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MANUFACTURE OF HYDRAULIC AND STEAM SAFETY HOISTING MACHINERY.—OTIS BROTHERS & CO. N. Y.—(See Page 243.)

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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 276.

For the Week ending April 16, 1881.

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THE UTILIZATION OF KNOWLEDGE.

It is a suggestive circumstance—suggestive to young inventors at least, and encouraging withal—that the very first manifestation of electric action observed by men, namely, the attraction which an electrified body has for light objects, is the last to be signally utilized in the arts; and that, too, not in some new or original art by some learned investigator in electrical science, but by a couple of boys, and in an industry which is as old as civilization.

The development of what is called frictional electricity by lightly rubbing a poor conductor, like amber, wax, glass, or hard rubber, by another like silk or fur, is and long has been an initial experiment in all courses of electrical instruction. It is the earliest experiment made by or for the student; and one of the substances commonly mentioned as well suited to exhibit the phenomena of electrical attraction and repulsion is bran.

The desirability of some more effective means of separating bran from flour has been recognized by millers, doubtless, from time immemorial. Latterly the desire has been very strongly felt. As shown in last week's issue of this paper, frictional electricity satisfies the requirements of the case absolutely and with singular economy and simplicity of apparatus. That its availability should have waited so long for recognition is little less than marvelous, since multitudes of millers have been as familiar with the property of electricity now utilized as with the needs of the flour mill.

Why was the electrical bran separator never invented before?

While it may not be possible to give a specific answer to this question, it is still possible to discover causes which must have contributed materially to keep the now so obvious application of electricity from being made earlier. Chief of these, it is safe to say, is the non-suggestiveness of familiar knowledge. Men are apt always to overlook the means which lie nearest at hand and seek assistance from afar. When a new discovery is made in science scores of practical men stand ready to consider whether it can be put to useful purpose.

The possibilities of any old truth they are apt to assume to have been already explored, forgetting that it is but a little while since the utilization of knowledge became the occupation of any considerable class of men, and that new developments in the arts are now constantly opening up opportunities for applying old knowledge—often knowledge which previously gave no promise of utility.

Thus, while the newly discovered phases of electrical action—electro-magnetism, thermic electricity, galvanic action, dynamo-electric energy, and the rest—have become influential factors in the arts, frictional electricity has lain neglected, every one tacitly assuming that its possible utilizations must already have been worked out.

The moral to the young investigator, who would like to be an inventor, is plain. Do not wait to acquire a large store of knowledge before you begin to seek original applications for it. As each new fact or phenomenon comes within the range of your investigation be sure to consider its possible utilization. Think how it may be practically applied. Use it as a factor of invention, and follow it, if you can, through the range of its present applications. You will find again and again that your inventions have been anticipated by others; but that should not be a source of discouragement. Invention is the best school for the inventor. The ability to invent grows with the practice. Great inventions are never the first fruits of a mind unpracticed in the art, and our greatest inventors have achieved their most valuable results only after years of more or less successful effort. The young man who invented the electric purifier is no exception to this rule. The habit of inventing is a long-established one with him, early developed and urged on by an inherited tendency to invent, his family being gifted in that direction.

His knowledge of electricity was limited, but he had been in the habit of applying his learning as he got it, and that habit brought him the opportunity to make the invention referred to. One of the great mistakes of students, fostered unfortunately by the conventional methods of instruction, lies in making education acquisitive mainly. The idea is to get knowledge, much knowledge, and then, if possible, apply it, forgetting that the mental habit acquired by the search for knowledge for its own sake is rather calculated to make the man an intellectual miser, a hoarder of information, than a practical user of knowledge. Much less information, coupled with a habit of turning information to use, is worth infinitely more to the possessor and to society.

Knowledge acquired as an end in itself is a delusion, a source of weakness rather than power. It is apt, also, to be of a shadow elusive sort, in no way to be compared with the real knowledge which remains after each fact or idea has been worked over, tested, weighed, and measured by practical application.

And the student who aims to become something more than a learner, namely, a doer, possibly a creator, must never allow himself to think that the possibilities of any fact or phenomenon have been exhausted, so far, we mean, as its utilization is concerned. The habit of inventing, in other words, seeking novel and useful applications for the knowledge gained, should go hand in hand with acquisition. The apparent progress will not be so rapid, may be, as by the method of cramming, but it will be real and not liable to backslidings, while the possible profit of it will be incomparably greater.

THE AMERICAN FISH CULTURISTS' CONVENTION.

The tenth annual meeting of the American Fish Culturists' Association was held in this city during the last days of March. A large number of the representative students of the finny tribes, fish breeders, and dealers, were present, and several valuable papers were read.

The first communication was from the vice-president of the association, Mr. George Shepard Page, now in England, with special reference to the possible introduction of American shad in English waters. The present head of the British Fish Commission, Professor Huxley, is much interested in the project.

A practical paper on fish culture in this State, by the Superintendent of the New York State Hatchery, Mr. Seth Green, discussed at some length the question of hybridization. An account was given of experiments in that direction made at Caledonia, particularly with brook trout and California salmon, the results being very encouraging.

A paper by Mr. H. D. McGovern, of Brooklyn, recounted experiments on carp in New York waters, dwelling at some length upon the capacity of these fish to endure cold weather in shallow water. Professor Goode stated in the subsequent discussion that carp are best adapted to Southern waters.

A valuable paper, by Dr. T. H. Bean, was entitled "A Contribution to the Biography of the Commercial Cod of Alaska." The true cod, tomcod, polar cod, pollock, and halibut, are found in profusion, and of good size, near many parts of the Alaska shores, and are sure to become of great commercial value.

In "Epochs in the History of Fish Culture," Professor Goode gave a chronological record of the changes and discoveries in fish culture from its beginning in Germany in 1741. Fish culture began in France in 1820; in England in 1832; in the United States in 1853.

Thursday's work comprised the reading and discussion of several important papers and the election of officers, as follows: President, Robert B. Roosevelt; Vice-president, George Shepard Page; Treasurer, Eugene G. Blackford; Corresponding Secretary, Barnet Phillips; Recording Secretary, James Annin, Jr.; Executive Committee: Frederick Mather, of Newark; Professor G. Browne Goode, of Washington; Samuel Wilmot, of Ottawa, Ont.; Benjamin West, of New York; Thomas B. Ferguson, of Baltimore; James Benkard, of New York; and John B. Morgan, of Brooklyn.

A statement, compiled by G. M. Lampheare, gave the amount of the various kinds of fish received in the wholesale markets of New York from March 1, 1880, to January 1, 1881. The value of last year's supply of fish in this city was given at $3,339,827.

Papers were read by Mr. Frederick Mather on "Fish Living in both Fresh and Salt Water," and by James Annin, Jr., giving his experience with "Poachers," at the Caledonia trout ponds, the most mischievous being kingfishers, herons, bitterns, muskrats, and minks. A paper by Professor Goode, entitled "Light in Europe on the Eel Question," led to a considerable discussion of the spawning habits of European and American eels, which appear to differ materially. The last paper was an elaborate one by Professor W. O. Atwater, on "Food Properties of Fish," the more important facts of which will be given elsewhere.

PIGS AND BABIES.

It is a pity that babies have no market value.

For some years the Agricultural Department has been trying to impress upon the western hog raisers the need of more carefully guarding against contagious diseases among swine, and to prove the need of such care, the department has taken pains to gather much statistical information with regard to the losses entailed by hog cholera and other swinish diseases.

For some reasons unexplained certain foreign commercial agents in this country have become greatly exercised over the untimely death of so many pigs, and have misused the information furnished by our statistical authorities to create something like a panic among pork dealers abroad, the ostensible fear being that public health may be grievously endangered by the use of American pork, the real fear obviously being the loss of trade and profit through American competition.

The result is that pigs have risen to the dignity of being the subject of international diplomatic correspondence.

The annual loss of from six to sixteen per cent of the swine of a great State like Illinois is unquestionably a sad thing to contemplate, especially as the average weight of the dead animal appears, from the official tables, to be about 100 pounds, showing that the most of the untimely dead are pigs, and too small for the pork barrel.

Doubtless this swinish death rate might be, and ought to be, materially reduced. Doubtless, too, it will be reduced; for pigs have a market value and will grow to be salable hogs if kept in health, on the average, a year or so longer.

When we think how much the pigs of the future will have cause to be thankful for the present flurry in pork, and among pork dealers and statesmen, tracing thereto the greater care taken of their health and comfort, we can not but wish that it were possible to raise a corresponding excitement about the physical wellbeing of babies.

Last year there died in this city nearly 15,000 children under five years of age—human pigs, so to speak. To make the comparison strictly fair it would be necessary to take the deaths of children under twelve or fifteen years of age. The percentage, however, is excessive enough when we take five years as the limit; and the fact that no one except the bereaved parent pays much attention to these unreasonable losses shows how unfortunate it is for the babies that they have no commercial value.

We do not pitch upon the infant mortality of New York for illustration because the figures are relatively excessive here, but simply because they are handy. In some years thirty per cent of the deaths in this city are of children in their first year, and ten per cent more die in their second year. If the life of pigs, or lambs, or colts, or calves, was anything like as precarious, the newspapers would be full of discussions of causes and of means of prevention. When half the babies die before reaching maturity we talk of reconciling ourselves to the dispensations of a mysterious Providence!

The terrible and needless loss of life among children is not confined to our cities. The mortality is excessive throughout the country. The ignorance of people with regard to the proper care and feeding of children is simply appalling; and the indifference commonly manifested with respect to the spread of infectious diseases among children, especially in rural districts, is not unfrequently murderous. A man living in a healthy country will take no discredit to himself—will rather think himself a proper subject for sympathetic commiseration, when he confesses that he has buried five out of six children or eight out of ten. If he were to have no better "luck" with his colts and calves, his neighbors would probably organize, for the benefit of his stock, a local society for the prevention of cruelty to animals.

Ignorance is criminal when it is associated with an assumption of duty requiring knowledge and leads to loss of life; for example, when a man, who lacks the knowledge essential to the right management of an engine, pretends to be an engineer, and through incompetence brings on an explosion in which some one is killed.

The assumption of parental duties without an effort to discover the proper care of infancy, now the usual custom among us, is as likely to be fatal as to undertake ignorantly the care of a steam engine; and we trust the time will come when it will be popularly recognized as quite as criminal. That good time for babies would not have been delayed until now if they had been, like pigs, a factor of commerce.

If there are so many children that half of them require to be killed to give opportunity to the rest, the killing ought, at least, to be done with discretion, picking out the least desirable specimens for that fate, as we do with kittens. To lose half, and that at haphazard, is as uneconomical as it is morally intolerable.

CHARGES FOR HANDLING GRAIN IN NEW YORK HARBOR.

The investigation by the Assembly Canal Committee of the method and cost of handling grain for shipment in this city brings out some facts of general interest. The great elevator business is the growth of recent years. In 1860 there were no floating elevators and but two or three warehouse elevators, which charged 10c. a hundred for trimming, their storage business furnishing their profits. In 1861 the warehouse elevators charged one-quarter cent a bushel, the floaters three-eighths cent. The next change was three-eighths cent for the former and one-half cent for the latter; then one-half cent and five-eighths cent respectively; then five-eighths cent and three-quarters cent. Then the charge was made three-quarters cent for both for the sake of uniformity. In 1875, in consequence of the reduction of canal tolls, the rates were reduced to one-half cent a bushel, where they remain with occasional rebates. Another half cent per bushel is charged for weighing. If the grain is blown and screened for preservation, the charge is one-quarter cent additional, but last year only a small quantity of grain was blown. The charge for stowing the grain is from $7 to $8 per 1,000 bushels. The grain storage capacity of Brooklyn is 16,500,000, and in New York at the New York Central Elevator 2,500,000. The great elevators at Jersey City add several millions to the storage capacity of this port. The charge for elevating includes ten days' free storage. About 3,000 bushels can be elevated in an hour.

The charges in New York are less than in Chicago, St. Louis, Detroit, Buffalo, Toledo, Baltimore, Boston, and Philadelphia. There is no practice of charging shortage on our canal boats. Our weighers are accurate, and weigh closer than in any other city. They do not charge a shortage whether there is shortage or not. Experience shows that there is always a shortage of about half a bushel to every 1,000. The average shortage at a Brooklyn warehouse last year was about four bushels to 8,000.

The charge for storage after ten days is a quarter cent per bushel. In Baltimore, Boston, and Philadelphia it is three-eighths cent. There are about nineteen storage elevators in New York and Brooklyn, and about forty floaters. During a large portion of the year, one-half of these could do the business. The stationary elevators in 1880 elevated about 48,000,000 bushels.

Another witness who had been in the storage and elevator business for thirty years estimated that from eight to twelve million dollars is invested in storage elevators and about five millions in floating elevators. That is exclusive of the railroad elevators. One-half the grain goes through the railroad elevators. His stores and elevators are valued at from five to six million dollars. He elevated 5,300,000 bushels last year, about one-third of which was blown. He has a double elevator which can discharge from 6,000 to 8,000 bushels an hour.

A witness in the lighterage business testified that the lighterage charge is one and a quarter cent per bushel for all points in the harbor. Out of this the lighter must pay one-half cent for unloading. It is estimated that 8 000 bushels pay $100 for lighterage. After paying expenses the lighter has left $20, less shortage, which is the cheapest terminal charge in the world.

THE INTERNATIONAL EXHIBITION OF ELECTRICITY AT PARIS, 1881.

An important circular relative to the Exhibition has been issued from the Department of State at Washington, under date of March 31.

It will be remembered that the late Congress failed to make any provision for the representation of the United States there, notwithstanding the public interest which must attach to such an Exhibition and the importance of having this country properly represented, to say nothing of questions of international courtesy.

Accordingly the President has appointed an Honorary United States Commission to serve as the official channel of communication between American exhibitors and the French General Commission at Paris.

The commission thus appointed will consist of the Assistant Secretary of State, as Acting Commissioner General; George Walker, Honorary Executive Commissioner; George E. Gouraud and Charles R. Goodwin, Honorary Commissioners. All communications in regard to the admission of applications and requests for forms, and generally all correspondence in relation to the preparation and exhibition of articles, should be addressed (postage paid) to the Acting U. S. Commissioner-General. Correspondence for the American Commission in Paris should be addressed to Mr. George Walker, Executive Commissioner of the United States, U. S. Consulate-General, Paris, France.

Exhibitors will have to bear all expenses of packing, shipping, and transportation of exhibits, delivering them at the Palace of the Champs-Elysées between July 1 and August 1, the latter date being set for the opening of the Exhibition, which will continue till November 15.

There will be no charge for space or flooring, and but a limited charge will be made for motive power. Exhibitors will have to defray all expenses of installation and immediate care of their exhibits. Favorable provision is made for the protection from piracy of all inventions or designs capable of being patented.

The time for receiving applications has been extended to May 15, and to insure seasonable transmission applications should be sent to the Department of State, at Washington, not later than April 20.

An International Congress of Electricians will be held in connection with the Exhibition, commencing Sept. 15, in the Trocadero Palace.

The Congress and the Exhibition cannot fail to draw to Paris the representative investigators and inventors in electrical science and art the world over, as well as their most important and instructive inventions and apparatus.

It is to be hoped that the United States, which have contributed so much to the recent progress of the telegraph, the telephone, the perfection and utilization of the electric light, and other practical applications of electricity will be adequately represented.

AN INVENTION WANTED FOR UTILIZING FLAX REFUSE.

The rapid increase of flax raising in the west, particularly in Minnesota, has made the disposition of the residue of the plant, after the separation of the fiber, a matter of considerable interest. The bulk of this rough woody matter is very large; and in a country where fuel is scarce it would be of great benefit to the cultivators of flax if the flax brakings could, by pressure or otherwise, be made into a substitute for firewood. We are informed that the stoves mostly in use among the Minnesota cultivators of flax are made of Dutch tiles. The question is whether the flax refuse can be economically compressed for use in such stoves. The problem would seem to be worth considering by inventors, as we are assured that a simple machine for the purpose would find a ready sale among the flax growers, and it could probably be profitably adapted also to the utilization of other waste fibrous materials.

