.

But we cannot grant this. We cannot at the same time pretend to search out the laws of nature, and admit the word accident into our scientific vocabulary. Accident is simply an unknown cause. When, therefore, Epikuros

attributed the meeting of atoms to accident he practically confessed that he did not know what made them meet.

It is worthy of note that Epikuros gave as his motive for inventing his system a desire to destroy superstition, to remove the dread of the gods, and to restore tranquillity to the mind. This means, in plain English, to abolish the Deity and personal responsibility.

Curiously enough, these mischievous atoms, after having become the basis of modern science, were so modified and adapted in the course of time that they have furnished Sir John Herschel and Prof. Maxwell with a very powerful argument to show that they could not have been evolved, but must have been created.

DESCARTES.

In more modern times thinkers endeavored to find in matter some fundamental property that inhered in it, while all other properties were only accidental or derived. Descartes, the inventor of analytical geometry (1596 to 1650), was led by the universality of geometric truth to regard extension as the very essence of matter. According to his system there can be no material atoms. A particle, however small, must still have dimensions, and it must therefore be divisible. If there are no atoms, there is no further necessity for imagining empty spaces. Nothing existing in nature corresponds to the conception of a void. If a void existed, no motion could be communicated through it. Space is only a figment of the imagination, and motion is possible by contact only. The whole universe is everywhere equally full of matter. When a body moves it does so by displacing other matter. It crowds out what is before it, while at the same time the matter behind it fills its former place. It is thus that a fish swims. While Descartes denied the existence of atoms, which, by their own nature, are indivisible, he admits that the Deity may have made certain particles indivisible in the sense that no creature can divide them.

According to this conception the sum total of motion imparted to the world at the creation remains unchanged. The universe is a vast machine, which transmits motion from one part to another, but does not destroy it.

(To be continued.)

NEW INVENTIONS.

Mr. Levi H. Roberts, of Cadillac, Mich., has patented an improved fastening for tool handles. The object of this invention is to secure handles to tools in such a manner that they will be held in place firmly, and can be attached and detached easily and quickly. The invention consists in a fastening for tool handles formed of a key and a plate roughened upon one side and smooth upon the other. The plate and key are inserted between the rear edge of the handle and the rear edge of the tool eye.

An improved attachment for fire-places has been patented by Mr. Frank S. Elsberry, of Montgomery, Ala. The object of this invention is to so construct the back of a fire-place or fire place grate, and to provide it with such attachments in the form of pipes and valves that it shall be adapted for receiving a supply of water and holding it while being converted into steam, which is distributed in pipes to different parts of the dwelling or other structure in which the grate is located.

An improved double-tree has been patented by Mr. John J. H. Parrott, of Salem, Oregon. The object of this invention is to provide a device to be applied to a vehicle whereby the hindmost horse shall be enabled to pull with more advantage than usual when endeavoring to draw abreast with the foremost horse. The invention consists of a straight rack fixed centrally on the front edge of a double-tree and gearing into a corresponding segment rack that is fixed on the tongue of the vehicle.

Mr. David James Rogers, of Bardstown, Ky., has patented an improved ice cream freezer of that form in which the can containing the cream is rotated upon a central pivot, and is provided with a vertical lifting beater or scraper, which removes the frozen cream from the sides of the can as it freezes.

An improved nose piece for bridles, patented by Mr. Rhodes Arnold, of Waltham, Mass., consists in the combination with the bit and the head piece of a bridle, of straps for counteracting the pressure of the bit on the mouth and lower jaw of the animal.

Mr. Francis M. Foster, of Coffeyville, Kan., has patented an improved sulky plow, which is so constructed that the plow shall be in front of the wheel, so that the plowman can see the plow and the team without changing his position.

Successful Treatment of Tetanus.

Dr. John C. Lucas, in the *Medical Times and Gazette*, strongly advocates the treatment of tetanus by smoking Indian hemp. The leaves of the cannabis indica are mixed with three or four times their quantity of ordinary tobacco. Directly there are indications of a spasm coming on, the fumes are inhaled until the attack ceases. The patient is then left quiet, but carefully watched, so that the pipe may be instantly handed to him on any appearance of the spasm returning. In this way the patient is kept continuously under the influence of hemp, day and night, nourishment being carefully administered at the same time. The advantages claimed for this mode of treatment are these: 1. The spasms are cut short. 2. They reappear gradually at longer and longer intervals. 3. They gradually become not only less frequent, but less severe. 4. This saves the patient's vital powers. Mr. Khasligr, of India, has also treated five cases of traumatic tetanus, all recovering by this method.

The Convention of the American Medical Society.

The thirty-first annual convention of the American Medical Society, in this city, the first week in June, brought together a large number of distinguished physicians and surgeons. In his presidential address Dr. Sayre spoke of the indebtedness of the world to American physicians and surgeons, in the development of new methods and novel operations, commencing with anesthesia, as associated with the name of Morton, and passing to ovariotomy, another American surgical discovery. This operation, said he, was first performed in 1809, in Danville, Ky., by Dr. Ephraim McDowell. Dr. Atlee, in 1844, revived the operation, and by persevering effort, in spite of all opposition and the very general condemnation of his contemporaries, was enabled at last, by his numerous brilliant successes, to establish the operation as a proper one in certain cases. Dr. Peaslee has stated that, in the United States and Great Britain alone, ovariotomy has, within the last thirty years, directly contributed more than 30,000 years of active life to woman.

In gynecology, the whole professional world gratefully acknowledges the original and invaluable contributions of Sims, Thomas, Emmet, Peaslee, Atlee, Kimball, Dunlap, Minor, Taylor, Pallen, and others. The new operation of litholapaxy, which consists in the fragmentation of calculous material, and the removal of the debris by aspiration through a tube, first performed and described by Dr. Bigelow, is also one of the grandest triumphs of modern surgery, and one of which any American surgeon may well feel justly proud. In conservative surgery, Americans certainly compare most favorably with Europeans. In the treatment of diseases of the joints, by which means the patients are able to take free exercise in the open air during the whole progress of the disease, thus acquiring power to overcome the constitutional dyscrasia better than by any means heretofore employed, and when the disease has progressed beyond repair, then to perform the sub-periosteal excision of the joint in such a manner as to leave the muscular power intact, and by judicious after-treatment to restore the function of motion, America has obtained a triumph in surgery of which the profession may well be proud. Another triumph of American surgery is seen in the application of the principle of absolute rest to diseases of the vertebrae.

A large number of papers were read, and several important meetings were held by related societies, among them the second annual convention of the American Laryngological Association, the fourth annual meeting of the American Medical College Association, and the fifth annual session of the Association of American Medical Editors.

A Lesson to Young Men.

In the nomination of General James A. Garfield for President at the recent Chicago convention, a lesson is taught from which all young men may profit. It may not be possible for every youth, be he ever so industrious and studious, to obtain a nomination for President of the United States, but by untiring industry and a persistent determination to acquire an education, as illustrated in the life of General Garfield, summarized by one of our contemporaries, it is possible for every young man of ordinary intelligence, be his origin ever so humble, to elevate himself to an honorable position in life.

After eulogizing General Garfield's military and political career, which it is not our province to discuss, the *Public Ledger* proceeds to say of his early life:

And what he is he has made himself, so far as any man is the builder of his own character, distinction, and honors. Left an orphan when he was but two years old, his widowed mother, with four children, being the possessor of a small farm in the "backwoods" of Ohio, he began to work as soon as he was old enough to aid in the support of the family. At sixteen he was a carpenter's boy; then driver of a canal boat, and subsequently a boatman, though not a man in years. He then intended to become a sailor on the lakes, but being persuaded by a young village teacher, he went to Geauga Seminary, and this turned the whole current of his life. Here the sturdy character of the future man showed itself. He had no money, except a very small sum his mother had saved. He and some others took a room and boarded themselves in a very abstemious fashion, being their own cooks. In the mornings and late afternoons he turned his hand to carpentering, and so supported himself. Continuing at the seminary, and at one of the country institutes, he kept himself going in the same way, varying his carpentering resources with teaching school in the winter, until he was twenty-three, and on his way to college, where he went through a two year term, came out the best Latin and Greek scholar, and was soon made professor and president of another academical institution.

More Inflammable Silk.

A recent fire in a bonded warehouse in this city, by which \$5,000,000 worth of goods were in danger, was traced to a lot of German black silk twist. Not long before a case of what was classed as silk goods was brought out of the hold of a Bremen steamship. The case had not been long on the wharf when it was discovered to be on fire. It was immediately thrown in the water, and, after the fire was extinguished, it was discovered that the case contained German black silk twist.

The ready combustibility of the silk in question is said to be due to a certain acid used in its preparation. Under very ordinary conditions oxidation takes place, and the silk becomes burning hot. When cooled it is found to be com-

pletely rotten. The large quantity stored in the endangered warehouse, it is thought, became overheated, the doors and windows being closed, and spontaneous combustion was the result.

Iron and Steel Making in Great Britain and America.

There are few British journals that are more thoroughly insular and anti-American in editorial ideas than the *London Engineer*. The following from its leading article is, therefore, quite refreshing:

Nothing connected with the crude iron trade possesses just now greater interest than the individual output of blast furnaces. For many years we were content in this country to blow with a comparatively small pressure, and to get from 180 to 220 tons of pig per week from each furnace. As time went on and competition increased, attempts were made to get more iron in a given time, and about fourteen years ago began the era in this country of large blast furnaces. In a very short time the dimensions increased from 14 foot to 16 foot boshes, and a height of 45 feet to 50 feet to 28 foot boshes and a height of as much as 80 feet. These enormous furnaces turned out a great deal of iron as a matter of course. It does not appear, however, they were eminently satisfactory either as to the quality of the product or the price at which it could be made. In the Lehigh Valley in the United States ore had for years been smelted with anthracite, the pressure of blast being 3½ pounds to as much as 6 pounds per square inch; the furnaces were small and the yields high. As the iron trade of America extended under the fostering influence of protection, a competition seems to have sprung up among iron manufacturers in the States. Each man tried to make more iron in a given time than his neighbor, and, as we have already recorded in our pages, a furnace of no great dimensions at the Edgar Thompson Steel Works has recently been making as much as 700 tons of excellent pig iron each week. Much of this success is due to the Cowper stoves which heat the blast. Something is due to the ore, but most is due to the skill and energy of the managers, who avail themselves of every chance, and rest not until they have satisfied themselves that no more can be got out of their furnaces. In this respect we are now far behind our American rivals, although it is not to be disputed that progress is being made. In 1860 the average annual make of iron per furnace in Great Britain was 6,574 tons. In 1866 it reached 7,384 tons; in 1871 it was 9,696 tons; in 1875 it was 10,119 tons, and in 1878 it attained 12,831 tons. Assuming fifty weeks to be a blast furnace year, there was for 1878 a weekly production of about 257 tons per week, or not one-half the duty of many American furnaces.

Next in importance to the production of iron is the production of steel. Here, again, we are beaten by the United States. In 1878 there were in America 27 converters, 20 of which were at work, and these turned out on the average 36,988 tons of steel per annum each. Last year there were at work in this country 68 converters out of 104, and the average annual production of these was but 12,272 tons each, or less than one-third of the yield of the American plant. Why this should be so is a question well worth discussion. We shall be under the mark if we say that Bessemer plant costs £10,000 per converter. However, for our present purpose the estimate is near enough. It appears, then, that we require $60 \times 10,000 = £600,000$ of capital, to turn out the same quantity of steel that can be turned out in the United States with $20 \times 10,000 = £200,000$ capital. The interest and depreciation on this sum cannot be reckoned at less than 10 per cent. Each converter, therefore, represents £1,000 a year, but its make in Great Britain being but, in round numbers, 12,000 tons, each ton must be charged with ten-twelfths of a pound sterling, or 16s. 8d.; while in the United States, as each converter turns out, in round numbers, 36,000 tons per annum, each ton must be charged with 5s. 9d. The balance in favor of the American on this item alone is, therefore, nearly 11s. per ton. When it is borne in mind that 2s. 6d. per ton in the price of rails may make all the difference between losing and obtaining an order, and that the cost of rolling Bessemer ingots into rails is now actually less than the cost of inspecting the rails, it will be seen that 10s. or 11s. per ton is an enormous percentage in favor of the American ironmaster. We shall not now stop to explain why the difference exists, nor is it, indeed, certain that the causes are as fully known as is desirable, but the questions involved are so important that they deserve prompt and full discussion.

As to the open hearth process of making steel, we have no means of knowing what the average production per hearth is, but, so far as we can learn, it may be taken at about 150 tons per week on the average. No good statistics exist as to the open hearth work being done abroad, so that we are unable to say with certainty which country obtains the best results; but there are not wanting indications that in this method of making steel America is ahead of us in the quantity turned out. We have said enough, we believe, to show that we cannot remain as a nation content with the progress we have made. Competition with the United States will become keener and keener every day. Protection, combined with other causes, has enormously stimulated the production of iron and steel in the United States; and internal competition prevents the consumer from feeling the evil effects of the tariff. The present demand from the States cannot last. The greatest energy is being displayed at the other side of the Atlantic in putting down plant. In the matter of new Bessemer and open hearth steel works alone, plant is now being constructed capable of turning out 600,000 tons per

annum, or, in other words, of doubling the present total make of the country.

The Howgate Arctic Expedition.

Notwithstanding the unfavorable reports of the board of naval officers as to the seaworthiness of the *Gulnare*, the vessel chosen to convey the Howgate Colony to Greenland, the expedition sailed June 21. The persons composing the expedition are: H. C. Palmer, captain; T. H. Bailey, first mate; A. L. Kenebly, engineer; J. H. Richardson, assistant engineer; Francis Hughes, assistant engineer; E. Smith, carpenter; W. C. Farquhar, steward; Frederick Keyes, cook; William Dowell, fireman; George Jones, fireman; Hugh McKenney, Peter Lawson, Peter Duprince, H. A. Evans, T. H. Dowling, Andrew More, and Arthur Keefe, able seamen; John McFarland, ordinary seaman. Ten of the enlisted men of the army who had been detailed for the service were, at their own request, discharged from the service, so as to go out with the expedition in the employ of Captain Howgate.

The scientific members consist of Dr. O. Pavy, naturalist; Henry Clay, secretary; G. H. Robe, surgeon; O. T. Sherman, astronomer; W. S. Jewell, meteorologist; George W. Rice, photographer.

The *Gulnare* will sail direct to Halifax and there take on board Lieutenants G. C. Doane, of the Second United States cavalry, and W. H. Low, of the Twentieth infantry, who have been granted leaves of absence by the Secretary of War, the former for four months and the latter for twelve months. After these officers are shipped the vessel will proceed to St. John's and coal. In consequence of the large quantities of ice floating in the neighborhood of Labrador, the *Gulnare* will sail to the east and thence to Lady Franklin Bay.

The colony to be established at Lady Franklin Bay will be under the command of Lieutenant Doane. Having landed the permanent party, the *Gulnare* will return to the United States for a second colony to replace the first, which having become acclimated, will then move further on toward the unknown interior. Though the *Gulnare* sailed without government aid or indorsement, she was permitted to fly the American flag.

Discoveries at Pompeii.

An almost perfect house has been lately disinterred at Pompeii. It is probably the best preserved of all the Roman dwellings hitherto discovered. There are two atria and a very spacious peristyle, in the middle of which there is an ornamental fountain. There is also a complete bath, which must assist in clearing up some of the doubtful points concerning the arrangement of Roman baths. The paintings in the interior of the house seem to have been executed with considerable taste, and they are in good preservation. Those on the first floor, representing for the most part marine animals, are especially interesting. The frescoes also which are contained in the wings of the building are excellent representations of scenes from animal life. They are so admirably preserved that they cannot fail to shed much light on the condition of painting among the Romans at the time, although they also give evidence of the influence of Greek art.

The Ice Trade in Maine.

Recent reports from the Kennebec Valley state that there is great activity in the ice trade of that region, and prices at Gardner, the headquarters, are fast approaching a fancy basis. The bulk of the sales were made at \$2 and \$2.50 per ton, but now dealers are refusing \$3.75 and holding for \$5 later in the season. The supply is fast going into the hands of the large dealers and speculators, and the cities of the Atlantic coast may soon look for another advance in their ice bills. The figures show that there were 800,000 tons secured on the Kennebec last winter, which at \$2.50 per ton will produce \$2,000,000, a large proportion of which comes into this valley for labor and profit on capital invested. This is more ice by 100,000 tons, than was ever secured on the river before, and the total crop of the State is estimated at 1,500,000 tons.

Another Gorilla in Philadelphia.

Rev. Dr. R. H. Nassau, of Gaboon, West Africa, has laid science under a second obligation by forwarding to Dr. Thomas G. Morton, of Pennsylvania Hospital, Philadelphia, another and larger specimen of the gorilla than the one dissected in that city two years ago. The last specimen is a full grown female and weighs about one hundred and eighty pounds; it is 4 feet 4 inches in height, and measures 41 inches around the chest; the arms are 38½ inches in length and 11 inches in circumference, and the legs are 31 inches long. It is in an excellent state of preservation, save that much of the beast's thick coat of hair has been removed by the action of the rum it was brought in. The animal was shot by an agent of Dr. Nassau, last February.

Fastest Time on Record.

Train No. 4 of the Pennsylvania Railroad recently made the fastest run on record from Philadelphia to Jersey city. The train consisted of locomotive No. 724 and two cars. Edward Osborne was the engineer, and Lewis Lilance conductor. The train left Philadelphia at 12:51, and Jersey City was reached at 2:24 P.M., the trip of ninety miles having been accomplished in precisely ninety-three minutes. Four stops were made, and twice the train was slowed up to cross bridges.—*New York Sun*.

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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Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 35, Jersey City, N. J.

Our new Stylographic Pen (just patented), having the duplex interchangeable point section, is the very latest improvement. The Stylographic Pen Co., Room 13, 169 Broadway, N. Y.

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Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

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

Best Oak Tanned Leather Belting. Wm. F. Forpaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

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

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For Alcott's Improved Turbine, see adv. p. 297.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Eclipse Portable Engine. See Illustrated adv., p. 413.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 13. Totten & Co., Pittsburg.

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

Blake "Lion and Eagle" Imp'd Crusher. See p. 13.

Steam Engines, Boilers, Portable Roadways, Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

Peck's Patent Drop Press. See adv., page 14.

Blake's Patent Belt Studs. The best fastening for rubber or leather belts. Greene, Tweed & Co., N. Y.

The Chester Steel Castings Co., office 407 Liberty 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 adv. p. 13.

Linen Hose for Warehouses and Hotels as protection from fire. Greene, Tweed & Co., 118 Chambers St., N. Y.

Silent Injector, Blower, and Exhauster. See adv. p. 13.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See adv. page 13.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

4 to 40 H. P. Steam Engines. See adv. p. 413.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 60 Broadway, New York.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See adv. p. 413.

Air Compressors. Clayton Stm. Pump Works, Bklyn, N. Y.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

New Economizer Portable Engine. See illus. adv. p. 13.

Catechism of the Locomotive, 635 pages, 350 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.

Valve Refitting Machine. See adv., page 13.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dugdon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 13.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., and 93 Liberty St., N. Y. city, U.S.A.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

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.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

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) R. C. writes: In finishing colored gold and gilt work with a scratch brush, electro-platers generally use sour beer, letting it flow freely on to the brush and work. The beer is dirty and bad smelling. Is there any clean fluid which would answer the same purpose? A. Try thin starch water to which has been added a trace of sulphuric acid.

(2) W. H. C. asks: How shall I clean old copper coins without injury to them? A. Dip in strong hot solution of potash or soda, rinse and dip for a moment in nitric acid, after which rinse quickly in running water.

(3) H. P. B. asks how to recover the silver that is contained in a solution of cyanide potassium. A. Place in the open air or under a hood with a good draught; add a small quantity of salt, then dilute sulphuric acid until no further precipitate forms; allow to settle, wash the precipitate with clean hot water; mix it with a small quantity of water acidified with sulphuric acid, and a few fragments of pure zinc; collect and wash the reduced silver, separate the remaining fragments of zinc; dry and melt with a little borax glass.

(4) S. S. writes: 1. A has a mill, the machinery of which is propelled by an overshot wheel with a vent or aperture of 144 inches under a head of water of 2½ feet, or 30 inches; he wishes to remove the overshot wheel and put in a turbine wheel, having 34 inches vent under a head of 20 feet water. Which of the two will discharge the greater amount of water in a given time, and how much, say, in one minute? A. The opening for the overshot wheel with a coefficient of discharge of 0.68, the overshot 318 gallons per minute, and the turbine 234 gallons per minute. 2. I have no work which treats of such questions. Please commend one, if you know of one such. A. D'Aubisson on Hydraulics.

(5) W. & D. ask: What is the best composition to renew the worn surface of gum belts? A. Manufacturers of rubber belts recommend "a composition of equal parts of black lead and litharge mixed with boiled linseed oil, and Japan enough to make it dry quick." It is to be put on with a painter's brush.

(6) W. B. asks: Does it make any difference where the exhaust pipe enters the cylinder of an engine? If so, where is the right place? A. If a horizontal engine, it is generally preferred to have it enter as near the lower side as possible, as it will then drain the cylinder of any water of condensation.

(7) W. P. L. writes: I have a stream of water which will supply 30 cubic feet a minute, with a

fall of six feet. Could I obtain sufficient power from it with any kind of wheel, to run a wood-turning lathe for turning small stuff without damping the water? What power would it supply? A. Your fall of water, if properly applied to a good water wheel, would give you about one-fifth of one horse power, which would do your work, but not without some kind of a dam, or its equivalent, to control the water.

(8) S. L. Z. asks: 1. What starch is used in laundrying new-made shirts, how applied, and how ironed? A. Use corn starch, boil to smooth paste, cool, and starch the goods; dry quickly. Before ironing, dampen down in thin, raw (unboiled) starch water. A little gum arabic or pure white wax is often added to the boiled starch to afford fine gloss. Iron in the usual way, with a common acid iron; then dampen slightly with a clean cloth and the starch (raw) water, and polish briskly with a polishing iron. 2. Where can I apply for information in regard to unclaimed estates in Germany? A. Probably German Consul General U. S. could assist you.

(9) "Fax" asks: What will effectually keep off mosquitoes? A. Try an infusion of pennyroyal in water, or an infusion of quassia chips.

(10) O. L. W. asks: 1. How is a vacuum in steam engine produced? A. By condensing the steam in the containing vessel. 2. How to line up a cross head and shaft of an engine? A. To explain this would require too much of our space. Consult "Roper's Hand Book of Land and Marine Engines," page 137. 3. The rule for figuring the horse power of an engine? A. Square the diameter (in inches) of the cylinder, multiply the result by 0.7854, then multiply this product by the average pressure of steam per square inch on the piston, and this product by the number of feet the piston travels per minute, and divide by 33,000. The quotient is the nominal horse power, from which deduct 20 per cent for friction. 4. How can we tell when the center of the piston is in the center of the cylinder? A. By measuring with proper gauges.

(11) O. N. B. writes: 1. A while ago, having found several scratches on my window, I wished to get them out; so taking some flour of emery and rubbing it down, I succeeded in getting out the scratches, but did not succeed in leaving the window as I wished. Now, the thing I wish to know is, what will restore the glass to its former polish? Have tried rotten stone and oil, but no effect was produced. A. Use finest rouge or putty powder, moistened with water. 2. Wishing to make some mucilage, and make it as cheaply as possible, I write to you to find out how to do it. A. Dissolve a sufficient quantity of gum dextrine or gum arabic in hot water, and add a few drops of clove oil to prevent mouldiness.

(12) J. V. R. asks: Would an electro-magnet wound with two smaller wires be as efficient as one wound with one wire just equal in weight of metal to the two smaller—in each case the magnets to be of the same size and contain the same relative weight of metal? A. No, as it would be impossible to wind the two wires as compactly as the one larger one; however, there would not be a great deal of difference.

(13) J. S. P. asks for a composition for rendering light canvas waterproof, which will not crack the canvas. A. Saturate the fibers with soap by boiling in strong soapuds (castile or curd soap); press out the excess of liquid, and steep for twenty-four hours in a strong aqueous solution of alum; rinse in water, and repeat if necessary.

(14) J. B. M. writes: 1. Suppose in a cylinder, with two pistons at liberty freely to move, we interpose a block between the two pistons and exhaust the atmosphere between the pistons, what is the pressure on the block as compared with what it would be if the block be placed between a stationary cylinder head and one movable piston and the air exhausted? A. There is no difference. 2. And in each case how is the amount of pressure to be estimated, taking no account of friction, weight, or inertia of the piston? A. In either case multiply the area of one piston in square inches by 14.75, the result is total pressure in pounds.

(15) B. W. M. writes: I wish to do my own insurance, and want to know what machinery I would need to throw an eighty foot stream of water, what size hose and nozzle, how much horse power, etc.? I have a twenty-five foot deep well, and my buildings will be seventy-five feet deep, fifty feet front, and about twenty-five feet high. A. Use one nozzle, 1½ inches diameter, or two of ¾ inch diameter; hose 2½ inches diameter. A steam pump, with 10 inches diameter steam cylinder, and 6 inches water cylinder, by 12 inches stroke, would suit; or if you use a "hand" fire engine, get one of the largest class, with 8 inches diameter pumps. When in full work they require about forty men on the brakes.

(16) R. E. M. asks: 1. Does a cylinder become smaller in the bore by the expansion upon becoming hot? The cylinder is 10 inches bore, about 1½ inches in thickness. A. No. 2. Can you inform me where I can get a good reliable book, at a moderate cost, giving directions for hammering saws? A. You will find a good article on the subject on p. 259, Vol. 36, SCIENTIFIC AMERICAN.

(17) W. L. I. writes: I have an engine cylinder, 2½x18 inches, and 7 foot drive wheel. Is a 1½ inch steam pipe large enough to give full power to engine? A. No, it should be at least 2½ inches diameter.

(18) E. J. O. writes: Having read your article on elevators in the SCIENTIFIC AMERICAN of June 5, it occurs to me that the differential block and chain might be applied to hoisting and descending; it would doubtless be safer than anything now used, and would require but a small engine to work at. I presume if some one or more of our elevator makers had the matter brought before them through proper channels they might be induced to try the experiment. A. We have no doubt such an application of the differential block might be made successfully.

(19) E. S. M. asks: How much pressure can one man give with a jack screw, lever four feet long, and screw four threads to the inch? A. 192 times the amount of pull on the end of the lever, less about thirty per cent for friction.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C.—The samples probably contain no gold; a fire assay is the only way of settling this point beyond doubt.—A. A. R.—It is a ferruginous (iron impregnated), siliceous clay, containing a small quantity of carbonaceous matters. Of little value.—A. M. C.—They consist chiefly of iron sulphuret (pyrites). Of little value.—H. F. C., Jr.—quartz and mica.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

June 8, 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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POST OFFICE DEPARTMENT.
WASHINGTON, D. C. June 22, 1880.

In compliance with a provision in the law entitled "An Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1881, and for other purposes," approved June 11, 1880, requiring a re-advertisement for proposals for Mail Locks and Keys, notice is hereby given that SEPARATE SEALED PROPOSALS will be received at this Department UNTIL 12 O'CLOCK NOON, ON THE SECOND DAY OF AUGUST, 1880, for furnishing five new and different kinds of Locks and Keys for the sole and exclusive use of the United States mails, including, besides those to be used for mail bags, such as are to be used on the street letter-boxes of the United States.

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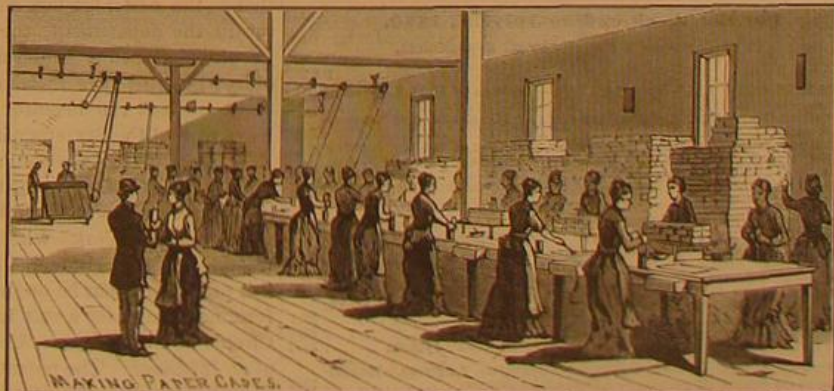
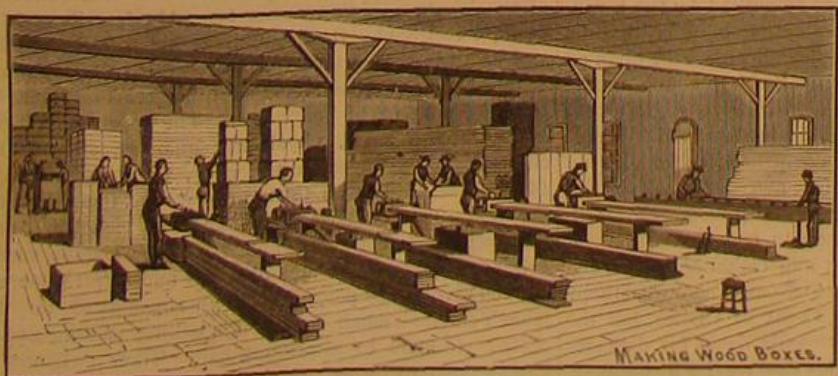
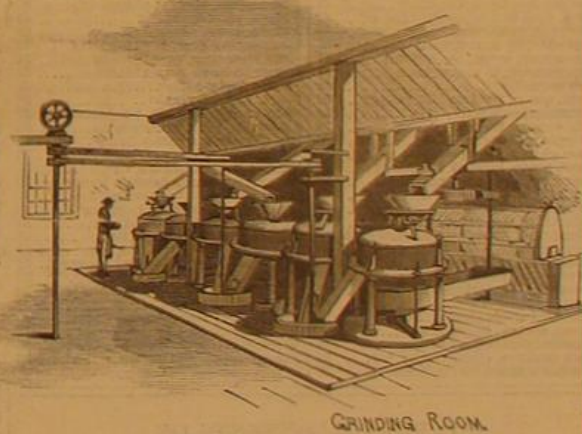
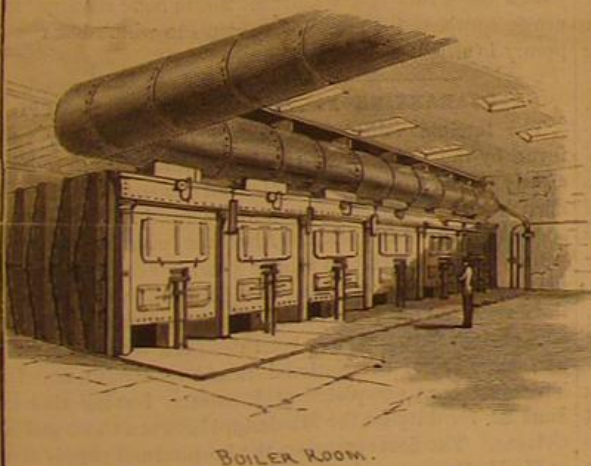
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GOVERNMENT USE OF PATENTS.

Inventors are to be congratulated upon three recent decisions of the courts which open the way to an efficient judicial remedy for use of patents by government officers. There has been a vague idea that obtaining a patent does not protect the inventor against gratuitous use of his invention by authority of government. This view was founded upon English practice; an English patent is understood to be inoperative against the crown. But the reasons for this do not prevail in America. In this country a patent is a compact with the inventor to induce him to disclose his invention for the public benefit. In England patents are a preserved class of "monopolies"—a privilege which the sovereign is allowed to give to favored persons.

Although the right of an inventor as against government has been for some years recognized, to see how he could have a remedy has not been so easy. As long ago as 1858 a claim was preferred to the Secretary of War for payment for government use of the Sickles' cut-off. The government contracted with Merrick & Son to build a steamboat. The contractors attached the cut-off to the engine without paying royalty, considering that government was entitled to the free use of the invention. Sickles applied to the Secretary of War, and that officer asked the opinion of the Attorney General. The Attorney General of the day, Judge Black, advised that the government was equally bound with an individual to pay a royalty; and that the Secretary might pay a reasonable one if there were an appropriation available. This "if" gravely embarrasses the inventor's right in most cases. What he has needed has been an efficient remedy in the courts. But the courts cannot render judgment against the government for wrongs done by its officers. Nor can they enjoin the government directly from using an invention; and if they could, or could stop the use by enjoining the officers personally, this is not what the inventor wishes; he wishes his invention used and a royalty paid.

In 1863, and again in 1868, suits were argued in the Court of Claims seeking to recover royalties for government use of inventions. In the first of these cases the Warden of the United States Penitentiary in the District of Columbia set up six patented broom making machines in the prison, and employed the convicts in making brooms. There was nothing like a bargain between him and the inventor; and the Court of Claims said that for want of some contract binding the government to pay, that court could not render any judgment. In the other case, a patented army tent was adopted by the War Department and a contract was made by direction of the Secretary, with the inventor, to pay him a royalty. For reasons connected with his participation in the rebellion the payments were stopped; but on proof of the special contract, he recovered judgment. Obviously these views gave no protection in all that large class of cases where executive officers were disposed to use inventions as if they were free to the government.

Three recent decisions present the subject in new aspects, and indicate the law to be that if, upon request of the inventor, an officer competent to contract for use of an invention makes use of it without payment, the Court of Claims may award compensation to the inventor upon a theory of an implied promise to pay him, while if the invention is used against the inventor's consent, or by an inferior officer or contractor, the individual thus infringing is personally liable in substantial damages, recoverable in the circuit courts. In one of the cases, Lieutenant McKeever, being the patentee of an improved cartridge box, submitted it to the War Department in the hope that it might be adopted. It was adopted. But upon the theory that government is not bound to pay royalties, none was paid to the inventor. He brought suit in the Court of Claims. That court decided that the government has not the right to use an invention, and that as the cartridge box had been submitted by the inventor to the department, the presumption must be that the government used it under an implied license and upon an obligation to pay a reasonable royalty. It could not be supposed that the inventor intended to give a gratuitous leave or that the Secretary intended a lawless infringement. A judgment for a substantial compensation founded on this theory of contract was therefore awarded.

Another suit was brought against an officer—the Postmaster of New York—who refused to enter into any contract with the inventor, believing and claiming upon English precedents that he ought not to do so. There was, therefore, no ground for a suit in the Court of Claims, but the Circuit Court held the officer personally liable for damages as an infringer. The patent in this case was for an improvement in canceling the letter stamps. It enabled the clerks to cancel the stamp on a letter by the same implement and stroke which imprinted the postmark. The device obviously diminished the time consumed in stamping letters by nearly one half; and the pecuniary saving realized in the New York office during the term covered by the suit was shown to have been \$63,000. That is to say, the officer had saved, and presumably had remitted to the government at Washington, \$63,000 of postal moneys, which he otherwise must have expended in paying salaries of stamping clerks. The court adjudged him personally liable for this sum to the inventor. The fact that he had paid it over to government did not protect him. The inventor was declared entitled to his damages, and the task of coaxing the money back from the Treasury was left to the Postmaster.

The third of the decisions mentioned, earlier in date than the others, applies the same principles to the simpler and easier case where certain contractors, because they were

manufacturing for government, assumed to use, as they supposed government had the right to do, the complainant's invention without paying him. But the Circuit Court very promptly told them that they had no such privilege.

These decisions are subject to the ultimate approval of the Supreme Court at Washington. Should they be finally sustained they will enable an inventor to seek redress in the courts, whatever may be the way in which his invention is pirated under pretense of a use for government.

AMERICAN INDUSTRIES.—OUR ILLUSTRATED SERIES.

Not only our home subscribers, but our patrons abroad, express great satisfaction with the feature adopted by this journal, more than a year ago, of publishing illustrated articles on the prominent industries of this country. To some of our foreign contemporaries it seems to be a mystery how it is possible to gather the material and prepare for every weekly issue the full page illustrations which embellish the initial page, together with the other not less beautiful wood cuts which appear in other portions of the paper.

Nothing like it has ever been attempted before by any weekly newspaper devoted to industrial and scientific subjects, and only to a publication having a very large circulation could the expense attending the preparation of so many costly, original engravings be afforded.

From every number of THE SCIENTIFIC AMERICAN our English, French, German, Spanish, Italian, and frequently Russian contemporaries, also transfer to their pages the illustrations and descriptions of some of our best inventions and more important discoveries, and some of them have reproduced the full page cuts of some of our industrial series.

This will explain to many perplexed persons whose works or machines have been described in these columns what has been to them a mystery.

They receive letters from every part of the world inquiring about their wares or their inventions, as the case may be, often in a language they understand not, and they wonder how the writer, in such an out-of-the-way place, ever heard of them or their inventions.

The London *Printing Times and Lithographer*, of June 15, just received at this office, referring to our series of articles descriptive of American industries, makes mention of the three subjects in their special line which appeared in consecutive issues of this paper not long ago, with extracts from our articles. Farmer, Little & Co.'s type casting works; Geo. Mather's Sons printing ink manufactory; and the Albion Paper Company's extensive works at Holyoke. The editor might with propriety have added to the list the printing press manufactory of Cottrell & Babcock, which appeared in the issue next preceding the three industries to which the writer refers, and this would have rendered more nearly complete the range of subjects to which our contemporary is allied.

A QUARANTINE FLEET FOR THE MISSISSIPPI.

The terrible visitation experienced in 1878, by yellow fever, by the cities along the lower Mississippi, indicated clearly to the United States Medical Department the great need of a more perfect system of quarantine regulation, inspection, and disinfection. Also, the want of swift, properly appointed craft to relieve passing vessels of sick persons and to convey such to the quarantine stations along the river. To meet the peculiar requirements of the case a fleet of four steamers has been designed by Dr. J. F. Turner, Secretary of the National Board of Health, and these have just been completed at Pittsburgh, leaving that city, June 23, for duty on the Mississippi between Cairo and New Orleans. The fleet comprises the hospital and supply steamer H. H. Benner, and the steel launches Sentinel, Lookout, and Picket. The Benner is a stern wheel iron hull steamer of the Western high-pressure type, 112 feet long, 18 feet beam, 4 feet hold. On the main or boiler deck she carries an iron disinfecting tank for the reception and steaming of bedding, etc., supposed to contain the germs of fever. This tank is 6 x 8 feet, of boiler iron. The upper deck is fitted up with bath room, physician's quarters, and medicine chests. The main cabin is a clear, well ventilated space 14 x 50 feet, fitted with thirty iron cots for the reception of the sick. The launches are of handsome model and are 36 feet long by 7 feet beam, and 3½ feet hold. Engine vertical, driving propeller of 32 inch diameter and 6 feet pitch, making 250 revolutions per minute with steam at 120 lb. Each launch carries a small cannon for calling passing and suspected steamers to a prompt halt. Their swiftness will enable them to hurry the unfortunate sick to the nearest quarantine station, and a physician will be on board each launch. The Benner will be in charge of Dr. F. W. Reilly, of Chicago, and the crew will be selected from men who have run the dread gauntlet of "Yellow Jack." The cost of this laudable enterprise to the government will be about \$35,000. The quarantine stations already provided for are located at Cairo, Vicksburg, Memphis, and New Orleans, and also at the mouth of the Red River.

INCREASE IN THE RUBBER MANUFACTURE.

It is interesting to note, in connection with the extended description of the rubber manufacture we published last week, that the total imports of crude rubber and gutta percha for the United States, for the nine months to April 1, amounted to 13,444,750 lb., valued at \$7,436,560, against importations for the nine months to April 1, 1879, of 11,010,677 lb., valued at \$4,387,971. This shows a material advance in prices within the past year, the average rate for

the earlier period being not quite 40 cents a pound, while for the nine months ending April 1 last, it was over 55 cents a pound. This average includes the importations of all descriptions, the best rubber having been all the time a good deal higher than these figures, and now being quoted by the importers at 90 to 95 cents a pound for choice Para. The advance in prices was primarily due to a speculative combination of Spanish houses in the trade, although it is also largely attributable to the greatly increased demand for rubber in Europe as well as here, and the difficulty in obtaining the requisite labor for getting it in and curing it at all the South American producing points. In the valley of the Amazon particularly, whence the choicest rubber comes, the trouble in obtaining efficient labor for any kind of work is the most serious bar to the progress of that fertile country, the climate being a very trying one, and the natives lazy and indolent.

The wonderful variety of useful articles into which rubber is worked up makes it one of the most important of our imports of crude material, and the large place it fills in the supply of such necessities as belting, hose, and packing, either in competition with or as superseding the use of leather, gives it an importance in our industries far beyond the money value that the figures showing the importations seem to represent.

A PATENT CASE OF GENERAL INTEREST.

All the shoe manufacturers in the country have been particularly anxious to know, for about a year past, how much longer they would have to pay the royalty, averaging $1\frac{1}{2}$ to 2 cents a pair, on shoes bottomed by the McKay sole sewing machine. A case bearing upon this point came before Judge Blatchford, of the United States Circuit Court for the Southern District of New York, on the 25th ult., and his decision, though not conclusive as to the whole question at issue, has an important bearing thereon.

The patents owned by the McKay Sewing Machine Association have, from 1860 to the present time, been those under which probably nine-tenths of the machine-made shoes worn in the United States were bottomed. The association made the machines and leased them to manufacturers, under a license by which the latter were obliged to pay a royalty on each pair made, which was done by placing on the shoes stamps purchased from the McKay Association. Over one thousand boot and shoe manufacturers, embracing all the large establishments in the country, are in this way licensees of the McKay Association. This license is a very carefully drawn up document, and, besides everything else therein calculated to protect the interests of the association, it has a provision by which the licensee agrees not to contest the McKay patents during their existence. No real resistance has been made in many years to the validity of the patents, and, the business of the association having been from the first conducted with marvelous energy and ability, the patents have returned clear profits to their owners of several millions of dollars. In July and August of last year two of the most important of these patents, with the extensions which had been granted thereon, ran out, and, although the machines were covered by other and less important patents, the shoe manufacturers have, since that time, been debating the question of how long they must continue to pay these royalties. The obvious answer is that so long as they use a McKay machine, and are bound by their license, they must pay. In this connection it is important to note that the McKay Association have, during the past year, been taking back many of their old machines, where the manufacturers would allow them to do so, and furnishing in their stead new and improved machines, but the latter have patents in them bearing date of 1879, and, of course, cover their use for the full term of the last patent.

To meet this difficulty, and provide a way of using only the McKay patents that had expired, Andrew H. Jackman, of Nyack, N. Y., has lately obtained a patent on a machine of his invention, which he has used since May last, sewing 3,000 pairs of soles weekly thereon, and which he was about to offer to the trade. The McKay Association immediately commenced proceedings against Jackman, and moved for a preliminary injunction on the ground that two of their patents had been violated, one on the "process" and the other on the "product," as separate from the machine, and also because the defendant had violated his license. Considerable evidence was introduced, and able arguments were made, but Judge Blatchford finally put aside all question regarding the validity of the patents, and decided to grant the injunction on the license alone, holding that it was of the substance of a contract, and until it was broken, or the defendant released from its provisions, the association had a good case against him. The license provides several ways whereby the association may terminate it, or where it would be broken and become inoperative, but it is not at all clear that there is any easy way for the manufacturer to get rid of its provisions without the consent of the association, who are likely to be as tenacious of their contract rights under its provisions as they have heretofore been determined in upholding their patent claims.

An Opportunity for Inventors and Lock Makers.

The present kind of mail lock and key having been in use for a long time, it has been deemed expedient to make a change. To this end the Postmaster-General has just issued a notice, which will be found in our advertising page, announcing that proposals will be received for furnishing five new and different kinds of locks and keys for this purpose.

He does not prescribe a model, and on that point says that, 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 all 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.

BURNING OF OIL TANKS BY LIGHTNING.

The suggestions recently made by us in connection with the late disastrous fire at Titusville, Pa., caused by the firing of an oil tank by lightning, have called forth a variety of interesting communications from different correspondents. Our suggestion was that the light vapors from the oil, rising high above the tanks, formed a conductor and led to the firing of the gas in the tank.

One of our correspondents, whose letter we publish in another column, suggests a different theory. He thinks that the electricity enters the tank by running along the oil supply pipe, and that sparks are discharged from the end of the pipe at its termination within the roof of the tank. He further thinks that the electrical charge may fall upon the pipe at some distance from the tank and yet the gas in the tank will be ignited. Our correspondent may be right. His theory is worthy of careful consideration. The smallest spark produced in this way will do the business. We all know how minute an electrical spark will fire an explosive mixture of gas. Even the rubbing of the feet on a carpet and a touch of the finger to an open gas pipe will light the gas.

Although it might be expected that any electricity received by the underground tank pipe would be wholly dissipated before reaching the tank, still if the original electrical charge were sufficient, and if the exterior of the pipe was more or less insulated, as it might be if it passed through dry earth, or if its surface were covered with oil, it would seem that there might be a leap of a spark from the extremity of the metallic pipe, within the roof of the tank, to the side or interior casing of the tank, and mischief would result.

When the tank is made wholly of iron, and the end of the supply pipe, where it enters the tank, is attached to and forms a good contact with the iron of the tank, then no spark could be expected. But if the roof of the tank is made of wood, and the sides of iron, as is frequently the case, no actual connection existing between the iron casing and the supply pipe, then some portion of a charge of electricity, running along the pipe, might enter the tank and leap from the pipe as we have mentioned. As a measure of prudence it would be advisable for tank owners to connect their ground pipes electrically with the iron casings of the tanks. This may be readily done by means of stout copper or iron wires outside the tanks, the ends of the wires being well soldered respectively to the pipes and to the iron casing, so that if any electricity comes along the pipes it will pass, without resistance or sparking, to the iron case and so to earth.

We are greatly obliged to those correspondents who have sent us their views on this matter, and we hope to hear from others. The subject is one of such importance that it ought to be discussed and studied until a sure protection is discovered and an end put to the long series of lightning disasters that for years past have regularly occurred in the oil regions.

The fire at Titusville on June 11 was followed June 30th by the burning of another iron oil tank, at Olean, N. Y., holding 25,000 barrels, which was also set on fire by lightning. This tank belonged to the Acme Refinery.

SERIES FORTY-NINE.

Not with egotism, but with a commendable pride, do we direct the reader's special attention to the beautifully executed engravings which embellish this number of the SCIENTIFIC AMERICAN. The reader will also find profit and be interested in the somewhat lengthy description of the extensive industry carried on by the Kingsford Starch Works, whose product is not only laundry starch, as the title of the works might imply, but a dietetic commodity which is favorably known in every part of the civilized world.

The Kingsford Works, illustrated in this week's issue, comprises the forty-ninth of our industrial series already published; and we would here announce that we have in preparation engravings of a number of other extensive establishments, illustrating the processes of manufacturing other articles, not generally known, which we are confident will be of equal interest to any of the industries which have been already illustrated and described in these columns.

London's Stock Companies—Limited.

The English people are famous for forming stock companies (limited) in conducting all sorts of enterprises. Some time ago Truefit, the celebrated London barber, converted his shaving and hair cutting establishment into a stock company, at which some of the newspapers made considerable fun, naming several lords and bankers as among the shareholders. But Truefit understands his business, and, it is said, has made a fortune out of it, and in all probability the stockholders in his company will receive larger dividends and be more secure in their investments than if they placed their means in some other more pretentious companies. Mr. Truefit's business is certainly legitimate, and a useful one, and can only be made profitable by industry; therefore we

see no reason for our London contemporaries casting slurs at any of the stock owners, if they be princes or lords.

But a new joint stock company (limited) has just been registered which is nothing more nor less than an old curiosity shop. From the prospectus we learn that the company seeks to raise £2,000, and proposes to buy, sell, and exchange works of art, books, and used foreign postage stamps. No doubt the venture is a *bona fide* one, and it is satisfactory to note that the promoter takes 1,000 of the 2,000 shares. But it is somewhat of a *reductio ad absurdum*. *Capital and Labor* thinks, to turn such a business into a joint stock company. Will there be any directors? the writer inquires; What will be their remuneration, and where will they meet? Perhaps, he adds, in the shop among the old foreign stamps, the works of art, and the books and mummies! The capital of the company is certainly not extravagant, but probably sufficient to conduct the canceled postage department, if it does not go far towards purchasing "old masters."

Basal Plane Quartz Crystals.

Until within a very few years crystals of quartz with the basal plane have been accounted excessively rare. So recently as the year 1877, Professor Egleston, of Columbia School of Mines, remarked, in a lecture before the Academy, on some rare quartz crystals, that five years before "only three crystals of quartz with the basal plane were known to the scientific world: one owned by the British Museum; one by the Imperial Museum at Vienna; the other in St. Petersburg, and these came from Brazil. They were considered priceless treasures, and the very *ultima Thule* of rarity in the mineral kingdom."

In a communication dated Morgantown, N. C., May 20, Mr. W. E. Hidden, mineralogist, informs us that in a locality in the South Mountains of Burke county, North Carolina, quartz crystals with the basal plane are comparatively abundant. Mr. John T. Humphreys, who discovered the locality, has more than a dozen of them, and Mr. Hidden himself has seven. In these specimens the apex of the pyramid of the crystal is cut off at an exact right angle to the sides of the crystal, as shown in the annexed cut.

THE BOSS PUZZLE ABROAD.

The "fifteen puzzle" epidemic, which prevailed so alarmingly here last year, has extended to England and the Continent, and our foreign exchanges come to us laden with solutions of the problem. Scientists even have taken the subject up, and communicate to their favorite papers the formula which expresses the mathematical possibilities of it, and editors write columns on the subject for their respective papers. It was a good while reaching the other side of the ocean, but, like the phylloxera, is doing its devastating work.

The American Science Association.

The twenty-ninth meeting of the American Association for the Advancement of Science will begin August 25, in the Massachusetts Institute of Technology, Boston. An exceptionally large gathering of prominent scientific workers is anticipated. One of the morning sessions will be held at Cambridge, and the rest of the day will be devoted to an inspection of the various departments and museums of Harvard University and the Observatory.

DISASTROUS STEAMBOAT ACCIDENT.

On the afternoon of June 28 the fine passenger steamer Seawanbaka, carrying 350 or 400 passengers, while going at full speed up the narrow and dangerous pass known as Hell Gate, between New York and Brooklyn, was discovered to be on fire. The flames spread with amazing rapidity. Captain Smith with remarkable bravery kept his place at the wheel, was surrounded with fire and badly burned, but nevertheless directed and grounded the boat on a safe point ashore, free from rocks. But during the brief period that elapsed before the boat touched, many of the terrified passengers were compelled by the flames to leap into the water. About sixty lives were lost.

The cause of this accident is not yet known; but so far as we can gather from the newspaper reports we are inclined to think it was due to the bursting of one of the boiler flues.

It would seem from the reports that the boat was carrying about all the steam allowed by her certificate, that a slight explosion was heard, that steam first appeared in the upper cabin, then fire, and that flames blew out of the furnace door. These circumstances indicate a probability that by the bursting of a flue the gases of the furnace fire were driven out against the woodwork of the vessel and instantly set her in a blaze. The steamer carried two boilers, set in the hold. Whether our theory of the cause of the fire is correct cannot be determined till the boilers are raised.

This dreadful disaster forms but another evidence of the inadequacy of the present means for safety on steamboats. We hope that our inventors will exercise their ingenuity in discovering new appliances by which such accidents will be rendered impossible. A light fireproof material, to take the place of the dry woodwork now used for cabins, is especially needed.

AMERICAN INDUSTRIES.—No. 49.

THE STARCH MANUFACTURE.

About forty years ago Mr. Thomas Kingsford, whose son is at present the head of the firm of T. Kingsford & Son, of Oswego, N. Y., invented a process for the economical manufacture of a superior article of starch from Indian corn, and from his success then and improvements subsequently introduced have grown up an industry of great magnitude. In other countries starch had been manufactured from very early dates, but principally from potatoes, beans, the sago palm, Iceland moss, peas, and wheat, and the manufacture was carried on in a comparatively expensive way, giving a generally imperfect product. The principle involved in the manufacture is perhaps best explained by a simple illustration. If a little wheat flour be made into a paste in the hand, and then held under a small stream of running water, kneading continually, there will be left a tough substance of dirty white color, principally gluten, and the milky fluid which has passed off, when allowed to settle, deposits a white powder, which is principally starch, with more or less impurities. The perfect process of manufacturing corn starch is that which economically takes from the kernel all of the starch, and thoroughly frees it from the oil, gum, and glutinous products contained in the whole grain; this requires many washings, in some of which chemical solutions are employed, and most careful mechanical manipulation, with the aid of elaborate machinery, besides a great deal of experience in the workmen.

In our first page illustrations of to-day, and also on this page, we represent some of the most important of the processes and details connected with the manufacture of pure and silver gloss starch for the laundry, and prepared corn (or corn starch) for culinary use, as carried on at Oswego, N. Y., by the Oswego Starch Factory, the largest establishment of its kind in the world. Here, on the Oswego River, near where it empties into Lake Ontario, in close proximity to the great corn producing area of the West, and with the lowest possible cost for carriage over the waters of the great lakes and their tributaries, Messrs. Thomas Kingsford & Son, in 1848, commenced the manufacture and erected a factory. The buildings at present cover five acres of ground, and give twelve acres of floor room, while the ground actually occupied for factory purposes amounts to seventeen acres. Here the corn comes direct from its place of first shipment to the immense storage bins of the establishment—"the deepest corn bins in the world"—extending to the full height of the five story buildings, and with a capacity to hold two hundred thousand bushels at a time. Of course these buildings are very strongly put up and heavily braced to carry such an immense weight, capacious elevators being employed to discharge the grain from the vessels and afterward remove it as it is to be used in the works.

The grain first passes through immense fan mills, to remove chaff and dirt, or any substances which might afterward injure the machinery. Thence it is passed to enormous vats, where it is soaked, so as to render its constituents more easily separated, that the starch may be extracted. After a sufficient time here the grinding process follows; and for this purpose twenty-four pairs of burr stones and six pairs of heavy iron rollers are used; these mills work day and night, and, operating on wet grain, change it into pulp rather than into flour, the object being to crush and thoroughly disintegrate the particles. This pulp then passes through a great number of screens and drum sieves, which do the first part of the work of separating the starch from the hull, the refuse being used as a food for cattle.

The milky fluid which results from the washing is conducted into immense cisterns or vats, of which there are in all the factories 689, having an aggregate capacity of 3,150,000 gallons. The liquid, however, has to receive several washings, during which various solvents and filtered water are used for the removal of all impurities, and the separation of the pure starch from all the other constituents of the



grain. For this purpose the establishment has forty-eight pumps, capable of raising 850,000 gallons of water per hour, and there are 6¼ miles of gutters in use for the various distributions of the contents of the vats, besides four miles of water pipes varying in size from 2 to 24 inches in diameter. The purification of the starch, however, depends more upon the practical experience of the workmen or manager



than upon any rules which can be given, the thorough washing and careful separation requiring a practiced eye and the best of judgment. After this is done the starch water, as it may be called, is allowed to run into moulds, where, when it has entirely settled, the deposit will have made a long, box-like cake, which may be broken into the required squares, each weighing about seven pounds after drying, the quantity desired for each package.

The illustration at the top of the first page shows one of the immense rooms where the latter part of the work is being carried on. The middle of the room is filled with long tables, where the starch has been tipped out of the moulds, and a workman may be seen standing over one of the bars of starch and marking it with a slight indentation at each place where the bar is to be broken, when another workman following places a knife under this point and deftly breaks the bar, the practice of the workman and the consistency of the starch being such that it is seldom there will be a variation of an ounce in the weight of the squares broken off. Others may also be seen passing these squares of starch to the side of the room, where they are placed on an endless belt to be taken up and placed in the ovens above. Here they are kept at a low heat until dried, when a thin yellow crust is found on the surface, representing what has been left of gum or husk after the previous purifications. This is scraped off by hand with large knives, when the cakes are wrapped in blue paper and again placed in ovens until dry crystallization takes place, so that, on opening the paper, the starch will split into columnar masses, in which form it is generally sold.

The other illustrations on the first page require but little explanation further than that given by their titles. The office, as shown in the center, is a large, high room, beautifully fitted up, which would do credit to many a banking institution; on the right is seen a representation of one of the mills for grinding the corn, and on the left the furnace and boiler room. The establishment has the advantage of an excellent water power from the Oswego River, for utilizing which fourteen turbine wheels, of an aggregate of 1,200 horse power, are employed, but besides this they run ten steam engines of 845 horse power, and have thirteen large steam boilers, 33¼ miles of steam pipes being in use for drying purposes and warming the works. The making of paper boxes and cases and the wood box making are the subject of separate sketches. In the latter department 5,000,000 feet of lumber are used yearly; two nailing machines are kept at work here, but, so minutely is every detail economized, the sides and ends are dovetailed, as making not only a better box, but contributing an important saving in the way of nails. In the making of paper boxes and cases 600,000 lb. of paper are required annually. This work is principally done by hand, but some machines crease the sheets where folds are to be made, and others cut the paper and press it into the required shape when the form of package calls for such work.

In the packing room may be seen a little machine, under which empty packages are held to be filled from a spout. This is the way the pulverized corn starch, or prepared corn for culinary use, is packed. The little machine is so arranged that it will let out just enough for a package, and then the stream stops until the touching of a little spring shows that the operator has placed another empty package in place to be filled. The number of packages put up by a girl in one day will average from 1,400 to 1,500, and the whole operation is so conducted that

no dust escapes. This pulverized corn starch, as it is known here, is hardly known by that name in many foreign ports, to which it is shipped in large quantities, and where it is called only prepared corn. It is exported to every part of the world, and has obtained a high reputation for its dietetic excellences.

The large view on this page, entitled the "Separating room," shows a prominent department in this industry, and one in which the ingenuity of the Messrs. Kingsford has been attended with most important results. It represents the



THE SEPARATING ROOM.

operation to which the pulp is subjected first after the grinding and crushing by the rollers. In the immense circular vats here shown a shaft revolves to which is attached arms of particular shape and form, which has been a matter of much experiment, to churn up and separate the different constituents of the grain, an operation which is now conducted far more expeditiously and efficiently than was formerly the case. A smaller view on the same page shows the interior of a nicely furnished hall which the establishment furnishes for the use of its employes for holding meetings, etc., and which is christened "Firemen's Hall," as being the headquarters of a volunteer organization of that kind among the men employed. In the papering and drying room, also shown here, the work is all done by men, although a large force of women and girls find employment in the establishment; and it is perhaps as well to remark here that the firm exercise the utmost care in the selection of their employes, not only as to their personal character, but insisting on the most thorough neatness and cleanliness in every department.

The main buildings of this immense establishment are all of stone, brick, and iron, some portions being seven stories high, making a total frontage of 800 feet by 200 feet deep. Besides these there are other large buildings, such as the box factory, storehouses, machine shops, etc. The works are now making at the rate of 21,500,000 lb. of starch and prepared corn annually, or about 35 tons per day, giving employment to upwards of 950 operatives. The Kingsfords have been continuously engaged in the manufacture of starch for about half a century. The Oswego Starch Factory was incorporated in 1848. Dr. S. Willard, of Auburn, N. Y., was elected President of the Company at its first organization, and has held that office continuously to the present time. A. G. Beardsley, Esq., of Auburn, N. Y., is the Secretary and Treasurer of the company. T. Kingsford & Son is the style under which the manufacturing business is carried on at Oswego, and E. C. Chapin, of 146 Duane street, New York, who is also one of the Board of Trustees, is the general agent.

IMPROVED STREET LAMP.

We give an engraving of an improved street lamp recently patented by Mr. John Stewart, of Chicago, Ill. The invention relates entirely to the frame of the lamp, which is made of cast, malleable, and sheet metal. In external appearance it is much like the ordinary lamp, but it is better calculated to resist the wind and other forces which frequently destroy the common lamp.

The socket fitting the lamppost and the base plate of the lamp frame are made in one casting, and the sides of the base plate are provided with flaring flanges having at the corners sockets for receiving the malleable iron corner pieces which are fastened by riveting, as shown in Fig. 2, which represents a portion of one of the corners in section.

Fig. 1.



STEWART'S STREET LAMP.

These corner pieces are angled to receive the glass, and are beaded at the outside corner to give them strength and rigidity. Small thin tongues project from the angle, and are

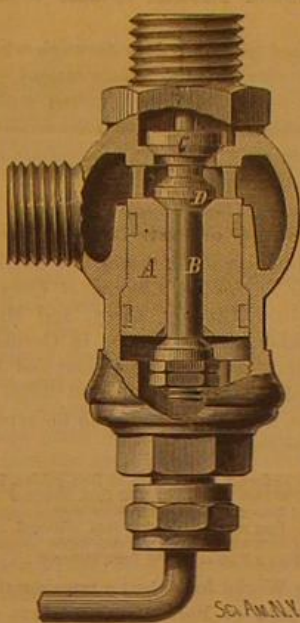
bent over the edges of the glasses to retain them, as shown in Fig. 3. The upper ends of the corner pieces are soldered to a sheet metal frame, which supports the upper glasses and the chimney. The door frame, of tin, is hinged to the upper frame of the lamp so as to swing vertically, and is provided with a small bolt at the bottom, which is easy of access, and will hold the door locked by its own gravity. The hinges are made entirely of brass, and cannot therefore corrode, so as to interfere with the opening or closing of the door.

The inventor says that the lamp sets perfectly solid on the post, and is entirely free from the warping and twisting so common to the ordinary lamp and so destructive to the glass. We understand that there are now about one thousand of these lamps in use in Chicago giving excellent satisfaction.

For further information address Mr. John Stewart, Department of Public Works, Chicago, Ill.

AUTOMATIC SAFETY CYLINDER COCK.

The improved safety valve and cylinder cock shown in the annexed engraving is the invention of Mr. Thomas J.



PARADINE'S CYLINDER COCK.

Paradine, of Erie, Pa. It is capable of letting the water of condensation out of a steam cylinder without waste of steam, and is a perfect safeguard against injury to the cylinder by an accumulation of water.

The safety valve and exit cock are arranged in a casing connected directly with the cylinder and communicating with the steam chest by a small pipe entering the lower end.

The safety valve, A, has two seats in the casing, one above, the other below the lateral discharge opening of the casing, and it is pressed upward by steam acting on its lower end, the difference in the area of the two ends being sufficient to secure this result. The valve, A, is bored longitudinally to receive a spindle, B, carrying at its upper end two valves, C D, which are seated in the valve, A, above and below a chamber in the upper end of the valve. The lower end of the spindle, B, is also provided with a valve which has its seat on the lower end of the valve, A. The upper valve, C, is somewhat larger in area than the other valves attached to the spindle, and controls the escape of water from the cylinder.

Under ordinary conditions the pressure of steam on the lower end of the valve, A, will hold it to its seat, but when an extraordinary pressure is brought to bear upon it, as, for instance, when there is more water in the cylinder than the clearance will contain and the piston is just completing its stroke, the valve will be forced from its seat, and the water will escape through the lateral opening in the casing. In working regularly, when the steam is acting on the piston, it also presses the valve, C, to its seat so that neither steam nor water can escape, but when the steam exhausts the pressure on the valve, C, is less than that on the lower end of the spindle, B, consequently the spindle is forced upward and the valve, C, is opened, allowing the water to escape. When steam is shut off from the engine, the valve, A, will drop of its own gravity and allow all of the water in the cylinder to drain out.

Two circumferential grooves formed in the valve, A, are filled with wicking or other packing to prevent grit from working into and around the valve.

The working of this valve is entirely automatic, and it is claimed by the inventor that it is less expensive and more durable than ordinary cylinder cocks. The inventor informs us that he has had this valve at work on a pair of large engines day and night for fifteen months without once failing or showing signs of wear.

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

Whaling on the Pacific Coast.

According to the present practice of whalers the blubber is chopped off at sea and the rest of the carcass is left to sink or float as it may until it decays or is devoured by sharks and birds. A less wasteful system has been adopted

by a company at San Francisco, which has organized a whaling and fertilizer industry, to be carried on at that point and along the coast.

The first vessel for whale hunting has just been finished. It is a screw steamer, 65 feet long and 16 feet wide, completely decked over, and very strongly built. It is fitted with two compound engines, and will carry coal for a run of thirty days, to enable the search for whales to be prosecuted along the Alaska shore if necessary. The whales are to be killed by the whaling rocket or bomb lance. They are then to be towed to the reduction works on shore, where the carcass will be treated by an improved process, which utilizes every part. In this process the whale is cut up, without separating blubber or flesh, and digested by steam at high pressure in large iron tanks. The process requires about eight hours, when the oil is drawn off and the residue of flesh and bones is taken out, dried, and ground together to produce a fertilizer. Three digesters have been set up, each large enough to hold a ten foot section of a whale, and three "tries" can be made in a day.

ENGINEERING INVENTIONS.

Mr. Robert E. Greenwell, of Osage Mission, Kan., has patented improvements in railway joints of that form in which a set of bolts project through the fish plates and have ends slotted lengthwise to receive a key which is driven in in a plane parallel with the bolt.

A machine for deepening river channels has recently been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. This machine is so constructed as to deflect the current of a river downward, and thus cause the current to deepen the channel of the river.

A device for insuring a more perfect combustion than is usual in the fire boxes of steam boilers, evaporators, etc., has been patented by Mr. John Mailer, of San Francisco, Cal. The invention is an improvement upon the device for which Letters Patent No. 219,283 were granted to the same inventor, September 2, 1879.

Mr. Frank Laufkotter, of Collinsville, Ill., has patented an improved safety stop for elevators, buildings, mine shafts, and other purposes, so constructed as to stop the elevator cage and hold it securely should the hoisting rope break.

Ice without Freezing.

A new skating surface, called "crystal ice," has been invented by Dr. Calantarients, of Scarborough, England. Considering that after all ice is merely a crystalline substance, and that there is no lack of substances that are crystalline at ordinary temperatures, Dr. Calantarients experimented with a variety of salts, and after a time succeeded in making a mixture consisting mainly of carbonate and sulphate of soda, which, when laid as a floor by his plan, can be skated on with ordinary ice skates; the resistance of the surface is just equal to that of ice, it looks like ice, and indeed when it has been skated on, and got "cut up" a little, the deception is quite astonishing; a small experimental floor has been laid in the skating rink at Prince's, and has proved so successful that no doubt a large floor will be laid there or at some other convenient place in the autumn. This floor will obviously have great advantages, both over artificial ice floors, which are very expensive indeed, and over floors for roller skating. The surface can at any time be made smooth again by steaming with an apparatus for the purpose, and the floor itself, when once laid, will last for many years. The mixture of salts used contains about 60 per cent of water of crystallization, so that after all the floor consists chiefly of solidified water.

A NOVEL WHEELBARROW.

The engraving represents an improvement in the class of wheelbarrows whose body is pivoted to adapt it to dump its contents by tilting or turning on its pivots. The improve-



KINCANNON'S IMPROVED WHEELBARROW.

ment consists in the extension of the front end of the frame beyond the wheel and body of the wheelbarrow, so that when the frame is suitably inclined its front end will rest on the ground, and together with the wheel, constitute a firm support for the pivoted body while being tilted.

This invention was recently patented by Messrs. J. and F. L. Kincannon, of Verona, Miss.

REPAIRING SPIRAL SPRINGS.

BY H. N. MAXWELL.

I find the impression is common among mechanics that it is not possible to mend a broken spiral spring. It might be well, therefore, to place the readers of the SCIENTIFIC AMERICAN in possession of my method, which is inexpensive, very simple, and thorough.

Take a piece of flat metal, of, say about one sixteenth inch in thickness, and cut it in the shape of a parallelogram, the length being one eighth inch greater than the diameter of the broken spring, the width equal to four of its coils; bore two holes on each side exactly the diameter of the spring apart, and sufficiently large to admit the spring wire; make, with a round file, a slight groove just opposite each hole, as shown in the engraving. Screw the broken ends of the spring into these holes from opposite sides, and the job will be complete, and at a trifling cost of material, time, and labor.

It will be seen at a glance that two springs of different diameters can be coupled together by the same process. Also, that a piece of similar metal with two holes upon one side and one hole on the other side will make a superior end piece for securing spiral springs.

The angles of the piece of metal used for mending, should equal those formed by the coils and side of the spring.



MENDING BROKEN SPIRAL SPRINGS

Copper-plating on Zinc.

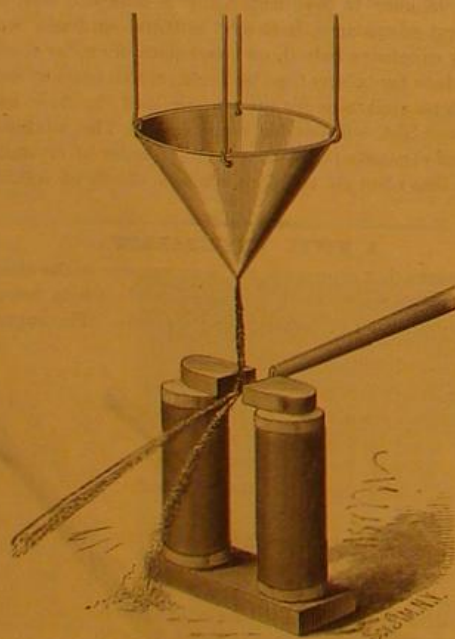
The use of cyanide baths for plating on zinc has the double disadvantage of being poisonous and expensive. Hess has overcome the objections by rendering the cyanide bath unnecessary. This he accomplishes by the use of an organic salt of copper, for instance a tartrate. Dissolve 126 grammes sulphate of copper (blue vitriol) in 2 liters water; also 227 grammes tartrate of potash and 286 grammes crystallized carbonate of soda in 2 liters of water. On mixing the two solutions a light bluish-green precipitate of tartrate of copper is formed. It is thrown on a linen filter, and afterwards dissolved in half a liter of caustic soda solution of 16° B., when it is ready for use.

The coating obtained from this solution is very pliable, smooth, and coherent, with a fine surface, and acquires any desired thickness if left long enough in the bath.

Other metals can also be employed for plating in the form of tartrates. Instead of tartrates, phosphates, oxalates, citrates, acetates, and borates of metals can be used, so that it seems possible to entirely dispense with the use of cyanide baths.

NEW ORE SEPARATOR.

In one of our recent issues we described a device invented by Mr. Edison for separating magnetic sands from the non-magnetic particles of ore by altering the trajectory of the



EDISON'S ORE SEPARATOR.

falling magnetic substance by means of an electro-magnet. We now give an engraving of another magnetic ore separator recently invented by Mr. Edison, which operates on an entirely different principle, and effects a still further concentration of the ore by the separation of the metallic from the non-metallic part by diamagnetism.

The auriferous sands are placed in the hopper and allowed to fall between the poles of a powerful electro-magnet, and a blast of air is directed at right angles against the falling stream of sand just as the latter passes between the poles of the magnet. The non-metallic substances are readily blown away, while the metallic portions are retarded by diamagnetism, so that the blast of air has less effect on them than it has on the non-metallic substances. The consequence of this operation is that the sands are divided into two heaps, one containing a large percentage of metal, the other containing a very small percentage, or none at all.

A Georgia Meteor.

About midnight, June 30, an exceptionally brilliant meteor was seen from Macon, Ga. The light is described as like an electric light, but whiter and vastly more powerful. The course of the meteor was from the zenith straight toward the horizon, which it would have reached at a point between north and northeast. At the zenith it appeared as large as a barrel and intensely white. At 45° elevation the light changed to a brilliant red, faded into saffron, and then into all shades of green. As it began to change its hue it emitted particles or balls of fire that followed or lingered in its wake. Surrounding it, also, in this stage, was a dense vapor of

smoke that reflected all the colors through which the ball had gone. At 30° elevation the light went out. Three minutes after a heavy report was heard, mixed with a metallic ring not heard in thunder or in ordinary explosions. The meteor was visible about five seconds. It is to be hoped that specimens of this body may yet be found.

The Largest Sheets of Plate Glass in the World.

The "Société Anonyme des Manufactures de Glaces et Produits Chimiques de St. Gobain, Chauny, et Cirey," owns the works of St. Gobain, Chauny, Cirey, and Montluçon, in France, and Mannheim and Stolberg, in Germany. There are two other factories besides at Jeumont and Aniche.

The following plain white and silvered plates were exhibited by these firms, says Mr. C. Coluë, in his report on glass, at the Paris Exhibition:

	Pounds.
St. Gobain; 1 plate 21-15 feet x 13-48 = 285 10 feet, white, 7-16 in.	1,573
St. Gobain; 1 plate 17-00 feet x 9-94 = 117-92 feet, silvered	770
Jeumont; 1 plate 17-81 feet x 11-51 = 205 feet, white,	1,100
Jeumont; 1 plate 17-21 feet x 10-82 = 182-12 feet, silvered	770
Aniche; 1 plate 15-76 feet x 10-43 = 164-38 feet, white	660
Aniche; 1 plate 14-78 feet x 9-05 = 132-58 feet, silvered	550

The St. Gobain Works furnished a number of mirrors to the new Grand Opera of Paris; among others one 21-29 x 9-67 feet; others from 45 12 to 52-48 feet long.

St. Gobain also exhibited 3-16 inch thick plate glass for windows, weighing only 22 to 26 pounds per square meter; thick polished slabs, such as were used in the aquarium, 7-56 feet long by 2-60 feet wide, 9-16, 11-16, 14-16 inch thick; a series of silvered reflectors, deck lights, bull's eyes, plates of a rough cast glass, smooth on one side and corrugated on the other, used for roof covering, weighing about 27 pounds per square meter, from 1 to 2-8 inch thick. The designs on the surface consist of fine parallel corrugations or small and large corrugated and plain lozenges. The large lozenges are used as a substitute for painted or stained glass in churches for economical reasons. The small lozenges are used for partitions, doors, panels, windows, covered yards, hothouses, roofs, etc.

They also make glass tiles, pressed in imitation of the clay article. These tiles are used for roofing, and are moulded in such a shape that they can be laid alongside of one another, making tight-fitting joints without any cement or mortar; it takes 13 tiles to cover a square meter; each tile weighs about 5½ pounds.

Glass flooring made of flags or slabs of rough cast glass are also manufactured in large quantity by these works; they consist of pieces 6 x 1½ inches thick, 11 inches long, and weigh 165 pounds per square meter; the upper surface is generally moulded in diamonds. Pavements of glass are also exhibited; these are made in the same style as the slabs, with the upper surface moulded in diamonds, but are much thicker, and are intended for pavements for carriage ways. They are made of cubes of about 6 x 6½ inches, and weigh each 19-80 pounds; they are sold by weight. Rough slabs are also made of 6-56 x 2-65 feet, varying in thickness from 9-16 inch to 1½ inches; weight from 213 to 492 pounds.

This company also exhibits all the different rough cast glasses used in the manufacture of lighthouse apparatus, such as rings, parts of rings, and rough lenses. As a specimen of the thickness that can be given to cast glass, there was shown a disk 4-03 feet in diameter by 8½ inches thick, weighing more than 1,320 pounds. This disk is an exact duplicate of the one offered to the French Observatory to make a mirror for their large telescope.

Testing Alcoholic Liquors.

The following hints in regard to alcoholic liquors are given by Dubrunfaut in a French journal: Commercial alcohol and alcoholic drinks differ from each other partially by a characteristic flavor, partially by different chemical properties. A characteristic distinction is the amount of acid in the different liquors. All pure alcohols contain only 1 per cent of acid, while freshly distilled cognac shows 3 per cent, and this increases considerably when kept long in barrels. In ten or twelve years the same cognac will have 8 or 9 per cent of acid, while the original percentage of alcohol is reduced from 64½ to 50 per cent. The quantity of alcohol is decreased both by evaporation and the formation of acid. All other alcoholic liquors show the same changes, and in

addition also contain copper. The presence of this metal is easily proved by ferrocyanide of potassium or sulphuric acid. If there is only a trace of copper the dry residue is burned and the ash tested. As a rule, industrial alcohol also contains copper. The percentage of acid varies enough to furnish a test for the addition of commercial alcohol to rum, brandy, etc., as an adulteration, or to strengthen it. The copper, however, furnishes no reliable clew.

A Steamer Runs Down a Lock Gate.

An unexpected source of danger in canal navigation has been demonstrated at Montreal. On June 30 the steamer Bohemian, carrying fifty passengers and an assorted cargo, entered canal lock No. 2 from the Lachine Canal Basin at half speed. For some cause, as yet unexplained, a full head of steam was put on and the steamer was hurled against the gate which separated the lock from a mass of water thirteen feet higher, a mile in length, and several hundred feet in width. The gates were smashed, and the flood which poured out carried everything before it. The Bohemian was driven back and sank almost instantly. The water drove

furiously on, submerging wharfs, sinking many small vessels, engulfing numbers of laborers, and carrying terror and ruin in every direction. It is said that the deluge of water set the huge ocean steamships in the harbor of Montreal dancing like so many cockle shells.

The outrush of water from basin No. 2 left the vessels in it on the bottom, many of them with broken backs. Others were severely strained and their cargoes much damaged. Several weeks will be required to repair the mischief; meantime navigation will be impeded and several important mills stopped.

Progress in Rifle Shooting.

The victory of the American rifle team at Dollymount, June 27, with a score of 1,292 against 1,280 for their Irish competitors, six shooting on each side, shows that the limit of progress in rifle making and in rifle shooting has not yet been reached. This may be safely inferred from the fact that the best previous shooting in any match has been exceeded in this, and yet there is a considerable margin between its record and absolute perfection. The precision already arrived at, however, is such that but one of the 540 shots fired at Dollymount would have missed a man, the ranges being 800, 900, and 1,000 yards.

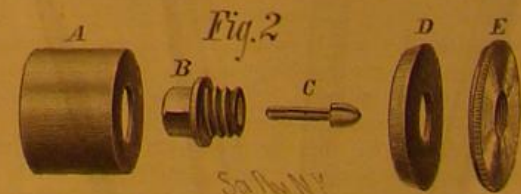
IMPROVED CARTRIDGE.

Cartridges as commonly made consist of four pieces—the tube, the head rimmed disk, an inner disk fitting in the tube, and a screw connecting the disks together and clamping the tube. This construction necessitates the use of a re-enforcing strip at the base of the shell, and the head disks lack strength. Our engraving represents a new method of constructing cartridge shells or cases, recently patented by Mr. Julien Saget, of New Orleans, La.

Fig. 1



Fig. 2



SAGET'S CARTRIDGE.