If any of our readers has such a machine to sell or feels disposed to invent one he may find it worth while to communicate with our informant, the editor of the *Mennonitische Rundschau*, Elkhart, Indiana.

Another International Exhibition.

An International Exhibition of power and work machinery for trades and dairy purposes is to be held in Altona, near Hamburg, North Germany, from August 18 to October 17, 1881. The object of the exhibition is chiefly the improvement and development of the smaller trades and the dairy. It will consist of four groups: I. Power machines for trades; II. Work machines and tools for trades; III. Products of trades manufactured by the machines and tools of I. and II.; and IV. Machines and implements for dairies. The awards will be medals of silver and bronze and honorable mention. The chairman of the local committee is H. C. Nothnagel, town deputy of Altona. Forms of application may be had at the offices of the committee, Königsstrass 116. Ground and wall rent for exhibits range from two to ten marks a square meter. Though specially designed to revive the now depressed "smaller trades" of North Germany, this exhibition may offer some attractions for American manufacturers of trade tools, implements, and machinery.

The Jeannette Search Expedition.

Lieutenant R. M. Berry has been ordered to command the steamer Mary and Helen on the proposed Arctic expedition in search of the Jeannette. He has been furnished with a list of the naval officers who have volunteered for this service, and he will have a choice in the selection of the officers and crew. Lieutenant Berry commanded the Tigress in search of the missing members of the Polaris crew. He is a native of Kentucky, and is thirty-five years old. Among the appliances that will be added to the ship will be an observatory balloon, from which it is expected a view of thirty miles can be had if it reaches the altitude of balloons sent up in this climate. Bombs will be used in the progress of the search to give sign of their presence in the Arctic. The vessel is not to winter in the Arctic except to promote the search for which she is sent out, nor then except in a secure harbor; nor is she to remain more than one winter away from home.

Sabino Berthelot.

This eminent naturalist died November 22, 1880, at Santa Cruz de Teneriffe, at the advanced age of 86½ years. He retained in his old age the enjoyment of his intellectual faculties, and only a few weeks before his decease had contributed to the *Revista de Canarias* an extensive, learned, and interesting paper upon the "Trees and Woods of the Canaries." Many of his researches related to the advancement of the Fortunate Isles, where he lived for about sixty years. In the early part of his life he was the director of the celebrated Botanical Garden of Orotava. In 1828, in conjunction with the celebrated naturalist, Phillip Barker Webb, and others, he was engaged in the production of that splendid series of works, the "Natural History of the Canary Islands." Not least among the treasures of the Astor Library, in this ctiy, are the six large quarto volumes, under the title just named, full of beautiful drawings, many of them colored. These books give some idea of the vast amount of careful labor which M. Berthelot and his admirable coadjutor, Webb, expended upon that remarkable task. Our limited space prevents a notice of the many other important scientific labors in which M. Berthelot was engaged.

He was Consul of France, Member of the Legion of Honor, an officer of the French Academy, Member of the Society of Natural Sciences and Geology, and of all the principal scientific societies of the Canaries and of Europe. He was a clear, accurate, and able writer. His life was a most useful one. In his adopted home, Teneriffe, he was greatly beloved. His memory will long be cherished as a benefactor

The Earl of Caithness.

James Sinclair, F.R.S., Earl of Caithness, who died suddenly in this city, March 28, was a man of considerable scientific ability and withal an inventor who had reason to be proud of his attainments. His principal invention was the ship's compass which bears his name. The Caithness gravitating compass is one of the steadiest known to navigators, and is widely used. He perfected a steam motor for macadamized roads, acting as his own engine-driver when testing it. He also invented and patented a tape loom by which the weaver was enabled to stop any one of the shuttles without stopping the loom. This invention was pronounced unpractical at first, but after a short trial in a Lancashire factory, it was found to answer the purpose better than the old device, and has since been universally adopted in the manufacturing centers of North England.

Of late years the Earl has traveled largely in this country and Europe, has written somewhat, and delivered many scientific lectures.

Colonel E. A. Roberts.

Colonel E. A. Roberts, the inventor and patentee of the successful torpedo for oil wells, died after a brief illness, in Titusville, Pennsylvania. Colonel Roberts was a man of great enterprise as well as ingenuity, and had much to do with the development of the Pennsylvania oil region.

Carl Weyprecht.

Carl Weyprecht, the Austrian Arctic explorer, died at Vienna, March 29. Weyprecht and Julius Payer were joint commanders of the Austro-Hungarian Expedition in the "Tegetthoff," which discovered Franz Josef Land after months of drifting with an ice floe, in which the Tegetthoff was abandoned in August, 1874.

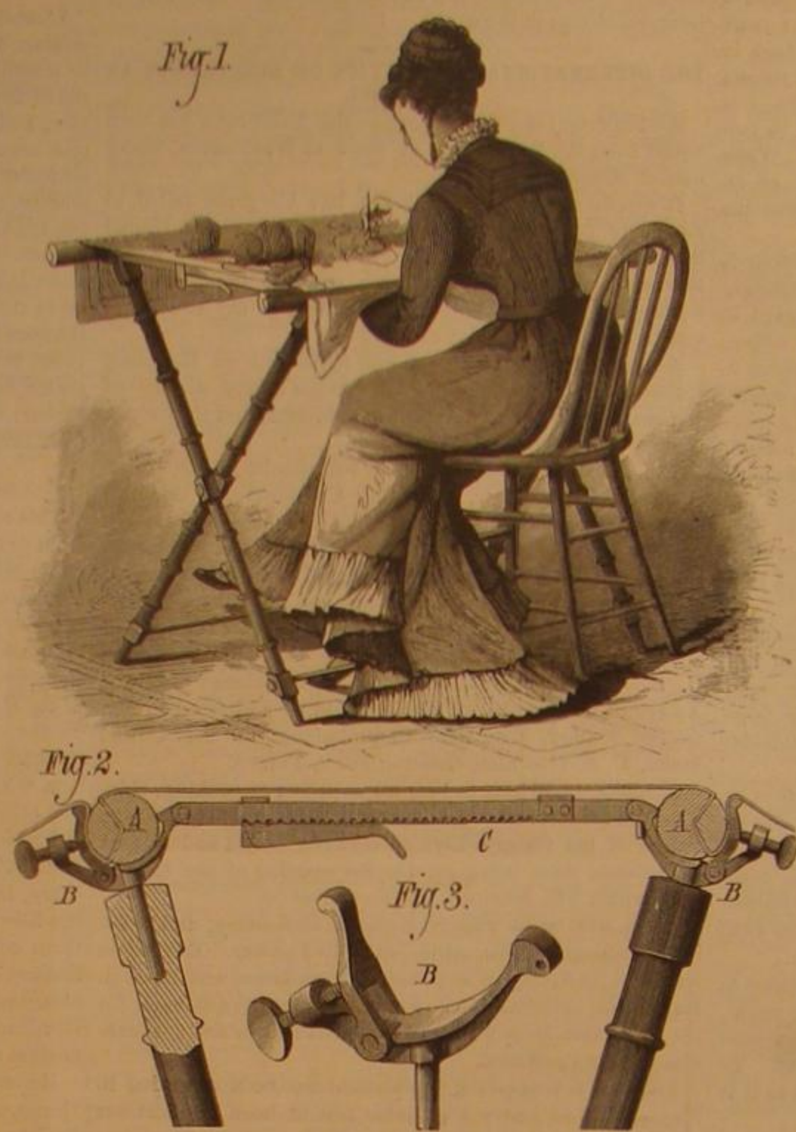
THE fire which occurred in the works of J. A. Fay & Co., of Cincinnati, on the morning of the 6th ult., proved to be less disastrous than at first supposed. The large Corliss engine and boiler, the new four story brick shop, over one hundred and fifty feet long, and portions of another large building were saved. In order to meet the emergency occasioned by the fire additional factory facilities have been secured which give a capacity to work four hundred men. We are informed that, should it be found necessary in order to keep up with orders, a set of night and day workmen will be employed. This company has commenced the erection of extensive buildings, which will be completed, equipped, and in operation within the next ninety days.

NEW EMBROIDERING FRAME.

The annexed engraving represents an embroidering frame, which affords every convenience for needlework of this class, and is also very light and compact, and capable of being folded into small compass for transportation or storage. The invention consists of two pivoted crossed legs, having at their upper ends clamps of a peculiar form holding horizontal bars, which are divided longitudinally to receive the canvas or other material upon which the work is to be done. Fig. 1 gives the general appearance of the frame, and shows the manner of using it. Fig. 2 is an end view of the upper portion of the table, showing the ends of the bars, A, and the screw clamps, B, fitted to the upper end of the leg and connected with its fellow on the opposite side by an extension rod, C, formed of two iron bars sliding together, one of them being provided with a series of notches or teeth, which are engaged by the short arm of a lever pivoted to the other. By means of this device the two bars, A, which hold the canvas are pushed apart so as to strain the material sufficiently to work upon.

The great advantage of this frame is that it will receive a fabric much larger than itself, in fact of any size, and a portion of it of suitable size to work on may be readily put under the proper tension. In addition to this the matter of shifting the fabric is rendered very simple, it being only necessary to loosen four thumb screws, and then place the fabric in any desired position.

This useful device is the invention of Mr. C. E. Bentley, Nos. 39 and 41 East 13th St., New York city.



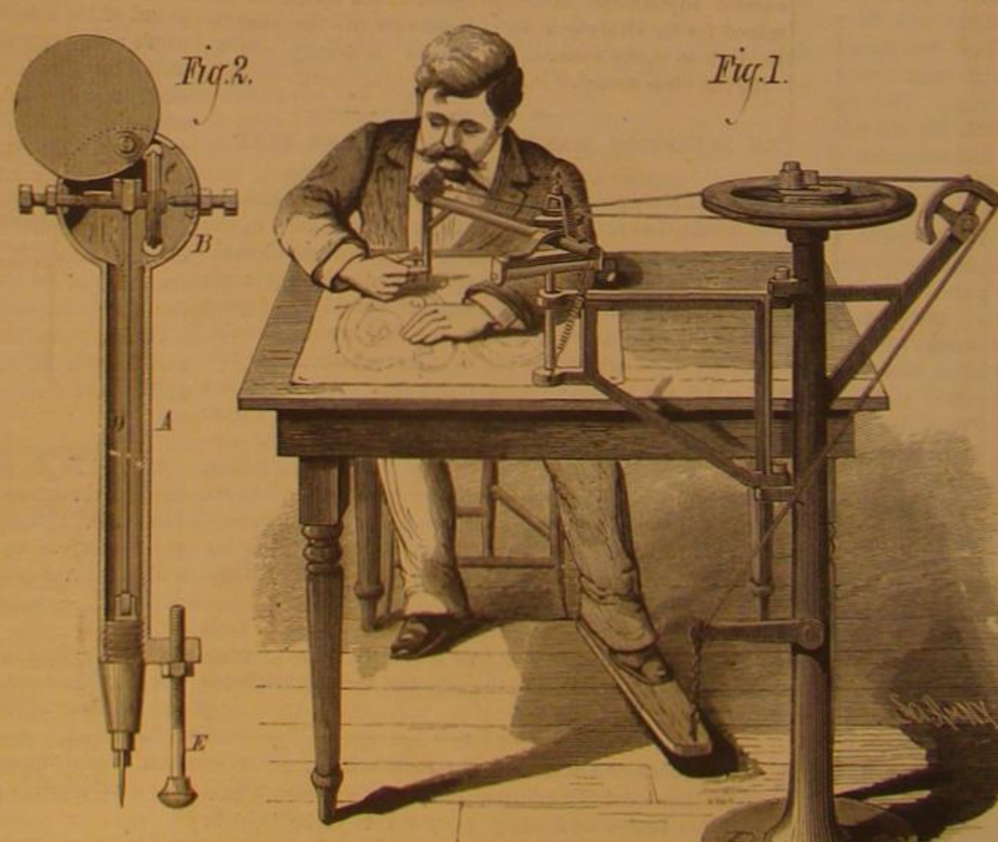
BENTLEY'S EMBROIDERING FRAME.

NEW PERFORATING MACHINE.

A simple and effective machine for perforating patterns for various purposes, such as stamping textile fabrics for embroidery, stenciling designs for fresco and fret saw work, is shown in the annexed engraving, the complete machine being shown in Fig. 1, and the perforating pen being represented in detail in the enlarged sectional view, Fig. 2.

The machine, as will be noticed, is self-contained, and the arm which carries the perforator is jointed so that it may be moved with perfect freedom in any direction over the face of the table upon which the paper to be perforated is laid, and at the same time the needle is held rigidly perpendicular, insuring a uniformity in the size and direction of the holes. This support renders it perfectly easy to control the guiding motion, as none of the weight is supported by the hand. The vertical standard supports the driving wheel, which revolves in a horizontal plane, the wheel being driven by a treadle through the medium of a straight lever and a strap attached to a bell-crank lever. The power of the driving wheel is transferred to a small countershaft above the second joint of the arm, and a belt extends from a pulley on the countershaft to the crank shaft of the perforator. The perforating needle is actuated by the crank on this shaft, so that it reciprocates vertically with great rapidity. The guide or tube containing the needle carries an adjustable rounded button, which rests upon the paper and regulates the distance the needle penetrates the paper. The stroke is sufficient to perforate 20 thicknesses. By means of this simple and ingenious mechanism the design is quickly made in small perforations, through which the impression is made upon the textile or other substances by rubbing in chalk, or by the use of stencil ink. All the parts are interchangeable so that if worn they may be easily replaced.

Further information may be obtained by addressing the inventor, Mr. C. E. Bentley, Nos. 39 and 41 East 13th st., New York city.



BENTLEY'S PERFORATING MACHINE.

A Remarkable Passage.

One of the quickest passages recorded between England and the United States has just been accomplished by the White Star Liner Britannic. This steamer, which is one of the finest vessels on the Atlantic service, sailed from Queenstown on Friday week at 4:30 P.M., and arrived at New York on the following Friday morning at 2:30 A.M., having completed the passage in six days and ten hours.

Gas Engines.

At a recent meeting of the Society of Engineers, London, a paper on the above subject was read by Mr. Charles Gandon. In his opening remarks the author pointed out that the use of gas as a motive power was still in its infancy—which was not a matter for surprise, seeing that its introduction for lighting purposes dated only from the commencement of the present century. So early as the year 1794 a patent was taken out in England for producing an inflammable vapor force by exploding the spirits of tar or turpentine in closed vessels. Between that date and the year 1860 various other inventions were patented for obtaining motive power by the explosion of various mixtures, gaseous and solid; but all the descriptions appeared to be somewhat obscure as to the nature of the explosive compounds to be used, and the means for obtaining them. Carbureted hydrogen, a constituent of coal gas, was mentioned by some; but it appeared that the idea of using coal gas, as manufactured for lighting purposes, for working engines, was first practically applied in the Lenoir gas engine, patented in 1860, and first introduced to this country at the Exhibition of 1862, where it attracted much attention. The general principle of the Lenoir engine was described, and it was pointed out that, among other defects of this engine, was the damage done to the working parts by the sudden and violent nature of the explosions, and also the necessity of the use of electricity for the explosion of the charges of gas and air with which it was worked. The latter objection had, however, now been overcome in more modern engines by the employment of gas jets for the same purpose.

Mr. Gandon then described the Otto and Langen gas engine, the chief improvement in which is, however, due to the compression before ignition of the charge of mixed gas and air, by means of which it is found that a much larger proportion of air can be employed than would form an explosive mixture at ordinary atmospheric pressures, and the force thus obtained is gradual and conti nuous, instead of sudden, resulting in an economy of gas and more regular working. Advantage has been taken of this discovery in several of the more recent designed gas engines. The general principles of the Otto—which are now well known—were described, and its consumption of gas stated to be at the rate of about 21 cubic feet per horse power per hour, as compared with from 40 to 70 cubic feet with former engines.

The author then pointed out that on account of the heat generated by the explosions in gas engines, it was found necessary to surround the cylinders with water, and that advantage had been taken of this in a gas engine called the Eclipse, in which the water, instead of being allowed to escape when heated, was stored in a separate chamber, where it generated steam, which was used, together with the gas, to assist in working the engine. Attention was also drawn to the Bisschop gas engine, which is meritorious chiefly on account of the small sizes in which it is made, and which range from one-half man, or one-eighth horse power, upward. This engine, although not comparatively economical in its consumption of gas, was recommended, on account of its simplicity and small size, as available for purposes to which it would otherwise be impossible to apply mechanical power.

Referring to comparisons which have been made between the cost of working steam and gas engines, the author observed that the practice had generally been to take the total cost of working in each case, including labor, and that, when this was done, the comparisons were invariably in favor of gas engines; but he pointed out that such estimates were liable to be misleading. As a gas engine requires little or no attention, the results of the comparisons depend mainly upon the amount estimated for labor for the steam engine with which the comparison is made. With a small steam engine it would in most cases be unfair to estimate the whole time of one attendant, while, as the size increased, the proportionate cost of attendance would diminish. Instances were given where estimates had been made showing steam engines to be from twice to seven times more expensive in working than gas engines; but although such estimates had doubtless been made with every care, they only served to show that it was impossible to frame such comparisons so as to be generally true. By comparing the costs of the gaseous and solid fuels it was shown that gas must necessarily, both theoretically and practically, be more expensive than solid fuel. When, however, the labor, wear and tear, and first cost were also considered, the conclusion arrived at by the author was, that for engines of small sizes, gas would always be the most economical. Even with larger engines, if the same economy could not always be maintained, circumstances would, in many cases, render gas engines the most advantageous and convenient, particularly where an engine was required for intermittent use.

Artificial Vaccine Lymph.

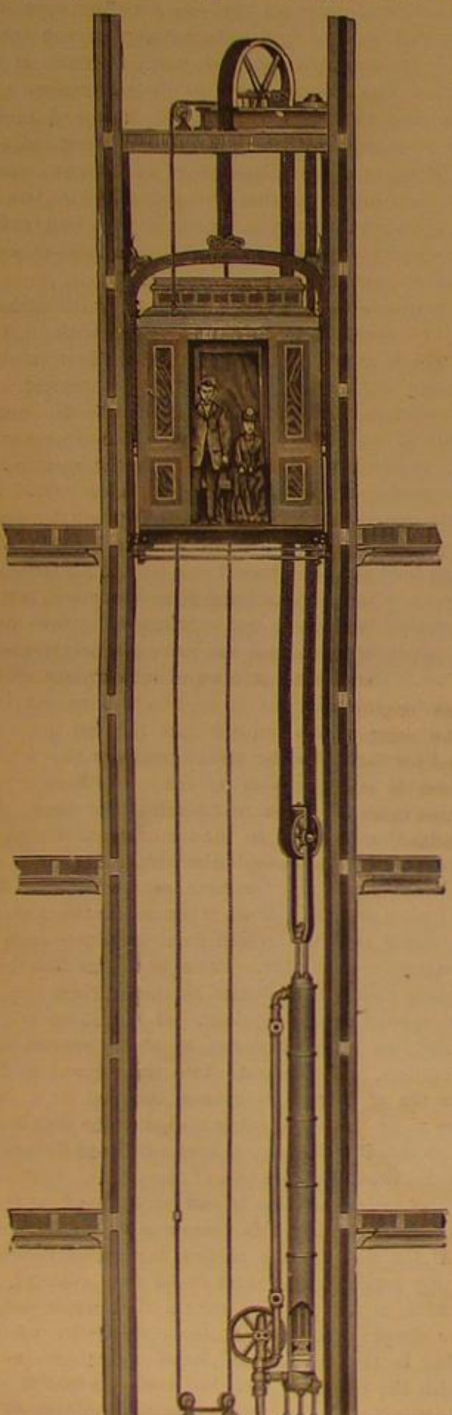
The success of Pasteur in cultivating the organic virus of chicken cholera in artificial solutions has suggested a like plan for cultivating vaccine organisms. It is expected that vaccine lymph so produced will be free from possible taint of septic, syphilitic or other noxious germs, which he lymph may contain when taken from living animals or men.

Mount Baker, Washington Territory, has shown slight symptoms of volcanic activity for several years. An unmistakable eruption is now in progress, causing some little consternation among the scattered settlers of that region. The display of fire and smoke is said to be magnificent as seen from Upper Sumas, about fifty miles distant.

AMERICAN INDUSTRIES.—No. 71.

THE MANUFACTURE OF HYDRAULIC AND STEAM SAFETY HOISTING MACHINERY.

The most eligible building sites in our large cities now command almost fabulous prices. The figures paid for a small lot on which to erect a warehouse in some parts of this city are equal to a very respectable fortune. On this account owners are generally putting up taller buildings, or changing those already erected, so as to give additional stories above the roofs of old-time structures. Thus, in New York city and some of the other large business centers of the country, the available space for offices, etc., is being doubled in a manner which would have been deemed entirely useless twenty years ago; it being hardly a stretch of language to say, as we now sometimes hear, that the city is being repeated in miniature in the clouds. And this has been made possible as a consequence of the introduction of improved elevators. By this means quick and convenient access is afforded to the several floors of a building, without calling for the loss of time and severe labor required to mount long flights of stairs. The devices by which this end has been attained are now represented by a complete system of machinery, brought to its present state of absolute safety, ease of operation, and thorough efficiency, through a long



SECTION OF ELEVATOR.

course of close observation and careful experiments. Accidents entailing loss of life or making cripples were in former years of frequent occurrence from the use of the common factory elevators, or hoists, which have been employed for generations. When builders, therefore, in their efforts to meet the modern demands, began to introduce passenger elevators in high edifices, it is not strange that they should have met with strong opposition. It was at first common to hear people say that they "would not trust their lives" in them. But the urgent necessity for such facilities has called forth a corresponding activity on the part of inventors and manufacturers, and the result is that the old prejudices have been almost entirely eradicated, as their causes have been completely removed. The improvements made in response to this demand have also been widely beneficial to the entire class of factory operatives, as employés now have no excuse for using the frail and dangerous hoisting machinery which was formerly the occasion of so much peril to life and limb.

Among those who first appreciated the importance of this matter, and bent their efforts to obtain a practical success, were the members of the firm now constituting the pioneer house in the business in the United States, Messrs. Otis Brothers & Co., of New York. Their establishment at Yonkers, for the manufacture of all that pertains to the erection of standard hydraulic elevators, with safety hoisting machinery of every kind, furnishes the subject of our leading illustrations this week, in connection with which, also, we give views of three prominent structures, conspicu-

MORSE BUILDING.

ous even in New York for their architectural features, in which these elevators are employed—the Boreel and the Morse buildings (used mainly by banks, insurance companies, and for suites of offices) and the New York Post Office.

The factory at Yonkers, a good illustration of which is shown on the first page, occupies a ground space of 2:0 feet square. It is nearly thirty years since the Messrs. Otis Brothers commenced the manufacture of hoisting machinery, and they at an early day experienced the difficulties so commonly met with in making improvements or getting uniform work where one has to depend upon varying degrees of skill and thoroughness, or insufficient appliances, in several different shops. They have, therefore, combined in this one establishment all the facilities which their long experience has suggested as necessary in every department of the business. Their workmen have been especially drilled in this specialty, they use no low-priced, poor quality materials, and all their productions have that thorough adaptation of parts, careful adjustment, and uniform strength which have obtained for the Otis elevators so large a share of popular favor through so many years.

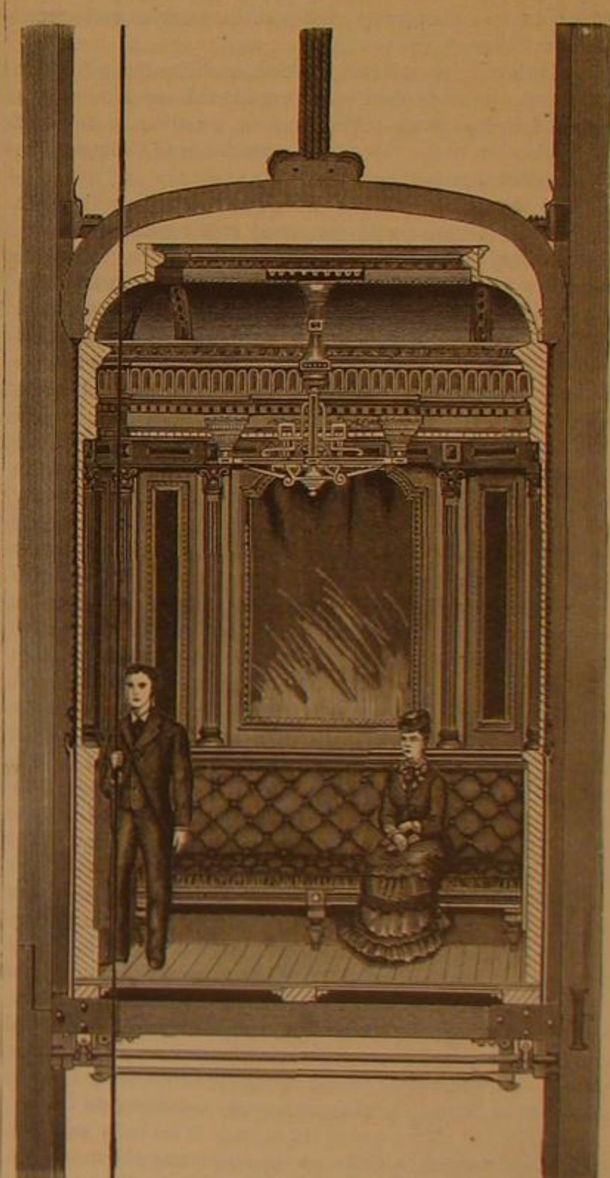
In the view given of the engine erecting room we have a

NEW YORK POST OFFICE.

representation of only one of ten different rooms in which the work of this department of their business is carried on. The variety of the machine work called for is very great, as, beside the numerous different constructions of hydraulic and steam elevators for hotels, offices, mercantile buildings, and residences, they furnish elevators and hoists for warehouses and factories, furnaces and mines, winding engines for inclined planes, screw and gear combination lifting powers, with many special modifications of engines and appliances to meet the demands for all kinds of service. In this work they endeavor to make each piece of every machine a duplicate of the corresponding piece in all similar machines, so that when a particular part may need replacing from wear or injury no delay or trouble need occur. So thorough, however, is the workmanship, so well adapted the strength of the different parts to do the work required of them, and with so little friction, that the instances are comparatively few where an elevator needs any repairs in the first five years, while many of them run for a much longer period in as good condition as when first started.

The testing room, shown at the bottom of the page, gives a view of the operations in a department of the utmost importance as affects both the safety and durability of all kinds of hydraulic hoisting machinery. All the pipes and cylinders are here subjected to a hydraulic pressure of much greater severity than they will ever be called upon to bear in actual use, and the gates and valves are carefully tried to see that they fit accurately and work smoothly and with precision. None of the machinery furnished by the firm is ever allowed to leave the establishment until it has passed this ordeal.

The principle on which the hydraulic elevator is operated will be readily understood from the section plan herewith.



HOTEL ELEVATOR.

The carriage is suspended by wire ropes, four or six in number, which pass over a fixed pulley above the highest point of the lift, and thence under a pulley connected with the piston rod of an upright cylinder, with which is a weighted block; the ends of the wire ropes are permanently attached at as high a point as the fixed pulley, but he weight of the car is about evenly balanced by the weighted block and the piston. The power required to make the lift, and the ease with which the speed of the elevator is regulated, both ascending and descending, may be readily understood with a knowledge of the simplest principles of hydraulics. The piston being at the top of the upright cylinder, and the car at the bottom of the shaft, the pressure of the water on the top of the piston, either from a street main or a tank on the roof, forces the piston down and causes the car to rise, the water in the cylinder under the piston being allowed to flow out at the bottom at the exact rate which it enters at the top. In this way the air pressure, as well as the weight of a column of water of the diameter of the large cylinder, and as high as the tank on the roof, or its equivalent in the head from which it is supplied, is exerted in lifting the load. The cylinder, however, is always full of water, the escape valve at the bottom being open only when the piston is falling and the water coming in at the top; when the car is going down and the piston rising the escape valve at the bottom is closed, and the water is simply forced thereby through a circulating pipe from the top of the cylinder into an opening at the bottom, thus only being transferred from above to below the piston, and the car and piston cannot move any faster than the gates and valves will allow this flow to take place. These valves can be fixed so that the speed at which the car is to move can be exactly regulated, independent of the will of the operator in the car, who, by opening and closing them with the hand rope, governs the running. As a further provision, however, against too rapid movement, either ascending or descending, a governor is run by the passage of the elevator which can be set so as to regulate the speed as desired, and the maximum speed desired by the proprietor can in no case be exceeded.

What this rate shall be is to some extent a matter of choice with users of the Otis hydraulic elevator, for while many other machines are so made that they must be run slow, the Otis elevators may be readily run as fast as 250 feet a minute, and everything work smoothly, without jar or friction, and with no excessive wear on any of the parts.

Of course, the size of the cylinder and the head under which the water is supplied to it must determine the maximum load. The usual arrangement for passenger elevators is to have the motion of the car only twice, or at most three times that of the piston. This reduces the friction and the wear to a very small item as compared with what it is when the car is made to move from eight to twelve times as fast as the piston, as is the case in some of the elevators used. The cylinders are of cast iron, three-fourths of an inch thick, bored out true and smooth, and, from their upright position, they experience but slight wear, and no lodging place is afforded for sand or gritty matter in the water to make trouble with the packing.

No higher commendation, indeed, could be given for any system of elevators than was awarded this machinery by a board of United States officers which reported in favor of their adoption in the Government buildings at Chicago. In their report they say:

"One source of accidents, which we are told are the most frequent in elevators with the usual steam-hoisting drums, and are very dangerous, is the holding up of the car while descending, caused by obstructions which may be accidentally placed so as to project beyond the floors at the doors of exit, perhaps temporarily holding the car up while the engine continues to run, thereby unwinding the ropes until they become slack, leaving the car entirely without their support; then, of course, when the temporary obstruction yields, the car must fall. Such an accident cannot possibly occur with the Otis machine, as the piston in the hydraulic cylinder is in such cases held in position by the solid column of water above and below it; consequently the ropes are kept perfectly tight under strain, and no motion of the car can take place until the car is released from the obstruction. No water can escape when the valve is set to allow the car to descend, so the car must be held; and, when allowed to move, can only descend as fast as the water can pass through the pipes and valves. If the 'shipper' or starting rope breaks or becomes detached so that the valves cannot be closed by the operator in the car, the piston can only descend to the lower part of the cylinder, raising the car to the top of the lift, where it will be held safely until the rope can be readjusted or the valve be opened by hand. For the same reason the car cannot by any means be raised too high."