The tube, which is of paper, has one end flanged internally to receive the thimble or cup, A, which is threaded to receive the hollow screw or anvil holder, B. A flanged plate, D, is fitted over the end of the cartridge, and the plate, D, and thimble, A, are drawn tightly together by the anvil holder, B. The shank of the anvil, C, is now inserted in the holder, B, and a circular steel plate, E, is screwed on the anvil holder, completing the cartridge shell, as shown in Fig. 1. The shell is charged in the usual way, and a cap is placed on the anvil, C, and pressed home.

Should the paper tubes be injured by the explosion or otherwise, it is readily replaced by a new one, thus saving the more expensive parts of the cartridge.

The steel plate added to the portion of the cartridge which receives the blow of the hammer, renders the cartridge more durable than those of ordinary construction.

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

ELECTRO-THERMIC TELEPHONE.

To the Editor of the Scientific American:

Some of the recent European scientific papers contain an abstract of a paper read by Mr. W. H. Preece before the Royal Society, in which he describes a telephone receiver, whose action is due to the linear expansion of a thin wire under tension when placed in a microphonic circuit. According to his own statement the instrument is inefficient, as it fails to articulate distinctly, and requires a very strong current, which would soon destroy any microphone or telephone transmitter.

This experiment is exceedingly interesting and is undoubtedly new to Mr. Preece, but, as many of my friends can testify, I tried the same experiment long since, and as it seemed to give promise of being a good telephone receiver, I followed the idea with great avidity, until I found, after a great deal of experiment with wires of different metals and of different lengths and thicknesses, that only tones with their modulations could be produced; articulation being almost entirely wanting.

Among the metals tried were iron, steel, copper, aluminum, magnesium, and platinum. The only alloys tried were brass and German silver. I also tried very thin pencils of carbon.

The apparatus by means of which these experiments were carried on was so similar to that of Mr. Preece that I send a sketch of it herewith. The head of an ordinary telephone case, containing a thin iron diaphragm, $2\frac{1}{4}$ inches in diameter, was secured to one end of a board about three feet in length. Near the opposite end was placed a post supporting a hook, to which was attached one end of the wire to be subjected to electro-thermic influence, the other end of the wire being attached to the center of the diaphragm.

The diaphragm and the post were placed in a microphonic circuit, and a long copper wire attached to the base of the post was wound several times around the expansion wire, so that it could be moved along to expose more or less of the expansion wire to the action of the current, thus virtually altering the length of the wire.

Currents of various strengths were employed during the course of the experiments; but with all the modifications of the apparatus, or of the current applied to it, I was utterly unable to get anything like the distinct and perfect articulation secured by either the Bell or Edison receiver when used in connection with a good transmitter. However, I soon found a practical application of the electro-thermic principle, in a telegraphic relay, and adapted mechanism to the expansion wire which would faithfully render the impulses of a line in a local circuit, notwithstanding the variable expansion of the wire under different strengths of current.

Although the electro-thermic telephone receiver was practically a failure, I do not regret the course of experiment, as it has resulted in the development of an invention of practical utility, but widely different from that which was originally sought for.

GEORGE M. HOPKINS.

New York, June 28, 1880.

American Wood Engraving.

In a review of the volume of proof impressions of wood cuts from *Scribner's Monthly* and *St. Nicholas*, Mr. Philip Gilbert Hamerton, the distinguished English art critic, says that "modern wood engraving, imitating the qualities of many different kinds of art, has never been carried so far in Europe as it is now in America. A more versatile process it would be impossible to imagine. The only objection that strikes us is the painful sense of the toil involved when we know how the work is done; but this toil may be pleasurable to the engravers themselves when they have reached such a high degree of skill."

Apple Jelly.

Much inquiry has been made of late years for the best way to utilize the surplus crops of apples in abundant years. As the promise is strong for a heavy crop in 1880, it will be well for owners to prepare for the best modes of marketing. In addition to selecting and shipping fine specimens, drying, and converting into vinegar will be largely employed. Another mode, less known, and less extensively adopted, is manufacturing the fresh juice into jelly.

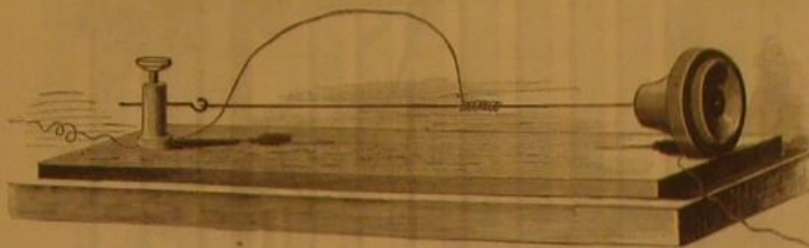
One of the most successful manufacturers of apple jelly, and who succeeds in making uniformly an excellent product, is Isaac Mekeel, of Poplar Ridge, Cayuga county, N. Y. By several years' experience he has brought the process to great perfection. The first, and a most essential requisite, is to use good apples—such as would be regarded as excellent table sorts. They must be fully ripe. If not quite ripe, they must be allowed to remain in heaps after gathering. Autumn table sorts are first employed, and as the manufacture continues, winter varieties ripened in a warm place come into use.

The next essential requisite is a cool temperature. The juice being separated with a grater cider mill, will ferment too soon if the weather is warm. The thermometer should never range higher than 60° in the middle of the day; 40° or thereabouts is preferred. The work is commonly commenced about the middle of October, and is continued till the first of December. If a warm day occurs, the manufacture is omitted till the weather is cooler. The slightest

fermentation of the juice spoils the character of the jelly. In cold weather the whole process may extend through three or four hours, from the grinding of the apples to the completion of the jelly; but if the temperature is as high as 60°, the time must be less than an hour.

Cook's copper evaporator is used for boiling down the juice. Iron will not answer. The evaporator is thoroughly washed daily. The juice is reduced to about 30° or 32° of the saccharometer, and three quarters of an hour to one hour is required for the process. A barrel of juice will make fifty pounds of jelly. A gallon will weigh about eleven pounds—or nearly five gallons are made from a barrel of juice. The evaporator is twelve feet long, the process is continuous, and one barrel or more is reduced per hour. The jelly is poured into the moulds while hot and liquid.

Mr. Mekeel manufactures more largely in abundant years. In 1878 he made twelve tons of jelly. One bushel of apples will make five or six pounds. Not over twenty or



ELECTRO-THERMIC TELEPHONE.

twenty-five bushels of apples are ground or worked at a time, as it is all-essential to evaporate before there is any fermentation. The fruit should be well assorted, so as to have all of equal ripeness. The cost of manufacturing is about a cent and a half per pound, including fuel. The price of the best apples is of course greater than the labor. The wholesale price of the jelly is eight cents per pound, and large quantities are shipped to purchasers. The jelly will keep any length of time; it has been found good and fresh after the lapse of four years.

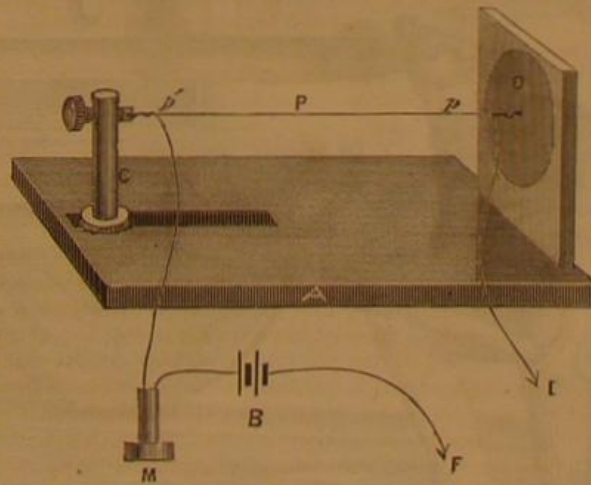
It is probable that the process of manufacture might be continued into winter, in a large basement, any desired degree of coolness being secured by ventilation.—Country Gentleman.

NEW TELEPHONE EXPERIMENTS.

At a recent meeting of the Royal Society a paper was read "On some Thermal Effects of Electric Currents," by William Henry Preece, General Post Office.

I have been engaged for some time past in experimenting on the thermal effects of electric currents, but the final results of those experiments are not sufficiently ripe at present to justify my bringing them before the Royal Society. I have, however, obtained one result which I believe to be sufficiently novel to justify a short preliminary note.

The most striking facts elicited by these experiments are: 1. The extreme rapidity with which thin wires acquire and lose their increased temperature. 2. The excessive sensibility to linear expansion which fine wires of high resistance evince.



THERMAL TELEPHONE.

Now as the rate of heating, and therefore of expansion and contraction, varies very nearly directly as the increment or decrement of the currents when these variations are very small, it occurred to me that if a long wire of small diameter and high resistance were attached to a sounding board or to the center of a disk (such as one of those used for telephones and phonographs) and it formed part of a circuit conveying telephonic currents, sonorous vibrations ought to be reproduced.

The sketch shows the arrangement of the apparatus used for the experiment.

A was a stout base of mahogany, on which a brass support, C, was attached so that it could slide and be fixed at any distance from D.

D was at first a disk of thin paper, and then of thin iron.

P was the wire experimented upon whose loose ends were connected to terminals on the wooden base, so as to be inserted in the circuit containing a microphone trans-

mitter, M, and a battery, B, of six bichromate of potash cells in another room out of hearing.

A platinum wire of 0.003 inch diameter and six inches long from p to p was first used, and the sonorous effects were most marked and encouraging when the microphone transmitter, M, was spoken into. The articulation, though muffled, was clear, and words could easily be heard.

1. Experiments were first made to determine the length which gave the loudest sound and the clearest articulation, and, after repeated trials with every variation of length from one inch to six feet, it was found that a wire six inches long gave the maximum effect.

2. Experiments were then made to determine the diameter of the wire that gave the best effect, and after repeated trials with every gauge drawn from 0.0005 inch to 0.005 inch, it was found that wire of the diameter 0.001 inch gave the best effect.

3. Experiments were then tried with wires six inches in length and 0.001 inch diameter of different materials, namely, gold, iron, aluminum, silver, copper, palladium, and platinum, and they came out in the following order of merit:

Platinum, very clear; aluminum, very variable; palladium, clear; iron, clear; copper, faint; silver, faint; gold, very poor.

4. The effect of mechanical strain was tried. It was found not to vary the effect. When once the requisite tension, which varied with each metal, was obtained, further tightening up did not vary the clearness or loudness of articulation. Gold would scarcely bear the tension required to reproduce sonorous vibrations, hence its low position.

5. Very thin carbon pencil, 0.0025 inch diameter, was tried under compression and under tension, but no effect whatever was experienced unless a bad joint was made, when at once a faint microphonic effect was apparent.

6. No sibilant sounds whatever could be reproduced.

7. That the effect was due to heating and cooling was shown by the fact that it was possible to increase the current to such a strength as to render the temperature of the wire sensible to the touch, and then to make its elongation and contraction by low sounds evident to the eye.

It therefore appears from these experiments that wires conveying those currents of electricity which are required for telephonic purposes expand and contract as they are heated and cooled, and as the variations in the strength of the current are small compared with the strength of the current itself, the expansion and contraction vary in the same ratio as the condensation and rarefaction of the air particles conveying the sonorous vibrations which produced these vibrations.

The mechanical changes, or molecular vibrations in the wire, due directly or indirectly to telephonic currents, which result in the reproduction of sound, bear a close analogy to the mechanical changes due to the direct transmission of sound, but with this important difference, that while the vibrations due to sound are progressive along the wire, and their velocity is low and easily measured, those due to thermal effects are practically instantaneous, and therefore affect simultaneously the whole length of the wire.

Note.—De la Rive, in 1843 (*see "Electricity,"* vol. i, p. 304), observed that an iron wire emitted sounds when rapid discontinuous currents were passed through it; but he attributed the effect to magnetism, for he failed to obtain the same effect in non-magnetic wires like platinum or silver.

Graham Bell found, in 1874, that a simple helix without an iron core emitted sounds, and (in 1876) that very distinct sounds proceed from straight pieces of iron, steel, retort carbon, and plumbago, when conveying currents.

Professor Hughes showed that his microphone was reversible, that is, that it could receive as well as transmit sonorous vibrations.

Mr. Weisendanger (*Telegraphic Journal*, October 1, 1878) reproduced sounds on a microphonic receiver which he called a thermophone, and attributed the effect to its true cause, namely, the expansion of bodies under the influence of heat, which, in fact, is the explanation of all microphone receivers.

Adler reproduced speech by the vibrations of a wire conveying currents of electricity, but he found that only magnetic metals were effective, and therefore, like De la Rive, he attributed the result to magnetic agencies (*see Count du Moncel, Telegraphic Journal*, March 1, 1879).

These and many other sonorous effects of currents on wires may be really due to such heat effects as I have described.

The Hudson River Tunnel.

The bill "to provide for excavating and tunneling and bridging for transportation purposes within the villages and cities of this State," passed by the New York Legislature, has been signed by Governor Cornell. The completion of the Hudson River Tunnel is now authorized, and becomes purely a question of scientific and financial engineering.

Honors to Electricians.

A committee appointed in 1876 and presided over by M. Dumas, have reported to the French Chamber of Deputies in favor of granting the first Volta prize of 50,000 francs to Prof. Graham Bell, of telephone fame, and the second prize of 20,000 francs to M. Gramme, the well known inventor of the dynamo-electric machine bearing his name. The first one to receive this distinction was Ruhmkorff.

NOVEL GATE CLOSER.

The engraving shows a simple and effective device for closing gates automatically without the application of springs or weights. The gate rises bodily as it opens, and is closed by its own gravity. It is hung upon hinges having long pintles, and is supported by an inclined rod, having a bearing at its upper end in a socket attached to the gate, and at the lower end in a socket attached to the post eccentrically to the pintles of the hinges. Opening the gate causes it to rise bodily by throwing the inclined rod into a more nearly vertical position, when the gate is released its own weight closes it.

The socket which receives the upper end of the inclined rod is rigidly attached to the hinge strap, making a strong and durable bearing.

A patent for this device was recently issued to Messrs. John Kohnmann and Samuel R. Latta, of Dyersburg, Tenn., who may be addressed for further information.

Philadelphia's Textile Industries.

Mr. Lorin Blodgett, who has in charge the census of the textile industries of Philadelphia, finds 400 power mills or groups of mills in the city, and about 200 hosiery and carpet manufactures, not using steam power. In a recent statement concerning this branch of industry Mr. Blodgett said:

"It is well known that Philadelphia is the greatest manufacturing center of the world, but it is not so generally known that the textile manufacturers contribute more than any other class to this marked distinction of our city. The census now being taken will show that the value of the products for the present year of the various manufactures of our city will reach the grand total of \$600,000,000. To this the textile manufacturers will contribute: In woollens and cottons of the general table, \$48,500,000; in carpets, \$23,000,000; in hosiery and knit goods, \$23,000,000; in worsted yarns, \$12,500,000; in silks and mixed goods, \$7,000,000—an aggregate of \$115,000,000—over one sixth of the whole, an amount of which they may justly feel proud, not only on account of the position which it aids in giving to our city, but also because of the means of subsistence which it affords to so many of its people. The outlying districts, of which Philadelphia is the business center, will add \$38,000,000 to this, making for Philadelphia and vicinity \$153,000,000."

NEW CAR MOVER.

The device shown in the annexed engraving is applied to one of the wheels of a car when it is desired to move it for a short distance. It consists of a wooden lever having on one side two triangular steel bars whose edges are capable of biting into the side of the car wheel. A stout bolt bent at a right angle projects from the side of the lever near the triangular steel bars, and is threaded so that it may be adjusted to wheels of different thicknesses.

When in use one end of the lever is placed against the car axle as a fulcrum, and the edge of the wheel is clamped between the triangular steel bars and the hooked end of the bolt.

By pulling or pushing on the long arm of the lever the car wheel is turned and the car moved. When pushing, the lever is placed over the axle; when pulling, it is placed under the axle.

This device was recently patented by Mr. O. B. Blakeslee, of Rankin, Ill., and is manufactured by J. T. Mug & Co., Lafayette, Ind., who may be addressed for further information.

Lake Ontario Shad.

The attempt to stock Lake Ontario with land-locked shad turns out less favorably than seemed probable a short time ago. The *Times*, of Watertown, N. Y., says that on the 19th of June the Edith Sewal, on her trip to South Bay, passed through compact masses of dead or dying fish, extending in windrows ten feet wide and miles in length, while scattered fish in countless numbers covered the waters between the rows.

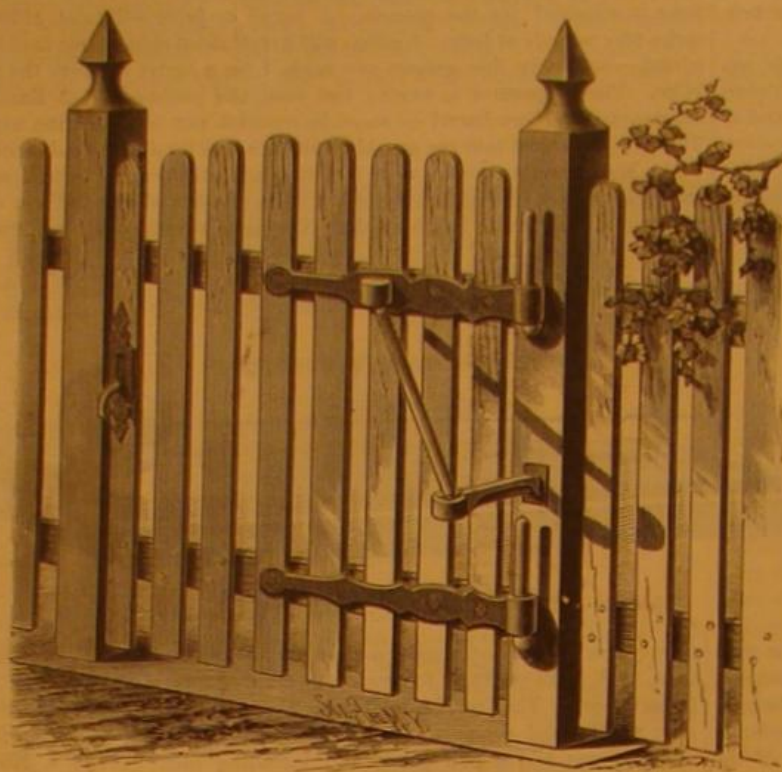
The fishermen, who say that each fish has a mossy spot upon it, of a yellow cast, with a red look about the edges, have had hard work to get rid of the multitudes of dead fish, whose stench polluted the air.

MISCELLANEOUS INVENTIONS.

Mr. William V. Henry, of Sacramento, Cal., has patented an improved pumping apparatus. The object of this invention is to furnish simple and durable apparatus, especially adapted for raising large quantities of water for ir-

rigating purposes and for draining mines. The invention consists in pump barrels suspended from a walking beam and reciprocating upon a valved piston head that is held upon a fixed rod. The barrels are fitted with check valves, and the whole apparatus constitutes a balanced force pump that may be fitted in open or bored wells and driven by horse, wind, or steam power.

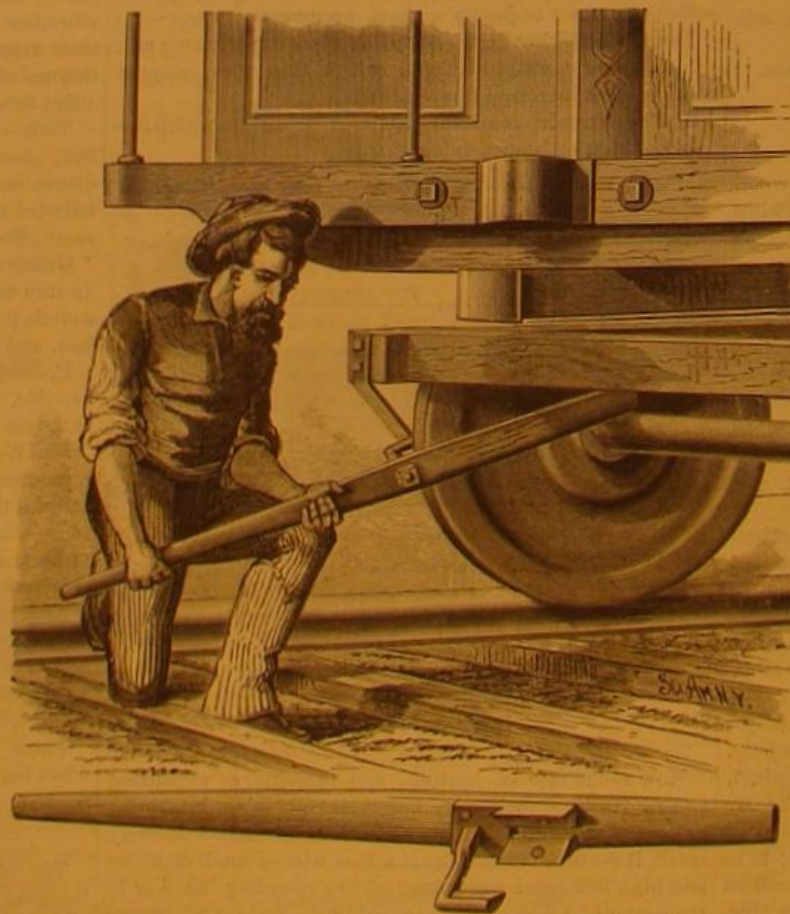
Mr. Granger W. Smith, of Chili, N. Y., has invented an



KOHNMANN'S GATE CLOSER.

improvement in paper-cutting machines. The invention relates to a machine for trimming the edges of magazines, pamphlets, or books, and for cutting paper into sheets of different sizes, and for other similar purposes; and it consists in a novel arrangement of an adjustable table for holding the book or paper to be trimmed or cut, a frame for supporting said table, and an adjustable bar for clamping the book or paper, and a knife used for the trimming or cutting process.

An improved starch press has been patented by Mr. Richard Johnson, of Madison, Ind. This invention relates to means for extracting water from starch, which has heretofore been accomplished by means of ovens and other devices involving the necessity for the employment of heat.



BLAKESLEE'S CAR MOVER.

An improvement in harrows has been patented by Mr. William L. Waddy, of Peytona, Ky. The object of this invention is to enable a harrow to be reversed and slid on runners.

Mr. Silas Courtright, of Hooker's Station, O., has patented an improved tug attachment which is designed to render the tug elastic to a certain extent, and thus relieve the horses from undue strain.

Mr. John Tuggle, of New Middleton, Tenn., has invented an improved currying knife. The improvement consists in a novel construction and mode of attachment of the blade and stock of a currying knife, whereby provision is made for adjusting the blade to suit the different kinds of work.

A novel and convenient device for supporting window shades and curtains has been patented by Mr. George Baldwin, of South Manchester, Conn. The invention consists in a combination of brackets, shade rollers, curtain cornice, and curtain rod.

A button so made that the face and shank can be readily separated and again united, has been patented by Mr. Henry H. Schmitt, of South Brooklyn, N. Y. The invention, although simple, cannot be described without engravings.

Mr. William P. Owen, of Mount Pleasant, Tenn., has patented an improved folding extensible fire screen, which is composed of hinged or both hinged and sliding sections.

Mr. John L. Paxson, of New Hope, Pa., has patented an improved register adapted especially to the tallying of lumber, but applicable also to indicating the speed of machinery, or for adding a column of figures, or for measuring distances, etc.

Mr. Joseph B. Eaton, of Shamokin, Pa., has patented an improved machine for making lozenges which is simple, convenient, and effective in operation. It consists in arranging narrow belts between the cutters so as to allow the lozenges to pass through, while they hold the scrap down and feed it forward.

Mr. August Hoen, of Baltimore, Md., has patented an improved process of lithocautic engraving, consisting in drawing parallel crossed lines on the etching ground covering the lithographic stone, for the purpose of giving a roughened surface of even texture to the stone, then applying an acid for the purpose of deepening and broadening the lines and producing pyramidal points, then

covering the lines with a solution of gum arabic in water, then rubbing down or otherwise reducing the points to produce the uneven surface required for the lights and shades of the engraving.

An improvement in dividers for striking circles with chalk or pencil points has been patented by Mr. Charles F. A. Reimann, of Pine Bluff, Ark. The object of the invention is to strike two or more concentric circles at one sweep of the instrument. It consists of dividers with the pencil foot adapted to receive two points, and in providing the dividers with an adjustable arm adapted to receive several points and hold them on a level with the feet of the dividers.

An adjustable smoke stack especially designed for steam fire engines, whereby the draught from the boiler can be increased or diminished at will, has been patented by Mr. Asa W. La France, of Elmira, N. Y. It consists of a section of a flanged and longitudinally-ribbed pipe, smaller than the outer section of the smoke stack set within said stack and vertically adjustable therein, whereby the exit of the smoke stack may be diminished or increased at pleasure.

Mr. William Klemm, of Pittsburg, Pa., has patented an improved curtain cord tightener, consisting of a cam pivoted in a clamp that slides on the vertically-placed rack, so that the tension of the cord that is passed around the outer end of the cam forces the inner end of the cam against the face of the rack and holds the cam and clamp immovable.

Mr. William Keane, of Stratford, Ontario, Canada, has patented an improved tow cleaning machine. Heretofore the tow has been cleaned by hand by tow pickers and beaters, operations involving considerable expense and waste of tow, besides not being effective. For a proper understanding of the nature and objects of this invention, it should be understood that the tow is the refuse from flax scutching machines, which are made in various forms, but generally using revolving cutters, which remove the rough fibrous shives and other refuse while the flax is held by the scutcher. The tow is then partially cleaned from the shives and refuse by separate operation. In this machine the beaters of the scutching machine are used for cleaning the tow after it is removed from the flax, and deliver the cleaned tow separately from the shives and other refuse, thus accomplishing the complete operation without extra machines.

Mr. William E. Huse, of Brookfield, Mass., has patented an improved cattle stanchion. The object of this invention is to furnish attachments for cattle stanchions so constructed that cattle may be released from their stanchions and from the stable in a moment and without entering the barn.

THE TEREBELLA AND HERMELLA.

While wandering along any of our sandy coasts, we frequently come across some moderately large tubes projecting from the sand, and rather conspicuous in the little puddles left by the receding tide. Round their mouth is usually a set of forked filaments which, like the tube itself, are composed of fragments of sand agglutinated together. The substance of this tube is very soft, but very tough, and will endure a tolerably hard pull without breaking. If the inhabitant of these tubes be sought, it will not be found without much labor, for the terebella retreats to the further extremity at the least indication of danger; and as the tube is a foot or more in length, and is always conducted under stones or among rocks, it is not easily dislodged.

As in the case of the sabella, this annelid performs its architectural labors by means of its tentacles, which are most wonderfully constructed, so as to be capable of extension or retraction, and at the same time can seize or throw away a particle of sand at any part of the tentacle. The method of working is very well given by Mr. T. Rymer Jones in "Wood's Natural History."

"If a specimen be dislodged from its tube, it swims by violent contortions in the water, after the manner of various marine annelids; the tentacles and the branchiae are compressed and contracted about the head, like a brush; and as the animal is very soon exhausted by such unnatural exertions, it soon sinks to the bottom. Should a quantity of sand be now scattered from above, the tentacles, speedily relaxing, extend themselves in all directions to gather it up, sweeping the vessel quite clean, so that in a very short time not a particle is left behind that is within their reach, the whole having been collected to be employed in the construction of a new artificial dwelling, adapted to shelter the naked body of the architect."

"We will suppose a tube to have been partially constructed into the side of the aquarium wherein a specimen is about to take up its permanent abode. During the earlier part of the day the animal is found lurking in its interior, with only the extremities of the tentacles protruding beyond the orifice, and it will so remain until towards noon. But scarcely has the sun passed the meridian than the creature begins to become restless; and towards four or five it will be seen to have risen upwards, the tentacles extending with the approach of evening, until after sunset, when they are in full activity. They are now spread out from the orifice of the tube like so many slender cords; each seizes on one or more grains of sand, and drags its burden to the summit of the tube, there to be employed according to the service required. Should any of the tentacles slip their hold, the same organs are again employed to search eagerly for the lost particle of sand, which is again seized and dragged toward its destination."

"Such operations are protracted during several hours, though so gradually as to be apparently of little effect. Nevertheless, on resuming inspection next morning, a surprising elongation of the tube will be discovered; or, perhaps instead of a simple accession to its walls, the orifice will be surrounded by forking threads of sandy particles agglutinated together."

There are many species of terebella, and even on our own coasts we may be gratified with several beautiful forms of these interesting annelids. They have, to a considerable extent, the power of reproducing lost portions of the body; and it has been found that even the whole mass of plumy tentacles can be removed without much injury to the terebella, which retreats to its tube, and after a while reproduces the whole of the missing organs.

FISH PARASITES.

BY A. W. ROBERTS.

The leeches which commonly swim free in the water, and only occasionally attach themselves to the bodies of verte-

brate animals to drink themselves full, have their nearest relations in those which attach themselves to the exterior of fishes and crustaceans. While, however, the free swimming leeches have ringed bodies, the parasitic leeches of fish and crabs have soft and smooth bodies, especially in the

skinned animals. The accompanying illustration represents the skate sucker, *Pontobdella muricata* (natural size). From the fact that it is more frequently found adhering to the different members of the skate or ray family of fishes, it is most commonly known as the skate sucker. This genus of

marine leeches can be generally distinguished by the numerous tubercles on the rings of the body, which produce a very curious effect. The prevailing color of the skate sucker is a greenish gray.

These marine leeches are provided with a large and powerful sucking disk, by which they can maintain themselves in a horizontal or perpendicular position; but their most common position, when at rest and attached to inanimate objects, is a spiral, the head being in the center.

On my return to the aquarium, one of the large fresh water tanks which had been neglected for several months had become so infested with a small variety of parasitical leech that it was with difficulty the glass front could be kept clear of them. Even the extreme tops of the aquatic plants growing in the tank swarmed with thousands of them constantly extending themselves in their endeavors to catch on (they not being free swimmers) to the tails and fins of the lake dogfish, or the large specimen of fresh-water eels contained in the tank. The eels instinctively avoided resting on the floor of the tank or coming in contact with the plants or rock work sides of the tank, but remained suspended night and day in the open clear mid-water. Still,

with all the precautions taken by the eels, many of them became fringed with hundreds of the leeches. I have seen the eels repeatedly loop themselves so as to bring the head and tail together, in which position they would strip off the leeches with their teeth; and in so doing they often bit or tore off small pieces of their flesh and fins, so that in course of time (when the wounds did not heal rapidly) they became badly covered with fungus. What with the leeches and the fungus the eels had become floating skeletons. To save the few remaining, I placed them in the "hospital tank" for treatment. The course of treatment was to rapidly pass them through a bath of warm and very salt water (a nearly saturated solution). This salt bath I never knew to fail in destroying leeches and fungus, if the fish so treated were not too far gone.

The bottom of the "hospital tank" contained a heavy flooring of Coney Island sand, in which the eels embedded themselves as if only too glad to take a rest after their long suspension. At night they were fed to repletion on raw beef. Under this treatment they soon became "solid" and happy.

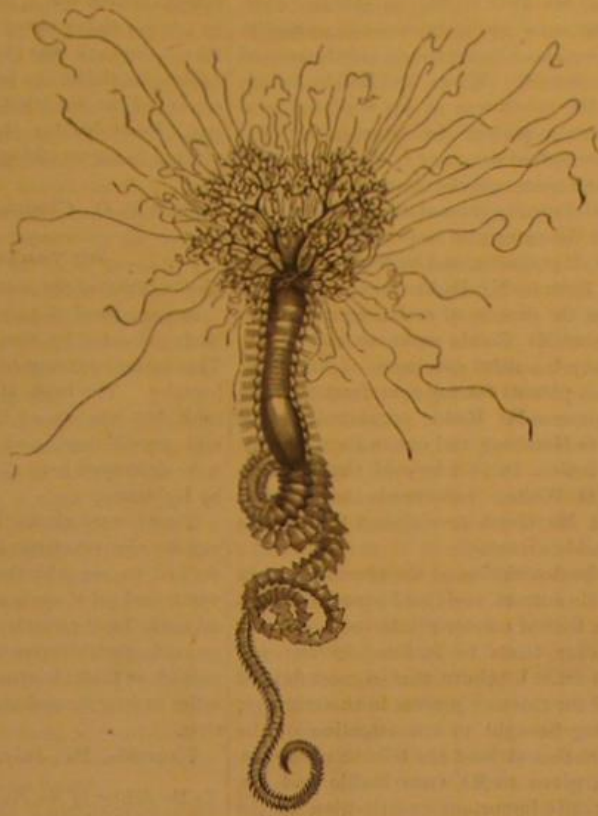
The tank out of which the eels were taken was then cleared of all the fish remaining, after which a half barrel of quicklime was cast into it, and in one hour's time the lime had done its work, everything living was burnt up, the tank was then drawn off, scrubbed, and washed out, and a heavy bottom of fine sand introduced.

One of the most beautiful tanks I ever had, and of which I was very proud, contained some twenty-five weakfish, thirty kingfish, twenty striped bass, two pilotfish, and several bluefish. They were all in perfect health, high color, and feeding well. In one night all the kingfish died; the next day the weakfish departed, then the pilots, and the blues.

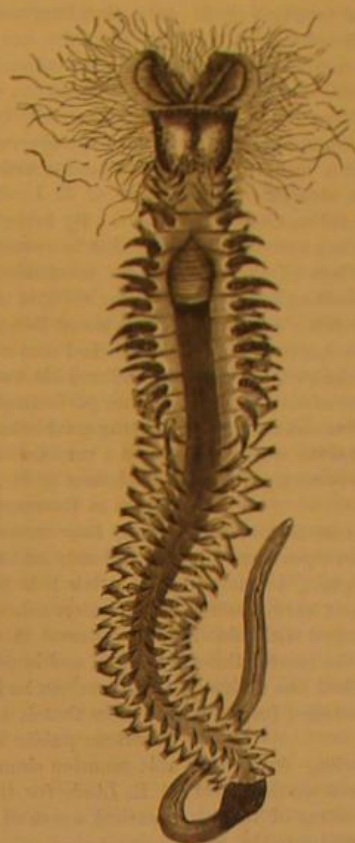
I had nothing in the way of an explanation, as I had never in all my long experience known of fish dying in this unaccountable manner. I examined the dead fish carefully; both externally and internally they appeared to be in perfect health; their gills seemed to be unusually healthy for fish kept so long in confinement.

Next to this tank was a tank of plump and healthy blackfish, who were fed as blackfish were never fed before; and these, too, died in the same unaccountable manner a short time after the other fish.

Next to the blackfish was a tank containing over one hundred spotted codlings, and who were so fat that they seldom swam for more than five



TEREBELLA EMMALINA.—[Natural size.]



HERMELLA.—[Magnified.]



TUBES OF THE HERMELLA.—[Natural size.]

Molactobdella. In other words, there are leeches which occasionally prey upon warm-blooded animals, and are hardly to be called parasites. Others are to be found only on the skin of cold-blooded vertebrates, and, finally, those of thoroughly parasitic character, which adhere to crabs and soft-

SKATE SUCKER.—*Pontobdella muricata*.—[Natural size.]

THE STRUCTURE OF MATTER.

Read before the New York Academy of Sciences by Prof. C. F. Kroch, of the Stevens Institute of Technology.

[Continued from page 25.]

LEIBNITZ.

Leibnitz (1646-1716), one of the inventors of the calculus, maintained that extension is not a fundamental, but a derived idea. It can be explained by the assumption of some thing of which it is the property, of something that is itself simple, without parts, and consequently without extension, shape, or divisibility. He imagined the universe to be made of such simple, ultimate things, and gave them the name of monads. Although a monad has no parts, it may nevertheless be the exponent of numerous perceptible relations, just as a point in space may be viewed as the vertex of numerous angles. Great numbers of these monads are continually acting upon our senses with infinite rapidity, and producing in our minds confused images of the external world. We perceive what we call the properties of matter only because we are incapable of analyzing the impressions made upon us by these immaterial monads.

A monad can be produced by creation only, and can be destroyed by annihilation only. This follows from the assumption that it has no parts. Nothing can be added to it nor taken from it. Being a created thing, it must be subject to continual change, and the cause of this change must lie within it. In consequence of this changeability there must exist an infinite variety of monads. They appear to us to occupy space, because they have certain positions with regard to one another, certain geometric relations, and because many of them act upon our senses at once. Motion is the sum of infinitely small impulses exerted by them; yet they in no wise act upon one another, but each monad moves independently by virtue of the force that is in it, and enters into various relations with other monads in obedience to a predestined harmony which is the law of its being.

To account for the phenomena of life Leibnitz goes so far as to endow his monads with greater or less degrees of consciousness, of perception and volition; but in these speculations we need not follow him.

KANT.

Kant (1724-1804), the originator of the nebular hypothesis, fixed upon mobility in space as the essential property of matter. Our senses can be affected by motion alone. Extension is explained in this system by supposing that a body fills space by reason of the resistance it offers to all motion tending to displace it. This resistance is itself motion in a direction contrary to that of the invading body. It may be called a repulsive force, and must be inherent in all its parts. If every particle of matter is endowed with repulsive force, we have an explanation of expansion, elasticity, and impenetrability. Infinite divisibility also follows from this conception, because the mobility of every particle makes it separable from every other particle. The divisibility of matter must, therefore, be commensurate with the mathematical divisibility of space.

To account for the occupation of definite space by a body we must also endow its particles with an attractive force, which counteracts repulsion and prevents the particles from flying off into space.

It will be perceived that we are now entering a region of thought more familiar to the modern chemist and physicist.

BOSCOVITCH.

The idea that the particles of matter are endowed with both attraction and repulsion constitutes the basis of the atomic theory of Boscovitch (1759), which has formed the working theory of scientific men until quite recently.

When bodies are said to touch each other they are by no means in mathematical contact, but separated by an insuperable repulsive force, so that a distance of $\frac{1}{1000000}$ of an inch intervenes. Within this interval, according to Boscovitch, there are several alternations of attraction and repulsion. In other words, if two atoms, separated by $\frac{1}{1000000}$ of an inch, are brought a little nearer together they will attract each other; if still nearer, they will repel, and so on, with this limitation, that no force however great can bring them into mathematical contact. At distances greater than $\frac{1}{1000000}$ of an inch atoms attract each other according to the law of gravitation. It is evident that at smaller distances there will be intermediate positions of stable and unstable equilibrium, and that atoms moved from these positions in any direction will oscillate to and fro by virtue of their inertia, until they either return to their old position or arrive at a new one, where there is again a balance of attractions. It is thus that the phenomena of cohesion and elasticity are explained.

Boscovitch interprets the three states of matter as follows: In a gas, the repulsive force prevails between the particles, so that it would expand indefinitely if no external force interfered. In a liquid, the particles are maintained at a definite distance by mutual attraction and repulsion; and each particle is free to rotate in any plane. In a solid, the distances between the particles are also determined by both forces; but the particles are polarized or obliged to rotate in certain definite planes. If any particle is swung out of its natural plane, it will return to it again after performing a certain number of oscillations.

In this and all the other atomic systems the fundamental assumptions are:

That matter does not continuously fill space.

That its particles are separated by distances which are great in comparison to the size of the particles.

That they act upon each other at a distance, and not by contact.

That the particles are extremely hard, and both indivisible and unalterable by any means, physical or chemical.

That the particles are impenetrable and possess inertia.

That the chemical and physical properties and behavior of bodies depend upon the collocation and motions of its atoms; and consequently,

That our senses deceive us when they convey to our minds the impression that bodies are continuous, and when they appear to reveal to us any other changes than changes of place.

Those who endeavor to make the atomic system account for the existence of the physical universe, and reject creation, are obliged to make certain additional assumptions, which will be examined elsewhere.

FARADAY.

Faraday, in his speculations touching electric conduction and the nature of matter (*Phil. Mag.*, 1844), reasons as follows: Of the two constituents of matter involved in the atomic hypothesis (atoms and spaces), space is the only continuous one. Consider, then, he says, the case of shellac, a non-conductor, space in it must be an insulator, whatever the atoms may be; for if it were a conductor, the shellac could not insulate. But now take the case of platinum, which must also be composed of atoms and spaces. Since platinum is a conductor, space, being its only continuous constituent, must be a conductor. Space, which is everywhere uniform, is therefore both a conductor and a non-conductor. "Any ground of reasoning which tends to such conclusions as this must be false." He then adds, Why should we assume the existence of matter independent of force at all? and he modified the system of Boscovitch by substituting the term "center of force" for atom. According to this view matter, in the ordinary acceptance of the term, disappears entirely, to make room for the emanations of force which fill the universe, and the atom is replaced by points at which lines of force converge.

THE LATEST VIEWS.

Since by the labors of Joule, Clausius, Krönig, Maxwell, and others, the science of thermodynamics has been created, the hypothesis of atoms and molecules has been greatly developed by the mathematical study of their motions, so that we are no longer obliged to define them after the vague manner of former theories; but we possess tolerably definite information relative to their size, weight, distances apart, velocity, and energy. I shall have to content myself this evening with giving a single example of this new knowledge, postponing the evidence. Thus we know with tolerable certainty of the hydrogen molecule:

1. That its weight is $\frac{46}{1000}$ gramme.
2. That its volume is subject to great variation in its compounds. In its elemental state its volume is taken as the unit of comparison, and corresponds to a diameter of $\frac{5.8}{1000}$ meter (5.8 tenth-meters).
3. The distance between two neighboring molecules of hydrogen is $\frac{965}{1000}$ meter (965 tenth-meters).
4. The velocity of vibration 0° C., 1,859 meters per second.
5. The number of collisions between hydrogen molecules per second is 17,750 millions.
6. Novert can draw 4,000 lines in the breadth of a millimeter. The interval between two such lines can be seen with a good microscope. I have calculated that a cube with an edge of $\frac{1}{1000000}$ mm. would contain about 17 million molecules of hydrogen.

The theory that matter is continuous has been revived to a certain extent. In studying elastic bodies Prof. Stokes has availed himself of the idea that the smallest portions into which we can divide them are sensibly homogeneous. The theory of fluxions and modern mathematics then become applicable, provided we do not carry the divisibility too far. The smallest particles considered must be sensibly similar. Sir Wm. Thomson illustrates this by the statement that contiguous cubes of water $\frac{1}{1000000}$ cm. in breadth are sensibly similar, but cubes of $\frac{1}{1000000000}$ cm. must be very sensibly different. Take two lengths of masonry, he says, each of 20,000 cm.; one may contain 1,000 bricks, and the other 999 bricks and two half bricks. They would then be sensibly similar. If, however, you take two lengths of 40 cm., one might contain 2 whole bricks and the other 1 whole and 2 halves. They would be sensibly dissimilar.

In Boscovitch's theory there is no contact of atoms, and all action is therefore action at a distance. Of this it is impossible, at least for me, to form a clear and philosophical conception. Clerk-Maxwell in his electrodynamics drops this assumption entirely, together with that of hard atoms. He imagines the ether filling space to contain a system of cells with elastic walls and cylindrical cavities, in which elastic balls can rotate and be flattened out by centrifugal force. In the cells there must be other balls of invariable volume as friction rollers. These would rotate freely; but their centers of gravity, in insulating media, would merely be displaced by elastic yielding of the cell wall; in conducting media every displacement would be attended with resistance similar to friction in a viscous liquid. Motion is transferred in these balls by surface adhesion only. Their displacement produces dielectric polarization in the medium, and their onward motion an electric current. The rotation of the elastic balls corresponds to the magnetizing of the medium, the axis of rotation being the direction of the magnetic force. While Helmholtz designates such a conception

as too artificial, he admits that Maxwell has developed from it a complete and mathematically very elegant theory of all electrical phenomena. An entirely novel and suggestive view of the construction of matter was originated by Sir William Thomson.

Vortex Atoms.—Helmholtz had shown that if any portion of a perfectly homogeneous fluid, incompressible, continuous (not made up of molecules), and devoid of internal friction, is caused to rotate, it will form a vortex ring of invariable volume. The matter partaking of this rotation is thereby differentiated from all the rest, and will remain so for ever. Nothing short of a creative art can start or stop such rotation. If two such rings are linked together, they can never be separated, and if a single one is knotted on itself, it can never be untied.

The formation and properties of such rings may be studied experimentally, bearing in mind that we have only imperfect fluids to deal with. Prof. Wm. B. Rogers, in the *American Journal of Science*, 1858, p. 246, described various methods of producing them. Prof. J. Trowbridge, in the *Philosophical Magazine*, 1877, says: "All liquid drops falling from such a height that the surface of the liquid in which they are about to diffuse themselves is not too much disturbed to enable the drop to be acted on symmetrically by the forces at the free surface, will form rings, if too great differences of density do not exist." To render them visible the drop may be colored. "That a drop of pure water will descend through the same liquid in a vortex ring can be shown experimentally by covering the free surface of the water with a fine light powder." (I would suggest lycopodium.) "Particles of the powder will be carried down by the drop and will be seen to rotate in a ring shape far below the surface."

Prof. Tait rendered visible the formation of vortex rings in air by means of a cloud of finely divided sal ammoniac. He used a common wooden box of a capacity of about two cubic feet. In one end there was a circular hole about six to eight inches in diameter, while the other end had a towel stretched over it. By sprinkling ammonia over the bottom and then generating in it hydrochloric acid from common salt and sulphuric acid, he obtained a copious evolution of sal ammoniac vapor, which rendered the rings visible. They were produced by sudden blows upon the stretched towel. Two such rings impinging upon each other behave like rings of solid India-rubber. As such a ring approaches one's face its inner particles are seen to rotate forward, and its outer ones backward, while the air in the center moves forward faster than the ring itself and strikes the face first.

These rings suggested to Sir Wm. Thomson the idea that the universe is continuously filled with a perfect fluid, and that whatever produces upon us the impression of matter is portions of this fluid in vortex rotation. In other words his atoms are vortices, and it proposed to explain all the properties of matter by the laws governing vortex motion.

While the atoms with which we have dealt heretofore are in reality patch-work, altered and amplified to suit each new discovery in chemistry and physics, the vortex atom is not capable of such adjustment. As Maxwell puts it: "His primitive fluid has no other properties than inertia, invariable density, and perfect mobility, and the method by which the motion of this fluid is to be traced is pure mathematical analysis. The difficulties of this method are enormous, but the glory of surmounting them would be unique."

Rankine, in a paper on "Molecular Vortices," before the Royal Society of Edinburgh, 1849-50, illustrated knotted vortex atoms by means of diagrams and wire models. "Their endless variety," says Sir Wm. Thomson, "is infinitely more than sufficient to explain the varieties and allotropies of known simple bodies and their mutual affinities."

Helmholtz, Tait, Maxwell, Rankine, Stokes, and other celebrated men have all contributed to this theory.

CONCLUSION.

Having now passed in review the leading theories of the structure of matter up to the present day, I shall conclude my paper by a brief statement of the manner in which it is my purpose to continue my studies.

I shall, in the next place, examine the idea of an atom and the question whether the material universe can logically be constructed according to the requirements of the atomic system. Then will be presented the evidence metaphysical and experimental of the existence of molecules. This will include the beautiful experiments of Crookes. Another chapter will be devoted to the facts ascertained about molecules, such as their weight, relative and absolute; size, relative and absolute, shape, velocity of motion, length of path, number of collisions per second, etc. I may mention in this connection that I have no less than seven different lines of argument based on experimental data, all of which concur in assigning to molecules a diameter not far from the $\frac{1}{1000000000}$ of an inch.

Finally, I shall endeavor to show how such a knowledge of atoms enables us to explain the behavior of gases under pressure, the spectra of gases, liquids, and solids; heat resulting from chemical action, quantivalence, and other phenomena.

A LARGE HORSE.—One of the largest horses ever seen in this city arrived from Ohio June 22. His registered height is 20 hands and 1 inch, or 81 inches; his weight is said to be 2,450 lb. The animal was bred from native draught stock, is of a dark bay color, well proportioned, and in excellent health. It is said that a horse measuring 21 hands 2 inches was shown in this city many years ago; and more recently one which measured 19 hands 1 inch.

Wages and Earnings in Pennsylvania.

Mr. Miles Humphreys, chief of the Pennsylvania Bureau of Industrial Statistics, has issued a report embodying the information gathered by him last year by circulars addressed to employers in various parts of the State. Mr. Humphreys is careful to mention the fact that in many cases the returns received show only the weekly wages paid, and that, in tabulating them on a basis of fifty-two weeks, the aggregate earnings must be considerably over-estimated. When the necessary deductions are made for lost time the total must be materially reduced. Many circulars were issued to ascertain earnings from the wages worker's standpoint, but not a sufficient number of intelligible replies were received to furnish the information desired. The failure is attributed to the fact that workmen as a rule do not keep accurate yearly accounts of earnings and expenditures.

The summary of employers' reports is given in the following table.

SHOWING THE AVERAGE WEEKLY WAGES OF EMPLOYERS, THE AVERAGE WEEKS EMPLOYED DURING THE YEAR, WITH THE TOTAL EARNINGS FOR THE YEAR 1879:

Occupation.	Weekly wages.	Weeks worked.	Earnings for the year.
Miners, coal (anthracite).....	\$9.28	43	\$399.04
Miners, coal (bituminous).....	8.51	40	340.40
Blast furnace employees.....	9.04	48	433.92
Puddlers (iron).....	15.14	38	575.32
Boilers (iron).....	17.98	40	719.20
Rollers (iron).....	23.52	37	870.24
Hot turners (iron).....	40.97	44	1,802.68
Roughers (iron).....	17.94	44	789.36
Catchers (iron).....	9.50	45	427.50
Refiners (iron).....	16.97	46	780.02
Forgemen (iron).....	15.56	39	606.84
Hammermen (iron).....	17.50	40	700.00
Roll hands (iron not specified).....	22.66	47	1,065.02
Helpers (iron).....	11.00	34	374.00
Shearers, sheet (iron).....	18.90	43	812.70
Straighteners (iron).....	10.00	32	320.00
Hammer driver.....	12.00	43	516.00
Steel millers.....	30.48	39	1,189.72
Steel converter.....	16.50	22	363.00
Steel helper.....	15.00	38½	582.50
Nailers.....	19.27	36	693.72
Tack maker.....	22.70	26	590.20
Nail cutter.....	12.00	25	300.00
Spike maker.....	9.00	48	432.00
Nail packer.....	8.40	52	436.80
Rivet maker.....	20.00	36	720.00
Wire drawer.....	15.00	52	780.00
Pipe threader.....	9.00	50	450.00
Moulders (iron).....	11.26	43	484.18
Blacksmiths.....	10.33	48	495.84
Bricklayers.....	12.87	43	553.41
Carpenters.....	10.61	48	509.28
Cabinet makers.....	7.80	46	358.80
Carriage makers.....	8.62	48	413.76
Engineers.....	15.10	48	724.80
Glass workers.....	18.29	45	823.05
Machinists.....	10.84	47	509.48
Painters.....	9.86	42	414.12
Plasterers.....	7.71	44	339.24
Printers.....	8.66	50	433.00
Sawyers.....	15.78	35	552.30
Shoemakers.....	8.08	45	363.60
Stonecutters.....	9.32	41	382.12
Stonemasons.....	9.02	33	297.66
Tailors.....	8.00	46	368.00
Hatters.....	6.00	52	312.00
Tanners.....	7.53	50	376.50
Tinsmiths.....	11.12	51	567.12
Gasfitters.....	10.50	36	378.00
Track foremen (railroad).....	10.00	33	330.00
Brakemen (railroad).....	11.94	49	585.06
Flagmen (railroad).....	7.30	51	372.30
Firemen.....	7.74	50	387.00
Teamsters.....	8.50	46	391.00
Slater.....	6.00	39	234.00
Quarrymen.....	6.25	46	287.50
Laborers.....	7.08	42	297.36
Butcher.....	10.00	36	360.00
Calker.....	9.00	31	279.00
Coopers.....	6.75	45	303.75
Brass finisher.....	6.24	48	299.52
Iron ore miner.....	9.00	48	432.00
Lead furnace helper.....	7.00	41	287.00
Carpet weavers.....	6.50	51	331.50
Loom fixer.....	11.71	52	608.92
Beamer.....	10.00	50	500.00
Dyer.....	10.00	52	520.00

The Projected Florida Ship Canal.

The survey of the route of the proposed ship canal across the peninsula of Florida has been completed under the direction of General Q. A. Gillmore, who reports in favor of the work. The principal direct benefits expected are the saving of about five hundred miles in the passage from our Atlantic ports to Gulf ports, and the avoidance of the dangerous passage through the Florida Straits.

The eastern terminus of the canal is fixed at Camp Pinckney, at the head of ship navigation, and twenty-nine miles above the town of St. Mary's. From here it will run south-westerly to and through the Okefinokee Swamp, crossing the Suwanee River, near Blount's Ferry, in Columbia County, and thence to Ellaville, in Madison County. At first it was contemplated making St. Mark's the western terminus of the canal, but General Gillmore failed to approve this selection, owing to the increased distance involved. The St. Mary's River is ascended by means of seven lift locks, each of fifteen feet lift to the summit level, one hundred and eight feet above tide. No guard lock is required, as the lift of the first lock exceeds any rise or flood in the river. The summit level enters the Okefinokee Swamp, through which it extends twenty-two miles, eleven and a half miles above Camp Pinckney. Fourteen miles beyond the Suwanee River is reached, near Blount's Ferry, the waters of which will be raised by means of a dam to the height of the summit level and taken into the canal. Crossing the river in the lake so formed the canal continues eighteen miles beyond to the end of the summit level, which has a length of sixty-two miles. From this point the line descends by two locks, each of ten feet lift, crosses the Alapaha, and, turning again to the south, crosses the Withlacoochee River, near Ellaville, and thence runs through the center of San Pedro Bay, descending from it by five locks of fifteen feet and one of ten feet lift directly to the level of the Gulf.

A channel will have to be dug from the mouth of the canal

to the deep water of the Gulf, seven or eight miles from the shore. The protecting jetties will form a harbor of safety for shipping.

The length of the canal route is about one hundred and sixty-nine statute miles, or one hundred and forty-seven nautical miles, divided as follows:

From the bar to mouth of St. Mary's River.....	5.5
Navigation of St. Mary's River to Camp Pinckney.....	34.0
Canal.....	122.0
To deep water in Gulf.....	7.5
Total.....	169.0

The plan contemplates a cross section of canal eighty feet wide at the bottom and twenty-five feet deep. The water surface will be one hundred and eight feet in width. The canal is widened, however, to one hundred and fifty feet at the bottom and two hundred and fifty feet at the top for one thousand feet above and below each pair of locks to permit the approach of vessels, and there are passing places one thousand six hundred feet by thirty feet every six miles.

The locks are five hundred feet in useful length (from the end of the gate chamber to face of breast wall), sixty-five feet wide at the gates, with twenty-five feet of water on the sills. They are arranged in pairs, side by side, to prevent the interruption of traffic during repairs, and the walls are carried to five feet above the water line. The lifts are ten and fifteen feet. The locks have about the same dimensions as those advised for the Panama route, except in the matter of lift.

The estimated cost of the canal is \$50,000,000. The drainage area available for the summit level is one thousand two hundred square miles, with an average annual rainfall exceeding four and a half feet.

The Nicaragua Canal Concession.

The interoceanic canal concession granted by Nicaragua to the American Provisional Society has been ratified by the Nicaragua Senate and published as a law by the Republic. It secures to the society the exclusive privilege of constructing a ship canal across the territory of Nicaragua.

The canal is to be of sufficient dimensions to accommodate steamers of the largest class used between Europe and America, and the locks are to be not less than 500 feet long and 28 feet deep. The concession is for 99 years from the date of the opening of the canal for general traffic, and at the expiration of that period the Nicaraguan Government is to take possession of the canal in perpetuity, with the right reserved to the company to lease it for another 99 years. During the period of the concession the company is to have the privilege of constructing a railway along the whole or any part of the canal; also, such telegraph lines as it deems necessary for the construction and working of the canal, and these lines shall transmit public messages free of charge. The Government of Nicaragua will declare the terminal ports, and the canal itself throughout its length to be neutral, and that the transit in case of war between other powers and Nicaragua shall be uninterrupted. In general, the canal shall be open to free navigation of all vessels, provided they pay the dues and observe the regulations of the company. Troops of foreign nations and vessels of war will be allowed to pass through the canal under regulations of existing treaties. Vessels of war belonging to other nations engaged in hostilities with Nicaragua or any other republic of Central America will be rigorously excluded.

This concession, with all its advantages and privileges, will appertain to a construction company, and is transferable only to the company which is to be organized by the Provisional Society, and in no case can it be transferred to a foreign government or power. It is to be organized in the usual manner of such enterprises, with its principal office in New York or elsewhere, as it may deem most convenient. Its designation will be "The Nicaraguan Ship-canal Company."

The Increasing Use of Steel Castings.

The rapid substitution of steel castings for expensive forgings, and for iron castings where great strength is required, has compelled the doubling of the capacity of the works of the Chester Steel Castings Company during the past year; and now the company announce a still further extension of their establishment. Their chief success, as well as the heaviest part of their business, is in the production of heavy gear wheels, pinions, roll spindles, couplings, coupling boxes, etc., for rolling mills and sugar mills. In heavy plate mills their steel castings outlast many times the iron castings formerly used. It is claimed also that nearly all the locomotive builders and makers of large steam engines are now using the Chester castings, and that the fifteen thousand crank shafts and several thousand cross-heads on locomotives of their make show a better record for durability and smoothness of wear than any equal number of forged pieces for the same uses.

The Manufacture of Coal Tar Dyes.

The extent to which the manufacture of coal tar colors is now carried is shown by the following statistics of labor and production at one of the principal coal tar color works in Germany. There are employed over 1,000 workmen, in addition to 40 overlookers and branch managers, 25 chemists, 1 engineer, and 30 clerks and accountants. The yearly consumption of coal amounts to 17,000,000 kilos; anthracene, 825,000 kilos; naphtha and benzol, 950,000; chromate of potash, 280,000; caustic soda, 1,245,000; sulphuric acid, 2,250,000; muriatic acid, 4,050,000; nitric acid, 825,000; alcohol, 91,500; and sundry chemicals, 3,560,000.

Photographic Prizes.

The following is the list of prizes which the Photographic Society of Vienna offer for competition in the course of the present sessional year:

VOIGHTLANDER MEDALS.

(Open to members of the society only.)

1. A gold medal, value 140 ducats, for a method of increasing the sensitiveness of wet plates.
2. A gold medal, value 140 ducats, for the most reliable and sensitive dry process.
3. A gold medal, value 50 ducats, for researches into the gelatine emulsion process.
4. Medals in gold, value from 40 to 100 ducats, in silver, and in bronze, for scientific treatises, discoveries, and improvements, which have been published in the official journal of the society—the *Photographische Correspondenz*.
5. Medals in silver and bronze for the achievement of valuable results in the practice of photography.

SOCIETY MEDALS.

(Open to members or non-members.)

1. A gold medal, value 140 ducats, for the production of plates in relief for printing copies of drawings in half tint.
2. A gold medal, value 140 ducats, for monograph on pyroxyline and collodion.
3. A gold medal, value 140 ducats, for an improvement of the collotype process which will render unnecessary the constant wetting of the plate between the pulls.
4. A gold medal, value 50 ducats, for a rigorous investigation of the conditions of sensitiveness of asphalt.

Further particulars of the competition are contained in a detached programme, which, together with the prospectus and rules of the society, will be forwarded post paid on application to Dr. E. Hornig, 9, Hauptstrasse, Vienna III., to whom also should be addressed applications for admission to membership.

Curious Experiment in Magnetism.

M. Obalski describes a pretty magnetic curiosity to the Académie des Sciences. Two magnetic needles are hung vertically by fine thread, their unlike poles being opposite one another. Below them is a vessel containing water, its surface not quite touching the needles. They are hung so far apart as not to move toward one another. The level of the water is now quietly raised by letting a further quantity flow in from below. As soon as the water covers the lower ends of the needles they begin to approach one another, and when they are nearly immersed they rush together. The effect appears to be due to the fact that when the gravitation force downwards is partly counteracted by the upward hydrostatic force due to immersion, the magnetic force, being relatively greater, is able to assert itself.

Progress in Utilization of Solar Heat.

Since May, last year, M. Mouchot has been carrying on experiments near Algiers with his solar receivers. The smaller mirrors (0.80 m. diameter) have been used successfully for various operations in glass, not requiring more than 400° to 500°. Among these are the fusion and calcination of alum, preparation of benzoic acid, purification of linseed oil, concentration of sirups, sublimation of sulphur, distillation of sulphuric acid, and carbonization of wood in closed vessels. The large solar receiver (with mirror of 3.80 m.) has been improved by addition of a sufficient vapor chamber and of an interior arrangement which keeps the liquid to be vaporized constantly in contact with the whole surface of heating.

This apparatus on November 18, last year, raised 35 liters of cold water to the boiling point in 89 minutes, and an hour and a half later showed a pressure of 8 atmospheres. On December 24 M. Mouchot with it distilled directly 25 liters of wine in 85 minutes, producing four liters of brandy. Steam distillation was also successfully done. But perhaps the most interesting results are those relating to mechanical utilization of solar heat. Since March the receiver has been working a horizontal engine (without expansion or condensation) at the rate of 120 revolutions a minute, under a constant pressure of 3.5 atmospheres. The disposable work has been utilized in driving a pump which yields 6 liters a minute at 3.50 m., or 1,200 liters an hour at 1 m., and in throwing a water jet 12 m. This result, which M. Mouchot says could be easily improved, is obtained in a constant manner from 8 A. M. to 4 P. M., neither strong winds nor passing clouds sensibly affecting it.

Rise of Butter and Cheese at Sea.

When the schooner Eddie Pierce, from Boston, bound to Baracoa, Cuba, was southeast of Nantucket, about 300 miles from Sandy Hook, June 18, a firkin of butter was seen to rise in the water. Others followed until three hundred and twenty-seven had come to the surface. Boxes of cheese also came up, to the number of twenty-four, and were secured, when the schooner turned back to Boston, where her owners filed a libel for salvage. The marks on the packages were illegible. There are two theories regarding the origin of the butter and cheese thus found "derelict" at sea. One is that some unknown freight vessel had been lost at that spot, and that the packages were released by its breaking up. The other theory is that the butter and cheese were lost from the compartments of the Anchoria after her collision with the Queen, near that place, June 12, and that the refrigerators in which the packages were stored had only begun to break up when the Eddie Pierce arrived upon the scene.

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. 127 The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Asbestos Board, Packing, Gaskets, Fibers, Asbestos Materials for Steam & Building Purposes. Boiler & Pipe Covering. Asbestos Pat. Fiber Co., limited, 194 B'way, N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole m'frs., H. Lloyd, Son & Co., Pitts'g, Pa. "Temper is everything," and in the pens of the Estabrook Steel Pen Company the temper will be found all that is to be desired.

For Sale.—One Spoke Tenanter, Throater, Facer, and Sand Belt. Nearly new and improved. Edward Hollingsworth, Wilna, Md.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

The Mackinnon Pen or Fluid Pencil is the champion writing instrument of the age. Uniform in stroke, uses any ink, always with you, always ready. Diamond pointed. See SCIENTIFIC AMERICAN, April 24. Mackinnon Pen Company, 300 Broadway, New York.

OLD ORCHARD HOUSE, Me., June 18, 1880.

To the H. W. Johns M'fg Co., St. Maiden Lane, New York: The Old Orchard House, having just been completed with two coats of Johns' Asbestos Paints, in a manner perfectly satisfactory to me, I would endorse them as being not only of the most wonderful covering capacity, but also on the point of economy and manner of working under the brush. . . . Although two coats were called for under the contract, yet under the large piazza I found one coat was entirely sufficient.

(Signed) E. C. STAPLES, Proprietor. Road Locomotive for sale. Aveling & Porter 12 H. P. Nearly new. Apply W. C. Oastler, 43 Exchange Place, New York.

Portable Engine on Wheels for sale. English manufacture; 12 H. P.; new. W. C. Oastler, 43 Exchange Place, New York.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 235, Jersey City, N. J.

Our new Stylographic Pen (just patented), having the duplex interchangeable point section, is the very latest improvement. The Stylographic Pen Co., Room 13, 109 Broadway, N. Y.

Advertising of all kinds in all American Newspapers. Special lists free. Address E. N. Freshman & Bros., Cincinnati, O.

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., 53 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.

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

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 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 Hoghead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna Blue, 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, B'klyn, N. Y.

Blake "Lion and Eagle" Imp'd Crusher. See p. 13.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 420 Grand St., New York.

Forsyth & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Eclipse Portable Engine. See illustrated adv., p. 413.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Sheet Metal Presses, Ferracite Co., Bridgeton, N. J. For best low price Planer and Matchner, and latest improved Sash, Door, and Blin Machinery, send for catalogue to Rowley & Hermance, Williamsport, Pa.

Peck's Patent Drop Press. See adv., page 14.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See adv. page 13.

4 to 40 H. P. Steam Engines. See adv. p. 413.

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.

For Standard Turbine, see last or next number.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'frs. 23d St., above Race, Phila., Pa.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted.—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 28.

For Wood-Working Machinery, see illus. adv. p. 23.

For Separators, Farm & Vertical Engines, see adv. p. 28.

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

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 28.

Soapstone and Empire Gum Core Packing, the best for Railroads. Greene, Tweed & Co., New York.

\$375 Horizontal Engine, 20 H. P. See page 28.

For Patent Shapers and Planers, see illus. adv. p. 28.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 301.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 29.

Patent Steam Cranes. See illus. adv., page 29.

Nellis' Cast Tool Steel, Castings from which our specialty is "Flow Shares." Also all kinds agricultural steels and ornamental fenceings. Nellis, Shriver & Co., Pittsburg, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Wairoa Leather, Emery, and Polishing Goods. Greene, Tweed & Co., 118 Chambers St., New York.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

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

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 28.

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) Block Works. See illus. adv. p. 28.

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) J. A. S. asks for the ingredients and proportions used in making picture frame makers' putty. A. Glue, 14 lb.; resin, 7 lb.; linseed oil, 2½ pints; water, 5 pints (more or less); whiting, q. s.; ¾ lb. pitch is sometimes added. Melt the resin, add the oil (hot); soften the glue in cold water, then dissolve it in hot water. Add the glue to the oil and resin, beat together, and add enough warm whiting to make a stiff dough. Oil the mould with sweet oil, and mould by pressure. The dough will not keep—it soon hardens, so that it should be prepared only as required. 2. If in your power also give me the recipe for making the gold lacquer used to give silver leaf the gold color, also used by picture frame makers. A. Shellac, 2½ oz.; gum sandarac, 2 oz.; gum eliall, ¾ oz.; spirits of wine, 2 quarts. Mix, and keep for two or three days; strain, add dragon's blood and turmeric to color, and thin with wine spirit.

(2) J. N. C. asks how to clean the inside of a mercurial siphon barometer tube. Having been out of use for a long time the mercury was gone and the inside of the tube has become dirty from dust and oxidation from the mercury. A. Try a small quantity of warm nitric acid. Then rinse with water, rinse with absolute alcohol, and finally with ether; warm, to expel the vapor of ether.

(3) J. L. W. asks (1) for the best known process of pickling cucumbers to keep through the winter. I want the fruit to remain firm and brittle, the pickling ingredients not to be impervious. A. Steep in strong brine for a week; then pour it off, heat it to boiling, and pour it over the cucumbers. In 24 hours drain on a cloth, pack in wide-mouth bottles, fill these with strong hot pickling vinegar, and seal at once. Various spices are added in the bottles. 2. Also, why is sand worked with cement; is it done to keep the cement from cracking, or to make it go farther, or to make it harder when dry, or dry faster? A. Sand hardens and prevents cracking, and lessens the cost of the work.

(4) G. F. W. asks how to prepare the solution and the proportionate quantities necessary to silver in different colors the glass globes such as are often used to trim Christmas trees, etc. My impression is that the globes are blown of different colored glass, and but one solution is required. A. Lead, ¾ oz.; tin, ¾ oz.; melt together; add immediately ¼ oz. bismuth, and carefully skim off the dross. Remove the alloy from the fire, and before it cools stir in 5 oz. of mercury (with care to avoid inhaling the fumes). When the amalgam is to be used for silvering, strain it through a linen cloth and pour it into the clean dry globe through a paper funnel reaching nearly to the bottom of the globe. When the globe is turned about the amalgam will attach itself to the glass. Pour out the excess. 2. Lead, 3 oz.; tin, 2 oz.; bismuth, 5 oz. Put the alloy into the globe, expose it to a gentle heat until the compound has melted (it melts at about 197° Fah. Then by turning the globe slowly around an equal coating may be laid on, which, when cold, hardens and firmly adheres. For the different colors use suitably colored glass.

(5) D. F. H. asks: Can I with six cells of Daniell's battery sound an alarm on a bell located about ten rods distance, in a church tower? A. No, but you can with your battery let off mechanism driven by weight that will do the work.

(6) J. M. asks how to take green mould off from brownstone. A. Try a little strong hot potash solution (aqueous), rinse well after.

(7) M. B. C. writes: I have a boiler 12 feet long, 44 inches diameter, with twenty-two 4½ inch flues, the flame passing under boiler, returning front through one half of the flues, going back through the other half. What would be the horse power of such a boiler? A. About 24 horse power. 2. The flame as it leaves the boiler, passes through a damper, with 12 inches by 23 inches opening, passing down, then up stack. Is the damper of sufficient size? Would there be any gain in passing flame up through damper? Is flue in chimney a proper size, being 21 inches at base, increasing to 28 inches at top; square brick stack, height 70 feet from bottom of ash pit? A. Make your damper opening fifty per cent larger. Instead of passing the flame through one-half the tubes and returning through the other half, return through all the tubes, and do not make the second return. Your draught is now very poor; these alterations will improve it.

(8) G. B. asks: 1. How much power in pounds will it require to run a 16 foot boat, 4 feet beam, on smooth water? A. 70,000 to 90,000 foot lb. 2. Will a smaller propeller than 11 inch run it with any success? A. No. 3. How many revolutions must the screw make to the engine's once, per minute. A. The propeller should run the same speed as the engine. 4. How many revolutions must the governors make in accordance with the screw? A. You need no governor.

(9) P. L. C. asks what is the best solution in which to dip shingles to make them more durable. A. Zinc chloride, mercuric chloride (corrosive sublimate), and creosote, dissolved in water, have been used for this purpose. Water shed from roofs covered with such shingles is unfit for drinking or culinary purposes.

(10) J. E. B. asks if a boiler with sufficient capacity to generate steam to an engine of 24 inches cylinder, at 50 lb. pressure per square inch, be capable of furnishing steam to an engine with cylinder twice the area, with only 25 lb. steam, other things being the same. A. A boiler furnishing steam at 50 lb. pressure to a given cylinder, the steam would have a total pressure, including atmosphere, of 64.75 lb., and would furnish a cylinder of double capacity (not considering radiation and condensation) with steam 32.375 lb. total pressure—equal to 32.375—14.75=17.625 lb. pressure above atmosphere.

(11) J. L. writes: We are about building a school house of six rooms, two stories. The members of the school board differ as to the best method of ventilation and heating the building. Some are in favor of stoves, others are for hot air. I am in favor of getting the opinion of those who understand such things, and having every confidence in the opinions expressed in the SCIENTIFIC AMERICAN, I ask you to give us information as to the best method of ventilating and heating a school building of six rooms. A. To heat by steam, half the heating surface to be indirect coils in the basement and half long wall coils, in the rooms on the outside walls and under the windows. In the inside walls of the rooms there should be built for ventilating three flues for each room of 144 square inches cross section each. The flues for the upper rooms to start at the floor and run straight through the roof, and finished with an Emerson top, or something like it. The flues from the lower rooms to start at the floor also, and to pass direct to the roof and to have no connection with the flues for the upper story. The heating flues from the basement for the indirect coils to second floor should be in the outside walls, and run from close under the cellar ceiling to two feet above the two story floor. The registers for the first floor may be through the door near the outside walls, and opening directly over the heating coils. It is not actually necessary to warm the outlet flues, in the inner walls, if each has a separate cowl or top. The life of a good steam apparatus is unlimited, except the boiler, which will last about twenty years. The cost would be from \$750 to \$1,000. Have a competent steam heating engineer make plans, and be sure he is correct as to quantity and quality; then submit the plans to the bidders, and see that the party who gets the job carries it out to the letter. If plans are to be submitted, it is best to receive them without price, on their merits only, and throw the best plan open to competition.

(12) W. C. writes: 1. I send you this day a sample of sand, and would like to know if it contains any of the precious metals. A. It probably contains a trace of gold. A fire assay would be necessary to determine this. 2. I would like to know how many pounds of steam I can safely carry on a small copper boiler, No. 18 of the wire gauge. Dimensions of the boiler are 12 inches in length and 9 inches in diameter. A. 30 lb. per square inch of joint head sufficiently strong. 3. Where is there a good school I could attend for studying civil engineering for beginners? A. "Rensselaer Polytechnic Institute," Troy, N. Y.; "Stevens Institute," Hoboken, N. J. 4. What would be the best manner of heating the above mentioned boiler—by petroleum or coal? A. Coal.

ing civil engineering for beginners? A. "Rensselaer Polytechnic Institute," Troy, N. Y.; "Stevens Institute," Hoboken, N. J. 4. What would be the best manner of heating the above mentioned boiler—by petroleum or coal? A. Coal.

(13) A. W. P. asks: 1. What size engines will it require to drive a buggy that will carry two men over ordinary roads? A. Two engines, 3 inches cylinder by 6 inches stroke. 2. How many square feet of heating surface will be required to make steam for the engines? A. 100 to 120 feet. 3. Will a vertical tubular boiler be best? A. Yes. 4. Should I use one or two engines? A. Two. 5. Give the weight of boiler, engines, etc., as near as possible. A. Weight will depend much on the kind of boiler. 6. What power will I get from an engine, two inch and four inch stroke, with 60 lb. steam, and 300 revolutions? A. One horse power.

(14) F. H. A. writes: I have the following machinery running at the speeds given: Will you give me, through the SCIENTIFIC AMERICAN "Notes and Queries," the horse power required to drive them all at once, or a mile by which I can find out myself? No. 1, 3,600 revolutions, 3½ in. belt, lathes; No. 2, 2,000 revolutions, 4 inch belt, lathes; No. 3, 2,800 revolutions, 4 inch belt, circular saw, 12 inches diameter? A. Multiply the speed of the belt in feet per minute, by the width of the belt in inches, and divide by 600; the quotient is the horse power the belt will drive easily.

(15) E. G. McD. asks: Would you consider a lightning rod, on a frame building, which is run into a rain water cistern (say 10 feet deep in the ground), a good protection? Of course the lower end of the rod would be under water always. A. In order to make a lightning rod really safe, the bottom of the rod should have a large conducting surface connected with the earth or with water in the earth. Simply dipping the lower end of the rod for a short distance into the water is not sufficient. For example, if the rod is one inch square, and extends one foot into the water, you have a conducting surface of only 49 square inches in contact with the water. This is not enough. If it were 49 square feet of conducting surface, that would be better. One of the best of all ground connections is to have the bottom of the rod soldered to the exterior of an iron water pipe that extends a few hundred feet under ground. In this way a conducting surface of great extent is obtained, and comparative safety secured.

(16) J. L. writes: Your answer to querist how to cut glass tubes for gauges, I think I can tell you a better way. Lay the glass on a pen rack or anything so it can be revolved, and scratch it with a file, and then blow with a blow pipe a flame upon it until it is quite hot, and then blow cold, and it will snap off right where it was marked every time.

(17) D. J. writes: 1. I have an engine 3½ x 13½. What size force pump would it work? A. Area of pump piston about one-third area of steam piston, if of same stroke. 2. What size should I make the air chamber? A. 8 to 12 times the capacity of pump. 3. From what depth would it suck water and about how high would it throw water? A. 30 to 24 feet suction, height depends upon the size and form of delivery nozzle. 4. What size should the feed and discharge pipes of the pump be? A. About three-fourths the area of pump piston. This thing would be of no use as a fire engine.

(18) C. E. R. asks: How much cold water pressure do I want to give a boiler to carry 75 lb. steam using same steam gauge in both cases; in other words, what proportion, or is there any rule? A. By government rule, 113 lb. Steam pressure allowed is two-thirds the cold water test pressure. 2. I am using a steam engine, 12x20, with a lead the thickness of writing paper. It will not cut off till the crank has traveled within two inches of next center. How can I change it? A. If the engine is to work at a high velocity, give one-eighth inch lead, and if you wish to cut off shorter, give the valve more lap, say one-half inch. 3. Will it give any more power by cutting off sooner? No, but you will work with more economy. 4. I am not getting power enough now; my boilers are scaled bad. What is the best way to rid of the scale and keep them clean? A. Heat the water to the boiling point before forcing it into the boiler.

(19) L. F. T. writes: In your answer, April 10, page No. 234, question 4, you did not say how I should apply the hydrofluoric acid in glass engraving. A. After waxing and cutting the design, place the plate face downward over a warm shallow leaden tray partly filled with powdered fluorspar thoroughly moistened with strong oil of vitriol (sulphuric acid) for half an hour or more.

(20) A. F. S. L. asks: What is the fastest time ever made by a locomotive engine? A. For a considerable distance, about 60 miles per hour; for short run, 75 miles to 80 miles.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

N. C. F.—1. Clay iron stone. 2. Quartz and slate. 3. Orthoclase-feldspar. 4. Quartzose rock. 5. Quartz, hornblende and mica. 6. Mica slate. 7. Principally hornblende. 8. Sandstone with molybdenite. 9. Sandstone. 10. Gneiss. 11. Oolitic limestone. 12. Limestone pebble. Nos. 4 and 5 may carry a little silver.—R. D. McC.—1 and 5. Chiefly quartz. 2 and 6. Altered feldspar and limonite. 3. Quartz and obsidian. 4. Limonite. 7. Metallic lead (button). Some of these may contain small quantities of silver; an assay would be necessary to settle this point.—S. R. It consists chiefly of copper and iron sulphides and carbonates, probably carrying silver. If the sample is representative of the body ore, the property is likely to prove a valuable one.—N. P. F.—A variety of syenite-feldspar, hornblende, and quartz. The specimen contains a small quantity of graphite (blacklead).—E. G. A.—1. Magnetite. 2. Argillite and iron pyrites. 3. Limonite. 4. Chiefly feldspathic rock.

COMMUNICATIONS RECEIVED.

Why the needle points northerly. By E. W. On Capillarity. By G. H. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

June 15, 1880.

AND EACH HEARING 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 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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From June 4 to June 15, 1880, inclusive.