The factor of safety in these elevators, and this is the first condition in all devices of this class, seems to be so large that no accident can possibly happen for which the machinery will be at fault. One of the most approved forms of safety catches is provided, and the number of cables is many times greater than are actually needed. There are no cogs, racks, belts, or shafts liable to fracture, and the power is exerted in a direct up and down motion. The economy of the system is also well shown by the operation of the four elevators used in the Boreel Building, where the constant flow of business in its 150 offices makes the crowds in its halls and corridors often equal to those on the Broadway sidewalks. A pump in the basement keeps a 4,000 gallon tank on the roof supplied with the water necessary to run all these elevators, and a similar tank at the bottom receives the discharge, the same water being used over and over again, with scarcely a perceptible loss from evaporation. It is believed that from 80 to 90 per cent of the power of the water is actually utilized in these machines, and their smooth and noiseless working certainly goes to show that the amount of friction has been reduced to a minimum.

Beside their hydraulic elevators the Messrs. Otis Brothers have been for many years prominent in the manufacture of steam hoisting machinery, in which they have introduced many improvements, covered by a wide range of patents. These machines, as they now offer them, represent the results of over twenty years' investigation and experience, and their universal or factory elevator is to be found in nearly every manufacturing town in the country. They are provided with governor attachment, cut gear and pinion, safety drum grooved for wire rope, self-oiling loose pulleys and boxes, safety ratchets, wire lifting and operating ropes, with all necessary chains and connections. They do not recommend these machines as passenger elevators, giving the preference to the hydraulic system for this purpose, but in factories where a large amount of power is in constant use they are in great favor, and are employed for both freight and passengers. Where the only power needed in a building, however, is that which is required in running the elevator the hydraulic system is much cheaper, as a comparatively small pump, working all the time, will keep the tank supplied, and the elevator can at any time by called upon to lift its maximum load. Their self-oiling loose pulley, patented in 1865, has proved a most important adjunct in this branch of their business, and it has now been in use for a sufficiently long period to thoroughly demonstrate its practical usefulness. These pulleys are now used on all the hoisting machines of the firm.

These elevators are now in daily use in most of the large cities of the United States and Canada. They are at present being put in three of the most notable structures just approaching completion in New York city—the United Bank building, corner of Wall street and Broadway, the London, Liverpool, and Globe edifice in William street near Wall, and the "Post" building in Beaver street, of which George B. Post is the architect. They are to be found in most of the recently erected prominent buildings devoted to public use, or for business offices, hotels, apartments, or private residences, as well as in factories and warehouses, and their simplicity, economy, and efficiency, united with the growing public conviction of their entire safety, render it extremely probable that the field of their future use will be rapidly and greatly enlarged.

The New York office of Messrs. Otis Brothers & Co. is at No. 348 Broadway.

Danger of Lightning from Telephone Connections.

The Cantonal Government of Zürich, having been applied to by a telephone company for permission to fix the supports of insulators on the tops of certain public buildings, applied to Prof. Kleiner for an opinion. The following is a summary of the chief points in his report:

1. The danger of lightning in houses over which telephone wires are stretched is not increased, but lessened, if the total conductivity of a wire is approximately equal to that of a lightning conductor. This condition is not always fulfilled under existing arrangements. It may be insured by very simple arrangements, such as the introduction of a special wire for the conduction of lightning wherever the number of wires of two millimeters in thickness running in the same direction is less than sixty. This should be insisted upon in all cases. Single connections running along the houses should be stronger than at present—as least as strong as telegraph wires.

2. As the properties of a telephonic plexus for attracting and conducting lightning extend over far wider tracts than those of a lightning rod, a strict regulation of their make and condition is necessary.

The use of telephones should be suspended during thunderstorms.—*Neue Zurich Zeitung.*

THE REESE FUSION DISK.

A few weeks ago we referred to a letter published in *La Nature*, and written by Mr. Jacob Reese, on the subject of his so-called fusion disk. This letter, it will be remembered, contained detailed statements of the alleged remarkable phenomena attending the severance of a bar. The inventor maintained that when a circumferential velocity of 25,000 feet per minute was given to the disk, and the bar to be severed was brought into close proximity, but not in contact, with the edge of the disk, a narrow groove was fused in the bar, which rapidly deepened, and ultimately divided it, but the melted metal was cold, would not burn the fingers, discolor paper, etc. The theory set forth was that the particles of air in proximity to the disk were propelled with a "melting velocity," and that in this way the bar was severed. We suggested that—giving all credit for sincerity—Mr. Reese was mistaken as to the action of the disk, and that it was nothing more or less than an ordinary cold saw,

except that the bar to be cut was rotated. Since writing this note we have received a piece of steel cut with the machine, and we annex an illustration of the work done, which we think—unless Mr. Reese can offer some satisfactory explanation—will prove conclusively the fallacy of all that he has advanced in this respect, as well as the very wild statement that hundreds of thousands of revolver chambers are finished off by it. The bar illustrated was cut in the manner prescribed by Mr. Reese, and with one of the machines he had supplied and received royalty for. It was found that until contact was established between the surfaces no effect of any kind was produced, but that when the disk was kept in contact with the bar, the latter was cut through in the rough manner shown in the drawing. None of the phenomena so minutely described by Mr. Reese were present, and the purchaser of the machine has been always unable to detect any indication of their existence. It will be noticed that the characteristics of the severance are: a burr around the circumference of the bar, radial lines upon the cut face produced by the hard contact of the disk, and a broken tongue of metal with sharp edges drawn out from the center. We shall be very glad to receive from Mr. Reese any explanation he may have to offer on the subject, and to give publicity to any well authenticated experiments which will serve to refute the conclusion to which the illustrations we have given incontestably point.—*Engineering.*

The Reese letter above mentioned was published in the Scientific American of April 2, 1881, and an engraving of the Reese machine was given in our Supplement, No. 260.

Correspondence.

The Reese Circular Saw.

To the Editor of the Scientific American:

Gentlemen, in your issue of April 2, I notice a very interesting communication from the pen of Jacob Reese, Esq., on the phenomena of his metal cutting disk, and after stating that a person may put his "hand in the stream of white and apparently molten sparks without being burned, and even white paper without discoloration," etc., while at the same time the sparks thrown into the atmosphere "more than five feet burn like a hot poker," he calls upon French and German scientists to explain "so wonderful a phenomenon." It appears to me that it may be thus explained. The periphery of the disk traveling through space of 25,250 feet per minute coming in close contact with a metal bar traveling in an opposite direction creates heat by friction sufficient to ignite the oxygen of the atmosphere, which is the supporter of heat, while nitrogen is the exact opposite. The intense heat produced creates at once a vacuum, and the air rushes in (or is forced in by atmospheric pressure) to fill up the vacuum produced, thus supplying a rapid and constant flow of oxygen, which is as rapidly consumed, so that the space below the point of fusion is largely nitrogen, which is heat extinguishing, so that the molten sparks are caught in a heat-extinguishing atmosphere and cool instantaneously.

The sparks, however, that happen to fly off instantly into the natural atmosphere come in contact with oxygen in its flight, which supports their heat until their velocity is so diminished that oxygen ceases to be its supporter.

For example, electricity is not heat, nor the supporter of heat, but in its rapid flight through the atmosphere, compressed at about fourteen pounds to the square inch, the friction produced ignites the oxygen, before which the most obdurate metals yield. Again, heat the end of a bar of iron at a forge or furnace to a white welding heat, and while at this high heat at once place it in a cold blast from a blower or bellows, which gives a large flow of oxygen, intensifying the heat, and the iron is not only fused but runs down into a pile, appearing like slag, the principle being substantially the same as the forcing a blast of air through molten iron metal and so intensifying the heat as to burn out the carbon as well as base metals and minerals, this being the first step in the Bessemer process; and it matters not whether the heated metal is forced through the atmosphere or the atmosphere through the metal, the result is the same. Whether you swing the firebrand in the air or blow it with the bellows the result is the same; either intensifies the heat.

Mr. Reese claims that the metals do not touch each other in the fusing process. Well, if he makes this statement on the principle that no atomic particles touch each other, I have no argument to offer. But if he claims that the cutting or rotating disk is not affected by the cutting, *i. e.*, worn, I must decidedly take exceptions. If Mr. Reese will turn or dress the face of his disk flat, so as to present cutting or sharp corners, and then put it into use, he will find that the corners are soon worn rounding, and that in a short time the face will become rounding also, and the disk burr on its edges, so that it will make a kerf a full one-sixteenth of an inch wider than the thickness of the disk.

He may claim that this is caused by the heat fusing the edge of the disk, but this theory is very questionable, because if the disk fuses a particle it must of necessity melt away very rapidly on account of its great velocity.

But such is not the case, for the disk wears very slowly, for the simple reason that nearly its entire periphery is traveling in the air without heat enough to create combustion with the oxygen. Another evidence that it comes in direct contact with the metal to be cut is proven in the fact that while running in open air but little power is consumed in comparison with the power required while in the act of severing a bar of metal, and the larger the bar to be severed the more power is required. I have had experience in severing metal with rotary disks, and think that I know something about the principle. In 1870 I suggested the adoption of toothless disks to the manager of Messrs. Jones & Laughlin, at the American Iron Works, which was successfully adopted in cutting large bars of iron, and I think this was the first ever used in Pittsburg. At that time I recommended 23,000 feet per minute for the rim of the disk to run. Since that time they have come into general use.

J. E. Emerson.

Professor Bell's Reception.

To the Editor of the Scientific American:

In a recent issue of your paper you notice a "reception given to Professor Bell by the Mayor and Corporation of Brantford, England." For the credit of our little city, permit me to correct you. It was Brantford, Ontario, that tendered Professor Bell the reception. It was here also, I understand, that Professor Bell's first experiments were made, and Brantford claims the parentage of the telephone.

W. T. Mair.

Brantford, Ontario, March, 1881.

American Arctic Research.

One of the items of the Sundry Civil Appropriation Bill of the late Congress was $175,000 for an expedition to the regions north of Behring's Strait for the relief of the Jeannette and the missing whalers. The steam whaler Mary and Helen, of New Bedford, now at San Francisco, has been purchased for the purpose. The price paid was $100,000, thus leaving $75,000 to be used in making the vessel ready for the new service and in providing for her outfit.

It is announced that two other expeditions, under the direction of General Hazen, Chief Signal Officer, will be dispatched to the north next summer for purely scientific investigations. One of these, to be commanded by Lieutenant Greeley, of the Signal Corps, will go to Lady Franklin Bay; the other to the north coast of Alaska. The Washington correspondent of the *Tribune* says that Professor Baird, of the Smithsonian Institution, and Captain Patterson, of the Coast Survey, are co-operating with General Hazen and will each be represented in one or both of these expeditions. These enterprises are a part of polar observation in which several European nations are participants with this country. Russia has promised to occupy two stations, one at the mouth of the Lena in Eastern Siberia and the other on the New Siberian Island, which is some distance east of Wrangel Land. Sweden has promised to occupy North Cape in Finland. Denmark will establish a station at Upernavik, Greenland. Germany—though she has not made an absolute promise to do so—is expected to send an expedition to the island of Jan Mayen, east of Greenland. Holland will occupy the mouth of the Ob and Spitzbergen. Austria, represented by Count Wilszek and Lieutenant Weyprecht, will occupy Nova Zembla. Canada will probably occupy Melville Island. Italy will fit out an expedition to the Southern Hemisphere, and will probably select its location on Cape Horn. It is also expected that the Island of Georgia, in the Southern Hemisphere, will be occupied by an expedition from some other European nation.

Lieutenant Greeley's expedition will consist of three officers of the army and twenty-one enlisted men. It will be assembled at Washington, not later than the 15th of May, and in St. John's, Newfoundland, about one month later. It is expected that the expedition will leave St. John's about the 1st of July, and, touching at Disco, will take on board Dr. Pavey, the naturalist of the expedition, who has been in Greenland during the last winter collecting dogs, sledges, and other material for the expedition. Several teams of dogs will be taken from Disco and Upernavik with two Esquimau hunters. The vessel is expected to reach Lady Franklin Bay by the last of August, when, disembarking the party, it will return to the United States.

In addition to the scientific observations to be made by the permanent party, the northern coast of Greenland probably will be explored, and it is believed that the question as to whether Greenland is an island or a continent can be settled, and also whether land exists to the northward of Cape Britannia, the furthest point seen by the English expedition of 1865. The station is to be visited annually by vessels which will bring fresh supplies and a number of new recruits, in order that those unfitted for the work by reason of disease or otherwise may return to the United States. Lieutenant F. E. Kislingbury, of the 11th infantry, an officer who has already made a creditable record as a scientific man, has been designated as the geographer of the expedition. The third officer of the expedition has not yet been selected.

The meteorological observations of the expedition will be made by a party of four Signal Service observers specially trained for it. Mr. William Rice, of Washington, who will probably be the photographer of the expedition, has already had experience in photography within the Arctic circle. The enlisted force is to be selected from a large number of volunteers who have seen difficult service in the extreme Northwest, and who for that reason are better prepared to resist the rigors of the Arctic winter. Lieutenant Greeley's experience as a Signal officer will, it is expected, be found of great value in making communications from point to point. For this purpose he will use the Myers signal code, sending signals by the heliograph for distances of forty miles when the sun shines, and by flags and lanterns for shorter distances at other times. This will be an advantage which former expeditions have not possessed.

The Isthmus Ship Railway.

Captain James B. Eads has gone again to Mexico to have his Tehuantepec grant confirmed by the Mexican Congress. He will then go to Tampico, where some of his engineers are surveying the harbor for the United States Government. Thence he will proceed to the Isthmus, where he will spend a month and make a thorough inspection of the route for his ship railway. This done, he will sail for San Francisco, and, as consulting engineer of the State of California, examine the mouth of the Sacramento River. From there he goes to Oregon, where he will inspect the mouth of the Columbia River and Humboldt Bay. He will then return to St. Louis, and shortly afterward visit Toronto, where he will inspect the harbor at the invitation of the British Government, after which he will sail for England and Holland.

Captain Eads is thoroughly sanguine that his ship railway scheme will be successful. His advices from Mexico are even more favorable than he anticipated. He has three parties of engineers now at work on the Isthmus, and rapid advance is being made in the surveys. The Mexican Government is also aiding him in having eight engineers and a gang of seventy laborers engaged in surveying and cutting a passage 12 feet wide through the forest from a point on the Uspanara River, 35 miles from the Gulf, where the railroad is to begin, to the pass in the Cordilleras, 60 miles distant.

Captain Eads says the reason why he feels so sure that his railway will be built is because there are three possibilities, either of which is almost a certainty:

"I believe Congress will give us the legislation asked for—in fact, I am almost sure of it. But, if America will not do this—the Mexican concession names no particular government—I shall carry the grant to England, and see what will be done there. They will not be blind to its advantages if Congress is, and, in the event I can get no government aid, I can build the railway by private enterprise. I have canvassed the situation so thoroughly that I know this can be done, but I do not want to take this last alternative. The route by the Isthmus is only a thousand miles longer than the average of the transcontinental railway, and this furnishes a sure remedy against a carrying monopoly. But, if private enterprise builds the road, there is no guarantee that the same syndicate might not get control of the railway as was the Isthmian route, and thus prevent the competition so desirable.

Experiments upon the Temperature of the Breath.

It having been observed that by breathing upon thermometers enveloped in silk or other similar material, a temperature considerably above that ordinarily attributed to the breath is indicated, Mr. C. J. McNally has taken up the subject, and has communicated the results of his experiments to *Nature*, from which we extract the following:

He says that the question is entirely physical, and not physiological. Wrapping the thermometer is a new factor in taking the temperature of the breath, and is, *primâ facie*, the cause of the high temperature. Some further experiments which he has just completed place the matter beyond all doubt.

1. A current of air directed upon the bulb of a naked thermometer caused no appreciable rise; neither did the mercury rise when the bulb was enveloped in silk; but when it was enveloped in *dried* silk it rose several degrees. (The silk was dried by heat, and allowed to cool in a stoppered bottle.)

2. Three thermometers (1), bulb naked, (2) bulb wrapped in silk, (3) bulb wrapped in *dried* silk—placed in a current of *hot damp* air for some minutes, marked respectively 116°, 120°, and 123° F.