Air engines, J. A. Woodbury et al., Boston, Mass.	
Colored glass windows, J. A. Farge, Newport, R. I.	
Compound explosive, R. H. Dimock, New Haven, Conn.	
Diving bell, C. F. Pike, Philadelphia, Pa.	
Lacing hooks for boots, M. Bray, Newton, Mass.	
Locomotive engines, J. B. & G. B. Smith, Dunmore, Pa.	
Lubricating mechanism, C. J. A. Dick, Philadelphia, Pa.	
Metallic alloys, manufacture of, C. J. A. Dick, Phila., Pa.	
Paper pulp, manufacture of, C. & H. A. Chapin, Springfield, Mass.	
Railway switch, J. S. Williams, Riverton, N. J.	
Rivets, manufacture of, M. Bray, Newton, Mass.	
Rotary steam engines, H. Thibault et al., N. Y.	
Sewer gas, preventing, entering buildings, A. F. Pfeilhaupt, Brooklyn, N. Y.	
Spring for railway carriages, A. Middleton, Phila., Pa.	
Timber cutting machine, D. R. Proctor, Gloucester, Mass.	
Vehicle hand propeller, A. Vick et al., Mt. Carmel, Conn.	
Velocipedes, N. S. C. Perkins, Norwalk, Ohio.	
Vessels, construction of and propelling, A. Olsen, Ephraim, Utah.	
Water closet trap, J. E. Folk, Brooklyn, N. Y.	

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
(About eight words to a line.)
Engravings may have advertisements at the same rate per line, by measurement, as the letter press. 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.

PROPOSALS FOR MAIL LOCKS AND KEYS.

POST OFFICE DEPARTMENT.

WASHINGTON, D. C., June 22, 1880.

In compliance with a provision in the law entitled "An Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1881, and for other purposes," approved June 10, 1880, requiring a re-advertisement for proposals for Mail Locks and Keys, notice is hereby given that SEPARATE SEALED PROPOSALS will be received at this Department until 12 O'CLOCK NOON, ON THE SECOND DAY OF AUGUST, 1880, for furnishing five new and different kinds of Locks and Keys for the sole and exclusive use of the United States mails, including, besides those to be used for mail bags, such as are to be used on the street letter-boxes of the United States.

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 all such locks and keys for the purposes of the mails, the Postmaster General prescribes no models or samples 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.

Proposals, with samples, will also be received at the same time, for Safety Chains for Mail Keys.

Specifications of conditions and requirements as to proposals, samples, kinds and quantities, contracts, 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 specifications and forms.

The Contracts which may be made will be in conformity to the specifications and the accepted proposals.

D. M. KEY,
Postmaster General.BECKER'S PATENT
WASHING MACHINE IMPROVED.

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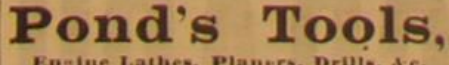
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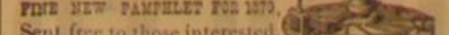
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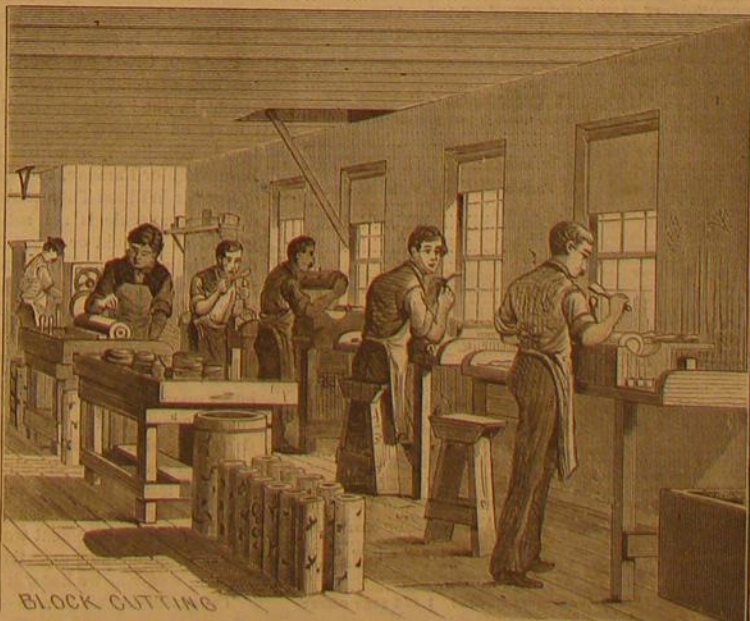
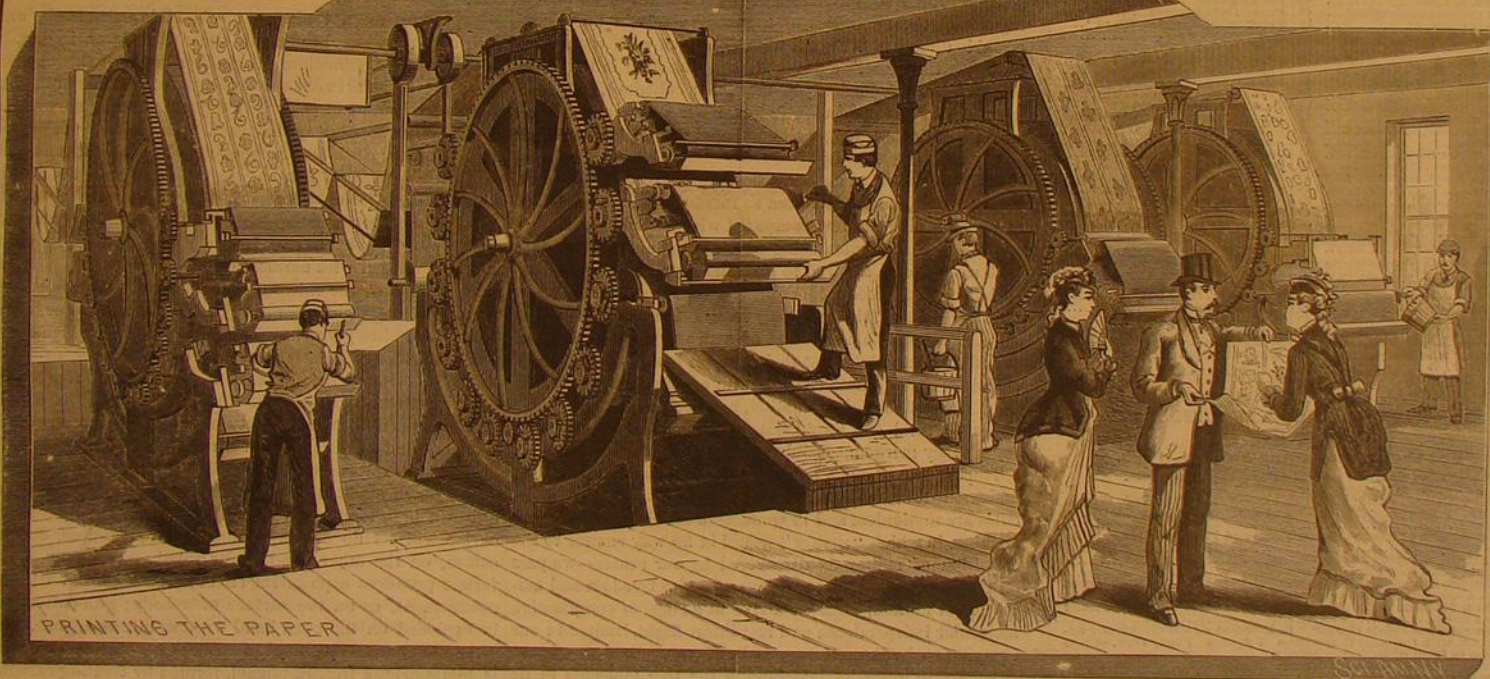
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MATTER AS A MODE OF MOTION.

It is a curious circumstance that while from the non-scientific point of view the unpardonable fault of modern science is its "materialistic tendency," the actual drift of scientific thought is toward eliminating from the scientific idea of matter everything which answers to the popular notion of it. Already science has permanently transferred to the domain of motion all those possibilities of sensation, such as light, heat, electricity, and so on, formerly defined as imponderable matter; and latterly the indications have been very clear that ponderable matter may sooner or later share the same fate.

This comes out strongly in the discussion awakened by Professor Crookes' discoveries touching the behavior of molecules in high vacua. As our readers are well aware, Professor Crookes claims to have demonstrated an ultra-gaseous or fourth state of matter, as unlike the other three recognized states of matter as they are unlike each other. In answer to a friendly challenge to make good his position, Professor Crookes has reviewed (in a letter to the Secretary of the Royal Society, to be found in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT) the accepted views as to the constitution of solids, liquids, and gases, and has added thereto a concise explanation of the ultra-gaseous state and his reasons for holding it worthy of a class by itself.

Stated with the utmost brevity, a solid is an aggregation of molecules held together by cohesion and oscillating about fixed centers. The movements of the molecules are large in comparison with their diameters, since the mass "must be able to bear a reduction of temperature of nearly 300° C. before the amplitude of the molecular excursion would vanish." What would result from the arrest of molecular movement and the actual contact of the molecules is beyond our conception, all we know of matter being based wholly upon our experience of molecular movements.

When the temperature of a solid is raised and the force of cohesion so far overcome that the molecules lose their fixity of position, the second or liquid state of matter obtains. A further raising of the temperature brings the liquid at last to a point at which cohesion ceases, the molecules fly apart freely, and the third or gaseous state begins. Under the restraining force of gravitation or the resistance of an inclosing vessel, the molecules of a gas fly about in every conceivable direction, with constant collisions with each other and with the vessel's sides. The gaseous state is thus preeminently one dependent on molecular collisions, the mean free path of the molecules, in other words, their flight between collisions, being small compared with the dimensions of the inclosing vessel.

The fourth state of matter, according to Professor Crookes, obtains when the gas has been so rarefied that the collisions of the molecules are few compared with the misses, the free path of the molecules being so long, on an average, that each molecule is allowed to obey its own motions or laws, without interference from collisions with other molecules or with the sides of the inclosing vessel. The same condition prevails when the molecules of a denser gas are so marshaled in their flight that their motion is rectilinear and no collisions occur. Between the third and fourth states there is no sharp line of demarcation, any more than there is between the solid and liquid states, or the liquid and gaseous states; they merge insensibly one into the other.

Thus starting from a possible, though in our present state undemonstrable, condition of matter, in which the molecules are motionless and in contact—a condition, we must remember, in which "matter" would in no way answer to the definition of matter as discovered by our senses—we pass on through stages of increasing molecular freedom and amplitude of motion, until we arrive at a stage of comparative molecular independence and rectilinear flight, limited in our experiments by the necessary walls of our vacuum apparatus. If we try to follow in imagination the free molecule in its flight into unlimited space, it loses all known properties of matter and becomes as if it were not. For what is a single free molecule in space? Is it solid, liquid, or gas?

Professor Crookes answers: "Solid it cannot be, because the idea of solidity involves certain properties which are absent in the isolated molecule. In fact, an isolated molecule is an inconceivable entity, whether we try, like Newton, to visualize it as a little hard spherical body, or, with Boscovich or Faraday, to regard it as a center of force, or accept Sir William Thomson's vortex atom. But if the individual molecule is not solid, a fortiori it cannot be regarded as a liquid or a gas, for these states are even more due to intermolecular collisions than is the solid state. The individual molecules, therefore, must be classed in a distinct state or category."

Further on Professor Crookes takes up again the consideration of the molecule, and describes it as the only true matter. "What we call matter is nothing more than the effect upon our senses of the movements of molecule. The space covered by the motion of molecules [from which we derive our idea of continuous matter] has no more right to be called matter than the air traversed by a rifle bullet can be called lead. From this point of view, then, matter is but a mode of motion; at the absolute zero of temperature the intermolecular movement would stop, and, although something retaining the properties of inertia and weight would remain, matter as we know it would cease to exist."

Thus, whether we pursue our quest of the ultimate basis of matter atomward or massward, we lose matter as a reality the moment we eliminate molecular interaction; and

molecular movement forms no part of the popular idea of matter.

EXPLOSIVES.

Were the question suddenly proposed to any intelligent person, "What is an explosive?" the chances that he would give a correct answer are indeed small. Our first and usual idea is that an explosive is something which will blow up, making a big noise and doing more or less damage. Generally it is some solid or liquid capable of burning with great rapidity and thus generating a large quantity of gas. Gunpowder is a familiar example; the niter furnishes oxygen to burn the sulphur and charcoal, most of the products being gaseous. Bunsen, who made some careful quantitative experiments upon the combustion of gunpowder, found that 1 gramme of sporting powder produced 193 c.c. of gas, while Linck obtained 218 c.c. of gas from 1 gramme of war powder, and as one gramme of powder will occupy less than 1 c.c. of space, the increase of volume is very considerable. But this is not all, for the temperature at the time of explosion is calculated to be about 3,000° C., and gases double their volume whenever the temperature is raised 273°.

Explosions are in but few cases due to the rapid combustion of solids or liquids, but more frequently they consist in the rapid combination of two gases, or of a vapor and a gas. When pure hydrogen and oxygen are mixed in proportion of two volumes of the former to one of the latter, a spark causes them to unite with explosive violence, although the resulting product, at 100° C., occupies but two-thirds as much space of the mixed gases, and at ordinary temperatures it occupies but 1/11th as much space. The rapidity with which a flame travels in such a mixture is not less than 100 feet per second. The temperature produced is very high, and at this temperature, of course, the gases occupy a very large space.

Rapid combustion of solids in a fine state of division may exhibit the usual phenomenon of an explosion, as has several times occurred in flouring mills, or wherever dust mixed with air has been ignited by a spark. The explosion of gasoline and benzine is of the same nature. The vapor is the substance in an extremely fine state of division and mixed with the air; as in the case of oxygen and hydrogen a union of the two takes place instantaneously throughout the mixture.

Explosives are not always combustible substances, and their explosion is not the result either directly or indirectly of their rapid combustion. A good example of this class of explosives is found in chloride of nitrogen. Neither of its constituents will unite directly with oxygen, but they are wedded to each other so slightly that each seems equally eager for divorce on the slightest provocation. It is the dissociation of this substance, which suddenly passes from the liquid to the gaseous form, that renders it a dangerous explosive. Many other nitrogen compounds behave in a similar manner; such, for example, as the iodide nitrogen, formed when iodine is washed with ammonia.

Then follow the nitro compounds, or nitrous ethers, familiar among which are nitro-cellulose, nitro-glucose, nitro-starch, and nitro-glycerine. These substances, which are so readily formed by treating cotton, glucose, starch, or glycerine with strong nitric acid, contain an atom of nitrogen united with two of oxygen. This nitro group is a mischievous partner, and is pretty sure to break up any stock company that he gets into as a member. He is not satisfied to walk out peacefully, but like Goliath pulls the whole fabric down about his ears. Although nitro-glycerine requires a high temperature to explode it, a very slight shock or jar will set up decomposition. Nitro-cellulose, or gun-cotton, on the other hand, burns quietly but rapidly. The former produces a powerful effect when exploded without confinement, as on the surface of a body; gun-cotton can be exploded on the open hand without inconvenience.

Another nitro compound of some interest as an explosive is picric acid, a trinitro-phenol, formed by treating carbolic acid with strong nitric acid. The nitro groups here, as in nitro-benzol, seem to possess an entirely different position, the result not being, as in nitro-cellulose, a nitrous ether. The potassium and some other salts of this acid possess explosive properties.

Finally we have a class of bodies known as fulminates. They have the same percentage composition as the harmless cyanates and cyanurates, with which they are said to be polymeric. They consist of a metal combined with carbon, oxygen, and nitrogen in the proportion of their atomic weights. Fulminating mercury was discovered by Howard in 1800. It is made by dissolving 1 part of mercury in 12 of nitric acid (sp. gr. 1.3), and when cold it is mixed with 11 parts of 85 per cent alcohol, and the mixture heated on a water bath. It must be removed from the fire as soon as it begins to show turbidity, then left to cool, decanted, and recrystallized from boiling water. It crystallizes in white silky needles. It detonates with great violence when forcibly struck, hence it is used in percussion caps, torpedoes, and the like. Ten grains of this substance produces 4 cubic inches of permanent gases, but at the high temperature of explosion occupy far more space. The explosion is so sudden as to be particularly dangerous when in large masses. Mixed with 30 per cent water it can be triturated on a marble slab with a wooden pestle, but when dry must be kept in small separate portions. One kilogramme (2.2 lb.) of mercury will make enough fulminate to fill 57,000 gun caps, but their preparation is not unattended with danger. Fulminating silver is made by the action of nitric acid and alcohol on nitrate of silver.

A substitute for fulminating mercury is employed in the needle guns in Germany. It consists of a mixture of equal parts of chlorate of potassium and sulphide of antimony. As both of these substances are largely employed in medicine it is highly desirable they should not be combined in the same prescription. A mixture of sulphur and chlorate of potassium will also explode by friction or percussion. When a solution of sulphur in carbon disulphide is poured upon finely divided chlorate the mixture will often explode spontaneously when the solvent has evaporated, if not, the touch of a feather is sufficient to produce a violent detonation. Chlorate of potassium and red phosphorus form a safe and powerful mixture for ignition by percussion, known as Armstrong's mixture.

In addition to the above explosives there are many compounds known only in chemical laboratories, which, either from their danger, uncertainty, or danger of preparation have not been made public.

From the above we see that an explosive may be a solid, liquid, or gas, and its explosion may result either from its dissociation or combustion.

They may be divided according to their effects into slow and rapid, although these terms are only relative. Gunpowder burns so slowly as to be well adapted as propulsive for projectiles, while nitro-glycerine decomposes so rapidly as to be useful only for bursting and rending, and should have well reserved for it the name of "rend rock." Gun-cotton has been used especially in the compressed form, for artillery, and picrate powder was used in France as substitute for gunpowder.

CURIOUS CAPILLARY PHENOMENA.

When a drop of water falls on a surface which does not absorb it, it is well known that it assumes a special form—that of a plano-convex lens. If above such a drop of water there be suspended, by means of a thread having no twist in it, a fine needle, the point of the latter, being repelled by the edges or attracted by the center of the convexity, at length remains stationary at the latter spot. There is, then, on the surface of this convex drop a point where the forces of tension are in equilibrium. But the above mode of experimenting is too imperfect to allow a serious study of the phenomenon, since the tension of the convex surface has to overcome the weight of the needle in order to swerve it from the vertical. M. Coutance, says the *Revue Industrielle*, has suggested an ingenious method of surmounting the difficulty by making the needle stationary and rendering the drop movable. A small piece of glazed note-paper is floated on water, and on the surface of this is placed a large and very convex drop of water. The paper, thus freighted, moves about under the slightest influence. Pushed gently toward the fixed point, it begins to move as soon as the latter touches the edge of the drop, and the two elements always arrange themselves in such a way that the needle point occupies the center of the convexity; thus proving the existence of a center of equilibrium for the tensile forces of the liquid surface. By means of this ingenious method of experimenting, we are enabled to determine points of equilibrium in drops of liquid having most varied outlines, but of a convex surface. For instance, a curved liquid surface, having the outline of an isosceles triangle, will, when presented by its apex, so displace itself that the needle, on traversing it, stops exactly at the center of gravity.

One of the most curious means of showing the equilibrium of tensile forces in these variously shaped liquids with curved surfaces is this: Draw a helicoidal figure on glazed paper with a moistened pencil. This will represent the circumvolutions of the snail's shell. Now carefully fill in the figure with water so that its surface shall have a broadly convex form. Then push the attenuated apex of the figure toward the fixed needle. As soon as contact takes place, leave the whole to itself. Then, all at once, the paper will be seen to gyrate, and the needle will traverse the whole spiral and stop just before reaching the broad base of the latter.

Here, then, we have the forces of tension of liquid surfaces shown by a physical phenomenon. The use of glazed paper in these experiments is attended with some inconvenience, because it absorbs water. It is better, therefore, to use cork or wax. In all these movable convex surfaces, the point of the fixed needle always locates itself at the exact center of the figure. Suppose, for instance, a convex figure having the outlines of France be made on the surface of the paper or wax; when it is placed in contact with the needle point, the latter will fix itself in the center of the country, *i. e.*, at a spot which would correspond to a point a little to the east of Bourges. To determine the center of a country by means of capillarity might, at first sight, seem an impossibility; but, as will be seen, the question is capable of being scientifically resolved. As to the practical applications of phenomena like these, it would be as yet difficult to cite them; but it is certainly remarkable to see revealed to our eyes, by means of these experiments, those forces whose operation our intelligence alone is powerless to understand, and whose laws can now be studied, analyzed, and translated into algebraic language.

A QUICK TRIP FROM GALVESTON.—The quickest recorded passage from Galveston, Texas, to this port, was completed July 6, by the steamship *Rio Grande*. Her actual running time from Galveston bar to Upper Quarantine, New York harbor, was 5 days 19 hours 29 minutes; distance, as shown by the ship's log, 1,935 nautical miles.

PANAMA HATS.

Now that the summer season is on us, it may not be uninteresting to the reader to learn something about the origin and manufacture of Panama hats. This is given by Dr Seemao, in an interesting article on the vegetation of the Isthmus of Panama, in the *Journal of Botany*. An indigenous production, he says, deserving of especial notice, is the "Jipijapa" (*Carludovica palmata*, R. and P.), a palm-like plant, of whose unexpanded leaves the far-famed "Panama hats" are plaited. This species of *Carludovica* is distinguished from all others by being terrestrial, never climbing, and bearing fan-shaped leaves. The leaves are from six to fourteen feet high, and their lamina about four feet across. The spathe appears toward the end of the dry season, in February and March. In the Isthmus the plant is called "Portorico," and also "Jipijapa," but the latter appellation is the more common, and is diffused all along the coast as far as Peru and Chili; while in Ecuador a whole district derives its name from it. The plant is common in Panama and Darien, especially in half shady places, but its geographical range is by no means confined to them. It is found all along the western shores of New Granada and Ecuador; and has been found even at Salango, where, however, it seems to reach its most southern limit, thus extending over twelve degrees of latitude from north to south. The Jipijapa, or Panama hats, are principally manufactured in Veraquas and Western Panama. Not all, however, known in commerce by that name are plaited in the Isthmus; by far a greater proportion being made in Manta, Monte Christi, and other parts of Ecuador. The hats are worn almost in the whole American continent and the West Indies, and would probably be equally used in Europe did not their high price (varying from \$2 to \$150) prevent their importation. They are distinguished from all others by consisting only of a single piece, and by their lightness and flexibility. They may be rolled up and put into the pocket without injury. In the rainy season they are apt to get black, but by washing with soap and water, besmearing them with lime juice, or any other acid, and exposing them to the sun, their whiteness is easily restored. So little is known about these hats, that it may not be out of place to give an account of their manufacture. The "straw" (paja), previous to plaiting, has to undergo several processes. The leaves are gathered before they unfold, all their ribs and coarser veins removed, and the rest, without being separated from the base of the leaf, is reduced to shreds. After having been exposed to the sun for a day, and tied into a knot, the straw is immersed in boiling water until it becomes white. It is then hung up in a shady place, and subsequently bleached for two or three days. The straw is now ready for use, and in this state sent to different places, especially to Peru, where the Indians manufacture from it those beautiful cigar cases, which sometimes bring as high as \$30 each. The plaiting of the hats is very troublesome. It commences at the crown and finishes at the brim. The hats are made on a block, which is placed upon the knees, and requires to be constantly pressed with the breast. According to their quality, more or less time is occupied in their completion—the coarser ones may be finished in two or three days, while the finest may take as many months. The best times for plaiting are the morning hours and the rainy season, when the air is moist. In the middle of the day and in dry clear weather, the straw is apt to break, and this, when the hat is finished, is betrayed by knots, and much diminishes the value.

THE PROTECTION OF WOODWORK.

It not unfrequently happens, when a frame structure is hastily erected, and in our country they are always hastily erected, especially bridges, that a good oil paint is properly applied, and yet in a comparatively short time it begins to peel off more or less completely, making it necessary to repaint them. What is still more unfortunate, some timber, which has had a good coat of oil or tar paint that did not peel off, begins to decay in a short time, so that the original intention of the paint is not fulfilled, but, on the contrary, the paint itself seems to hasten its destruction.

These and similar circumstances lead people to distrust paint as a wood protector, and from different quarters we hear the assertion that unpainted wood will last longer than it would if painted.

This view, says Engineer Sauerwein, requires modification. In judging this matter we must ask how long was it from the time the wood was felled until it was painted, and was it dry or not, for these unfortunate cases have only occurred in wood which were painted too soon.

It is well known that the sap of wood contains substances like albumen, gelatine, gum, etc., which easily undergo decomposition, and under certain circumstances, such as favor fermentation, and in warm damp air, are able to destroy very rapidly the stronger woody fibers. The more sap there is in the wood, that is to say the greener it is, and the sooner the evaporation of this sap is stopped by an airtight cover, the quicker the fermentation will set in, and with it the destruction of the woody fiber.

These circumstances are correctly understood by practical men, who prescribe that the timber be felled in winter, and try to obtain a free circulation of air through the structure.

They think they avoid the disadvantages above mentioned if they, further, demand "seasoned wood," because it is clear that there is less danger of decomposition in such wood than in fresh or green stuff. But here we at once stumble on this difficulty, namely, of determining what degree of dryness in the wood to be tested seems most advan-

tageous for its use, and the time required for this is much longer than generally supposed. The appearance of the wood is very seldom a reliable guide, and people are accustomed to think that the wood is much drier than it really is. The comparatively important changes which the wood undergoes during the first year from shrinkage enable us to measure approximately the time necessary to destroy the last evil effects of its interior life. Not until it has reached this stage, which requires four to six years, unless artificial seasoning is resorted to, is the timber benefited by covering it with a protecting coat of paint. At this time the paint must have a beneficial effect in protecting the wood, for it prevents atmospheric moisture penetrating into the wood to serve as a reagent to decompose the albumen, which is now dried and coagulated as well as less abundant.

Owing to the position of the lumber yards and the urgency for materials to build with it is seldom possible to obtain well seasoned lumber and wood. Sauerwein, therefore, proposes the following process:

The most rational and sensible process for large, heavy timbers is the impregnation, as for railroad ties, with chloride of zinc under six to eight atmospheres of pressure, where this can be done. (Fresh green wood is best for this.) No arguments are necessary in defense of the value of this method; it cannot be too strongly recommended, nor is the expense great—about \$1 per cubic meter. When there is no opportunity for impregnation the woodwork should be left two or four years unpainted.

In my experience, says Sauerwein, wood tar is better than coal tar, because it penetrates into the wood more easily, and, containing a larger amount of antiseptic substances, its effect is more permanent. Although wood tar is considerably dearer it is to be preferred. Its color being somewhat similar to wood color it can be used on small unimportant buildings. Its cost is only one-fourth that of oil paint and can be applied by a common workman.

Planed and worked surfaces should be merely oiled (three times) not painted. Besides having a better appearance, this oil varnish is necessary to prevent cracking and drawing of thin parts like doors and windows. It does not interfere with the gradual drying out of the wood.

After the expiration of three to five years the oiling may be replaced by a protecting coat of paint to prevent water from penetrating into the wood work. It should be added that it seems advantageous to mix about one part of elutriated chalk with three parts of the white lead which is used with the special color for all oil paints. This seems to make the paint adhere better to the wood, as shown by experience.

Without going into the subject of oil paints the author cautions the public against the many new fangled and highly extolled paints and substitutes. They are generally much dearer, he says, and at best are only equal to ordinary linseed oil paint made with equal care from well selected pure material. The chief effect of a good oil paint depends on the purity of the materials used, especially of the oil and white lead or zinc white, whether it is finely ground and thoroughly mixed, and the paint carefully applied in good weather.

THE BARTHOLOMI STATUE OF LIBERTY.

The completion of the subscription for the statue of Liberty on Bedloe's Island, New York harbor, was celebrated by a grand banquet in Paris, July 7. M. Laboulaye presided. Among the principal guests were M. Ferdinand de Lesseps; M. Lepère, late Minister of the Interior; General Pittié, Chef de la Maison Militaire of President Grevy; Oscar de Lafayette; Henri Martin, the historian; Victorien Sardou; General Noyes; Consul General Walker; and M. Bartholdi, the sculptor of the statue.

An address to the people of the United States—signed by the French participants at the banquet, and indorsed by 181 towns, represented by votes of municipal councillors, forty conseils-generaux, ten chambers of commerce of the most important towns, and 100,000 subscribers—announces that the statue will be finished in 1883, and erected on a monumental pedestal on Bedloe's Island. The preparation of a suitable foundation devolves, we believe, upon the American public. It is to be hoped that there will be no delay in completing the work. The placing and inauguration of the statue may form an appropriate feature of our World's Fair celebration in 1883.

49th Exhibition of the American Institute.

The annual exhibition of the American Institute, of the city of New York, will open September 15. The Board of Managers announce a novel and very promising feature, namely, an exhibition of the work of amateurs and apprentices in all branches of mechanical, industrial, and decorative art. Such exhibits will be admitted free of charge, and premiums are offered for the best. To pass upon exhibits of this character the Institute proposes to add to the corps of judges ladies who are proficient in art work, in which department are embraced sculpture, painting, drawing, bric-a-brac, fancy work, embroidery, decorated china, wood carving, sawing, and all other artistic handwork calculated to adorn American homes.

NEW CANAL IN CHILI.—The *Chilian Times* announces the completion of the Canal de la Merced. The canal is seventy-five miles long, and has been twenty-five years in construction. It is considered one of the most important works executed in Chili. It has cost about \$400,000.

MECHANICAL INVENTIONS.

An improved leather finishing machine has been patented by Mr. Fred B. Batchelder, of East Boston, Mass. The object of this invention is to furnish a machine for applying blacking, paste, blood, stains, or other mixture or dressing to surfaces of leather and other materials, in such a way that the opposite surfaces may be kept practically clean.

A new and improved pitman rod for mowing machines, so constructed that its bearings can be easily adjusted in case they become worn out, has been patented by Mr. David Horn, of Mohicanville, O. The invention consists in a pitman rod with a circular beveled adjustable socket, into which a beveled circular stud on the cutter head of the mowing machine fits at one end, and a beveled aperture into which a beveled sleeve or thimble mounted on a pin of the pitman wheel passes at the other end.

Heretofore balance staffs for watches have been made in one piece with the collet rigidly attached to the staff, and the collet formed with a countersunk end for entering the balance wheel center, the parts being attached firmly by riveting down the countersunk end of the collet. With this construction the work of replacing a broken staff with a new one involves considerable labor and risk of injury to the balance wheel. Mr. George G. Bugbee, of Gonzales, Texas, has invented a balance staff and wheel for watches, so constructed that a broken staff may be replaced with little labor and expense, and without risk of injury to the wheel. The invention consists, first, in attaching the collet permanently to the balance wheel; and, second, in connecting the staff thereto by a wedge or screw joint, by which the staff is rendered adjustable, and may be readily removed.

IMPROVED ROTARY PUMP.

The rotary pump herewith illustrated was designed with a view to obtaining a pump for general use, simple, and easily constructed, requiring the least amount of power to operate it, and which should wear well and be easily and quickly repaired. The general idea of a pump made in this manner is not new. But in the manner of working the floats a new feature is introduced, neither springs nor cams being used to operate them. This action is accomplished by direct water pressure acting through passages or ports, E F, in the face of the pump heads, as shown in dotted lines in the sectional view.

The pump consists of an outer case of two pieces joined on a central line. The upper half is bored cylindrically, having its center coincident with the center of the shaft, while the lower or bed piece is bored from two centers eccentric to the shaft, forming a central cam projection. As the centers are all on the line of the junction of the two parts of the casing, it will be seen that by bolting together two corresponding parts of two pumps much time and labor may be saved in boring out the shells. The inside cylinder, A, fits accurately between the two heads, and contains in this case three slots for movable floats. The heads are made "rights and lefts," in order to have the canals in their faces correspond.

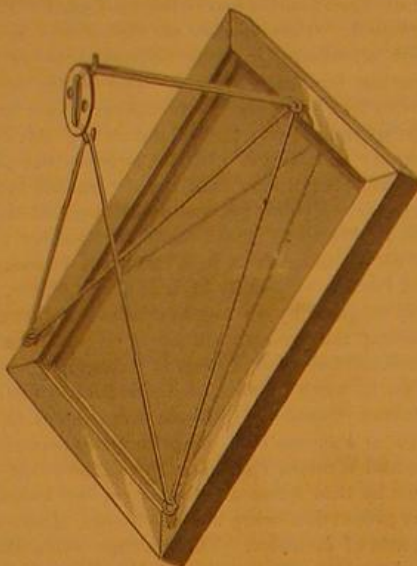
When the pump turns in the direction of the arrow, then H is the inlet and G the outlet, and the space in the cylinder on the outlet side and passage, F, will be under pressure, while none will exist in the inlet side nor in the passage, F. The float, D, is ready to go out into position, and therefore pressure is brought to bear on its inner end, through the passage, E, which pushes it out. After passing the junction line of the two parts of the casing the passage, F, is passed and the slot remains full of water. When the float arrives at the opposite side of the casing it is relieved of lateral pressure. Then the water in the slot empties itself through the passage, E, while the pressure at G pushes in the float. Three slots full of water are thus lost every revolution, otherwise the pump may be termed "positive."

The inventor claims that there is scarcely any wear between floats and upper half of shell, as there is nothing to push them out after passing the horizontal central line; that the pressure in the discharge side keeps the floats clear from the cam at the bottom of the casing. By adjusting the area of canals, E F, by plugs or valves, nearly all wear may be avoided on the cam. An adjustable piece may be used to counteract wear at the lower part of the casing. The passages in the heads serve to lubricate ends of cylinder, A. In large pumps for constant use, and sometimes in the smaller sizes, the floats may be made of wood—rock maple—which is said to last several months under constant usage, and when worn the floats are easily replaced. When wooden floats are used the inventor places a small rubber cushion in the bottom of each slot. This pump works lightly without jarring, and will run in either direction.

Further information may be obtained by addressing the inventor, E. B. Newcomb, Cumberland Mills, Me.

IMPROVED PICTURE HANGER.

The engraving shows an improved hook to be fastened to the wall, and a novel arrangement of the picture cord in relation to the hook and to the frame to be suspended, which admits of placing the frame at any desired angle by simply moving it so that the cord slides through the screw eyes. This arrangement is specially adapted to mirrors, as it ad-



MARSDEN'S PICTURE HANGER.

mits of adjusting them to such angles as are most agreeable to the eye, according to the size, height, and distance of the mirror from the user.

This invention was recently patented by Mr. Mark W. Marsden, of Connersville, Pa.

The Manufacture of Spools.

The prevalence of white birch along the St. Francis River above Drummondville, Canada, has made that town an important center for the production of spools. When received at the factories the wood is first sawed into strips about four feet long, and from one inch to an inch and a half square, according to the size of the spools to be made. The wood

men can turn out about one hundred and thirty gross per day. The round blocks pass from them to the finishers, who place them in machines which give them the shape of spools, and make them quite smooth. The spools are thrown loosely into a large cylinder, which revolves slowly, so that the spools are polished by the constant rubbing upon each other for some time. On being taken out of the cylinder, they are placed in a hopper with an opening at the bottom, through which they pass down a slide for inspection. Here the inspector sits and watches closely to see that no imperfect spools are allowed to pass; and a very small knot or scratch is sufficient to condemn them. They are packed in large boxes, made the proper size, and no additional packing is needed. The packers receive one-quarter cent per gross for packing, and a smart boy who is accustomed to the work can pack about 200 gross per day. One proprietor ships over 2,000,000 spools per month to England, and another firm ships over 1,000,000 spools to Glasgow, Scotland.

Paper from Bagasse.

The conversion of bagasse into paper stock at home is attracting considerable attention in Louisiana. Several parties in the North and West have tested the fiber produced from it by a new process, and speak of it as extremely promising. The chief difficulty at present appears to be in the bleaching process; but that, it is thought, can easily be overcome and the fiber made perfectly white. By converting the bagasse into fiber on the plantations three-fourths of the transportation charges will be saved. Louisiana produces 200,000 hogsheads of sugar a year; and the cane for each hogshead will yield one ton of paper fiber.

ENGINEERING INVENTIONS.

An improved process and apparatus for remelting soap, has been patented by Messrs. William Cornwall, Jr., and Aaron W. Cornwall, of Louisville, Ky. This invention relates to an improved process of remelting scrap soap or broken soap for the purpose of making it into soap of marketable form and quality. The process consists in subjecting the scrap or pieces of soap to the action of dry superheated steam. The mass of scrap is agitated or stirred by revolving arms, while the steam is allowed to enter it at the bottom of the tank or vessel in which it is contained.

A sectional turbine water wheel, so constructed that the sections may be easily put together and will be held firmly in place, has been patented by Mr. William Sims, of Stayton, Oregon. The invention consists in constructing the sections with inner rims having their ends rabbeted, inclined buckets, and outer rims made thicker than the inner rims, to give the inclined buckets a slight twist.

Messrs. John G. McAuley and William West, of Denver, Col., have patented a device for feeding coal dust and other pulverized fuel to smelting or other furnaces. It is an improvement upon that form of feeder in which a falling stream of the pulverized fuel, fed by a spiral conveyor or otherwise, is struck by a blast of air, which at the same time acts as a vehicle for the further transportation of the fuel to the fire chamber, and supplies the necessary admixture of oxygen for its combustion.

Mr. Gordon W. Hall, of Havana, N. Y., has invented a propeller having a hollow portion arranged to turn in the dead water under the stern of the boat and connected by a pipe with a condenser.

Mr. John W. Kramer, of New York city, has patented a portable turn-out or turntable for railways, especially street railways, whereby cars may be shifted from one track to another, or turned end for end, if necessary, when obstructions occur in the line. The invention consists in a frame fitted for being pinned to the ground between the tracks and carrying a pivoted section of rails, which may be turned to coincide with either track to receive the car, and then turned, as desired, to shift the car to the other track.

Mr. George M. Fenley, of Medora, Ind., has invented an improved drift wheel for preventing drifts, rafts, or logs from stowing against bridges, piers, or docks. It consists of a cylinder armored with spikes and vertically pivoted in front of a pier, dock, or similar structure, so that when the drifts or floating logs strike this wheel they rotate the same and slide along.

Mr. Alonzo Jillson, of Racine, Wis., has patented an improvement in traction engines. The invention consists in combining sliding journal boxes, slotted hangers, and adjusting screws with a cross shaft and wheels, the object being to readily throw the drive wheels into or out of gear.

An improved car coupling has been patented by Mr. Sylvester F. Newland, of Waynesfield, O. This invention relates to that class of couplers called "self-couplers," and it consists of a five-pronged spring-actuated coupling pin, which is held and guided between two vertical standards that are fixed on top of the draw head.

An improved hoof parer, patented by Mr. James York,

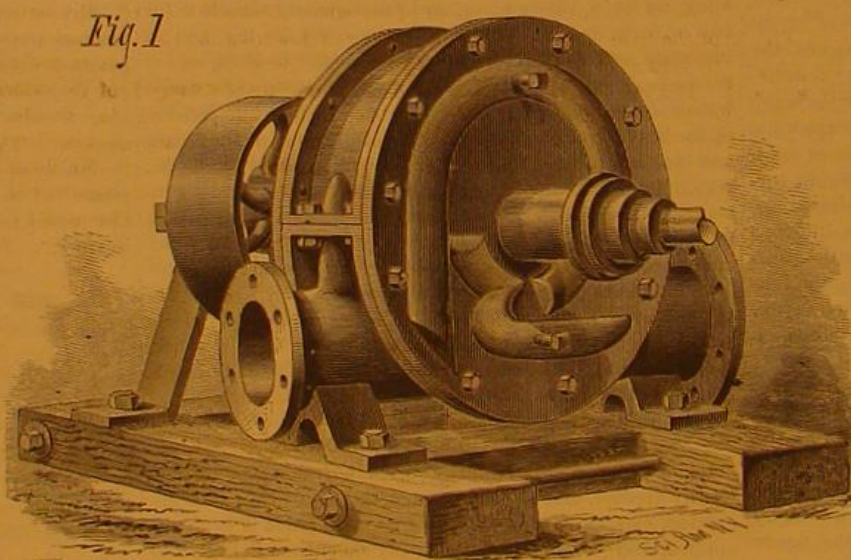
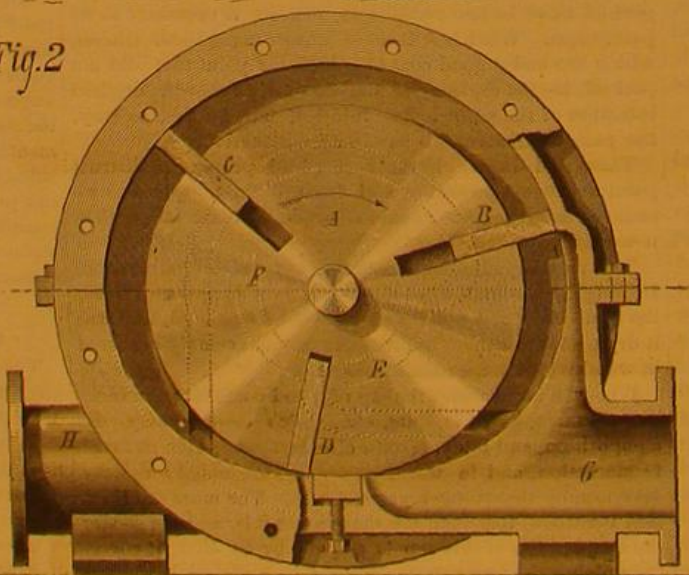


Fig. 2



NEWCOMB'S ROTARY PUMP.

is thoroughly dried, then roughly turned, cut into lengths for spools, and bored.

The machines used for this purpose are revolving planers, in the center of which is a revolving gimlet or bit, and immediately to the right a small circular saw with a gauge set to the proper size for the spools. The roughers receive one and a half cents per gross for their work, and experienced

of Coalesburg, Mo. It consists in certain novel details of construction, arrangement, and combination of a base and standard, a leg rest, a clamping device, and means for operating the paring knife, whereby the operation of trimming and paring the hoof is accomplished with economy of time and labor to the workman and more ease and comfort to the animal.

AMATEUR MECHANICS.

LENS MAKING.

To make an ordinary lens requires a certain degree of manipulative skill, but when compared with a fine job of filing, fitting, or even turning, it is easy, and there is a charm about making a nicely polished lens which is not found in metal working. The tyro should commence with small plano and double convex lenses, which he may mount singly or in pairs. After attaining a fair proficiency in making these he may proceed to larger work, and afterward by coupling study with practice he will be able to make fine work, such as the achromatic objectives of microscopes and telescopes, eye-pieces, lantern objectives, etc.

The first thing to be done in the way of the preparation of tools for lens grinding is to make gauges or patterns with which to gauge the convexity of the grinding tools. These may be made from pieces of sheet brass about one thirty-second inch in thickness, the plates for gauges for convex tools being chucked on a plane board secured to the face plate of the lathe, and the circular aperture turned out. The plate should be beveled each way from the aperture, forming a knife edge, and it should be separated by a saw into two or four parts, according to the size of the lenses to be ground, as shown in Fig. 1. The radius of the circle so formed will be approximately the focus of a double convex of this curvature, and the diameter of the circle is approximately the focus of a plano-convex lens of the same curvature.

Gauges for concave tools or concave lenses are made by turning disks of brass with V-shaped edges, as shown in Fig. 2, and an instrument for shaping small concave grinding tools is shown in Fig. 3. It consists of a sharpened steel disk attached to or formed upon the end of a bar, and used as a scraper for giving the final shape to the concave grinding tools.

For grinding convex lenses it is well to have two concave tools like that shown in Fig. 4. This as well as other grinding tools for small work should be made of brass. Drawn brass is preferable, as it is usually better metal, and more homogeneous than castings, and needs no external turning.

Having determined on the focus of the lens to be ground, the brass is chucked in the lathe, and hollowed out as nearly to the correct form as possible, the gauge shown in Fig. 2 being used from time to time to determine when the proper concavity is reached. The grinding tool is finally scraped with the cutter shown in Fig. 3. The counterpart of the concave tool shown in Fig. 5 is now turned as nearly to the gauge shown in Fig. 1 as possible, and is finally ground into the concave tool with washed flour emery and water.

A tool like that shown in Fig. 6 is necessary for finishing small lenses. It consists of a cylindrical piece of brass, having a chamber turned in the end for the reception of a mixture of pure hard beeswax and fine rouge. This mixture should contain sufficient rouge to make it rather hard, but not so hard as not to yield under strong pressure.

The glass for small lenses may be clipped from bits of plate (crown) glass and roughly shaped by means of an ordinary pair of pliers. It may then be cemented with pitch to the end of a round stick, as shown in Fig. 7. The glass is then ground on a common grindstone until it approximates the required shape. It is then polished with fine emery and water in one of the concave brass tools until a truly spherical surface is secured. It is then transferred to the other brass tool, and ground with fine washed flour emery until the surface is fine and entirely free from scratches. During the grinding as well as polishing the stick to which the glass is cemented must be turned axially, and at the same time its outer end must be moved about the prolongation of the axis of the grinding tool so as to present the glass to every portion of the grinding tool as nearly as possible.

The final polish is secured by pressing the smoothed glass into the wax in the end of the tool shown in Fig. 6 as the tool is revolved, and at the same time applying fine rouge and water from time to time. When the polish is nearly perfect the tool should be allowed to work nearly dry.

For a plano-convex lens the plane surface of the plate glass will answer very well for the plane surface of the lens, and the glass will be ground down as shown in Fig. 8. If the lens is to be double convex the finished spherical surface should be cemented to the end of the stick, and the opposite side proceeded with as before described. There are two methods of finishing the edges of plano-convex lenses: first, by holding the plane surface in a concave tool charged with emery and water until the edge is beveled to the required degree; and second, by chucking the lens on the end of a spindle projecting from the lathe mandrel, and centering it while the pitch or cement which holds it is still warm. Then a piece of brass, which

is concave to conform nearly to the periphery of the lens and charged with emery and water. This tool is held against the edge of the lens after the manner of turning. The lens will soon assume a perfectly circular shape, and may be readily reduced to any desired size.

In making concave lenses the convex tools will be used, and the final finish will be given by a piece of silk cemented to the tool with pitch and charged with rouge and water.

For grinding larger lenses of longer focus an attachment like that shown in Fig. 10 will be required. It consists of a wooden box supported by a curved arm inserted in the tool

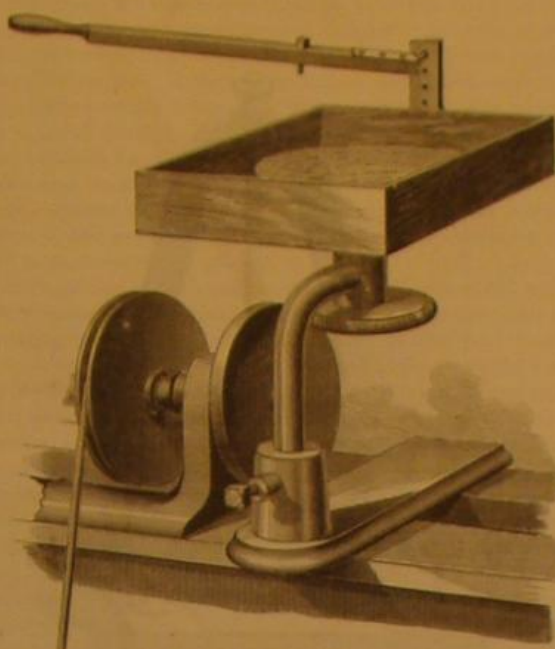
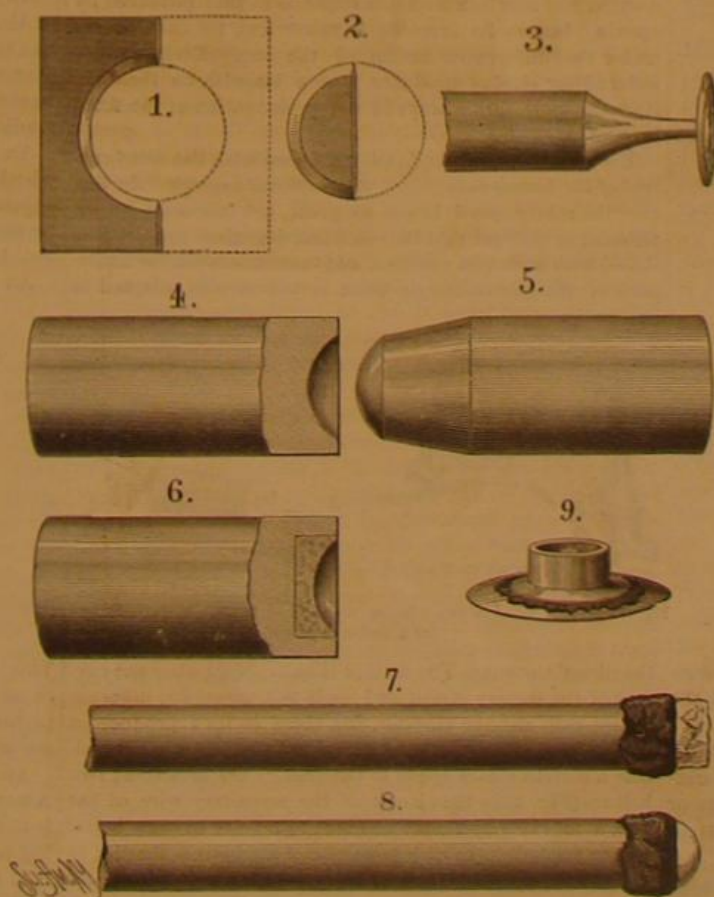


Fig. 10.—LENS GRINDING ATTACHMENT FOR FOOT LATHES.

rest support. A vertical journal box passes through the bottom of the box, and contains a shaft having upon its upper end a socket for receiving the grinding tool, and on the lower end a grooved wheel surrounded by a rubber friction band, which is revolved by contact with the face plate of the lathe. The speed of the wheel relatively to that of the lathe may be varied by raising or lowering the shaft by raising or lowering the box support in the tool port.

The glass to be ground is cemented to the face of a flanged casting as shown in Fig. 9, and is held down to the grinding tool by the lever attached to the box. The tool for large work may be made of cast iron. The center of the lens should be eccentric to the center of the grinding tool, so that the lens will be revolved on the face of the tool. The point



TOOLS FOR GRINDING SMALL LENSES.

projecting from the lever enters a small cavity in the center of the casting, to which the lens is attached and insures an equal distribution of pressure over the entire surface of the lens.

Grinding and finishing a large lens is substantially the same as in the case of the smaller ones, the only difference

being in the method of giving the final polish. In the case of a large lens, after the fine grinding, the tool is heated, covered with a thin coating of pitch, and a piece of thin broadcloth is pressed down on the pitch. This broadcloth surface is charged with fine rouge and water, and the lens is pressed down on it with considerable force as the tool is revolved. The cloth should be worked rather dry, and so much so at the end of the process as to offer considerable resistance to the rotation of the tool. M.

MISCELLANEOUS INVENTIONS.

An improvement in casting chilled mould boards, patented by Mr. Burnett B. Harris, of South Bend, Ind., consists in the combination, with the lower part of the flask having an opening in its bottom, of the chill having rabbeted edges and the buttons, so that the chill will be held securely in place and allowed to expand and contract freely; also, in the combination, with the chill and the mould board pattern, of core cups having tapering holes, so that the patterns can be removed without disturbing the bolt hole cores or dies. The lower parts of the flasks have openings in their sides, communicating with the connecting flues, so that the chills of a series of flasks can all be warmed at the same time and by the same furnace.

Mr. Samuel M. Wright, of Wagoner's Station, Ind., has invented an improved rein holder which is simple and convenient. It consists of a curved rod provided with a heart-shaped crutch at its upper end for receiving the reins. This rod is adjustably fastened in a frame attached to the dashboard of a vehicle.

Mr. Henry W. Fuller, of Seneca, Kan., has patented a reversible and double buckle having six bars, forming five loops, and provided with two tongues set opposite each other, but one pointing to the right, the other to the left, each tongue having its respective tongue bar and tongue rest bar.

An improved armature for electro-magnets has been patented by Mr. Peter Wagner, of New York city. The object of this invention is to increase the surface of attraction between the armature and the poles of the magnet, and thus augment the power of the electro-magnet and increase the length of the swing of the armature.

A combined forge and steam boiler has been patented by Mr. David E. Engle, of Jacksonville (Wind Ridge P. O.), Pa. The object of this invention is to utilize the heat developed in forge fires to generate steam for driving a fan blower and other machinery.

Mr. James A. Fancher, of West Granby, Conn., has invented a velocipede, whose movements, it is claimed, can be more easily and readily controlled than the movement of any of the velocipedes in common use. The invention consists in a peculiar combination of mechanical devices, which cannot be clearly described without engravings.

Mr. John L. Sippy, of Venice, Ill., has invented a simply constructed, light, and easily worked extension ladder, to be used by carpenters, builders, firemen, and others who often require a ready means of reaching an elevated position.

An improvement in dumping wagons has been patented by Mr. George B. Wiestling, of Mont Alto, Pa. The object of this invention is to furnish safety catches for dumping carts, wagons, and other vehicles, so constructed as to hold the loaded bodies of the vehicles from dropping back should the hoisting mechanism break.

A miner's lamp so constructed as to conduct the flame upward when moved forward, so that it will give more light and also protect the top of the lamp and the head of the miner from the flame and heat, has been patented by Mr. Louis Weihe, of Connellsville, Pa.

Mr. John Thompson, of Oakland, Md., has patented a compact and convenient machine adapted for the use of druggists in putting up prescriptions in pill form of any usual size.

Mr. Joseph S. Letourneau, of Tucker, Ill., has patented a device for use in raising the boxes of dumping wagons, whereby the power of the team can be used for raising a loaded box to dump it, and the labor and expense of shoveling thereby saved. The device is especially intended for use by farmers, and with four wheeled wagons the boxes of which are fitted for being raised at the forward end bodily. The invention consists in bars or rods recessed at one end for taking over the wheel spokes and formed with shoulders to take under the wagon box, so that when said rods are applied to the forward wheels and box and the wagon backed the rods will rise and lift the box. The inventor states that with this device it is an easy matter to unload a wagon load of fifty bushels of corn or sixty bushels of oats in three minutes.

An improved blinder for bridges has been patented by Messrs. George A. Gregerson, of Rochester, and Charles O. Weymouth, of Olmsted county, Minn. The invention consists in the combination with the blind plate, of metallic hinge plates for connecting the blind with the head piece and the bit strap.

An improved nut lock, patented by Mr. William S. Mitchell, of New Cumberland, Ohio, belongs to that class of

inventions that have for their object the securing of nuts on railroad tracks, bridges, machinery, etc. It consists of hinged lock plates provided with beveled sockets to fit over the nuts, the lock plates having their free ends locked together by lock and key.

Mr. Emory O. Bicknell, of Boston, Mass., has patented an envelope having bronze aniline lines arranged on the outside of the flaps and a little back of the edges, the lines being adapted to change color if the envelope is tampered with by the application of steam or moisture.

An improvement in churn powers has been patented by Mr. George W. Sampson, of Tecumseh, Kan. This invention relates to that class of churns that are provided with two dashers, set one above the other, and operating with a reciprocating vertical motion.

An improved separator for the distillation of whisky has been patented by Mr. Martin V. Monarch, of Owensboro, Ky. The inventor utilizes the heat of the low wines or vapors thereof as they pass to the condenser for heating the charge for the still to nearly the boiling point, and at the same time the escape of the alcoholic vapor arising from the charger is prevented, and mealy or improper substances are separated or eliminated from the low wines.

An improved thill coupling, patented by Mr. Frank P. Johnson, of Eyer's Grove, Pa., consists in a novel construction and arrangement of a spring and a locking lever, and the combination thereof with the thill iron and clip, whereby the coupling and uncoupling of the thill and holding the same securely in place are facilitated.

Mr. Sylvester W. Sheldon, of New York city, has patented a device applicable to barrels of different sizes, for supporting them so that they may be easily moved within fixed limits. It is designed for the use of grocers, housekeepers, and others, who are frequently obliged to remove barrels from under shelves and to replace them. The invention consists of two principal parts—a pivotal support for one side of the barrel and a jointed roller support for the other side. The pivotal support has a base plate containing a cavity for the reception of a pivot, carrying at its upper end a curved plate provided with two notched projections for receiving the chime of the barrel. The roller support is made in two parts hinged together to adapt it to barrels of different sizes, and supported on rollers, one roller being pivoted in each part.

Mr. Charles D. Hoffman, of Cairo, N. Y., has patented an improvement in the class of washing machines in which a suds box is mounted on rollers that run on horizontal rails and is reciprocated by means of a crank and pivoted connecting rod.

A combined clothes rack and mantel, which is simple and convenient, has been patented by Mr. Charles C. Field, of Crete, Neb. It consists in a hollow lintel having the front side pivoted at its lower edge and the upper part solid, and provided with a series of radiating recesses in front, in combination with bars.

An improvement in stock cars which will permit the loading of cars very rapidly, afford plenty of space for the animals, and permit their feeding conveniently, has been patented by Mr. Edgar G. Frisbie, of Monroe, Mich. The car is subdivided into several compartments by a longitudinal partition and several transverse hinged gates provided with spring latches. It is provided with troughs partitioned into two subdivisions, one for water, the other for feed.

An improvement in the class of mortise and rim locks having keyhole guards consisting of pivoted plates adapted to swing over the keyhole and prevent the insertion of picks on the outer side of the lock whenever a key is inserted on the inner side, has been patented by Mr. Josiah H. Browne, of Salem, Mass. The improvement consists in the construction and arrangement of sliding guards and the devices which co-operate with them, so that the movement of one guard causes the opposite movement of the other.

An improved headlight case, patented by Mr. Robert C. Greenland, of Connellsville, Pa., consists, principally, in a novel arrangement of oscillating valves for securing a uniform ventilation of the case; also in arranging the door so as to obtain an air-tight joint and a device for more securely fastening the door; and in connecting the top of the case with the dome by means of a double hinge, so as to permit the top to be opened in two directions.

Mr. Henry R. Robbins, Md., of Baltimore, has patented a novel form of press for forming a special construction of can-head, which head is made in one piece, with a skirt or flange at right angles to the main portion, and with a swell or bulge at the corner.

Mr. John T. Hodge, of Carter's depot, Tenn., has invented a convenient and simple device for containing and delivering groceries and other articles to scales to be weighed, thereby avoiding the necessity of keeping such articles in boxes and barrels under and about shop counters, and avoiding also the inconvenience and labor of frequently handling such boxes and barrels. The invention consists of a series of hoppers or equivalent receptacles placed on the floor of the room above the shop counter, and of pipes or tubes leading from each one of said hoppers or receptacles down to within a short distance of the counter, so that the scales can

be placed under the mouths of these pipes to receive the contents therefrom, the pipes being provided with gates or slides to regulate the delivery of articles from them.

FONVIELLE & LONTIN'S ELECTRICAL MOTOR.

This little apparatus, which was presented to the Académie des Sciences at its session of April 5, is composed of a galvanometric helix (Fig. 1) in which there is a small soft iron disk capable of revolving on its supporting pivot. If, on arranging a horseshoe magnet over this apparatus in such a way that its polar extremities are at the ends of the frame, an induction current from a small induction coil be sent into the wire of the helix, the disk begins to revolve rapidly

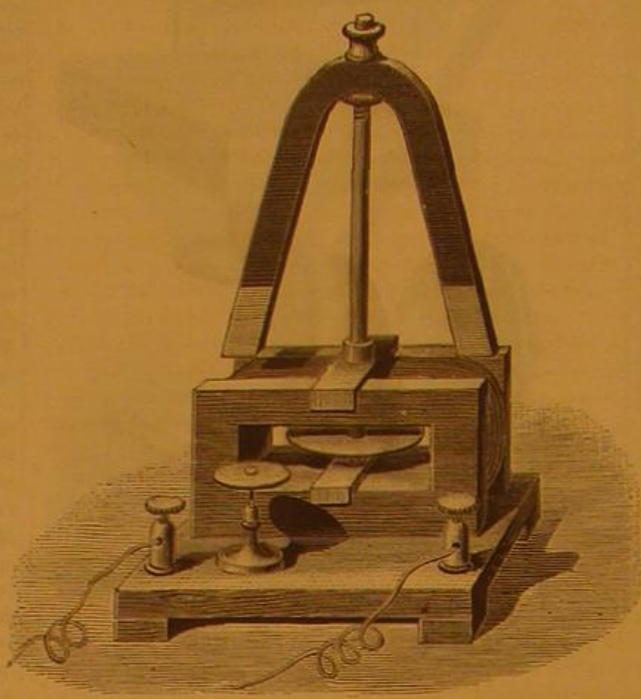


Fig. 1.—FONVIELLE & LONTIN'S ELECTRICAL ROTATOR.

and in a perfectly definite direction, which is dependent on the position of the poles of the magnet and on the direction of the currents induced in the wire of the galvanometric helix. When the magnet is crosswise, there is no longer any rotation. The phenomenon has been explained very simply by MM. Jamin and Du Moncel. As well known, the current induced by breaking is always more powerful than that induced by closing. The disk of soft iron polarized by the outer magnet behaves like a magnetized needle placed in a galvanometric helix, and assumes its motion under the action of a series of electrical impulses, the poles remaining fixed in space, while the disk displaces itself by its rotation. The current produced by closing the primary circuit of the induction coil acts in a direction opposite to that produced by opening, but as its intensity is much less, the disk moves under the differential action of the two. Each current induced by closing produces a new impulse on the disk, since the poles are always in the prolongation of the fixed magnet.

The same rotatory motion is produced with the direct current of the battery interrupted with sufficient rapidity. In this case the rotary speed is not so great, but this must be attributed to the fact that the electrical impulses are not produced with sufficient rapidity, and that, moreover, the resistance of the galvanometric helix is not so well adapted to

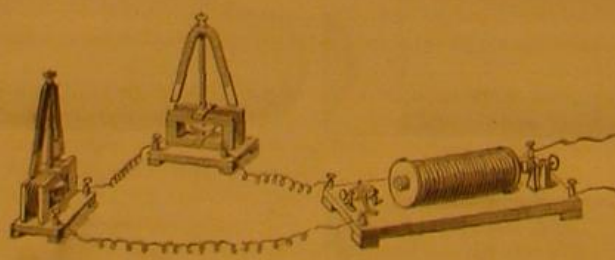


Fig. 2.—Arrangement of two rotators mounted in tension in the induced circuit of a Ruhmkorff coil.

the direct current. The motion is quite rapid when the current of the battery is sent and made to traverse the inductor of the coil and the vibrator, for there is then produced a series of impulses which are sufficiently rapid to communicate a certain rotary speed to the disk. On arranging two helices (Fig. 2) in the circuit of the secondary wire of the coil, a movable disk may be made to revolve in each helix; but on removing the disk from one of the helices the disk in the other takes an accelerated velocity. To explain this phenomenon, which appears to have somewhat astonished M. De Fonvielle, we have only to bear in mind the well-known reactions of magnets and currents. The rotatory motion is produced also with movable pieces of soft iron of various shapes—needles, stars, whole disks, split or annular, spiral bands, etc. On doing away with the fixed magnet the phenomenon takes place under the action of terrestrial magnetism, although to a less degree. The fact that there is no motion when the magnet is placed crosswise with the spirals of the galvanometer, proves the exactness of M. Jamin's

theory; for, in this case, the disk in the interior of the galvanometric helix forms, under the influence of the external horseshoe magnet, a true magnetized bar placed crosswise with the current, and consequently cannot assume any motion under its action. MM. Lontin and De Fonvielle's apparatus constitutes a new and original form for demonstrating the laws which govern the action of magnets and currents, and, as such, will take its place in physical cabinets alongside of analogous apparatus of Ritchie, Barlow, Faraday, etc.

Curious Intermittent Spring in Guatemala.

M. De Thiersant, Chargé d'Affaires of France in Guatemala, gives, in *La Nature*, the following account of a phenomenon witnessed by him in the last named country. At about ten miles from the capital, near a town called Nejapa, on the lowest declivities of the volcano of San Salvador, there is a spring known in the country under the name of Rio Huido (fleeing river), which, for a period of seven consecutive years, furnishes enough water to form a true river. The waters of this spring are crystalline and wholesome, and, it is said, are excellent for certain diseases like leprosy, and for strengthening the system when debilitated by the climate. As soon as the seven years are completed, these same waters disappear at a certain definite hour, the spring ceases to flow, and the river bed, becoming completely dried, exhibits thereafter nothing but sand and dust. The intermittent periods have been as follows: From 1866 to 1873 the waters flowed; from 1873 to 1880 the spring ceased; and in the month of January of the present year, the spring began to flow again. This phenomenon is doubtless not a new one, and science has long ago explained it, but there do not perhaps exist many springs the intermittent period of which is so long and so regular as that of the one at Nejapa.

Hallucination of the Senses.

Professor Maudsley remarks, in a recent lecture, that one striking feature observed by medical men who have had cases of hallucination under their charge is that the patients cannot be convinced that the objects they see, the sounds they hear, and the smells they perceive, have no real existence, and that the sensations they receive are the result of their excited nerves. It frequently happens, too, that a person who suffers from hallucination in respect of one sense has the others unaffected, and is, on all other matters, perfectly normal. Hallucination may arise either from an idea on which the mind has dwelt, appearing as something exterior, or from excitement of the sensory ganglia. It is said that Newton, Hunter, and some others of equal professional eminence, could, at will, picture forms to themselves till they appeared to be realities.

NEW INVENTIONS.

An improved wagon axle has been patented by Mr. John B. Herman, of Blair, Nebraska. The object of this invention is to furnish wagons so constructed as to run easier than when constructed in the usual way, and in which the bearings can be kept oiled and the brake can be readily applied.

An improvement in that class of vertically revolving wind-wheels having radial feathering sails or vanes, which are adjusted, according to the force of the wind acting on them, by means of a lever or governor vane, has been patented by Mr. Andrew D. Worman, of Frederick, Md.

An improved machine for packing meats into cans has been patented by Mr. William Steuerwald, of New York city. It is so constructed as to fill a can at one descent of the follower. It consists of a holder to receive the can, a top having a tapering tube to enter the hole in the can, a tapering hopper, and a contractible follower for forcing the meat into the can at a single movement.

Mr. John Law, of Lebanon, O., has patented a simple device to serve both to support the sides and back of the seat, and to hold the rails of a shifting-top buggy or other vehicle.

An improved clothes-pounder has been patented by John W. Troeger, of Naperville, Ill. This invention consists in an arrangement and combination of an outer cone and a series of inner cones provided with perforated concave diaphragms, whereby several advantages are obtained.

An improved bridle has been patented by Mr. John W. Aiken, of Tennessee, Illinois. The object of this invention is to lessen the amount of stock and labor required in making bridles, and at the same time furnish bridles that are neat in appearance, strong, and durable.

Mr. Robert E. Greenwell, of Osage Mission, Kan., has patented improvements in railway joints of that form in which a set of bolts project through the fish plates and have ends slotted lengthwise to receive a key which is driven in a plane parallel with the bolt. The invention consists in combining the fish plates, the slotted fish plate bolts, a key, and an elongated gib behind the key, which gib passes through two or more of the bolts and serves to tie them together and prevent them from being bent by the entrance of the key.

AMERICAN INDUSTRIES.—No. 50.
THE WALL PAPER MANUFACTURE.

Among the many ways in which modern household decoration has been developed, perhaps no one occupies a more prominent position than the use of ready-made paper, instead of paint or tapestry, to cover the walls. And this method has become popular because of the degree of excellence which has been attained by manufacturers of wall paper within the memory of the present generation, the work now done being such as is sought after in the adornment of the most luxurious mansions in the world, while there is a great deal, also, the cost of which is so low that the lowest paid mechanic can afford to frequently brighten and freshen the walls of his living apartment therewith. A considerable manufacturing industry has, consequently, been developed for furnishing this one product, which affords no inconsiderable market for the paper manufacturer, and the dealers in colors, gums, and varnishes, besides giving employment to a large number of operatives. The illustrations on our first page this week give views of some of the leading operations in the conduct of this department of manufacture, as carried on by one of the leading houses in that line, Messrs. Christy, Shepherd & Garrett, at their large factory in West Twenty-third street, New York city.

Those who are in any way familiar with the art of printing will probably suppose that there is, from the start, some similarity between the processes of making letter-press work and the methods employed in producing the many figured patterns which we find in wall paper. One does suggest the other throughout, but the means used and the mechanical part of the work are as different as the products. Wall papers are printed in water colors almost exclusively; very heavy pigments are used and stout bodies made, which require a great deal of time to dry, and these conditions also modify the character and substance of the type or blocks from which impressions are to be taken as well as the manner of taking them.

The "color mixing," an illustration of the department for which may be seen to the left hand at the bottom of the page, is one of the most important, as well as one of the most difficult branches of the business, where an extensive variety of fine wall paper is to be made. Besides the large room here shown for this purpose the firm have a special chemical department in an adjoining building at the rear, where they manufacture some of their own colors. In the mixing room, however, there may be found nearly every variety of earthy coloring matters, such as raw and burnt umber, sienna, etc., besides a good collection of mineral and vegetable colors, with an extensive assortment of gums and varnishes and the different kinds of clay which form the staple for making the body and carrying the color in every description of wall paper printing. The clay used comes principally from South Carolina and New Jersey. Both kinds are very nearly white, and readily divide into a fine powder, but the New Jersey clay has sufficient alum to render it best fitted for the second grounding in preparing the paper for "satining" or glossing. A large building in the rear is used for storing the clay, and a railway runs thence under the floor of the mixing room, 500 tons a year being about the amount of clay used here. The mixing of the colors is effected in large circular vats, in which arms operated from a shaft overhead are kept constantly revolving. From these vats the color is drawn off as wanted and transferred by a railway which runs through the room to an elevator leading to the various printing departments on the floors above.

On the basement floor, where the color mixing is carried on, is also the room for the reception of printing paper, which comes in rolls weighing about one hundred pounds each, and of just the regular width for wall paper, except such as is required for window shades, which is as much wider as may be desired.

The first part of the printing process, represented in one of the views at the top of the page, is the "grounding," or the covering of the whole white surface of one side of the paper with the ground color, on which the future patterns are to be printed. In this operation the color is put on the paper by brushes. Two wooden cylinders are arranged a short distance apart, carrying a wide belt of thick woolen cloth, the lower cylinder turning slowly in a trough containing the color, while a brush, operating against the cloth on the upper cylinder, transfers the color therefrom to the paper. The lower cylinder has a knife or rule pressing against the cloth as it comes out of the color, so that the quantity taken up may be regulated as desired. The brush which puts the color on has a slight, quick motion across the paper running through. The paper afterwards goes under brushes running lengthwise of the paper, and then again crosswise. This operation distributes the color evenly and leaves a good finish, varying slightly according to the work being done.

For all satin finished or glossed papers a second grounding is necessary. The first grounding, to adhere properly to the paper, requires an amount of glue which would render it too brittle to take a good polish, so a second coat is given, which carries a good deal more fine clay in a solution especially prepared to give a high polish. This operation is effected in a department not shown in our illustrations. It is done entirely on brushing machines, which work very rapidly, a cylinder about two feet in diameter revolving against smaller cylinders on its circumference, and the paper passing over one and under another until each portion of its surface has been vigorously brushed under six or eight cylinders.

All of the above work is preliminary to the printing

proper, which is shown in the large view in the center of the page. For this purpose there are several large and small machines, the largest standing about fourteen feet high, and fitted to print twelve colors, but all working on the same principle. Each of these machines has a large drum in the middle, around which passes the paper, and, set at exactly the proper distances around its under side, are small rollers on which are the designs to be printed, each different color or shade being represented by a separate roller. It would hardly be proper to call these rollers or drums impression cylinders, in the sense in which printers use that term, for they bear very gently on the paper. The large drum is covered with a thick band of rubber, and is so light that it can easily be lifted away from the rollers carrying the design, as is always done in getting the press ready for work. It is, of course, absolutely necessary that the different colors should each come in their proper place, and so the small design rollers are all run by one large cog wheel, into which they are all geared. The color is taken up on cloth, in the same way as for the grounding, from little troughs or fountains near each of the design rollers, but it is pressed directly against the latter from the cloth itself as the rollers revolve, and each separate color is printed in succession as the large drum moves around.

Perhaps one of the most interesting details connected with the printing is the method of drying. Considerable time is required to thoroughly dry these heavy bodied pure water colors, and to do this work quickly and effectually the end of the paper first coming from the press is taken up and carried along by an endless belt, at nearly the height of the ceiling, and for a distance of some fifteen feet; the middle portion will then sag down, when a wooden slat is dropped on buttons on this belt, and taking the paper as it is coming from the press, carries it along and upward from that point, making a loop, for each fourteen or fifteen feet of the roll as it comes out. These slats carrying the loops of freshly printed paper are being constantly pushed forward on overhead railways which extend the whole length of the room, and underneath these railways are lines of steam pipe, each floor having special ventilators to carry off the moisture. At the end of the room there is an ingenious automatic arrangement by which the overhead railway carries the paper around a turn and back over a line parallel to that on which it came from the press, and so it continues to travel back and forth until thoroughly dry.

In making the bronzed papers, or those which have more or less of their patterns in silver and gold, the drying of the other colors must be effected before the bronzing. The size which is to carry the bronze is made especially for this purpose, and, when the colors which have been printed are entirely dry, the size, printed also at the same operation, is just in the proper condition to take and firmly hold the bronze. This is put on in a box-like machine with many brushes, into which the paper passes continuously from the press, after it has gone through its journey over the steam pipes on the overhead railroad.

Where embossed papers are wanted, in any style, the otherwise finished paper is simply run under a steel roller, of the desired surface, whereby it is pressed against a hard packing to give the required effect.

From the bronzing press, as from all the others, the paper proceeds, in the same manner as before, to the small machines for rolling, operated by girls, the work of which is shown in one of our pictures. Attached to each printing press is a gauge which indicates how many rolls are run, and makes a slight cut on the paper at the exact length required for each roll. The end of the paper being fed to the roller, it quickly turns until stopped by the operator at each of these cuts or marks, when a knife cuts it off, the roll is removed, and another roll started. This is the final operation of the manufacture. As the loops of paper are pulled out in the rolling, the slats which have suspended them drop at a certain point, to be gathered up and taken back to the presses.

One of the most important departments of the work, however, and the one which comes first in all the higher grades of goods, is the making of the designs for new patterns and styles. Old patterns are, nowadays, entirely unsalable, and the rule is that each year's patterns must be entirely new and distinct from those of the preceding season. So much so is this the case that the blocks are not saved, on the supposition that some old pattern might again become fashionable. It will be readily seen that this condition imposes upon manufacturers who have to constantly supply large lines of new and attractive patterns a task of no small magnitude. Messrs. Christy, Shepherd & Garrett have always stood in the front rank in their trade in this respect. They have artists regularly in their employment the year round, and also receive many patterns for competition from Europe as well as at home, and from the large number thus collected make selections of those they deem most meritorious. The artist makes the pattern and colors it as he deems most appropriate; but of any pattern they decide to use they make a great many different styles, by using different grounds with different combinations of colors, bronzes, etc., so that from one pattern sometimes as many as forty different styles are made.

From the designer's hands the pattern, after it has been accepted by the firm, goes to the block-cutting department shown in one of our engravings. Here it is drawn in outline on cylinders of wood carefully prepared to be of the exact size, and as many drawings made on different cylinders as there are to be colors in the pattern. The workman

takes one of these cylinders and drives, in the line of the outline, little strips or pieces of brass, or it may be bits of brass wire, if a row of dots is wanted, or brass otherwise shaped to make a variety of small figures. A wire-drawing machine, with an assortment of dies, is kept to make many of the shapes wanted. When a large place is to be filled in to be printed in one color of which this brass work may form the outline, as a leaf, the center of a flower, etc., this space is filled with felt, firmly packed in. This brass and felt work, giving a perfect engraving on the circumference of the cylinder of all there is of one color to be worked in a pattern, stands up nearly a quarter of an inch from the wood; but that its surface may be entirely even and true, the face of the brass work is turned down under a file, and the whole is finally finished under an emery wheel.

Notwithstanding that, in nearly all of the operations of this establishment, the machinery works almost automatically, the firm employ during the busy months about 200 hands. The premises they occupy include a building 350 by 100 feet, and five stories high, besides several detached buildings in the rear. Their goods are exported to some extent to Europe, Australia, and South America, and have a large sale in every part of the United States; so that, although their facilities would seem to be so ample, they are frequently troubled to get the goods ready as fast as they are ordered. The total production last year amounted to about 6,000,000 rolls. The firm is one of the oldest, if not the oldest, in the country, having been established in 1836 by the late Thomas Christy, who died in 1874.

THE DEMAND FOR HEAVY HORSES.

The *Factory and Farm* states a fact which we have observed to exist in this city for some time past, i. e., an increase in the number of large horses used on trucks and heavy business wagons. During the past fifteen years, the writer remarks, there has been a great change in the demand for horses in this country. Formerly nearly every one bred in relation to speed and endurance. Now a large proportion of farmers breed with a view to increasing size and strength. This change is not the result of caprice. There has been a steady, increasing demand for heavy horses, and a corresponding falling off in the demand for light ones. Fashion has had little to do in the matter. Heavy horses are wanted because they supply an existing want. From present appearances it will be many years before the supply of heavy horses will equal the demand. The country is now well supplied with horses. At no time in its history, perhaps, were there as many horses to a given number of inhabitants as at present. Small work horses are low, but heavy draught horses continue to be high.

The importation of Clydesdale and Percheron-Norman horses increases every year. The first that were brought over were regarded as very uncertain ventures. At present they are of no doubtful value. The importers of horses from France and Scotland have suffered none of the reverses of the importers of short-horn cattle. With rare exceptions they have become rich. From present appearances we shall soon be sending Clydesdales to Scotland and England, and Normans to France and Belgium. The value of heavy draught horses was recognized in the Old World before it was in the New. Now that their worth is appreciated here, all persons having teaming to do seem anxious to procure them.

Large horses are less liable to injuries from the swinging of the poles of wagons than small ones. Their bones are firmer, and they are commonly more hardy. Large horses are more economical as respects harness, stall room, feed, and work required to take care of them. In all the countries of eastern Europe heavy horses have taken the place of light ones in general farming operations. That American farmers will soon generally employ heavy horses in field work seems certain.

Dangers of Elevator Cables.

To the Editor of the *Scientific American*:

I am informed that the superintendent of a well known hotel and apartment house, near Union square, this city, in order to learn what effect the continued bending and unbending of the wire elevator cable causes by passing over the pulleys and around the drum, detached the cable and, to his astonishment, found it actually rotten. In bending it twice across his knee it broke. This cable had been in use only two years. If this constant bending and unbending of the cable causes such a disintegration, should it not be more widely known, that examinations may be made and possible disasters prevented?