3. Two thermometers, one naked, the other wrapped in silk, were placed in a flask, with their stems passed through the cork. The flask was then immersed in hot water (about 150° F.). The naked thermometer rose rapidly, the covered one very slowly. After twenty minutes the temperature of the water was 120°, and the naked thermometer marked 112°, while the covered one registered only 108°.

4. Two thermometers, one naked, the second wrapped in dried silk, were fixed in a flask as for last experiment, but a little water was placed in the flask, which was then plunged into hot water as before. The naked thermometer rose rapidly at first, but it was soon outstripped by the covered one. The following was the result after some minutes. Water, 128°; naked thermometer, 118°; covered thermometer, 136°.

5. Two thermometers, one naked, the second enveloped in dried silk, were passed through a cover fitting a glass vessel which was carefully dried and heated, and the cover was cemented on to prevent the passage of moisture from the air. After an hour the naked thermometer had cooled to 81° (temperature of air), and the covered one to 83°. They were then changed to a similar vessel containing a little water; the covered thermometer rose rapidly till it nearly touched 94°, while the naked one remained stationary.

The conclusions to which these experiments point are too obvious to require demonstration.

Fireproof Excursion Steamer.

The first of the seven iron excursion boats promised by the Iron Steamboat Company of this city, was lately launched at Philadelphia. She is called the Cetus, and is described as a side-wheeler, 229 feet long over all, and 210 feet on the water line. Her beam is 32 feet, and over the guards her width is 59 feet 10 inches. Her depth is 11 feet 6 inches. Her stem is of rolled iron, 6 by 2½ inches; the stern post of the same material, 6 by 3 inches. The keel and keelsons are of extra size and strength. Her frames are of angle iron, 4 by 3 inches. They are placed 22 inches from center to center. The channel beams are of channel iron, 9 inches deep, with angle iron, 3 by 3 inches level, to the top edge. All of the deck beams are of angle iron, 6 by 3½ inches; they extend through the hull to the outside of the guards, one to every alternate frame. On these beams is laid a deck of plate iron half an inch thick. The outside plating is of extra thickness and laid flush. The hull is divided into sixteen water-tight compartments by seven thwartship bulkheads. From forward of the boiler to the thwartship bulkhead abaft the engine, she has a longitudinal bulkhead on each side placed about 3 feet from the outer skin. This space between each of these longitudinal bulkheads and the outer skin is divided into four compartments. She is to be propelled by a vertical beam jet condensing engine, with cylinder 52 inches in diameter, and 11 feet stroke of piston, and it is to be worked up to a pressure of 50 pounds. The valves are "double poppet," arranged with Stevens' cut-off. The main shaft is 14¾ inches in diameter in the main journals. The gallows frame is of wrought iron, of rectangular form, and runs down to the engine keelson, to which it is solidly secured. The wheels are 30 feet 9 inches in diameter and 9 feet face. The engine will be supplied with steam from two boilers of the locomotive type, with cylindrical shell, and furnaces. She will have one independent steam chimney, with separate connections to each boiler and united to one another by one steam pipe. The boilers are 9 feet 6 inches in diameter and 25 feet long. The furnaces are of steel, 4 feet in diameter, able to carry 50 pounds of steam.

The only wood employed in the construction of the boat is above deck. The deck houses, except the one inclosing the galley, are of wood, and so are the bulwarks. The Cetus is provided with four iron life-boats, 20 feet long, and two life rafts. She will also be furnished with 8,000 life-preservers.

We are sorry that the ingenuity of the builders has not gone far enough to dispense altogether with woodwork. It is to the presence of this inflammable material that loss of life is chiefly due on excursion boats. We have no doubt that the company would be glad to adopt any practical substitute for wood, and it would seem as if a good opportunity for some ingenious individual was here presented.

The Causes of Heat in Mines.

Lime is undoubtedly one cause of heat in our mines, but it is not the only nor the great heat producer. Lime is local in its action; the heat produced by it is confined to certain sections of the mines, while underlying the whole length of the Comstock lode is that which causes the general heat, namely, the deposits of iron pyrites. The hottest places in the mines are where the heat is generated by both lime and pyrites; it is the heat from the lime added to the general heat from nature's workshop below.

The hot springs of Colorado may derive a portion of their heat from the decomposition of lime, but this is but a secondary cause. The great and first cause of heat in springs and mines is the decomposition of iron pyrites—masses of iron and sulphur. At Steamboat Springs and other places in this State, and at most of the hot springs in California, the heat is produced by the burning out or decomposition of iron pyrites. At Steamboat Springs the course of the deposits of iron pyrites is northeast and southwest, the same as that of the great mineral-bearing veins of the State. The line of active springs follows the course of this deposit, moving toward the northeast. At the southwest end are to be seen places where the deposit of iron pyrites and similar minerals carrying large quantities of sulphur has burned out, and the springs have died away. The process of burning out is slowly moving toward the northeast. In 1860 the writer saw a new spring just starting up through a thick growth of grass in a bit of meadow land far in advance of the older and larger ones, but on the same general line, well out to the northeast.

The base metal deposit at Steamboat Springs also has the same dip as the Comstock, and is working east as well as toward the north. By going from half to three quarters of a mile west of the present active springs at Steamboat, one may see where the springs were ages ago, along near the croppings or upper edge of the deposit or pyritic matter. As the decomposition proceeded downward and eastward along the dip of the deposit, the steam and hot water found or forced new vertical channels of escape. Some of these openings are probably natural crevices, but the majority are undoubtedly rents produced by the force of steam and pent-up gases. Even on the surface of Steamboat Springs are to be seen long rents from an inch or two to over a foot in width that have a northeast and southwest course. In California some of the hot springs are observed to be dying out at one end of their line and advancing into new ground at the other.

At Steamboat Springs we probably see a big mineral vein (like the Comstock) in process of formation. Ages ago there was probably a line of hot springs along the course of the Comstock. The mines of Europe and Mexico, which are comparatively cold at great depths, are undoubtedly ages and ages older than the Comstock. The Comstock is probably the youngest mine in any part of the world that is now known or being worked. Here, down in our lower levels, we are following close upon the heels of nature—getting well down into her workshop.

As to the heat-generating power of sulphur and iron, those who desire to do so may satisfy themselves. Take a few pounds of iron filings, borings, and drillings from a machine shop, wet them and mix in a pound or two of sulphur, then tamp the mixture firmly into a hole in the ground—like a post hole—covering with two or three inches of dirt, and in a short time there will be seen a miniature volcano, the batch of iron and sulphur taking fire spontaneously.—*Virginia (Nev.) Enterprise.*

Cement for Rubber.

Powdered shellac is softened in ten times its weight of strong water of ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. As soon as the ammonia evaporates the rubber hardens again—it is said quite firmly—and thus becomes impervious both to gases and to liquids. For cementing sheet rubber, or rubber material in any shape, to metal, glass, and other smooth surfaces, the cement is highly recommended.

The Transportation of Wheat.

The cost per bushel of bringing wheat from the great centers of production and distribution to the leading markets of Europe has been elaborately compared and tabulated as follows by Mr. R. Meyer, in the *Austrian Monthly of Social Science and Political Economy:*

From	To	
San Francisco	England	$0.36@$0.39
The "Far West"	Atlantic Harbor	40
New York	Liverpool	10
Chicago	Liverpool	19
Bombay	England	13
Calcutta	England *via* Suez	18@ 29
Calcutta	England *via* Cape	15@ 20
Australia	England	21
Buenos Ayres	Havre	16@ 20
Odessa	England or Antwerp	13@ 22
Podwoloczisks	Delhi	44
Brody	Delhi	42
Brody	Hamburg	39
Ibraila	London	18
Galacz	Hamburg	57
Budapest	Hamburg	31
Budapest	Liverpool *via* Fiume	28
Lemberg	Frankfort-on-the-Main	26
Vienna	Frankfort-on-the-Main	24
Vienna	Fiume	21
Vienna	Trieste	21

From Odessa is shipped the wheat of Southern Russia. Brody, in Northern Galicia, collects the wheat of the upper valleys of the rivers of Southwestern Russia. Lemberg, close by, is the capital of Galicia. Ibraila is the shipping point of Wallachia. Galacz ships the wheat of the upper valley of the Danube. Budapest is the central point of Hungary, as Vienna is of Austria. It costs nearly as much to carry wheat from Brody to Lemberg, 58 miles (no railway), as it does from Chicago to Liverpool. From Vienna to Trieste is about 250 miles by rail; in cost of transportation it is further than from Calcutta to England around the Cape. California can easily compete with Hungary in the markets of Western Europe, the cost of raising the wheat being the same.

The Blue Sky.

M. Chappuis thinks that the blue of the sky may be due to ozone present in the upper regions of the air. He argues that the electrical discharges constantly taking place will produce ozone; and the recent researches of himself and M. Hautefeuille have shown that ozone, at any rate when near its condensation point, is of a blue tint. He has examined the absorption-spectrum of ozone and finds nine dark bands in it, three at least of which correspond with known bands in the telluric spectrum.

THE VELOCIPEDE HAND CAR.

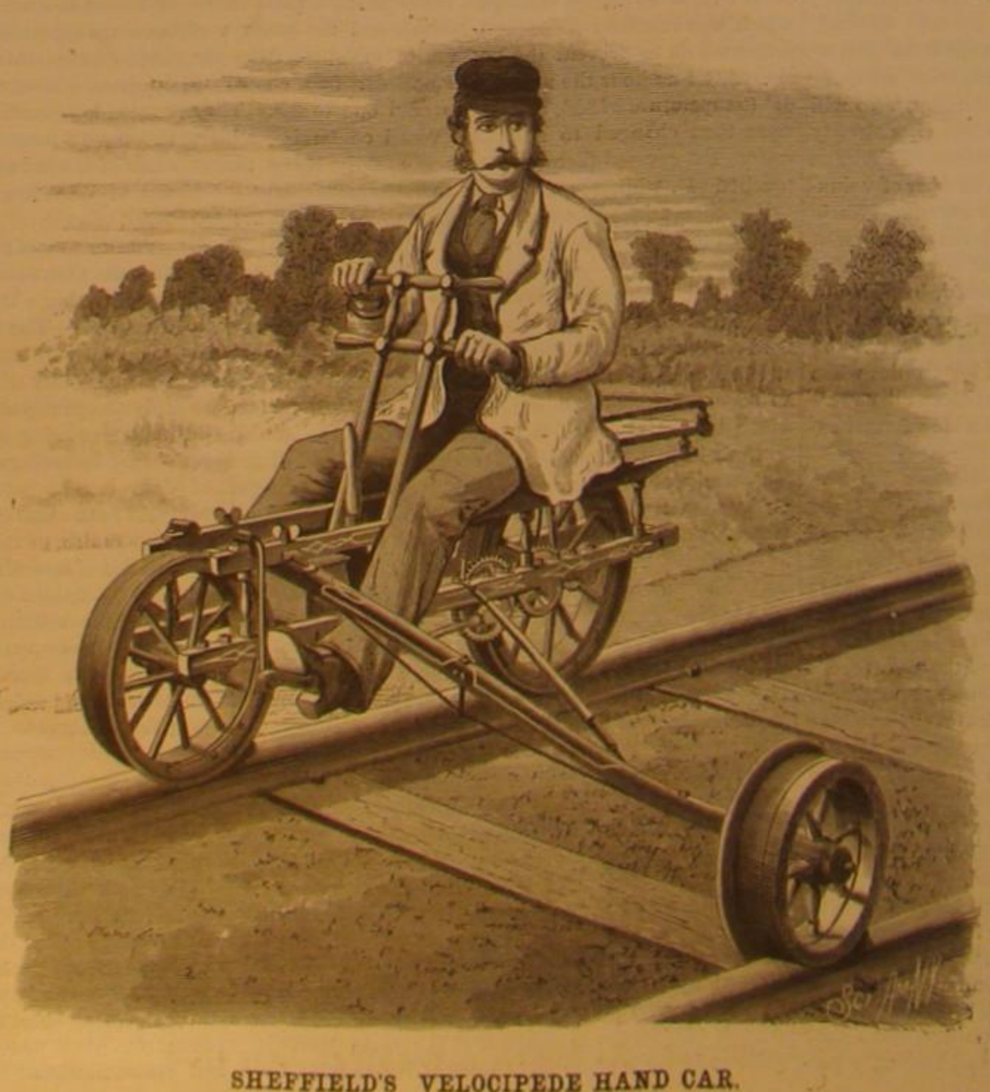
A railway track offers peculiar facilities for velocipede travel, since it is perfectly smooth and has an easy grade, and no attention whatever need be paid to guiding the vehicle, nor to balancing to maintain a vertical position. A vehicle of this sort has a wide range of application, and will be found of great utility to railway men, for roadmasters, engineers, superintendents of bridges, telegraph line repairers, track supervisors, wood and tie inspectors, track walkers, and others whose duties take them over the track for various purposes. In fact the velocipede shown in the engraving is already in use by a large number of the principal roads of the country, and they are highly recommended by officials who have adopted them.

The machine may be easily propelled at the rate of eight to ten miles per hour, and it is not difficult to run it at a speed of twelve to eighteen miles. The inventor informs us that he has many times made a run of thirty miles in less than two hours with one of them.

The engraving gives a good general idea of the velocipede. It is very light, weighing only about 125 pounds, and is therefore easily removed from the track when occasion requires. The frame, wheels, and arm are of wood, all of the parts being properly braced. The arm is adjustable, and readily removable for storage or shipment. The power is applied to the rear wheel by a hand lever in front of the operator and by stirrups for the feet, which are connected with the propelling machinery by levers. The handle between the levers controls the brake. If required, the machine may be constructed to carry two persons. The tread of the wheels is cast iron, and in the construction of the machine iron and wood are judiciously combined to form a strong yet light and compact vehicle.

The confidence of the manufacturers of this velocipede is so great that they offer to send out the machines on trial, to railroad officials, to be sold on approval.

Further information may be obtained by addressing Messrs. George S. Sheffield & Co., Three Rivers, Mich.



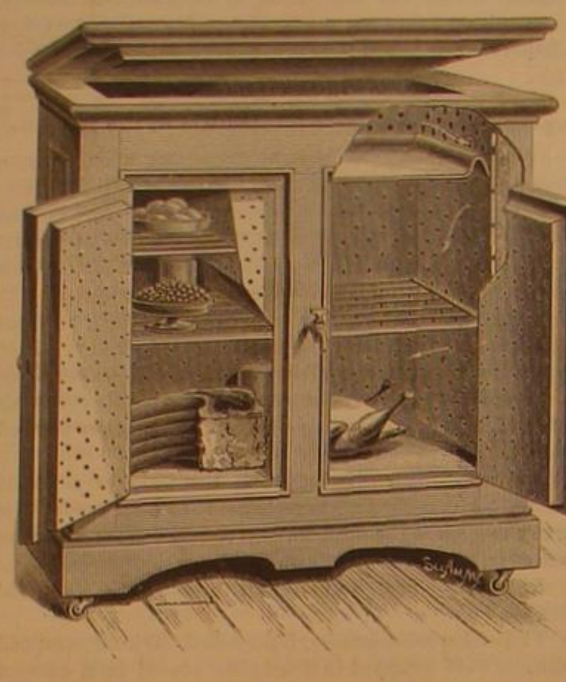
SHEFFIELD'S VELOCIPEDE HAND CAR.

Powerful Machinery.

Speaking of the machinery used in our Western mines, a prominent mining engineer recently said that in some of the deep mines there are employed single engines capable of raising a column of water weighing 90,000 pounds a distance of 1,600 feet, seven times a minute; also, that safety cages used in mines travel at the rate of 3,000 feet a minute, and propelled by a single engine are able to hoist 1,200 tons of ore a distance of 1,500 feet in one day.