SAMUEL SWAN, M.D.

13 West 38th St., New York.

[In view of the facts herein stated, we hope that the proprietors of elevators everywhere will cause frequent examination of their lifting ropes to be made. We think that the rope above mentioned must have been composed of extremely poor stuff. It is well known that properly made wire rope will stand the bending of elevator service better than any other known material and will last many years. If it has not been done already, it would be an interesting investigation to determine, by special experiment, the average life of such steel wire ropes as are commonly used in elevators. Mr. J. Burkett Webb, C.E., one of our correspondents, writing from Berlin, gives an account of recent testing experiments that he there witnessed, in one of which a steel rod fifteen inches long and one inch diameter had been bent over twenty millions of times, and was expected to stand some millions of bends more.]

THE HOLLAND HYDROCARBON RETORT.

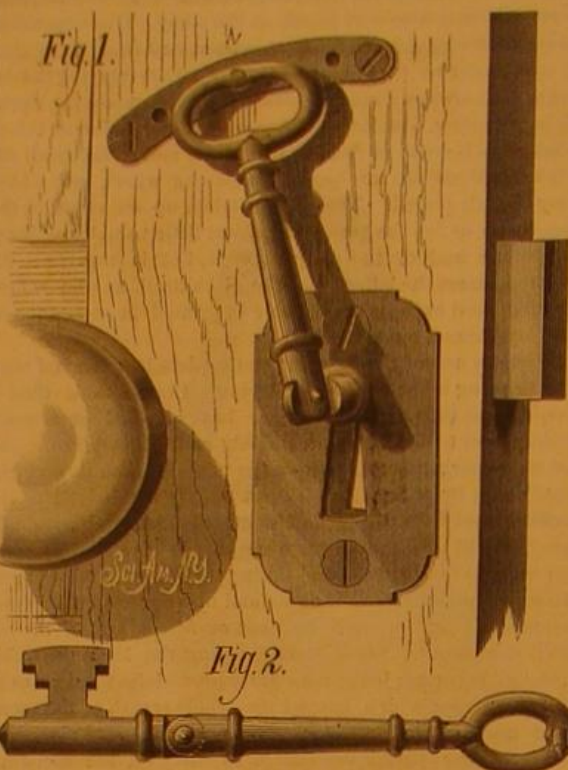
The accompanying illustrations will give a good idea of what the inventor claims for a method of producing heat and illuminating gas, which has attracted a good deal of attention within a few months past. As shown in an experimental way at No. 18 Vesey street, in this city, at the rooms of the company now developing the patents, the New York Heat, Light, and Power Company, it would seem that there could not be a more simple and effective process by which to obtain heat and light for household use, without any danger from explosion, at a very small cost, and without many of the annoyances at present experienced.

The stove shown in the sketch is an ordinary pattern of a small cook stove, with one corner at the top drawn to give an interior view. The fire pot is about a foot square, and here sets a small retort, of such size that its capacity would probably be about equal to that of a quart measure. Into this retort, which is divided into two chambers, naphtha and water are made to flow by a gentle pressure, the water into the left hand chamber and the oil into the one at the right. A fire being made in a sort of cup under the retort, by burning a spoonful or so of naphtha there for two or three minutes, the naphtha is admitted to one chamber of the retort, and the water to the other, the flow in this instance, and for stoves of this capacity, being stated as only a drop at a time, at about the rate of the beating of the pulse. The naphtha is immediately changed into gas and the water into superheated steam, when the gas passes out through one of the pipes shown at the top, and is carried down under the center of the bottom of the retort; the steam passes out from the other pipe, and is carried to the bottom of the retort, the termination of the pipe being a circle of about two and a half inches diameter, which surrounds the bottom from which the naphtha gas is discharged. This circle of steam pipe is pierced with small holes on the inner side, so that, combustion being set up, the superheated steam is discharged directly into the flame of the naphtha gas. And now we have, on a consumption of fuel given as almost infinitesimal, a fierce fire, the flame of which nearly fills the fire pot, and the heat being sufficient for all ordinary uses, while the combustion is so perfect that there is no perceptible smoke or smell, and the firebrick lining of the fire pot has not even been discolored. The flow of oil and water may be readily increased or decreased, as more or less heat is desired, so that the temperature of the stove can be nicely and almost instantaneously adjusted for the work in hand, but the supply pipes are so fitted internally with wire gauze that no excessive flow of oil can be set up, which, indeed, it is claimed, would not be possible on account of the pressure that would thereby be caused from the gas inside the retort. There is, of course, no necessity for a draught for this fire, which will burn equally well in all kinds of weather, and the only need of a stove pipe or chimney is in the burning of the small quantity of oil required under the retort to set up the initial heat.

The retort shown in the fire pot of the stove is separately illustrated, and there is also to the left, at the bottom of the picture, a sketch of another retort, in which are the same features as before described, with the addition of another chamber for making gas. The naphtha is supplied and its flow regulated in the same way, but instead of passing out to be consumed under the retort, it is made to go through pipes which lie against its side, whereby it is heated to make it less volatile and more of a fixed gas. From here it is conveyed through a box with iron filings, in order to separate from it any fluid naphtha, and thence to a small receiver, on the same principle as those ordinarily used. In this way the gas necessary for lighting a house may be made at the same time and by the same fire as is used in the cooking or for warming. The gas with which the company light their offices, as one of the proofs of the practical success of their process, where any one can see all the operations, is certainly very pure and bright, and its combustion seems to be absolutely perfect.

For the purposes of an open fire in a

fireplace, the same form of combustion is adopted as in the stove for making the heat, but in addition thereto the gas made by this process is conveyed into hollow cylinders, piled up to represent a tier of logs, and from regular openings in these the gas issues, so that, when the fire is started, a regular apron of flame passes backward and upward over their surfaces. It takes but a few minutes in this way to "light a fire," which, in starting, burns up somewhat like cannon coal, and so much gas is used that we should sup-



JOHNSON'S KEY FASTENER.

pose an ordinary room with such a fire would need no other light. It certainly would "not pay" to have such a fire if one had to count it in his gas bills, but the company claim that they make the gas so cheap that the expense of even such liberal use of it amounts to almost nothing, and the gas itself is so pure that no smoke, soot, or smell is made.

To show the merits of these processes the company have fitted up their offices in Vesey street so that two small tanks, of a capacity of perhaps one barrel each, one for water and the other for naphtha, are fixed close up to the ceiling, whereby they obtain a head of some twelve or fifteen feet on the naphtha and water in the pipes where they enter the retorts. They also have two small gas receivers of a total capacity of something like 500 feet, the whole apparatus being designed to show the practical application of these patents to household uses in heating and illuminating.

In addition to the above, however, and that which the company believe to be the most important field for their

patents, they are endeavoring to perfect and develop the application of this method of obtaining heat to locomotive uses. With this end in view they have already made some experiments in the construction of motors for street cars, and have actually adapted a locomotive and run a train therewith on the Long Island Railroad. They propose to use steam in the same way as other engines, but the different manner of obtaining the heat requires a radically different construction, the details of which they have not yet practically succeeded in working out. Should they do all they promise and expect to accomplish in this direction, the future locomotive will be one that can be run at one-tenth the cost of those of the present style in the way of fuel, and will give out neither smoke, cinders, nor offensive gases.

The first of the patents relative to these processes was taken out by Dr. C. Holland, of Chicago, in 1877, and the last one during the present year, there being ten patents altogether. The New York Heat, Light, and Power Company own the patents for New York, New England, and the South. The inventor's claim is, in the main, that the attainment of these marvelous results is due principally to the dissociation of water in its form of superheated steam, and the total consumption of both its gases by the free access of outside air, under the conditions in which the burning naphtha gas is brought into contact with the steam under the retort.

SIMPLE KEY FASTENER.

The engraving shows a very simple device for preventing locks from being burglarized. The lock may be of any construction; the invention relates to the key, the shank of which is jointed near the face of the door, and provided at or near its outer end with a stud, which enters a curved perforated plate attached to the door. The plate has a series of holes into any one of which the stud on the key may be inserted. This device effectually prevents turning the key from the outside by forceps or other instrument, and affords a sense of safety which is not felt when the key is left loose in the lock.

This useful invention was recently patented by Mr. Lenson Johnson, of Vincennes, Ind., who will furnish further information if desired.

HATCHING SPANISH MACKEREL.—A remarkable achievement in hatching deep sea fish is reported by Mr. E. G. Blackford, on the authority of a member of the United States Fish Commission. After many failures the eggs of the Spanish mackerel have at last been successfully hatched by one of the experts in the employ of the Commission.

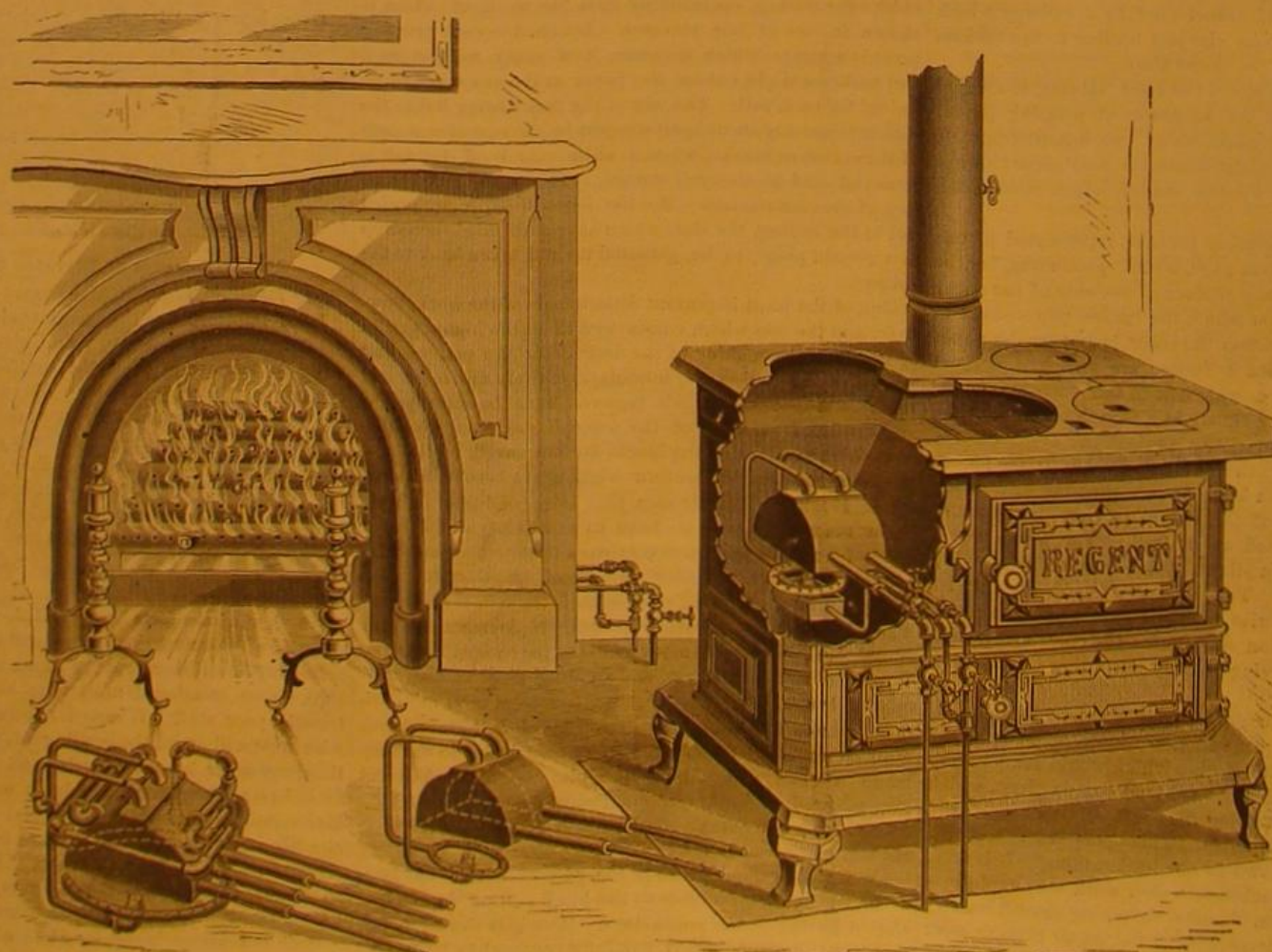
Benjamin Nadault de Buffon, French Engineer.

Professor Benjamin Nadault de Buffon, a grand nephew of the celebrated naturalist, died in France in June, aged 76 years. He was born at Montbard, (Cote d'Or), February 2, 1804; graduated from the Ecole Polytechnique in 1826; entered the government service as engineer of highways and bridges, rose to be chief engineer and professor of agricultural hydraulics at the imperial school of his department of engineering. He was a great authority on irrigation, and was widely known as the projector of the scheme

for reclaiming the Crau d'Arles plain by irrigation from the Rhone. He was long in charge of the Division of Hydraulics at the Ministry of Public Works, was intrusted with important commissions for the prevention of inundations, wrote several volumes on engineering subjects, and was promoted to the high grade of Officer of the Legion of Honor in 1864.

Not a Sea Serpent.

The dead monster seen by Capt. Ingalls off the coast of Maine, and noticed in the SCIENTIFIC AMERICAN a short time since, drifted ashore at Seguin, Maine, and proved to be a basking shark (*S. maximus*, or *S. elephas*). This is not the first time that the creature has been mistaken for a sea serpent, owing to its slender body and great length. It sometimes attains a



THE HOLLAND HYDROCARBON RETORT.

length of sixty or seventy feet. Its home is in the northern seas, but sometimes it has been seen as far south as Maine. Its natural history does not appear to have been well worked out, though it is hunted, to some extent, for its liver oil. It is inoffensive in its habits, probably herbivorous, and exhibits none of the characteristics of the shark family.

AGRICULTURAL INVENTIONS.

Mr. Jacob Anderes, of Pacific, Mo., has patented a hand seed planter, to the base plate of which are attached spring-closed spouts and a seed box provided with discharge holes. The planter drops corn in three places in the hill.

Mr. Isaiah H. Reiner, of Line Lexington, Pa., has invented a harrow which can be readily transformed into a sled to facilitate its transportation from place to place, and which can also be used to carry grain and agricultural implements to and from the place where they are used.

Mr. David B. Eberly, of Boswell, Ind., has patented an improved harrow. It is so constructed as to cut in pieces lumps and sods and pulverize the soil. It will adapt itself to uneven ground, and can be adjusted wider or narrower as required.

Mr. T. C. Baxter, of Glenwood, Kan., has invented a potato fork, which is more efficient than a plow or an ordinary hoe or fork in removing potatoes from the hill. To the rear of a fork of ordinary construction is attached a foot piece, that is bent outward and upward and secured upon the handle. A front handle is in like manner secured to fork and handle. When used by two persons the fork is placed back of the hill and thrust beneath the potatoes by their combined action; then it is pulled and pushed forward and upward at the same time, lifting and dragging out all the potatoes from the hill. As the potatoes remain upon the fork, a shake or two given to it will separate them from the earth, which will fall between the tines.

A spring harrow tooth so constructed that it may be secured adjustably to the bars of the harrow frame, will be firmly and securely held, can be readily adjusted, and will economize steel in its manufacture, has been patented by Mr. Arthur P. Sprague, of Kalamazoo, Mich.

Pearls in New Zealand.

The Auckland Evening Star reports the discovery of pearls in Oakley creek, New Zealand. While passing along the bank of the creek, Mr. Benjamin Gittos, an old resident of the district, observed a peculiar and, to him, new shell fish in the sand. A little search disclosed a large number of them of various sizes. The inner coating of the shell was found to be mother-of-pearl of fine quality, and in several of the larger shells he found loose pearls. The pearls are described as unusual in form and color, not perfectly round, but far more brilliant than ordinary pearls.

THE MOUSE-EATING SPIDER AT THE ZOO.

This formidable insect is one of the latest arrivals at the Zoological Gardens, Regent's Park. It comes from Bahia, a maritime province of Brazil, and is common in the South American forests. Its body, which is covered with hair, is three inches in length, and its legs are in proportion; so that, when extended, it is about as big as a cheese plate. It feeds on mice and small birds, which it catches by springing suddenly upon them from ambush in the hollow of a tree or beneath a large leaf. At the Zoo it is fed chiefly on a large kind of cockroach (twice as big as those often met with in our kitchens), which comes to England in the cages in which certain animals are imported, and have hitherto been a great nuisance to the managers of the gardens.—*Graphic*.

JAPANESE ART.

The engraving on this page will be recognized by every one as an example of Japanese art. This vase stands about four feet in height. It is of bronze, a favorite material with the Japanese metal workers, who are certainly unsurpassed by any people in the world for originality of design and skill in execution. This is an excellent specimen of their peculiar method. In the grotesques at the base and in the relief ornamentation on the sides we see that peculiar exaggeration and distortion of natural objects which many people prefer to the conventionalism obtaining with Euro-



JAPANESE BRONZE VASE.

pean artists. Here, too, in the elaboration of minute designs on the collars and the rim and in the superbly executed handles, we see the evidence of a patient, painstaking labor such as only oriental workmen practice.

Large Cuttle Fish.

All exact information about gigantic Cephalopoda is of interest not only as showing what immense marine creatures do exist, but as preparing us for the possibility of meeting with still greater. Prof. Verrill has collected a great deal of accurate and recent information as to the North American species, of which he publishes a list in the April number of the *American Journal of Science*, from which we cull the following: On November 2, 1878, a fisherman was out in a boat with two other men near Leith Bay Copper Mine, Notre Dame Bay, when they observed some bulky object not far from shore, which they approached, thinking it might be

part of a wreck. To their horror they found themselves close to a large fish having big glassy eyes. It was making desperate efforts to escape, and was churning the water into foam by the motion of its immense arms and tails. Finding it partially disabled, they plucked up courage and threw the boat's grapnel, which sank into its soft body. By means of the stout rope attached to the grapnel and tied to a tree the fish was prevented going out with the tide; its struggles were terrific, as, in a dying agony, it flung its great arms about. At length it became exhausted, and as the water receded it expired. Its body, from the beak of the mouth to the extremity of the tail, measured twenty feet, and one of the tentacles, or arms, measured thirty-five feet. This is the largest specimen yet measured of *Architeuthis princeps*. Prof. Verrill mentions eighteen species as now known on the northeastern coast of America.

NATURAL HISTORY NOTES.

A Monstrous Seaweed.—Of all marine algae, the *Nereocystis* is most wonderful. Its stem occasionally attains a length of three hundred feet, though it is extremely slender even at the top, where it is surmounted by an enormous floating bladder six or seven feet long, which affords a favorite resting place to the sea otter. The account, indeed, is apparently so fabulous as given by Mertens in an interesting paper on the botany of the Russian possessions in America, that it could not be believed did it not depend upon unquestionable authority. The filiform stem (which is about as thick as pack thread) when two or three feet long, swells suddenly above into a globose bladder. From the top of this springs a tuft of germinate leaves, mostly rising on five petioles. These leaves are lanceolate and membranaceous, from one to two feet long, and two inches broad in the center. As the plant grows older, the stem increases enormously in length, but only slightly in thickness. The globose bladder swells into a turnip-shaped or retort-like cylinder, six feet long and four feet six inches or more in diameter, in the widest part, the lower extremity gradually passing into the stem. The leaves, which at first were marked with a few faint nerves, split in the direction of the latter, cover a large space by their entangled mass, and attain a length of twenty-seven feet or more. Where the plant grows in any quantity, the surface of the sea becomes impossible to boats, in consequence of the dense floating masses of vegetation. The stem is employed for fishing lines when dry, and the large cylinder is used as a siphon for draining water out of boats, in the same way that another seaweed—the *Ecklonia buccinalis*—is used frequently at the Cape.

Bees and Flowers.—A writer in the *Midland Naturalist* says: "Bees, when gathering honey, seem to me (and I make the remark after many observations) to confine themselves during any given excursion to flowers of the same family. Thus, when I have watched a bee or butterfly gathering honey from a rose I have found that when it next alights it is invariably on another rose, and on no other flower." To this the editor adds the following notes from Kerner: "Flying insects in their search for nectar frequently confine themselves during their rapid visitation of successive flowers to the blossoms of one and the same species. For example, in a meadow at Trins, in the Gschnitz Valley, I saw *Bombus montanus* visiting only the inconspicuous flowers of *Anthyllis alpestris*, whilst the numerous and far more striking nectar-bearing flowers of *Pedicularis Jacquinii* and *P. incarnata* were passed over. Contrariwise in another place, in a meadow in the Padail Valley, I saw this same species of bee buzzing from one *Pedicularis* flower to another, whilst passing over the intermixed *Anthyllis alpes-*



THE GIGANTIC MOUSE-EATING SPIDER AT THE ZOOLOGICAL GARDENS LONDON.—(Natural Size.)

trix. On this passage, Dr. Ogle, the English editor of Kerner's work, remarks that a similar observation as to the habits of bees was made by Aristotle. "A bee," he says, "on any one expedition does not pass from one kind of plant to another, but confines itself to a single species, for instance to violets, and does not change until it has first returned to the hive."

Hybrid Fishes.—According to Mr. R. B. Roosevelt, the fish hatching Commission have raised hybrids between the following species of fishes: Salmon trout with whitefish; salmon trout with brook trout; brook trout with fresh water herring, with California salmon, and with the California mountain trout; shad with striped bass and herring. Of these crosses there are the young, now in the hatching house, of the salmon trout brook trout, brook trout California salmon, and brook trout California brook trout. It is observable of all hybrids that they are usually more shy and wild than either of their parents, and that in appearance they generally favor their larger parent. The cross between the brook trout and California salmon, and the salmon trout and brook trout bid fair to be fine fish. Those now in the hatchery are eight inches long. It is to be hoped that further careful experiments may be made to ascertain whether these hybrids are fertile and capable of producing fertile offspring.

The Mullein.—The common mullein, regarded as but a common coarse weed in this country, and so common in fields as to often prove a nuisance, is cultivated in England for its beauty. A writer in the *Gardener's Chronicle* says that it "is well worth the attention of both amateur and professional gardeners." It seems that it is known in England by the common name of "Aaron's Rod." "There are two reasons," says this writer, "why it should be called by this name: first, the Romans dipped the stems in tallow, and burnt them at funerals. Secondly, the simple spike is long, cylindrical, and on it is a quantity of densely packed, very large, handsome golden-yellow flowers. The stem is five feet high. The flowers, when dried in the sun, give out a fatty matter, which is used in Alsace as a cataplasm in hemorrhoidal complaints. Formerly the plant was called *barbasam*, from *barba*, meaning a beard, an allusion either to the shaggy nature of its foliage, or else to two of the five stamens, which are hairy."

Private Patents.

Secret processes in manufacture are not uncommon now and here, notwithstanding the reasonable cost of a patent and the facilities for obtaining it. In England, where the cost and trouble of procuring a patent is much greater than here, these secret processes and receipts are very common, and the visitor to manufacturing establishments is frequently interdicted from a thorough exploration. The practice is a perfectly proper one, as an inventor as much owns the product of his brain and skill as the money he has earned; but there is always more or less risk attending the attempt to keep secret any profitable knowledge. If only one man possesses the secret, it is liable to be lost by his sudden death, to be possessed again only by a re-discovery. And although a certain prominent public lecturer may have attached undue importance to what he calls "the lost arts," it is undoubtedly true that there have been lost to the world really valuable facts in mechanics and chemistry and other arts and sciences by these attempts at secreting facts.

But there are patents in use which belie the term. Anything that is patent is "known" or "seen," the terms being synonymous. Yet there are methods of manufacture, compositions of materials, and machines for operation which have been patented and yet have never become known to the public. In some of these instances this withholding of public information is designed and intentional, the holders of the patents working it for their own profit, and believing that to be better for them than sharing it and receiving a royalty. It must be acknowledged that these are wiser than those who depend for their monopoly on their confidence in human nature—in human fealty—and run the risk of losing their advantage by death or unfaithfulness; for at the worst those who would share in the profits of the patented article may be compelled to pay fairly for it.

The number of these private patents which are held and used would surprise one who did not have good opportunities to ascertain the facts. And some of them are wonders of ingenuity and skill. One noted only a few days ago is a case in point. Among the productions of a busy concern recently inspected was that of drawer-knobs of wood. The extremely low price at which these knobs were sold was a surprise until the process of manufacture was witnessed; then it was apparent that the trifling price asked allowed a handsome margin for profit. A boy sat at a machine placing bored cubes of wood on a projecting pin that presented itself almost as fast as he could conveniently handle the blocks. Yet, every time he placed a block on the pin, a finished knob was thrown off, requiring only the insertion of a plug with which to secure the knob to the drawer, and vouching to be ready to pack for the market. When the machine is prepared with the proper cutters it will turn almost any form of knob required, and being fed with the material in blocks it is absolutely automatic. "Only two of these machines were made," said the superintendent. "Where is the other?" was asked. "Out in the barn," was the answer. Here was a combination of self-acting tools that had been patented, and yet not used except in the concern where it originated, and so prolific was it in product that a second machine had been found unnecessary.

This is but a single instance of the use of an unknown though patented article. Some of the work done and some of the modes of work and action of these machines are very curious. It would quite astonish the reader if it was proper to describe the action of machinery seen in operation recently at a bolt-making concern. Some of the processes in the production of "bright goods"—those from stiff polished wire—practiced in certain concerns, and some of the operations in sheet metals, although patented, are unknown to "the trade" generally.

There is another class of unknown patents which are very like undeveloped mines of legally enjoined enterprises, of no profit to the owners and of no use to the world. Some of these patents lie useless because the holders have not the wisdom, energy, or money to push them. There are men who are keen enough to see the failures and note the shortcomings of others and cover their unprotected openings, yet who cannot understand their own advantage. They can invent and discover, perfect and improve, but they hardly know what to do with their creation or improvement. To be of any profit to them it should be made of use to others; but they neglect proper means of publicity, and eventually the invention or improvement is forgotten until some "live" man brings it out in different form, but perhaps no better shape, and claims the honors and reaps the profits. It is then, if ever, these slow coaches heave in sight. Then they begin to bluster about prior claims and prior discovery. But generally the enterprising reinventor takes all the honors, gives his own name to the invention, and gets the emoluments that attend on success.—*Boston Journal of Commerce.*

Submarine Topography.

The coast survey steamer *Blake*, Commander J. R. Bartlett, United States Navy, recently returned from a cruise taking soundings, serial temperatures, etc., in the course of the Gulf Stream, under instructions from C. P. Patterson, Superintendent of the Coast and Geodetic Survey, has brought some very interesting data in regard to the depths of the western portion of the Caribbean Sea. The depths and temperatures obtained last year in the "Windward Passage" between Cuba and St. Domingo were verified, and a few hauls of the dredge taken directly on the ridge in this passage. The data obtained render it very probable that a large portion of the supply for the Gulf Stream passes through this passage, and that the current extends in it to the depth of 800 fathoms. A few lines of soundings with serial temperatures were run from Jamaica to Honduras Bank, via Pedro and Rosalind Banks, and it was found that the temperature of 39½°, obtained at all depths below 700 fathoms in the Gulf of Mexico and the Western Caribbean, could not enter through this portion of the sea. But the temperature at the depth of 800 fathoms on the ridge in the "Windward Passage," between Cuba and Hayti, was found to agree with the normal temperature of the Caribbean and Gulf of Mexico, viz., 39½°. Soundings were taken between Hayti and Jamaica, developing a general depth between these islands not exceeding 800 fathoms, except where broken by a remarkably deep channel connecting the waters of the main Caribbean south of St. Domingo with those north of Jamaica. This channel runs close to Hayti with a greatest depth of 1,200 fathoms, and a general depth of 1,000 fathoms. Its course is northerly along the western end of Hayti, where it does not exceed a width of five or six miles; thence westerly, south of Navassa Island, with a tongue to the northward between Navassa and Formigas Bank, and another to the westward between Formigas Bank and Jamaica. A line of soundings was run from St. Iago de Cuba to the east end of Jamaica, where a depth of 3,000 fathoms was found twenty-five miles south of Cuba. This deep place was found by subsequent soundings to be the eastern end of an immense deep valley extending from between Cuba and Jamaica to the westward, south to the Cayman Islands, well up into the bay of Honduras. The Cayman Islands and the Misteriosa Bank were found to be summits of mountains belonging to a submarine extension (exceedingly steep on its southern slope) of the range running along the southeastern side of Cuba. This deep valley is quite narrow at its eastern end, but widens between the western end of Jamaica and Cape Cruz, where the soundings were 3,000 fathoms within fifteen miles of Cuba, and 2,800 fathoms within twenty-five miles of Jamaica. Near Grand Cayman the valley narrows again, but within twenty miles of this island a depth was found of 3,428 fathoms. The deep water was carried as far as a line between Misteriosa Bank and Swan Islands, with 3,010 fathoms within fifteen miles of the latter. On a line between Misteriosa Bank and Bonacca Island there was a general depth of 2,700 fathoms, and a depth of over 2,000 fathoms extended well into the Gulf of Honduras. Between Misteriosa Bank and Chinchorro Bank the soundings were regular at 2,500 fathoms. North of Misteriosa and Grand Cayman to the Isle of Pines and Cape St. Antonio the soundings were generally 2,500 fathoms. The serial temperatures agree, in relation to depth, with those obtained in the Gulf of Mexico by Lieutenant Commander Sigsbee, and in the Eastern Caribbean by Commander Bartlett; decreasing from the surface to 39½° at 700 fathoms or less, and constant at that temperature for all depths below 700 fathoms. At depths greater than 600 or 700 fathoms the bottom was always found to be calcareous ooze composed of pteropod shells with small particles of coral. These pteropod shells, as noted in previous expeditions by different nations,

appear to be an important factor in the determination of the movements of great bodies of sea water. The ridge at the "Windward Passage" is bare coral rock, and on the south side the pteropod shells were found to be much more numerous than to the northward of the ridge.

Soundings and serial temperatures being the special objects of the cruise, dredgings were only incidentally attempted, for the purpose of reconnoitering, as it were, the ground; and it was found that the area passed over was not nearly so rich in animal life as that in which dredgings were made last year under the lee of the Windward Islands, at the eastward of the Caribbean Sea.

The development of the extraordinary submarine valley in the Western Caribbean Sea is a matter of great interest, considered as a physical feature. This valley extends in length 700 statute miles from between Jamaica and Cuba nearly to the head of the Bay of Honduras, with an average breadth of eighty miles. Curving around between Misteriosa Bank and Yucatan, and running along between Cuba and the ridge of the Caymans for a distance of 430 miles, with a breadth of 105 miles, it covers an area of over 85,000 square miles, having a depth nowhere less than 2,000 fathoms, except at two or three points (the summits of submarine mountains), with a greatest depth, twenty miles south of the Grand Cayman, of 3,428 fathoms; thus making the low island of Grand Cayman, scarcely twenty feet above the sea, the summit of a mountain 20,568 feet above the bottom of the submarine valley beside it—an altitude exceeding that of any mountain on the North American continent above the level of the sea, and giving an altitude to the highest summit of Blue Mountain, in Jamaica, above the bottom of the same valley, of nearly 29,000 feet—an altitude as great, probably, as that of the loftiest summit of the Himalayas above the level of the sea.

For the deepest portion of this great submarine valley, the Superintendent of the Coast and Geodetic Survey has adopted the name of "Bartlett Deep."—*N. Y. Herald.*

CAPT. DOBBINS'S SELF-RIGHTING LIFE BOAT.

Capt. D. P. Dobbins of the Life Saving Service reports the practical success of the life boat built on his plan, the construction and testing of which was provided for by Congress last spring. Capt. Dobbins reports as follows to Supt. Kimball:

"The self-righting surf boat authorized by letters of March 3 and 4, was completed and tested Thursday, June 17, by the keeper and crew of Life-Saving Station No. 6, under my personal supervision. The boat proves to be a perfect success. It will right instantly and carry her entire crew around with her when full of water as she is, on righting, and with her crew at their stations. She shows a side of over six inches out amidship, so she can be bailed readily. She is very stable or stiff under foot and in a seaway. It was quite difficult for the seven men to capsize her, full as much so as it is for the crew of the English self-bailing and righting life boats to capsize them. The prescribed beam of the boat made it difficult to secure the ready righting I claim for my own dimensions, but I have succeeded at the loss of a heavier boat than I designed for a practical surf boat. She will weigh not over 1,000 pounds, however, which is 600 pounds less than our ordinary surf boats weigh. She is roomy, stout, stanch, and strong, and pulls easily, and is a most beautiful sea boat."

This boat, which is not to be patented, dispenses with the heavy keel of the life boats now in use by the Service, and is "self-righting" by virtue of its model.

Walnut Timber from Arkansas.

The towboat *Ida* reached New Orleans, out of the Arkansas River, on June 8, with a walnut log raft of unusual proportions. Additional interest attaches itself to this raft on account of it being part of an order for 10,000,000 feet from a Bridgeport, Conn., sewing machine factory. The growing scarcity of this desirable wood in the Eastern States, and the demand by European furniture makers has developed distant sources of supply. The raft in question had been ninety days making the trip from the forests along the White and St. Francis rivers, in Arkansas, and in that time drift, five feet deep, had accumulated beneath the logs. Of these the raft contained 2,500, 2,000 being walnut and 500 cypress. The latter are used as buoys for the heavier timber. This log island measured 400 by 208 feet, and many of the walnut logs were over six feet in diameter. They were cut by a band of 200 Canadians who are adepts at working in hard timber, and can get out 500 logs per day under favorable circumstances. From New Orleans the logs go by rail to New England, this transportation being found to be just \$3 per 1,000 less than by steamship. Col. S. M. Markel, of Missouri, has this contract, and has orders for walnut logs from Liverpool parties. The raft in question contained 600,000 feet, and is among the first shipments of the kind to the East.

A Sale of Fancy Cattle.

An important sale of short-horn cattle took place at Chicago the last day of June. The cattle were the property of Hon. M. H. Cochrane, of Compton, Canada, and Col. Le G. B. Cannon, of Burlington, Vermont. The Seventh and Eighth Duchesses of Hillhurst brought eight thousand dollars each. There were sold altogether thirty-two cows, averaging \$995, and bringing in all \$31,680. Eleven bulls were sold for \$6,845, an average of \$622.

The Sense of Smell.

The sense of smell is composed of two parts—a physical and nervous. The Schneiderian mucous membrane is the physical portion; the first pair of olfactory nerves constitutes the nervous portion. The Schneiderian mucous membrane (named in honor of Schneider, who first demonstrated that the nasal secretions came from racemose glands in this membrane, and not from the brain, as was formerly supposed) lines the entire nasal cavities. The olfactory portion, with which we have to deal in the study of the sense of smell, is easily distinguished from the rest of the nasal passages; in man, the sheep, and the calf, it is yellow; in most other mammalia it is of a brownish tinge; it is softer and thicker than other portions of the nasal mucous membrane. In man the epithelium of the olfactory membrane is covered with vibrating cilia, which are absent in most quadrupeds; this difference of structure probably is one cause of the inferior acuteness of the sense of smell in man. The olfactory membrane is limited by a tolerably well defined outline to the superior and middle turbinated bones and the upper part of the septum nasi. This portion only is capable of receiving odorous impressions.

The olfactory nerve or ganglia has three roots, the exact origins of which have not been definitely made out; the external root, which is of white matter, has been traced to the corpus striatum and optic thalamus, anterior commissure, and some fibers to the convolutions of the island of Reil. The middle or gray root arises from the caruncula mamillaris in the anterior lobe. The inner root of white matter arises from the inner and back part of the anterior lobe, and is probably connected with the gyrus fornicatus. These coalesce and run forward to the cribriform plate of the ethmoid bone, where there is a bulbous enlargement, from which are sent down the showers of filaments going to the olfactory mucous membrane. These filaments divide and subdivide, forming microscopic plexuses in the substance of the olfactory membrane, and appear to terminate between the fusiform cells of that membrane. The olfactory membrane also receives filaments from the nasal branch of the fifth pair of nerves, and is in direct communication with the sphenopalatine ganglion of the sympathetic. It seems probable that the sense of smell is due to the solution of the emanations from bodies in the fluid secreted by the racemose glands of the olfactory membrane, and in this condition coming in contact with the terminal filaments of the olfactory nerves produces a molecular change, either chemical or physiological, which change, when transmitted to the brain, gives rise to the sensation. As a general rule the longer the olfactory membrane is exposed to a particular odor the longer its effects continue; and in some cases it may be perceived for quite a while after the odoriferous substance has been removed. A person once having perceived a certain scent, will sometimes recognize the same odor (even though he may have forgotten it) without anything causing an idea of it, save perhaps an irritation of the ganglion.

This ganglion is situated, according to Ferrier, in the temporo-sphenoidal convolutions, and is by him regarded as the psychological center of the sense of smell.—*Medical Bulletin.*

The Eating of Clay.

Among the extraordinary passions for eating uncommon things, says Prof. Johnson (Chemistry Common Life), is to be reckoned that which some tribes of people exhibit for eating earth or clay. For instance, in Western Africa, the negroes of Guinea have been long known to eat a yellowish earth, there called *Caouac*, the flavor or taste of which is very agreeable to them, and which is said to cause them no inconvenience. Some addict themselves so excessively to the use of it, that it becomes to them a kind of necessity to their lives—as arsenic does to the Syrian peasants, or opium to the Theriakis—and no punishment is sufficient to restrain them from the practice of consuming it. When the Guinea negroes used in former times to be carried as slaves to the West India islands, they were observed to continue the custom of eating clay; but the *caouac* of the American islands, or the substance which the poor negroes attempted in their new homes to substitute for the African earth, was found to injure the health of the slaves who ate it. The practice was therefore long ago forbidden, and has now probably died out in the West Indies.

In Martinique a species of red earth or yellowish tufa was still secretly sold in the markets in 1751; but the use of it has probably ceased in the French colonies also. In Eastern Asia a similar practice of eating earth prevails in various places. In the island of Java, between Sourabaya and Samarang, Labillardiere saw small square reddish cakes of earth sold in the villages for the purpose of being eaten. These were found by Ehrenberg to consist for the most part of the remains of microscopic animals and plants, which had lived and been deposited in fresh water. In Runjeet Valley, in the Sikkim Himalaya, a red clay occurs, which the natives chew as a cure for the goiter. The chemical nature of the substance has not been examined. In Northern Europe, especially in the remote parts of Sweden, a kind of earth known by the name of bread meal, is consumed in hundreds of cartloads, it is said, every year. In Finland a similar earth is commonly mixed with the bread. In both these cases the earth employed consists for the most part of the empty shells of minute infusorial animalcules, in which there cannot exist any ordinary nourishment. In North Germany, also, on various occasions, where famine or necessity urged it, a similar substance, under the name of mountain meal, has been used as a means of staying hunger. In

South America, likewise, the eating of clay prevails among the native Indians on the banks of the Orinoco, and on the mountains of Bolivia and Peru. Humboldt states that the earth eaten by the Otomac Indians, on the Orinoco, is an unctuous, almost tasteless clay—true potter's earth—having a yellow-gray color, in consequence of the presence of oxide of iron. This they select with great care, and they are even able to distinguish the flavor of one kind of earth from that of another. At the periodical swelling of the river, which lasts from two to three months, and when all fishing is stopped, they devour immense quantities of earth. An Indian will eat from one-quarter of a pound to one pound and a quarter of this food daily. A similar practice prevails in the hill country of Bolivia and Peru. Dr. Weddell saw a species of gray colored clay exposed for sale in the markets of La Paz, on the Eastern Cordilleras, and which was called by the native name of *Pahsa*. The Indians, who are the only consumers of it, eat it in large quantities with the bitter potato of the country. They allow it to steep for a certain time in water, so as to form a kind of soup or gruel, and season it with salt. At Chiquisaca, the capital of the State, small pots made of an earth called *Chaco* are exposed for sale. These are eaten like chocolate. The eating of certain varieties of earth or clay may therefore be regarded as a very extended practice among native inhabitants of tropical regions of the globe. It serves, in some unknown way, to stay or allay hunger, stilling, probably, the pain or craving to which want of food gives rise. It enables the body to be sustained in comparative strength with smaller supplies of ordinary aliment than are usually necessary; and it can be eaten in moderate quantities, even for a length of time, without any sensible evil consequences. A fondness even is often acquired, so that at last it comes to be regarded and eaten as a dainty.