IMPROVED REFRIGERATOR.

The invention shown in the annexed engraving possesses several points of novelty, which should commend it to the notice of manufacturers and users of refrigerators, as it not only aims to maintain a low temperature, but to sweeten



TOOPE'S DRY AIR REFRIGERATOR

and purify the air and to absorb moisture and destroy all odors.

In this refrigerator the air, in passing from the ice chamber to the provision chamber, traverses a purifying chamber and enters the provision chamber perfectly dry and pure. The air purifying chamber is located inside the space usually filled with charcoal or other non-conductor, and beside acting as a purifier it assists in preventing the entrance of heat and in preserving the required low temperature. In Toope's refrigerator the inner wall of the provision chamber and the casing surrounding the ice chamber are perforated, and the air in passing from the cooling chamber to the provision chamber is forced to traverse a layer of air-purifying material, which filters out everything objectionable, and leaves the air in the best state for the purpose of cooling and preserving the contents of the provision compartment. Beside this action of the absorbent material it receives the emanations from the provisions and destroys all odors. The action of the absorbent is continuous, and no renewal of it is required. When the cover of the ice chamber is opened it acts as a piston, and draws upward from the purifying chamber the air contained by it, and in this manner reverses the direction of the air currents in the refrigerator and ventilates the absorbent.

This useful invention was recently patented by Mr. Charles Toope, 353 East 78th st., New York city.

MISCELLANEOUS INVENTIONS.

Improvements in car brakes of that type which automatically apply the brakes through the movement of the draw-bar, have been patented by Mr. Henry Gallager, of Savannah, Ga. The improvements contemplate the constant pressure of the brakes upon the wheels whenever the draw-bar is in its normal position of rest, and which brakes are released or withdrawn from the wheels whenever the draught strain pulls the draw-bar out, or whenever the draw-bars are driven in by backing, so that whenever the locomotive approaches a condition of rest, whether in moving forward or backward, the brakes commence to be applied automatically, but are not applied when the power of the locomotive is being transmitted to the cars for transportation.

Mr. James M. Caraway, of Beloit, Kan., has patented a simple and effective machine for grading roads, making ditches, digging potatoes, etc. It cannot be described without engravings.

Mr. Julius Heimann, of New York city, has patented a trimming for garments which consists in two or more narrow strips of felt cloth sewed edge to edge in concentric or parallel overlapping rows. The rows may be further ornamented by embroidered stitching of colors to harmonize with the tints of the strips.

Mr. George W. Brumm, of Boise City, Idaho Ter., has patented a book protector, for containing a book and securing it from injury, and to securely fasten said case and book to desk, pew, or other permanent object.

An improved fence post, patented by Mr. Patrick Coughlin, of Prescott, Ontario, Canada, is provided with wings, which spread under ground, and prevent the post from being raised by the frost.

A nut lock, so constructed as to prevent the nuts from working loose or off bolts exposed to an intermittent or constant jarring, and which will allow the nuts to be readily screwed on and off, as required, has been patented by Mr. John W. Bunker, of Palmer, Texas.

Mr. Augustin Personne, of Paris, France, has patented an improvement in that class of electric clocks in which an electro-magnet is used to automatically give an impulse to the pendulum of the clock every time its oscillation decreases below a certain amplitude. For this purpose the electric current is, when necessary, sent through the coils of the magnet by means of a device mounted upon the pendulum, and having a differential motion caused and controlled by the resistance opposed to it by the air during its oscillation.

Mr. Max Rubin, of New York city, has patented an improvement in the class of shawl straps in which the straps are wound around a rod to clasp the package, the object being to simplify the construction and lessen the cost of manufacture.

An improved safety lamp has been patented by Mr. Mark A. Heath, of Providence, R. I. It has a chamber containing carbonic acid gas, which escapes when the lamp is broken, the intention being that the gas shall extinguish the flame.

An improved hydraulic air compressor has been patented by Mr. William R. Freeman, of San Antonio, Texas. The compressing cylinder being filled with air or gas, as the case may be, the air inlet is closed, as is also the waste water cock. The water supply cock is opened, allowing the water to rise in the cylinder, compressing the air or gas therein to a tension equal to the water pressure, and indicated by the pressure gauge. Communication being then opened by means of the three-way cock between the compressing cylinder and the nozzle, the air is allowed to pass to the place of storage or use. The air cock is then turned to communicate with the outer air or gas supply, the water cock is closed, and the waste cock opened, allowing the water to escape from the compressing cylinder, which at the same time becomes filled with air or gas, and the operation repeated.

Mr. Alvin H. Fogg, of Rockland, Me., has patented a strawberry car, designed for use in cultivating and gathering strawberries, cranberries, and in weeding and thinning out all kinds of root plants.

SIMPLIFIED HOLTZ ELECTRICAL MACHINE.

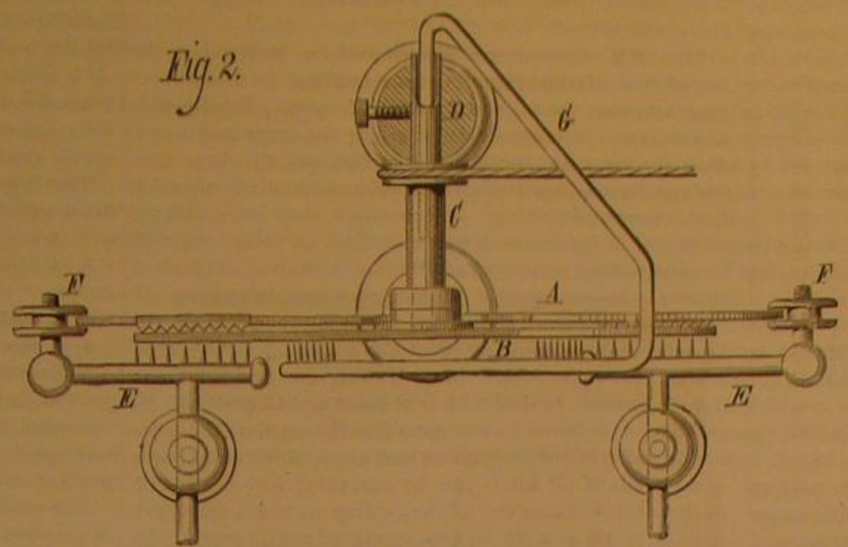
BY GEO M. HOPKINS.

In the domain of physical science there is nothing capable of being illustrated by more brilliant and pleasing experiments than frictional electricity; the means of studying it experimentally are in every one's hand, and if it were better known, doubtless many who are now comparatively uninformed on this subject would begin to make it a matter of study and experiment.

Many will recall the time in school days when the professor, with great exertion, trundled the ponderous frictional machine from behind the glass doors of the laboratory cabinet, and after no end of wipings, adjustments, and applications of amalgam, and after exerting an enormous amount of muscular force, succeeded in discovering that the atmospheric conditions were unfavorable to the generation of electricity, and the students, after being shocked by a quarter inch spark, were further shocked, and in another way, when informed that the philosophical machine must be reconsigned to its glass housings until a more propitious day.

Such was the general experience of the student of science a few years since, and such it is to-day in some of our educational institutions; but many of our schools—to their credit it may be said—have kept pace with the times and have provided modern apparatus capable of being used successfully under all conditions. The more recent forms of Holtz electrical machine are vastly better than the earlier ones, and the earlier ones were far superior to any of the forms of frictional machine. The makers of the improved Holtz machine in New York, Boston, and Philadelphia furnish them at reasonable prices, but there are numbers of our experimenters and students who would hardly feel warranted in purchasing one of them, who would construct one but for a few difficulties which at first sight seem almost insurmountable to the tyro. The questions that beset the inquirer are: (1) What kind of glass shall be used? (2) How shall the glasses be apertured? (3) How shall the parts be adjusted and manipulated to secure the wonderful results attained by this machine?

It is the object of this article to fully answer these queries and to give such details of construction as to enable any one having even a moderate mechanical ability to make, in a very simple manner, a machine fully as efficient as the best in market; and that, too, without any considerable outlay for materials. Without describing in detail the principle upon which the machine operates—these matters being fully treated in all works on physics—I will describe a machine which was made in odd moments as a matter of recreation, and which is as efficient as could be desired, yielding a spark fully six inches in length, equivalent to one half of the diameter of the rotating disk. This machine is shown in perspective in Fig. 1, and in plan in Fig. 2. Different forms of apertured disk are shown in Figs. 3, 4, and 5. The glass for the disks is selected from common window glass. It should be as thin as possible, of uniform thickness, and flat. It is not essential that the glass be absolutely free from imperfections, although this is desirable. The rotating disk is twelve inches in diameter, the fixed disk is fourteen inches in diameter. I begin with the glass disks, as it is here that most of the difficulty in making the machine is supposed to lie; the especial trouble being in making the aperture in the revolving glass for receiving its hollow shaft, and in making the three large apertures in the fixed glass. I dispense with the hole in the revolving disk and secure it to a vulcanite collar by means of a cement composed of pitch, gutta percha, and shellac equal parts, melted together. The method of applying the cement for this purpose is to warm the vulcanite collar, then cover it with a thin layer of the cement; then, after making the glass rather warm, lay it on a paper on which are described two concentric circles, one the size of the glass disk, the other the size of the collar, and while the glass is still hot press the collar down upon it. The vulcanite collar is screwed on the end of a wooden sleeve, C (Fig. 2), having at one end a shoulder to receive the collar and at the other end a small pulley to receive the driving belt. The sleeve, C, turns upon a piece of three-eighths inch brass tubing which extends through the vertical post, D, ten inches high and two inches in diameter. The end of the sleeve, C, next the glass disk, B, is countersunk to receive a screw which enters the end of the brass tube holding the sleeve in place. This screw is covered by the glass when the revolving disk is in its place in the machine. The glass for the stationary or apertured plate, A, is first cut in circular form and then divided diametrically, and the apertures are formed by cutting half from each plate, a very simple matter as compared with cutting the three holes from an entire disk. The lateral holes are two and three-quarter inches long, and one and three-quarter inches wide at the larger end, and their sides are nearly on radial lines extending from the center of the disk. The central opening through which the sleeve, C, extends is approximately circular, but is slightly elongated at *e e*, to facilitate the removal of the portion cut out. Of course the simplest way to get the glass into the desired shape is to have a glazier cut it with his diamond, but any one may do it with one of the twenty-five cent steel roller glass cutters sold everywhere. The disks of the machine represented were cut in this way, and the notches in the semicircles of the fixed disk were cut with one of these inexpensive yet useful tools. The only precaution necessary in cutting the notches is to make them rather flaring to permit of the removal of the piece after it is cut.

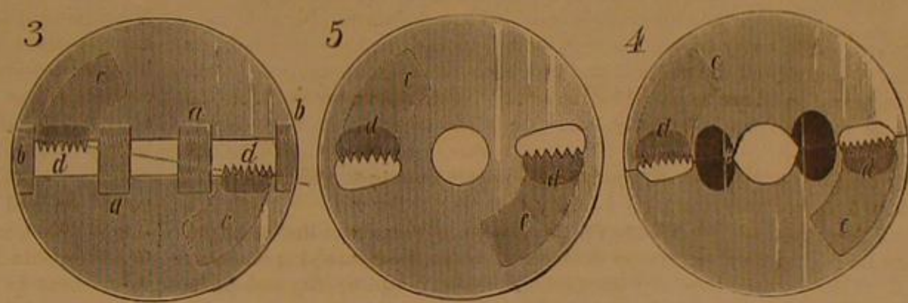


PARTIAL PLAN OF SIMPLIFIED HOLTZ MACHINE.

The two halves of the fixed disk are fastened together by two elliptical pieces of glass cemented to the two halves, between the central and lateral openings. The cement used is the same as that above described, and it is applied in a similar manner. The cement known as "stratena" answers very well for this purpose, but it must have several days to dry before the machine can be used.

The edges of the glass around the apertures and along the seams should be varnished with the best quality of alcoholic shellac varnish to prevent the accumulation of moisture.

Paper inductors, *c*, are attached to opposite sides of the apertured glass by means of starch paste made by cooking starch until it begins to thicken, and cooling it before it becomes clear, *i. e.*, while it is still of milky whiteness. These inductors are made of filter paper or of single thick drawing paper, and extend from the lateral openings or windows about one-third the distance between the two windows in a circular direction. The outer edges of the inductors are arranged on a circle a little smaller than the revolving disk. At the end of each inductor and upon the opposite sides of the glass are pasted pieces, *d*, of gilt paper, which project into the window, and when dry are serrated, the points of the teeth being on the center line of the windows.



APERTURED DISKS.

In front of the revolving plate, B, two combs or collectors, E, are supported upon glass columns having wooden bases and tops. These combs are made of three-eighths inch brass tubing, the two pieces being fitted together and fastened with soft solder. The points, which are simply bank pins, are driven into holes in the brass tube three-eighths inch apart. The inner ends of the tubes forming the combs are soldered to brass ball buttons; the outer ends are inserted in wooden balls, from which wooden screws extend backward to receive the deeply grooved wooden nuts, F, which hold the edges of the apertured disk, A. The points of the combs each cover a space 2½ inches long, or about equal to the width of the paper inductors. Care should be taken to avoid bringing the inner ends of the combs nearer together than is absolutely necessary, and the outer point should be at least one-eighth inch from the periphery of the revolving plate. The points should be as near the face of the revolving glass as possible without touching. The combs are clamped in place by wooden screws in the wooden tops of the glass standards.

The outer ends of the tubes supporting the combs are fitted to tubes soldered in the large hollow balls. Through these balls the discharging rods slide with a gentle friction. The inner ends of the discharging rods are provided with spherical knobs, and their outer ends are fitted with wooden handles well varnished.

The cross arm, G, instead of being supported from the center, as usual with the apertured revolving plate, is elongated and bent so as to enter the rear end of the tube which forms the bearing for the sleeve, C. It is split to create friction in the tubes to retain it in position, and in addition to this the screw which holds the tube in the post, D, passes through a hole in the tube and bears against the extension of the cross arm.

The free end of the cross arm is carefully rounded, and the pins correspond in number and position to those of the combs, E. The cross arm, when the machine is in use, is placed opposite the ends of the paper inductors, as shown in the illustration.

The lower edge of the apertured plate, A, rests in an adjustable support on the table.

The base of the machine is 13 inches wide by 14 inches long, with an extension 9 inches long for receiving the standard of the

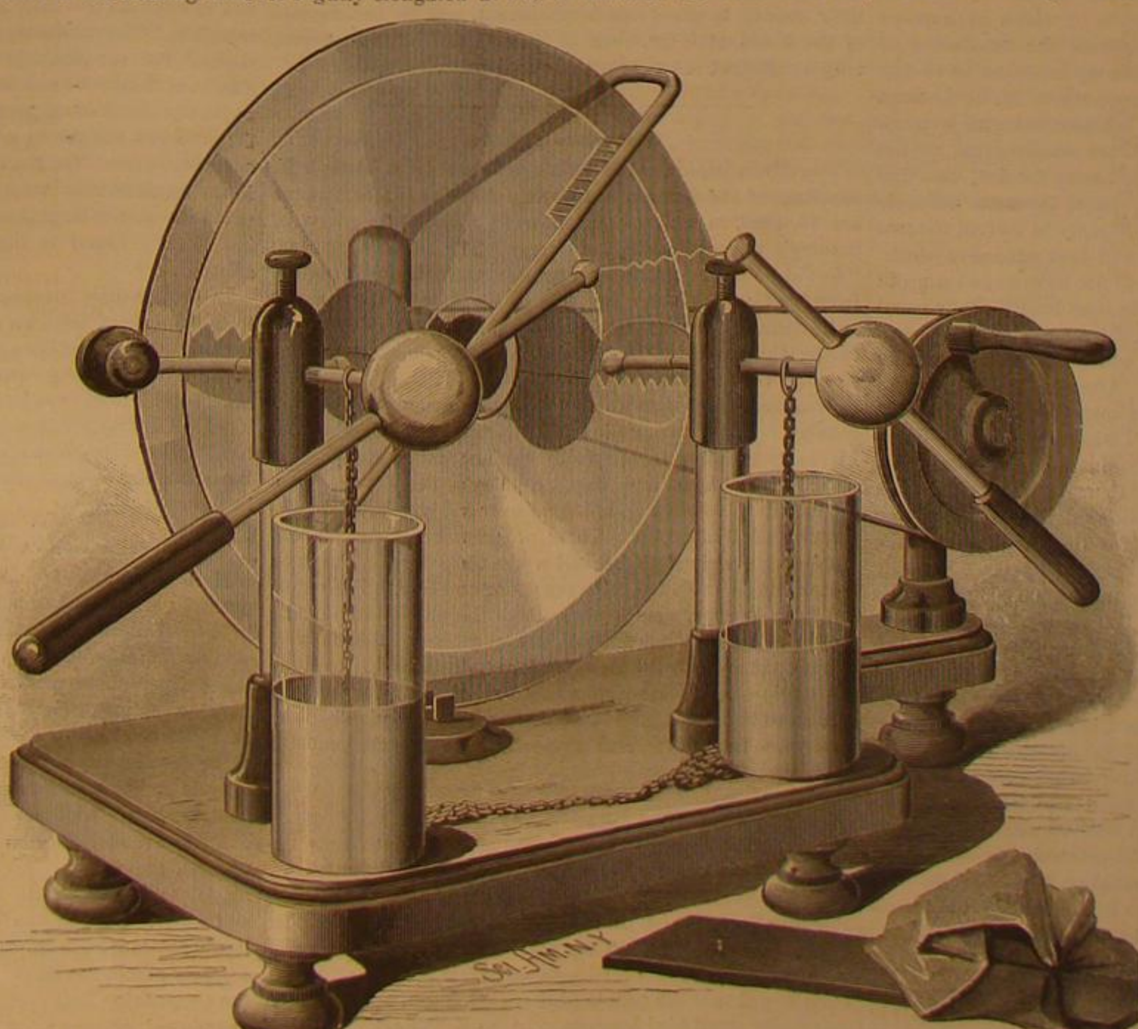


Fig. 1.—SIMPLIFIED HOLTZ ELECTRICAL MACHINE.

driving pulley, which is made adjustable on the table to tighten the belt, the table being slotted to receive the screw projecting from the standard, and the foot of the table answering as a nut to clamp the standard in any desired position. The pulley on the sleeve in 1¼ inch in diameter, and the driving pulley is 6 inches in diameter. Almost any kind of belting will answer, but a gut string is preferable.

To complete the machine two condensers or small Leyden jars are required. These may vary in size; in the machine shown they are 2½ inches in diameter and 6 inches high, and are covered on the inner and outer side with tin foil to within 3 inches of the top, the starch paste before mentioned being used to fasten the foil. The uncovered portion of the jar is varnished with shellac. If jars of the desired form and proportion are not obtainable, bottles may be readily cut by means of a hot curved rod of iron about one quarter inch in diameter.

The condensers are placed outside the glass columns under the tubes that support the combs, and a small chain hanging on each tube touches the tin foil lining of the jar.

The outer coatings of the jars are connected by a small brass chain lying on the table. The plate, A, should be placed about three-sixteenths of an inch from the plate, B, and it must be turned so that the edge of the windows to which the gilt paper is attached is exactly opposite the teeth of the combs, E.

To charge the machine the ends of the discharge rods are brought into actual contact, and a piece of vulcanite, a quarter of an inch thick, 4 inches wide, and 10 or 12 inches long, is rubbed with a catskin, a piece of flannel, or a piece of silk, and applied to one of the paper inductors. At the same moment the machine is turned toward the gilt paper points. A strong smell of ozone and an increased resistance to turning are the first indications of the successful charging of the machine. Now, by slowly separating the discharge rods the spark will pass over an increased distance until it is fully 6 inches long. To produce the silent discharge all that is required is to remove the chain on the table from one of the jars. No special directions are required as to the management of the machine. A dry atmosphere is favorable to its action, and it must be kept free from dust. Air currents interfere with its operation; therefore it should be used in a room with the doors and windows shut.

I have so far described only one form of apertured plate. In Fig. 3 is shown a form in which the disk has a central portion, 1⅝ inches wide, removed and the two parts are connected by glass strips, *a a* and *b b*, cemented in the manner already described. When this form of plate is used the combs must be inclined to correspond to the direction of the edges to which the gilt paper is attached. Fig. 5 shows the usual form of plate which requires the aid of the glass cutter, as the holes cannot be readily made by one unused to operations of this kind.*

* What has been said will enable the reader to make a very satisfactory machine, but for want of space the matter of experiment with it has not been touched upon. SUPPLEMENT No. 278 will contain further details in regard to the construction of the machine and of apparatus to accompany it.

The Panama Ship Canal.

The rapidity with which the subscriptions for the construction of the Panama Ship Canal were taken up by the public has been followed by an almost equally surprising celerity in the commencement of the works, ground having been broken on the first of February last. A report by M. de Lesseps, recently presented to a general meeting of shareholders, contained this announcement, together with much interesting information as to the mode by which he proposes to carry out the work that is to separate the continents of South and North America. Justifiably sanguine as to the triumphant termination of this great project, M. de Lesseps points out that the problem is not complicated with a number of the difficulties which beset the construction of the Suez Canal, that no ports will have to be formed, that the materials to be dealt with are of a nature far more tractable than the sands of Suez, that the difference in level of the two oceans will present no difficulty, and that extensive workshops and workmen's dwellings will not have to be set up in the midst of a waterless desert. The total length of the canal itself will be about forty-one miles, the remainder of the navigable channel being formed by widening, deepening, and straightening the River Chagres. After the Panama Canal Congress of 1879, when an approximate route was decided upon, an international commission was dispatched to Panama, and commenced a detailed examination at the beginning of last year. The result of the labors of this commission showed that a considerable reduction might be made in the amount of excavation necessary for the canal works, the originally estimated quantity of nearly 100,000,000 cubic yards being diminished by more than 2,500,000 yards, the total amount consisting of 59,381,000 yards of earth and soft and broken rock, and of 37,933,000 yards of hard rock. The total estimated cost of the whole work is £20,180,000, of which £17,200,000 will be absorbed in making the canal, the protecting banks for it, and for the Chagres and Rio Grande, and for the transport of material to the site of the great Chagres River dam, a supplementary work decided upon in consequence of some exceptional floods which occurred upon the Chagres last year. Nearly £2,000,000 will be expended in the construction of this dam, in protection works, along portions of the canal, and in making a pier in the Bay of Colon. The improvement of the ports, the formation of docks, and the establishment of lighthouses, etc., will absorb £1,400,000. The present year will be occupied in the final location of the route, and the establishment of preliminary works, which will necessarily be of an extensive and very costly nature, but it is expected that by the end of the season workmen's dwellings, repairing shops, and machinery will be erected, the temporary rail ways laid down, the system of transport organized, and a large proportion of the contractors' plant on the ground; and it is confidently anticipated that excavations will have seriously commenced.

That MM. Hersent and Couvreux have undertaken the completion of this enormous undertaking is a sufficient guarantee that the highest amount of energy, intelligence, and skill will be concentrated upon it; the large and somewhat similar works successfully carried out by these contractors have given them an experience peculiarly valuable in this new undertaking. The methods they have already employed in dealing with vast quantities of earthwork will be substantially employed at Panama, including excavators similar to those they used on the Suez Canal, in making the Gand and Terneuzen Canal, and in the improvement of the Danube, and the dredging plant also employed in the latter work. As for the rock cutting, MM. Hersent and Couvreux have learnt how to deal with it at Brest and Cherbourg. M. de Lesseps confidently anticipates that the canal will be opened for traffic in 1888, assuming that about 66,000 cubic yards of materials of all kinds can be excavated and dealt with during each working day of the coming six years, and that a force of 10,000 men can be kept employed continuously. An interesting feature of the works will be the utilization of water power from the Chagres, which will be required especially for the rock cutting. It is proposed to obtain this by forming the dam, already mentioned, as a necessary part of the work, and actuating by its fall the air compressors required for working the rock drills.

Such is a very general outline of the scheme for carrying out what will be, when completed, one of the greatest engineering undertakings that the world will have seen. That it will be carried to a successful issue there is no room for doubt, since the physical obstacles are great only from the magnitude of the materials to be dealt with, so that the contractors have but to repeat what they have done many times before on a smaller scale. The problem of raising the necessary capital has been solved by the 100,000 subscribers, and all the political and international difficulties appear to have been removed by the energy and diplomacy of M. de Lesseps. In every sense, conditions and opinions have changed since this indefatigable worker astonished the world with his proposal to divide two continents by the Suez Canal. In this country especially that proposal was met with ridicule, and received but little support. It was regarded as impracticable from an engineering point of view, and ridiculous as a financial undertaking. Objections like these have not been urged against the Panama Canal, for the successful completion of the Suez Canal, and, later, of such tremendous undertakings as the Mont Cenis and St. Gothard Tunnels, have silenced all disbelievers in the possibility of great engineering works; while the vast change wrought by the opening of the short road to the East must convince every one that this new gate to the Pacific will develop (and possibly divert) trade to an incalculable extent, and the army of large and small capitalists who have so readily contributed their money to effect this development, will be benefactors of the world at large, even if they should not themselves reap a sufficient reward for their enterprise.—*Engineering.*

Where Stanley Is.

The Philadelphia *Press* prints a letter from Yuseph H. Reading, of the Gaboon and Corisco Mission, dated December 17, 1880, in which the following tidings are given of Stanley's expedition up the Congo. The missionary says: "Count de Braya, an Italian explorer, arrived here yesterday from the Congo River. He went up the Ogowe River as far as he could get in a canoe, thence overland, six days' journey, to the Congo, down the Congo to the sea, and so here by steamer, thus making complete circuit. The point at which he reached the Congo was five days' journey inland from Stanley Pool. Coming down the river he met Stanley and his party 25 miles inland from a place called Avedi. He stayed with them one day. Stanley's party were in a mountainous country and obliged to travel overland, for the river was full of rapids. Their progress was slow. There were no provisions to be had where they were. The men were eating rice and the donkeys corn and hay, all brought out from Europe. He reports one of the missionaries of the English Baptist Mission shot in the groin by the natives. The Count goes up the Ogowe again to-morrow to continue his explorations. He represents the country far up the Ogowe to be a table-land 2,400 feet above the sea, comparatively free from fever, and supporting a large and peaceful population."

The English Skylark.

Another attempt is about to be made to introduce the English skylark to our fields and skies. Last summer Mr. Isaac W. England imported two hundred birds, a considerable number of which have survived the winter and are now in excellent condition. They will soon be set free, probably in the neighborhood of Ridgewood, New Jersey; and it is to be hoped that the people of that region will make it hazardous for small bird hunters to be seen thereabout during the next four or five years.

An Improved Soap.

We copy the following formula from the *Moniteur des Produits Chimiques:* Vegetable oil, 1,980 pounds; animal fat, 660 pounds; soda lye at 33¾° Tw., 4,400 pounds.

As soon as the whole of the lye has been absorbed the mass is kept at a gentle boil until completely liquefied, and there is then added, still keeping up the boiling: Silicate of soda, at 62° Tw., 440 pounds.

This is thrown in by degrees, while the mass is being continually stirred up. When all the silicate has been added the fire is slackened so as to stop the boiling, but still keep up a gentle heat, and the whole is left till it takes the appearance of an oily liquid, transparent, and of a pale amber color, showing that the silicate (which is only used here to clarify the soap) has been completely deposited.

The liquid part is then drawn off into a special boiler, fitted with:

1. A lid, fitting airtight.
2. A slide opening, through which liquids may be introduced.
3. A cock below for drawing off.
4. A screw agitator.

When the soap has been run into this boiler wait till the mass begins to grow pasty. The lid is then closed and the following liquids, previously mixed, are introduced by the side opening in successive portions: Ammonia, 286 pounds; purified oil of turpentine, 91 pounds.

The whole is then worked up for ten minutes with the mechanical agitator, and after settling for an hour it is run into forms.

The soap is said to be very firm, of a fine pinkish white, dissolves well with an abundant lather, and does not injure tissues.

[The yield from the above proportions is not stated.—*Chemical Review.*]

Extreme Sensitiveness of the Telephone.

Mr. W. H. Ash, writing from Penzance, in a recent note to the editor of the *Electrician*, says: "There are two cables landing here, one from Vigo and the other from Lisbon, both of which were, unfortunately for us, broken at the same time, the former in Vigo Bay, the other about 735 miles from here. Generally one or the other is always occupied, so that any experiments of this description are not possible, but being both idle, as well as our land line, I joined the two cables together here through a telephone. The other two ends being so far away I was curious to know what I should hear, and was very much surprised to hear Morse signals. After listening some time I found it was on the Brest cable of the new French Atlantic Company, their line running from Penzance to Brest (the cable lands about three-quarters of a mile from here), and their land line going to Penzance by a different route from this company's. So that with no earth connection here, and none on the other line except at Penzance and Brest, I could read the signals distinctly. No doubt it was by the induced current, but that it can be perceived at such a distance may suggest to some still further uses for this very delicate instrument."

Trichinosis.

According to a recent report to the Sanitary Committee of Massachusetts, it appears that of 2,701 pigs examined during five months no less than 154, or nearly 6 per cent, contained trichinæ. The animals came from different and distant regions, but the majority were from the Western States. The same report affirms that rats are affected with trichinosis at Boston to a much larger extent than in Germany. Of fifty-one rats caught in a Boston slaughter house thirty presented trichinæ. On the other hand, twenty-eight fowls fed in the establishment were found to be healthy. Forty rats taken in another large slaughter house all contained trichinæ, but of sixty found in different stables only six were thus affected.

In France little consideration has, until lately, been given to the danger of trichinæ in imported pork. At Lyons, however, inspection has been commenced, and has quickly borne fruit. An enormous consignment of lard, amounting, it is said, to 120 tons, was lately received at Lyons from New York. Of fifty specimens examined immediately after arrival three were found to be infested with trichinæ. At Barcelona six cases of death from trichinosis have occurred in three months.

Protoplasm—A Complicated Substance.

H. J. Reinke (*Botan. Zeitung*, 38, No. 48) has examined protoplasm obtained from *Æthalium septicum*, and discovered in it the following proximate constituents: Plastin (an insoluble albuminoid resembling the fibrins), vitellin, myosin, pepton, peptonoid, pepsin, nuclein, lecithin, guanin, sarcin, xanthin, ammonium carbonate, paracholesterin, traces of cholesterin, Æthalium resin, a yellow pigment, glycogen, sugar (non-reductive), oleic, stearic, palmitic, and traces of butyric acids, carbonic acid, fatty glycerides and paracholesterides, calcium stearate, palmitate, oleate, lactate, oxalate, acetate, formiate, phosphate, carbonate, sulphate (traces), magnesium (probably phosphate), potassium phosphate, sodium chloride, iron (compound not determined), and water. Plastin can be separated by pressure from the liquid portions of protoplasm. The albuminoids collectively scarcely amount to 30 per cent of the dry substance. Hence the supposition that protoplasm consists of albumen must be abandoned, and we must cease to compare a plasma cell with a particle of white of egg.

MECHANICAL INVENTIONS.

An improved gin saw gummer has been patented by Mr. John B. Clopton, of Elgin, Texas. The object of this invention is to furnish gin saw gummers, so constructed as to shear off the surplus metal in a solid piece from either side of the teeth, and thus bring the teeth to a point, making all the teeth of a uniform shape and size.