Botanical Notes.

Influence of Light on Size of Leaves.—M. Ch. Flahault, in the *Annales des Sciences*, brings forward additional observations to support his view that under equal conditions, the leaves of plants of the same species are larger in proportion as we go northwards, these relatively larger dimensions being due to the duration of light of relatively feeble intensity. In cases where the chlorophyll is formed in the absence of light it must be formed at the expense of the materials stored up in the tissues. The importance of these reservoirs of nutriment is still greater in the case of flowers. Thus, in the case of hyacinths, both blue and red. M. Flahault found no difference in the color of the flowers grown in the light or in the dark, the color being manufactured from the stores of material in the bulbs.

A Wonderful Tree.—Baron Ferd. Von Mueller says in his "Eucalyptographia," that one of the grandest trees of the globe, and one of the greatest wonders in the whole creation of plants, is the *Eucalyptus diversicolor*. Astounding records of the height of this tree have been given. The Messrs. Muir saw trees with stems 300 feet high up to the first branch, and Baron Von Mueller himself noticed many which approached to 400 feet in their total height. When closely growing the young trees may have a comparatively slender trunk, so much so that a tree 180 feet high may show a stem hardly more than a foot in diameter. In such a case the foliage, for want of space, is also only scantily developed, and the ramifications are but short in proportion to the tallness of the stems. In the mast-like straightness of the trunk and the smooth whiteness of its bark, this superb tree imitates completely the variety *regnans* of *E. amygdalina*, of Southeast Australia, with which also, and perhaps solely, it enters into rivalry as the tallest tree of the globe. Even the loftiest trees may not have been found out yet in the secluded humid forest valleys, in which *E. diversicolor*, like *E. amygdalina*, rejoices most and luxuriates to the greatest extent. But possibly in the 200 miles of uninterrupted length of *Sequoia* forests, a few years ago rendered known to exist in Southern California, mammoth trees of *Sequoia Wellingtonia* or *S. sempervirens* may occur, which possibly excel in stupendous height even the famous individual trees of the Calaveras grove.

Big Trees of the West.—Case's "Botanical Index" gives the following record of some large trees growing in Indiana: *Chestnut.*—In Jackson County there are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 22 feet in circumference 2 feet above the ground, and the height to the first limb is 70 feet. *Sassafras.*—This tree attains a remarkable size on the Lower Wabash. One of these, one mile and a half west of Springfield, is fully 3 feet in diameter, and for more than 60 feet clear of limbs and knots. Its height in full is 85 feet. *Catalpa.*—In this same region and along the Wabash the catalpa grows slender and tall, and in great abundance. It is used for both fence rails and posts, and for durability stands next to the black locust. *Sycamore.*—The giant tree of Indiana, in all probability, is a sycamore in the White River bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than 5 feet in diameter. The tree is not quite round, but still it is quite regular.

Botanical Gardens.—A paper on the botanical enterprises of the empire was read, May 11, to the Colonial Institute by Mr. Thielton Dyer, Assistant Director of Kew Gardens. The lecturer gave a history of botanical gardens, which date from the middle of the sixteenth century, when Alfonso

d'Este, Duke of Ferrara, the patron of Tasso, set the fashion of making collections of foreign plants and flowers. The earliest public botanic garden was founded by Cosmo de' Medici, in 1544, for the University of Pisa. The following year one was founded at Padua. In France, the earliest botanic garden was founded at Montpellier toward the end of the sixteenth century; and in Germany, that of Giessen was established in 1614; and in the Low Countries, that of Leyden dated from 1577. In England the Royal Garden at Hampton Court was founded by Queen Elizabeth, and supported by Charles II. and George III. Those which followed and still remain were: Oxford, founded in 1632; Chelsea, in 1673; and Edinburgh, in 1680. The origin of Kew as a scientific institution was entirely due to the Hanoverian princes. During the reigns of George IV. and William IV. Kew was much neglected; but since that date, owing to the efforts of Lindley and Hooker, this state of things has been remedied. Plant distribution to all parts of the world is extensively carried out from the gardens, especially that of cinchona, caoutchouc, and Liberian coffee. The herbarium is the largest in the world. The example of Kew in the matter of museums and economic botany has been followed by Hamburg, Berlin, Ghent, Paris, Boston, and the English colonies. Recently the whole vegetable collections of the India Museum have been transferred to Kew. Mr. Dyer stated that one of the most striking features of the gardens was the enormous correspondence with the botanic establishments of the colonies.

An *Interesting Botanical Fact* has been discovered by M. Lemoine, of Nancy, who finds that the stigmas of double flowers are capable of fertilization by the pollen of single flowers, with the result of yielding seeds which in the majority of cases produce double flowers.

Setting Type by Telephone.

The London *Times* contains an article describing the system of telephonic reporting adopted by that journal, in order to have the latest and fullest report of the speeches made in the Houses of Parliament. Permission having been obtained from the Metropolitan Board of Works to lay down the necessary wires in the subway of the Embankment, a new connection between the House of Commons and the *Times* office was formed, and one of Edison's loud-speaking telephones placed at either end. The immediate result of this arrangement has been to bring the compositor at the machine into direct communication with the Parliamentary reporter at the House, and to enable the debates to be reported and printed from half to three-quarters of an hour later than had previously been possible. The notes made by the reporter can be read directly into the telephone receiver in a room adjoining the gallery either by the reporter himself when relieved or by another person employed for the purpose; and the compositor, at his machine in the office, sits with his ears in juxtaposition with the other terminal of the instrument. The plan which has been found the most efficacious for the purpose of shutting out distracting sounds of other kinds is to place the disk of the telephone above and behind the compositor, and then to arrange two tubes, each with two trumpet-shaped extremities, in such a manner that these extremities are applied at one end to the two sides of the telephone disk and at the other end to the two ears of the compositor. The compositor is also furnished with a speaking instrument, with a key for ringing a bell, and with a bell which is rung from the House, a simple code of bell signals, consisting of one, two, or three strokes, sufficing for the ordinary requirements of each message. The compositor announces by the bell that he is ready, receives a sentence, strikes the bell to indicate that he understands it, sets up the type with his machine, strikes the bell again for the reader to continue his dictation, and so on until the work is carried as far as time will allow. If there is any doubt or difficulty about the words, a bell signal will cause them to be repeated, or explanations can be sought and received by direct vocal communication. In this power, indeed, resides one of the chief advantages of the method, and one which ought to lead to greater accuracy than has ever previously been attainable. The names of people, places, etc., can be spelled out letter by letter if there is any doubt about them.

Ice Gorge at Newton, N. J.

An interesting ravine, in which natural ice remains throughout the summer, is attracting local interest at Newton, New Jersey. It lies at the foot of Blue Mountain, is several hundred yards long, from ten to thirty feet deep, with caves and clefts in the rocks, filled with ice. The shade at the gorge is described as very dense, the sun apparently never penetrating it. The bottom of the gorge is covered with ice, and the little caves and crevices are filled with it. The parapet of the mountain, like the Palisades of the Hudson, is very nearly perpendicular, and rises about 400 feet above the ravine, through which a current of cold air sweeps constantly. The thermometer, which registered in the nineties in Newton, marked 38° at the bottom of this gorge—too cold for one to remain there any length of time. A few feet from one end of the gorge a spring of the most delicious sparkling water bubbles up. It tastes slightly of iron, and is very satisfying to the thirst. The water in this spring stands at 34°. The owner of the farm on which the gorge is found, says that it is much resorted to for ice, so that by the middle of August but little remains except in the caves and deeper holes.

On the Advantages of Moistening the Air in Cotton Mills.

Considering the immense expenditure of brains and money during the last forty years by inventors, machinists, and manufacturers, in perfecting machinery used in the several processes of cotton manufacturing, one might be led to suppose that a mill, equipped with modern machinery such as is turned out by the best makers, would always produce goods of uniform weight and quality. Experience, however, shows that at almost any time there may be found in such mills a variation of from one to five or more numbers in the yarn, and from one to three per cent in the weight of cloth, and sometimes the same or more in width, and a quality far from perfect, although the average weight may be at or near the standard by taking a month's work together. Carding and spinning overseers regularly weigh roving and yarn several times a day, and after gears if need be; yet with all this care and watchfulness they are not able to prevent the variations noted, although there has been no change either in cotton or in the general operations of the machinery.

In the light of present knowledge it is unreasonable for manufacturers to expect or require machine builders to make machinery that will produce uniform and exact results at all times, so long as no means are taken to produce a uniformity of atmospheric condition in which to operate the machinery. This has reference to variations of climate, and to electricity and dryness. Frictional electricity is generated by the motion of wind, belts, pulleys, fliers, bands, cylinders, beaters, etc.; also by the friction of rolls, bearings, etc. Its effects upon the cotton fiber are to cause it to cling to beaters, cylinders, and cylinder aprons, and to puff up the sliver, so that when it passes through the even trumpet it delivers less actual fiber than intended, and less than it would if there was an absence of electricity, thus not only making variable sized yarn and cloth (as the electricity varies), but causing the work to run badly in the subsequent operations, which are set and calculated for a specific size of roving or sliver. In doubling and drawing there is a constant loss and damage to the sliver occasioned by electricity, which causes the fibers to stand out and catch on to and lap round the rolls. The electrical condition of the air varies much, and we have so little knowledge about it, and so few means of measuring it, that it is almost impossible to tell when and how much to alter machinery to correct its effects. Some means are needed in every department of a mill to absorb or destroy this disturbing element. Now it would seem that a remedy exists in moistening the air, thereby rendering it capable of conducting away the electricity as fast as it is produced.

A short time since, a well known and skillful American manufacturer had new cards of English make, which, when started, would take in cotton well enough, but the combs would not take it off the doffers until he had pails of water set all around the cards, and had watered the surroundings. The trouble was too much electricity, and carders often have similar experience with common cards, especially in dry and windy weather. We must always remember that dry air is a poor conductor of electricity. On the other hand, too dry air in some respects affects the running of the work in a cotton mill in much the same way as electricity, especially as regards the puffing-up of the sliver. Dry air absorbs the moisture from oil placed on bearings, thus depriving it of an important element of lubrication. Every band that drives a spindle ought to be, and is supposed to be, put on with just the amount of tension needed to run it properly. If the air at the time is dry, and changes to damp, then the band will be too tight, requiring more power to drive it, and more oil to lubricate it; while, on the other hand, if the air were damp and changed to dry, the band would become loose, and would not drive spindle to speed, and hence would make slack-twisted, poor yarn. It is well known that carding and spinning as well as weaving runs better in damp air; moisture gives elasticity to yarn. In weaving, warp threads are sized or starched to prevent their being roughed up by the action of the reed and harness, but the reed and harness will rough up and rub off much fiber and starch unless the air is moist enough to keep them in place. The sudden blows of the lathe in driving in the filling strains the yarn severely; so, unless there is some elasticity in the yarn, it is very liable to break, and of course causes imperfect work and loss of production. It is a common practice among weavers to moisten the yarn by placing a wetted cloth over the warp beam, especially if the warp be hard-sized. Most manufacturers now acknowledge the need of regular moisture, and some vainly try to obtain it in weaving rooms by blowing off raw steam, which usually gives much heat, but little water to dampen the air with.

In our climate, when it is dry weather, the air contains one or two grains of moisture to the cubic foot of air, and when damp, from five to twelve grains of water to the cubic foot of air, each depending upon the temperature. It is not claimed that a proper regular humidity will remedy the defects of machinery, but it is claimed that it will absorb electricity, or destroy its power to injure the proper manipulation of cotton, as well as give the most desirable condition in which to produce the best goods at the cheapest cost.—*The Universal Engineer.*

Crystallized Prussian Blue.

To the various forms of Prussian blue already known, such as soluble, insoluble, etc., we may now add a crystalline form. Prof. Gintl, in Prague, says that when freshly precipitated Prussian blue is treated with a slight excess of concentrated hydrochloric acid and gently warmed, it will dis-

solve. A larger excess of acid will dissolve it cold. The resulting solution has a faint yellow color, and when diluted with water the blue pigment again separates. If the solution be allowed to evaporate spontaneously at ordinary temperature, or is slowly diluted by the absorption of moisture from the atmosphere, the Prussian blue will separate as a crystalline sediment, which possesses a magnificent copper luster in reflected light, and hence a glass surface covered with a thin layer of this sediment looks like a copper mirror. When magnified somewhat this sediment is seen to consist of individual crystals, which have an intense blue color in transmitted light, but seen in reflected light glisten with a fine copper red.

In every position the crystals present quadratic faces to the observer, and being perfectly indifferent to polarized light, we must conclude that they belong to the regular, or isometric system, although the crystals were too small to be measured. Gintl did not obtain crystals large enough to permit of an accurate determination of the crystalline form, hardness, and specific gravity, but, if the experiment were carried out on a larger scale, and by conducting the evaporation or dilution very slowly, probably larger crystals will be obtained.

It is also of interest to know that what is called Turnbull's blue, formed by precipitating a ferrous solution with ferridcyanide of potassium, reacts in the same manner when treated with hydrochloric acid, and similar crystals separate. This fact favors the theory previously advanced that Prussian blue and Turnbull's blue are perfectly identical compounds. If a solution of oxide of iron containing an excess of hydrochloric acid be mixed with a solution of ferrocyanide of potassium, also containing hydrochloric acid, no precipitate is formed until diluted. With ferrous oxide and ferridcyanide, both containing hydrochloric acid, a pale yellow solution also results. In this solution sulphocyanides produce a red color, showing that the iron has been oxidized at the expense of the ferridcyanide, and then it unites with the ferrocyanide formed. This favors the identity of Turnbull's blue and Prussian blue.

What Constitutes a Conspiracy?

The preliminary contest in the St. Louis courts in the conspiracy suits of the Vulcan Steel Works against their workmen has been decided in favor of the company. The case is a somewhat peculiar one. James Tighe, Dennis Griffin, Michael Dimon, Martin Hanifin, Bart Fenton, Patrick Reiley, and Martin Hooley were employees in the converting department of the Vulcan Works. On the evening of the 5th of last April, when two heats of iron were partially melted, the cupola ladle filled with molten metal and the pits covered with cooling ingots, these men are charged with conspiring together and suddenly going out upon a strike for higher wages. This placed the Vulcan superintendents in a predicament, and they allege that, were it not for the timely arrival of a sufficient force of men at the works just at the proper time, the metal would have become hardened in the receptacles, causing the works to lie idle and putting them to a great deal of expense in placing them in working condition again. With the assistance of the new workmen they succeeded in escaping actual loss. The arrest of the parties named followed for conspiracy. Their attorney moved to quash the proceedings on the ground that they had committed no offense under the common law. The acting State attorney claimed that it was both a statutory and common law offense. The case was finally argued before Judge Cady, who delivered, at the session of the Court of Criminal Correction, the appended decision: "The statement contained in the information filed in this case, if true, constitutes, in my opinion, a clear case of conspiracy. It is doubtless true that there is no crime in the solitary fact that the several defendants agreed or conspired together that unless higher wages were paid they would cease work, but it is equally clear that for these defendants to confederate, conspire, and agree together to stop work under the circumstances and for the purposes alleged in the information, is an offense. It is true that the mere failure or a refusal to perform a civil contract is not of itself a crime. But the circumstances alleged in connection with the refusal of these defendants and others certainly constitute an offense. I am, therefore, of the opinion that the motion should be overruled and the defendants put upon their trial."—*Coal Trade Journal.*

Labor-Saving Machinery.

The *Shoe and Leather Reporter* thus sums up the labor-saving appliances which have been introduced into the boot and shoe manufacture within a few years:

To enter into a detailed description, remarks the editor, of these labor-saving devices would be an almost endless task, but a general idea can be gained from the following: Among the latest inventions is the hydraulic shoe press, with which one operator can sole 700 pairs of shoes per day. Next comes the beating-out machine, which is a most necessary adjunct to a large shoe factory. Then come several designs in power machines for trimming and planing the edges of soles of shoes, each doing the work of three men, and better than by hand. Next comes the sewing-welt, or turn machine, making a shoe as pliable and comfortable as one hand sewed, and it is hard to detect any difference, one machine being capable of making 120 pairs per day. Again, there is produced a lasting machine, whose work is simply perfect and wonderful. Then we have a new welt shoe machine, or aid to hand sewing, which pricks the holes and trims the sole, ready for

the workman to simply put in the stitches, making the boot or shoe a hand sewed shoe in every essential particular. Then the numerous wax and dry thread sewing machines come in, adopted for every variety of work, from the finest French kid or velvet embroidered slipper to the closing up of the seams of the heaviest stoga boot or brogan. Again, we have a patent vamp folding machine, which neatly and rapidly turns the edge of the vamp, leaving a neat and finished appearance, instead of a raw edge; heel-scouring and sand-papering machines are made in every variety; stamping machines for monograms on the soles, heel trimmers, and an endless variety of small but useful machines; peg cutting and nail rasping machines, that will clean the pegs and nails out of a shoe from heel to toe, from a child's shoe to a heavy boot, leaving the inside perfectly smooth, which do not disturb the crimp or injure the upper in the least.

Then we have the boot and shoe crimping machine, two entirely separate inventions, the boot crimper being capable of perfectly crimping 12 to 16 cases of boots daily, and better than can be crimped by hand, and the shoe crimper that can finish in a perfect manner over 400 pairs per hour. In leather machinery we have glassing, stoning, pebbled, and polishing jacks, tanning and stuffing mills; hide unhairing machines that will do the work of 4 to 8 men, taking out the lime, doing away with the objectionable bating or drenching, and doing 800 sides daily with ease. Then we have the wonderful scouring or hide machine, that marvel of skill and ingenuity; union and belt knife splitting machines; bark mills, capable of grinding many cords of bark, wet or dry, daily; tan presses that will press perfectly one cord of bark per hour, and leave it so free from water that it can be immediately used for fuel; the wonderful leather measuring machine, for giving positive and instantaneous measurement of skins or leather. Then there is a new machine for softening leather, by which every fiber is loosened and softened without injury, leaving the leather strong, soft, and flexible, besides hundreds of other machines which are now being perfected. Our boot and shoe manufacturers are enterprising, and are always ready to adopt any new thing that has actual merit, and the shoe factories of to-day present a marked contrast with those of former years.

Yield of Butter from Cream.

I have, for some time past, kept accurate account of the quantity of cream put into the churn and the butter taken out, and I find that one quart of pure cream, weighing precisely two pounds, will make one pound of butter, as near as can be figured. This is the thick cream, which is taken in an adherent, leathery skin from a shallow pan in which the milk is three inches deep, and has been kept until it is sour, but not thick. From cream taken from a pail eighteen inches deep, and which stood four inches deep on the milk, but which was semi-fluid, three pounds of butter was given by four quarts of the cream. This cream was in good condition for churning, and needed no water to dilute it. It was distinctly sour, having been skimmed from milk set thirty-six hours, and was kept forty-eight hours before churning. The churning was sixteen quarts, which yielded twelve and one-half pounds; the temperature of the cream was sixty-two degrees, and the time of churning was eleven minutes. The cows were Jersey and Ayrshire. The more solid cream was all from Jersey milk, was in the same condition as the other as to sourness; twelve quarts were put into the churn, and eleven pounds fourteen ounces of butter came out; the cream was too thick to churn without considerable water being put in. The temperature of this churning was sixty-five degrees, and the time eight minutes. There is no doubt that sour cream will make better flavored and more solid butter, and more of it, than sweet cream; the butter will also keep longer in good condition. Sweet cream butter is excellent, and may be exquisite, if very well made, for immediate use, but it deteriorates very rapidly, while sour milk butter improves by keeping for several weeks, if well made and well kept. But neither the milk nor the cream should be permitted to turn to "clabber," as Mr. Bonner terms it.—*H. Stewart, in Country Gentleman.*

Rome to have an Exhibition.

It is proposed to have an International Exhibition in Rome in 1885-86, and a journal has been started to further the project. An effort is being made to secure for the Exhibition outside Porta Pia and Porta Salara, on the north side of Rome, embracing the Villa Albani, with its fine collection of sculpture and Italian garden; the Villa Borghese, with its pleasant walks and gallery; the Villa Ludovisi, adjoining the walls, with its casino, and the Aurora of Domenichino; the Villa Patrizi; the Villa Torlonia; the Villa Ada—lately the king's property, but since bought by Count Telfener—which reaches to the edge of the Anio; and the tract lying between these estates, from the furthest of which the laud drops suddenly down to the Campagna, giving a splendid view of Soracte and the Sabine Hills.

A New Breed of Whales.

A whaling captain, lately returned from the Arctic seas, declares that a new breed of whales have made their appearance in those waters. They are supposed to have emigrated from the open sea at the pole. The skipper describes them as very much larger than the old whales, and very gentle and confiding. In former years when a whale was harpooned the rest of the herd threw up their flukes and made off. The new breed do not seem to mind in the least the capture of one of their number.—*N. Y. Evening Post.*

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.

Wanted—Second-hand Baxter Steam Engine. Address J. W. Held, South Argyle, N. Y.

5 in. Telescopes, achromatic glasses by Wray, London, 185; 12 1/4 in. diam. Reflector, \$60; and all other sizes; finest quality. Ramsden & Co., 610 Arch St., Philadelphia, Pa.

Sample Specialties wanted for Export; notions, fancy goods, toys, etc. Address W. B., Box 773, N. Y. city.

We want Velocipede Wheels.—Manufacturers of same will please send us their price lists at once. We think some improved cast hub for these wheels will suit us best. United States Manuf. Company, Chicago, Ill.

Wanted—Parties with Capital to Manufacture on Royalty, or other ways, a Patented Article, suitable for the Carriage Hardware Trade. Address P. O. Box 630, Ramford, N. I.

Asbestos Board, Packing, Gaskets, Fibers, Asbestos Materials for Steam & Building Purposes. Boiler & Pipe Covering, Asbestos Pat. Fiber Co., limited, 191 B'way, N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole m'frs., H. Lloyd, Son & Co., Pittsburg, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 36, Jersey City, N. J.

Our new Stylographic Pen (patented), having the duplex interchangeable point section, is the very latest improvement. The Stylographic Pen Co., Room 13, 169 Broadway, N. Y.

Advertising of all kinds in all American Newspapers. Special lists free. Address E. N. Freshman & Bros., Cincinnati, O.

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., 32 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.

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

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros. 381 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 A. B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, 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 92 and 94 Liberty St., New York.

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

Blake "Lion and Eagle" Imp'd Crusher. See p. 13.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Forsyth & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Peck's Patent Drop Press. See adv., page 14.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See adv. page 13.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 63 Broadway, New York.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Friable's ad. p. 23.

For Separators, Farm & Vertical Engines, see adv. p. 28.

For Patent Shapers and Planers, see illus. adv. p. 28.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 29.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

Hollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

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

Silent Injector, Blower, and Exhauster. See adv. p. 45.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N.Y.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 15,000 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. 43.

For Alcott's Improved Turbine, see adv. p. 45.

Air Compressors. Clayton Sim. Pump Works, B'klyn, N.Y.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dodgeon, 24 Columbia St., New York.

For Superior Steam Heat Appar., see adv., page 45.

Millstone Dressing Machine. See adv., page 45.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 413.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 45,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 45.

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. 45. Totten & Co., Pittsburgh.

NEW BOOKS AND PUBLICATIONS.

DIGEST OF PATENTS ON CULTIVATORS.

Some time ago we had occasion to notice a valuable digest on seeding machines and implements, compiled by James T. Allen, of the Patent Office, Washington. Encouraged by the demand for that work, the author proposes to issue in two volumes a digest of all the cultivators and attachments belonging to that kind of machine, which have been patented up to July 1 of the present year. They number over 5,700, and each invention will be illustrated, similar to the engravings in the *Official Gazette*. The full claims of each patent will be given, and when necessary for a better understanding the invention extracts from the specification will also be made. To manufacturers of agricultural implements and for patent solicitors and lawyers this new digest will be found very useful. Mr. Allen, whose address is Lock Box 699, Washington, D. C., would like to hear from persons who wish to subscribe for the work.

A DIGEST OF PATENT OFFICE DECISIONS, 1869-1879. By William Edgar Simonds. Washington, D. C.: W. H. & O. H. Morrison.

A digest, in classified and chronological order, of substantially all the reported decisions of the Commissioners of Patents to January, 1880. The cases omitted are mainly those the reading of which, in the authors' opinion, throws no light on any principle of law, mechanics, or practice. The digests appear to have been made with painstaking care and sound judgment, and the volume cannot fail to be handy and serviceable to all having to do with patent law, whether inventors or attorneys.

ARCHAEOLOGICAL INSTITUTE OF AMERICA. First Annual Report of the Executive Committee, 1879-80. Cambridge: John Wilson & Son. 8vo, paper, pp. 26.

The Archaeological Institute of America has been formed for the purpose of promoting and directing archaeological investigation and research—by the sending out of expeditions for special investigation, by aiding the efforts of independent explorers, by publication of reports of the results of the expeditions which the Institute may undertake or promote, and by any other means which may from time to time appear desirable. Though but a year old the Institute has secured a large and influential membership, and has undertaken work which proves it worthy of a place in the front rank of American scientific societies. Its first year's contributions include a valuable essay by the Hon. Lewis H. Morgan, on the system of house building practiced by the Indians; Mr. J. T. Clarke's studies of the monuments and ruins along the Greek shore; and Mr. W. J. Stillman's investigations at Monte Leone in Italy. The Institute's work laid out for the present year includes an expedition to Colorado and New Mexico, to investigate the institutions and history of the Pueblo or village Indians of those regions.

THE CABINET MAKER AND UPHOLSTERER'S COMPANION. By J. Stokes. Philadelphia: Henry Carey Baird & Co. \$1.25.

This is a fifth edition of Mr. Stokes's work, with valuable additions, covering the treatment, finishing, restoration, and improvement of wood surfaces. The book is well indexed and has a full table of contents.

SEWAGE DISPOSAL. By Henry Robinson. London and New York: E. & F. N. Spon. \$1.50.

Reviews briefly the experience of British engineers and sanitarians in the disposal of water-carried sewage, no attention being given to any other methods of dealing with the waste matter of towns. Where suitable land is available Mr. Robinson advises irrigation, otherwise he would employ chemical treatment; but he does not encourage any extravagant expectations of profit from either method.

LETT'S POPULAR ATLAS. IN MONTHLY PARTS. London: Letts, Son & Co.

The first part of this promising series contains a double sheet showing the world on Mercator's projection, and a map of the British Isles. The maps are carefully drawn, clearly engraved, and well printed; size 17 inches by 14 inches. The price, seven pence a part of three maps, is very low for work so well executed. Ocean depths are shown by graded shades of blue; ocean currents by distinctive white and blue lines; ocean cables and main lines of land telegraph, by red lines. The plan includes special geological and railway maps. The first year's issue will cover the principal divisions of the globe; and subsequent parts will supply maps more in detail until the atlas is made complete. On special maps, roads, lighthouses, and other useful details will be given.

THE METRIC SYSTEM AND INTERCHANGE OF WEIGHTS AND MEASURES. By D. Beach, Jr., and E. A. Gibbens. New York: G. P. Putnam's Sons. 75 cents.

Apparently designed for a school book, to familiarize boys and girls with the names and comparative values of metric standards. The book is neatly made and seems likely to be useful.

THE AMERICAN BICYCLE. By Charles E. Pratt. Boston: Issued by the Pope Mfg. Company, 87 Summer street.

A second edition of Mr. Pratt's manual for "the Observer, the Learner, and the Expert" in the use of the "wheel," to which the author has added an appendix for 1880. The new matter reviews the recent progress of bicycling at home and abroad, improvements in the manufacture of the wheel, recent races, the rules of American bicycle clubs, and offers forty-five new excursion routes, with stations and distances.

MEMOIRS OF THE SCIENCE DEPARTMENT, UNIVERSITY OF TOKIO, JAPAN, VOL. II. On Mining and Mines in Japan. By C. Netto, M.E., Professor of Mining and Metallurgy. Tokio, Japan: Published by the University.

In the order of their importance the minerals of Japan are coal, copper, silver, gold, iron, kaolin, petroleum, sulphur, lead, antimony, tin, cobalt, quicksilver, marble, jasper, agate, amber, graphite. The yield in 1877 was nearly eight million cwt. of coal; 75,423 cwt. of copper; 56,213 cwt. pig iron; 354,392 oz. silver, and 11,281 oz. gold. The production of antimony is increasing. The yield of lead, tin, copper, quicksilver and petroleum, is not sufficient for home consumption.

THE MOULDER'S AND FOUNDER'S POCKET GUIDE. By Fred. Overman, M.E., with supplement by A. A. Fesquet. Illustrated. Philadelphia: Henry Carey Baird & Co. 12mo, cloth, pp. 342. 1880.

A new edition of the late Frederick Overman's successful treatise on moulding and founding, the construction of melting furnaces, the composition of alloys, etc., to which Mr. Fesquet has added nearly a hundred pages on statutory and ornamental moulding, ordnance, malleable iron castings, and other matters of importance to moulders and founders; also a careful index giving eight or nine hundred references.

CATALOGUE OF BOOKS AND PAPERS RELATING TO ELECTRICITY, MAGNETISM, THE ELECTRIC TELEGRAPH, ETC., INCLUDING THE RONALDS LIBRARY. Compiled by Sir Francis Ronalds, F.R.S., and edited by Alfred J. Frost. London and New York: E. & F. N. Spon. 1880. 8vo, paper, pp. 564.

As early as 1816 Sir Francis Ronalds demonstrated by actual experiment the possibility of an electric telegraph, and showed that frictional electricity could be practically used for conveying messages over long distances. It was his misfortune, however, that in this particular his views and experimental demonstrations were a quarter of a century in advance of those of his scientific and official countrymen. After thoroughly proving the practicability of his scheme he submitted his plan to the First Lord of the British Admiralty, Lord Melville. After some delay he received from Mr. Barrow (afterwards Sir John Barrow) Secretary of the Admiralty, a curt note informing him "that telegraphs of any kind are now wholly unnecessary; and that no other than the one now in use will be adopted." This note was dated August 5, 1816, at which time the government was supporting a semaphore telegraph between London and Portsmouth, costing \$10,000 a year, and usable only five or six hours a day in clear weather. For many years Sir Francis Ronalds devoted much time and money to the collection of a library of works relating to electricity, magnetism, and the telegraph, and the compilation of a catalogue of all such publications. After his death the collection was presented to the English Society of Telegraphic Engineers, and the catalogue, containing over 19,000 entries, has now been printed by the society. Its value to all specialists in this department of science goes without saying.

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) F. J. B. writes: I am an architectural designer, and finish all my drawings, shaded elevations, etc., only in pencil. The pencilling, however, rubs off too easy and dirties and spoils the drawing very badly. I should feel pleased to know of some liquid to pour over it and thus prevent the rubbing off of the pencilling without spoiling the drawings, which are stretched on drawing board. A very thin aqueous solution of gum arabic is sometimes serviceable. Thin collodion (plain) does very well; or white of egg dissolved in dilute ammonia water by agitation with broken glass.

(2) J. B. G. writes: I would like to know what is the best material to use for gluing two pieces of wood together that will stand boiling water without injury. A. Try a solution of gum caoutchouc in bisulphide of carbon. Before using add to it about one per cent of chloride of sulphur (dry). The solution should have about the consistency of molasses. Give the cement plenty of time to harden in the joint.

(3) W. H. D. asks: What can I clean copper coins with and keep them bright? A. Remove grease by dipping in strong hot potash lye, then clean with cyanide of potassium solution (aqueous); or dip bright in nitric acid and rinse immediately in running water. To keep them bright, oil them, or coat with a thin pale alcoholic solution of pale shellac.

(4) C. A. H. asks what the dry paper is, or what it is saturated with, which gas men use for testing the gas for sulph-hydrogen, or impurities. A. Saturate unglazed paper with a strong aqueous solution of acetate of lead, and dry. When moistened and exposed to gas containing sulphuretted hydrogen it is blackened.

(5) C. W. A. says: My house is connected with water main by 800 feet of 1, 1 1/4, and 1 1/2 inch iron pipe. The main is of wood wound with strap iron, and extends through the streets of the town. Now, I am going to put up lightning rods, and I want to know if it will give sufficient ground if I connect with the water pipe? What kind of rod, points, and fastening will be best? Please give me the method of destroying stumps by means of crude petroleum. A. The 800 feet of iron pipe will make a fair ground connection. Use several separate rods composed of one-quarter inch copper wire, one to each chimney and to each gable point. Attach the rod directly to house by staples; no insulators. Let each rod be in one piece; but if jointed see that the joints are well soldered. Carefully solder the terminals of the rods to the water pipe. Point the rods with a file. The important thing is to have several rods—the more the better—each rod thoroughly connected with the ground conductor, which in your case is the iron water pipe. As to stumps, bore deep with an auger, fill the hole with petroleum; repeat till the wood is well saturated with oil; then set fire.

(6) W. R. S. writes: Please inform me of some simple and efficient way to detect the presence of electricity passing from one body to another. A. For merely detecting a slight current there is nothing simpler than a bell telephone. If a current passes it will be readily detected when the connections are broken or established. If you desire to measure the current a galvanometer will be required.

(7) J. S. C. asks: 1. How can I make a good cheap foot walk? Would a walk made of lime and gravel last any length of time? If so, how is the right way to mix and lay it? A. See concrete floors and concrete walks in SUPPLEMENTS, Nos. 33 and 36. 2. Is a battery used with the telephone described in SUPPLEMENT, No. 142? A. No, unless a transmitter is used. 3. Can a battery be made of copper and zinc immersed in blue vitriol and water that will be strong enough to plate and electrotype with? A. Yes. See batteries in SUPPLEMENTS, No. 157, 158, 159.

(8) E. M. asks: Please tell how to test a steam boiler correctly. How many pounds water pressure will it need to safely carry 70 lb. steam pressure? A. Use a forcing pump. The government rule requires the test to be 30 per cent greater than the pressure of steam to be carried. For 70 lb. steam test, pressure 105 lb.

(9) F. F. asks: Please inform me in your next paper which of the different shafts in a factory is called the main shaft? A. The shaft, which first receives the power from the engine or water wheel, and from which the power is distributed to the various other shafts of the factory.

(10) T. D. writes: I have just completed a catamaran or double hulled sail boat, the plans for which I took from your SUPPLEMENT, No. 105. It has proved a great success, being very speedy and safe, and has in smooth water attained the speed of over 17 miles an hour.

(11) J. G. X. writes: In making a taper tap of say one sixteenth inch taper to the inch, I claim that after turning the taper you let the poppet head stand in the same position, and placing your thread gauge against the tap, set the lathe tool by the taper. The other party claims that after the tap is turned taper, you push back the poppet head to its true center, then set the tool with your thread gauge, bring the poppet to the taper again, and cut the thread. This I claim will not bring the thread square with the tap. Which is right? A. You are wrong. The pitch of the thread is taken on the center of the tap and not of the surface.

(12) L. W. asks: 1. What kind of a motor would be the best to run a fan 12 inches long, 8 inches through, shaft pulley 1 inch, with about 200 to 300 revolutions per minute, running for about 6 hours without attendance? A. A caloric engine, if you have neither steam nor water power.

(13) E. H. asks for a formula for making that paste or sticky substance for catching birds, something which will work as well in winter as in summer. I think it is called birdlime; if not, what is bird lime? A. Boil the middle bark of the holly, gathered in June or July, for six or eight hours in water, until it becomes tender; then drain off the water and place it in a pot under ground, in layers with fern, and surround it with stones. Leave it to ferment for two or three weeks, until it forms a sort of mucilage. This is pounded in a mortar into a mass and well rubbed between the hands in running water until all the refuse is worked out; then place it in an earthen vessel and leave it for four or five days to ferment and purify. This is an old fashioned receipt. Birdlime is also made from mistletoe berries and the bark of the wafaring tree.

(14) F. C. S. writes: I have an old house which has not been painted in twenty years. Can you tell me of a sizing or something to put on before I paint with lead and oil, to fill up with and which will not scale? A. Sizing is not used. In painting old work the painter first cleans it with the brush and knife, stopping out the

knots with red lead or shellac, filling cracks and holes with putty, and bringing forward new patches and decayed parts with a coat of priming (white lead thinned with about 3 parts of turpentine and one of oil with a small quantity of drier). The first coat (priming) is then applied expeditiously. It consists of white lead mixed with turpentine only. Then the finishing coats, thinned largely with oil, are applied.

(15) F. L. C. writes: I want a coloring matter, black, to mix with oils for use on leather. It must be either a liquid or something that will dissolve readily and thoroughly and leave no sediment. Lamp black I have found open to the last objection, besides not being a strong black. Cheapness desirable, and it must be of negative property that will not injure leather. A. Try soluble nigrosine dissolved in warm glycerine.

(16) C. R. J. asks (1) whether there is any kind of ink, and what it is, if any, that can be used with equal success with the copying pad shown on page 325, Vol. 41, of SCIENTIFIC AMERICAN, that will not fade as does the aniline violet. This seems to be the color used most, as the most copies can be taken with it according to present experience. Is there a way to render this color more durable? If so, how can it be done? A. The higher grades of soluble coal tar blues are more permanent. The fading cannot be avoided. 2. Who was the inventor of the process? A. The credit of the invention is claimed by several people. It probably belongs to a Viennese chemist.

(17) E. M. G. asks where to get the metallic cadmium. Is it an expensive metal? A. Cadmium is quoted at \$4 per lb. It can be obtained through any chemist.

(18) P. H. C. asks: What will remove the disagreeable smell arising from boots, shoes, etc., worn during the summer months? A. Try a strong solution of sulphate of iron—coppers—in water.

(19) C. L. S. writes: In one of your last issues I see a receipt for making a perfectly insoluble glue. Can you give me the proportions of tannic acid, glue, and water? A. The glue will require for its precipitation about an equal quantity (wt.) of tannic acid, water enough to dissolve the glue.

(20) H. asks: 1. How can a hemlock sole leather tan shoe bottom be changed to an oak tan (which gives the bottom a white appearance)? A. The difference is due chiefly to the coloring matter of the former. Try coating with a paste of chloride of lime and water, and after washing with a little hyposulphite of soda solution, finally rinse with water, dry and roll. 2. What is the article used in shoe factories known as French yellow? Is it turmeric? A. Extract of French berries, fustic, quercitron, and turmeric are used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. S. S.—Clay slate, contains arsenical pyrites—mispickite.—B. K. D.—The glimmering particles in the gravel are mica fragments of quartz and pyrites.—R. A. L.—We have not seen the samples.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

June 22, 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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