Mr. Samuel Potts, of Minneapolis, Minn., has devised an improved apparatus for driving millstone spindles. It is so constructed as to take the side draught of the driving belt off the spindles, and thus make it easier to keep the spindles vertical and the millstones in balance.

Mr. Micheal MacMahon, of Brooklyn, N. Y., has patented an improved compound steam engine, in which, by the arrangement and operation of suitable valves and ports, the exhaust steam is conducted from the one to the other side of the piston, and into a communicating low pressure or vacuum cylinder, for the purpose of equalizing the pressure upon the piston.

LAVATER'S APPARATUS FOR TAKING SILHOUETTES.

We reproduce, as a historical curiosity, an apparatus which was formerly much talked about, obtained a great success, and attracted the attention of savants and of physiologists, but which is entirely out of use at present.

Lavater, in his celebrated work on Physiognomy, describes it as an accurate and convenient machine for drawing silhouettes. The engraving represents the apparatus so well that it is not necessary to enter into a minute description of it.

"The shadow," says Lavater, "is projected upon a fine paper, well oiled and dried, and placed behind a piece of plate glass, supported in a frame attached to the back of the chair. Behind this glass the artist is seated; he holds the frame with one hand and draws with the other."

The proportions of a silhouette, on the authority of Lavater, must be judged principally from the length and breadth of the face. "A correct and well proportioned profile should be equal in breadth and height. A horizontal line drawn from the point of the nose to the back of the head (provided the head be erect) should not exceed in length a perpendicular line which extends from the top of the head to the junction of the chin and neck. All of the forms which deviate sensibly from this rule are so many anomalies."

LAVATER'S APPARATUS FOR TAKING SILHOUETTES.—(From an ancient engraving of 1783.)

In support of these observations Lavater gives a number of specimens of silhouettes, and insists upon the conclusions which he deduces from their study. We give five of these specimens. In No. 1 Lavater sees an upright soul, an even temper, taste, and frankness; in No. 2 the contour of the nose carries the infallible mark of a good temper; in No. 3 we have clearness of judgment. This science of physiognomy appears puerile to us. It may have afforded an agreeable recreation, but nothing more, in a scientific point of view. Lavater nevertheless obtained a great success in Europe. A crowd of persons flocked to Zurich to see the celebrated philosopher and demand of him the secrets of their character and even of their destiny. Lavater with uncommon sagacity was seldom deceived in his judgments; it was thus that he divined the characters of Necker, Mirabeau, and Mercier. The impartial historian must acknowledge that if the work of Lavater is vague, undecided, and sometimes errs in the domain of the imagination, Lavater himself was a man of lofty spirit, faithful to the grand principle of morality. With the idea of unmasking character, and opening the human soul, as one would a book, to inquire into its depths, he produced a great sensation among his contemporaries.—*La Nature.*

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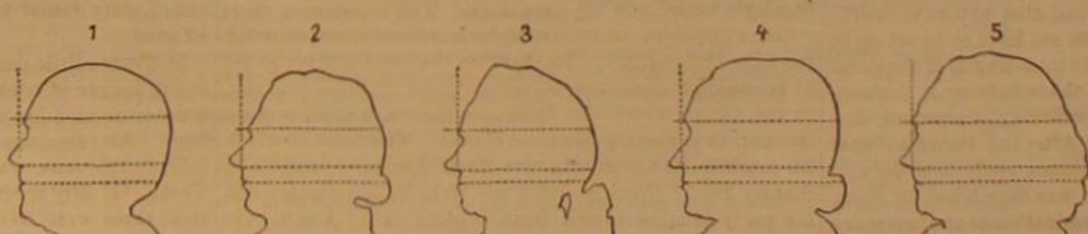

SPECIMENS OF SILHOUETTES OBTAINED BY LAVATER.

New Passenger Locomotive.

One of the largest passenger locomotives built in this country has lately been completed by the Pennsylvania Railroad Company, at Altoona.

It is of the usual American type, with four driving wheels and a four-wheeled truck. The former are 6 ft. 6 in., and the truck wheels 33 in. in diameter. The total wheel base is 19 ft. 5 in., that of the driving wheel 7 ft. 9 in., and of the truck 6 ft. 6 in. The cylinders are 18 in. in diameter by 24 in. stroke; steam ports, $16\frac{3}{4}$ x $1\frac{1}{2}$ in.; and exhaust ports, $3\frac{1}{4}$ in. wide. The maximum travel of valve is $5\frac{1}{2}$ in.

The boiler shell is 50 in. outside diameter on smallest ring, with 201 $1\frac{7}{8}$ in. tubes 10 ft. $11\frac{3}{4}$ in. long. The fire box is placed on top of the frames, and the springs and equalizing levers are hung below the main driving boxes. The fire box can thus be made the full width between the tires, only enough space being left between it and them for clearance. The grate is 10 ft. long by $41\frac{3}{4}$ in. wide. The height of fire box is 46 in. from bottom of mud ring to under side of crown sheet. As the fire box is intended to burn anthracite coal, it has a water grate. The crown sheet is braced or supported with crown bars and sling stays. Over the crown sheet is a wagon top 7 inches high. The height of center of boiler is 7 ft. $5\frac{1}{4}$ in. from top of track. The plates in the shell of the boiler are $\frac{3}{8}$ in. thick, excepting the outside crown sheet, which is $\frac{7}{16}$. The whole boiler is made of steel, excepting the tubes, rivets, and braces. The chimney is 18 in. in diameter and 15 ft. high from top of track. The heating surface in fire box is 125 square feet, in the tubes 1,080, the total being 1,205 square feet. The cross heads have double instead of the usual quadruple guide bars. One of these is placed above and the other below each cross head. The bars are $4\frac{1}{2}$ in. wide. The engine is worked with a steam reversing gear, having two cylinders 6 in. in diameter by $11\frac{1}{2}$ in. stroke. One of these is a steam cylinder, and the other is filled with oil to hold the valve gear in any position. The operation of this reversing apparatus could not be described so as to be understood without a drawing. The boiler is fed with two No. 8 Sellers injectors, and has no pumps. The dome is covered with a wrought iron casing without any mouldings, after the style of European locomotives. The driving boxes are made of wrought iron. The driving axles are 8 in. in diameter, and the journals are $10\frac{1}{2}$ in. long. The coupling rods are fluted, and have solid ends with composition metal bushings pressed into them. The holes which receive these bushings are bored out, and are then slotted, as they would be to receive a key. The bushings are cast in an iron mould of exactly the right size, which is also slotted for a key. A projection corresponding to a key is thus cast on the bushing and fits in the keyway in the rod, the former being pressed into the hole in the rod after its bearing for the crank pin is bored out. The ingredients of the composition are 16 parts by weight of block tin, 1 of copper, and 2 of antimony. The crank pin journals for the coupling rods are $3\frac{1}{4}$ x $3\frac{1}{4}$ in., and the main journals are $4\frac{5}{8}$ in. in diameter by $3\frac{15}{16}$ in. long. The engine has Westinghouse driving wheel brakes. The driving wheel centers are made of cast iron with steel tires, but a set of wrought iron wheels with steel tires made by Krupp have been imported. The total weight of the locomotive in working order is 92,700 lb., of which 65,300 is on the driving wheels.

If this engine works satisfactorily it is intended to build half a dozen more of them at once. They are intended for service between Philadelphia and New York.—*Railroad Gaz.*

The Stevens Car Brake Decision.

The opinion of Judges Bond and Morris, in the cases of Asabel Emigh against the Baltimore and Ohio Railroad Company, and Francis A. Stevens against the same, for infringement of the patent of Stevens' railroad car brake, was filed in the Clerk's Office of the United States Circuit Court, Baltimore, Md., March 17. The suit has been pending since February, 1864. Some years thereafter a decision was rendered in favor of the complainants, and the matter was referred to a master for examination and report. The report was made and an account stated, to which the respondent filed exceptions. The opinion just filed overrules the exceptions, and decrees in favor of the complainants at the rate of $25 per car per year for the use of the Stevens brake, amounting in the aggregate to $87,775.

RECENT INVENTIONS

Mr. Charles O. Allen, of Grand Rapids, Mich., has patented an improved carpet sweeper. The invention consists in the peculiar construction of the case, in a revolving comb combined with the brush and drive wheel, in the peculiar construction of the comb, and in the construction of an elastic spring bail combined with the handle and the carpet sweeper case.

Mr. John Murphy, of Columbus, Ohio, has patented an improvement in the class of pavements composed of stone blocks laid upon a concrete or other water-tight foundation. The pavement is formed of stone blocks, broken stone, and grout, applied and combined.

Mr. George H. Herrington, of Wichita, Kan., has patented a stilt employing an adjustable spring, which may be used at the will of the operator for leaping great distances and heights, and for walking or running with great rapidity and ease.

Mr. Frank F. Parker, of Gardner, Mass., has patented an improved folding chair which may be folded or collapsed so as to occupy less space whenever an economy of space becomes desirable, as in shipment of the goods, etc. The improvement consists in a chair composed of five principal members on each side, of which the back bars and hind legs are arranged on each side of the chair in the same plane and carry the seat, while the front legs and arms are in another plane, and the front and rear legs and the back bars are each jointed to a crossbar, which rests between the plane of the fore legs and hind legs.

Mr. James A. Bonsack, of Bonsack's, Va., has patented a cigarette machine which uniformly feeds and distributes the tobacco upon a continuous paper ribbon, then forms the same into a continuous roll, then pastes the paper around it, and, finally, cuts it off into definite lengths, all in a series of consecutive operations.

Mr. Samuel Bonser, of Dover, N. H., has patented an improved portable force pump for extinguishing fires, washing widows, wetting the roofs of buildings, sprinkling grass plats, plants, and trees, with water or other liquids. It is so constructed that it can be readily moved from place to place.

An improved ornamental bridle buckle has been patented by Mr. Thomas Noble, of Todd's Point, Ill. The object of this invention is to provide a device that, while serving both as buckle and ornament, makes the bridle stronger at the crossing of the brow-band, throat-latch, and bit-strap, by preventing the necessity of making a hole in the throat-latch or brow-band for the engagement of a buckle tongue.

A stock car that can readily be adapted for transporting cattle or other stock, or mixed stock, and can easily be converted into an ordinary freight car, has been patented by Mr. Thomas Noble, of Todd's Point, Ill. The invention consists of an improved folding feed-trough and supporting braces, movable water-trough, adjustable shutter or feeding platform, and adjustable and removable stall gates.

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.

Alden Crushers and Pulverizers manuf'd and sold by the Westinghouse Machine Co., Pittsburg, Pa., U.S.A.

Full Set Patent Office Reports, 1846 to 1871, inclusive, for sale. J. C. House, Lowville, N. Y.

At all seasons of the year use Van Beil's "Rye and Rock," which is the only genuine.

Rock Drill, with Hose and Portable Boiler. Machinery Exchange, 261 N. 3d St., Philadelphia, Pa.

For all kinds of Special Rubber Goods, address Akron Rubber Works, Akron, O.

For Sale.—Iron Tanks, imported, about 100 gallons capacity, at $10. Address 12 Cedar St., New York.

Authors of Unpublished Works should correspond with Local Printing House, Silver Creek, N. Y.

Use the Vacuum Oils. The best car, lubricating, engine, and cylinder oils made. Address Vacuum Oil Co., No. 3 Rochester Savings Bank, Rochester, N. Y.

Valuable Manufacturing Property for sale at half value, if sold at once. Situated in North Adams, Mass. Consisting of fourteen acres and thirty-seven buildings. Fine brick mill, five stories, 150 x 50, with fine water power, two elegant dwelling houses, twenty-eight tenement, and numerous other buildings. Dwellings and tenements rented. For terms, apply F. S. Perrin, Albany, N. Y.

The Patent for the Novel Fire Kindler illustrated on page 214, current volume, is for sale. Address Wm. Rausch, 1,828 Wood St., Philadelphia, Pa.

Engines and Boilers: 16 x 48, 15 x 30, 13 x 30 inch Horizontal; 16 x 28 Upright Engines; 30, 40, and 80 H. P. Locomotive Boilers; 20 to 45 H. P. Horizontal Tubular Boilers. Second-hand, but guaranteed in good order. Full line second-hand Wood-working Machinery. Send for descriptive list. Belcher and Bagnall, 40 Cortland St., N. Y.

For a Two Horse Roper Caloric Engine, nearly new, inquire of E. West, Lockport, N. Y.

Lathes, Planers, Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

Owners of steam boilers can save fuel, repairs, and delays by using Hotchkiss' Mechanical Boiler Cleaner, which removes all mud or scale-making properties from the boiler. Send for circular. 84 John St., New York.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Eclipse Fan Blower and Exhauster. See adv., p. 220.

The Newell Universal Mill Co., Office 7 Cortlandt St., New York, are manufacturers of the Newell Universal Grinder for crushing ores and grinding phosphates, bone, plaster, dyewoods, and all gummy and sticky substances. Circulars and prices forwarded upon request.

Blake "Lion and Eagle" Imp'd Crusher. See p. 221.

Ten Double-acting Presses, 8 single-acting Presses, 127 Foot Presses, for sale by The George Place Machinery Agency, 121 Chambers St., N. Y.

For best Duplex Injector, see Jenks' adv., p. 204.

Portable Railway Track and Cars of all Descriptions for Railroad Grading, Sugar Plantations, Mines, etc. Send for circulars. F. W. Corey & Co., 162 Broadway, N. Y.

L. Martin & Co., manufacturers of Lampblack and Pulp Mortar-black, 236 Walnut St., Philadelphia, Pa.

Send to John D. Leveridge, 3 Cortlandt St., New York, for illustrated catalogue, mailed free, of all kinds of Scroll Saws and Supplies, Electric Lighters, Tyson's Steam Engines, Telephones, Novelties, etc.

The Twin Rotary Pump. See adv., p. 206.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Brass & Copper in sheets, wire & blanks. See ad. p. 237.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

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

For best Indirect Radiators, see adv., page 237.

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

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Wren's Patent Grate Bar. See adv. page 237.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

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

New Economizer Portable Engine. See illus. adv. p. 237.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

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

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

Houston's Four-Sided Moulder. See adv., page 237.

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

For Mining Mach'y, see adv. of Noble & Hall, p. 236.

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

The Sweetland Chuck. See illus. adv., p. 204.

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.

The I. B. Davis Patent Feed Pump. See adv., p. 205.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 205.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 205.

Peck's Patent Drop Press. See adv., page 236.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Turbine Wheels; Mill Mach'y. O. J. Bollinger, York, Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Clark Rubber Wheels adv. See page 236.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

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

Eagle Anvils, 10 cents per pound. Fully warranted.

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

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

Burgess' Portable Mechan. Blowpipe. See adv., p. 204.

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

Long & Allstatter Co.'s Power Punch. See adv., p. 220.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Light Machinists' Tools, etc., see Reed's adv., p. 221.

4 to 40 H. P. Steam Engines. See adv. p. 221.

Grain Nickel, Nickel Salts, Nickel Anodes, Composition, Felt Buff Wheels. Greene, Tweed & Co., New York.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 337.

For Mill Macb'y & Mill Furnishing, see illus. adv. p. 237.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Saw Mill Machinery. Stearns Mfg. Co. See p. 237.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Cotton Belting, Rubber Belting, Leather Belting, Polishing Belts. Greene, Tweed & Co., 118 Chambers St., N.Y.

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

Saunders' Pipe Cutting Threading Mach. See p. 237.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Toope's Pat. Felt and Asbestos Non-conducting Removable Covering for Hot or Cold Surfaces; Toope's Pat. Grate Bar. C. Toope & Co., M'f'g Agt., 353 E. 78th St., N.Y.

Use Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

For Machinists' Tools, see Whitcomb's adv., p. 237.

Vick's Seeds best in world. Floral Guide tells how to grow them. See adv., p. 204.

Wiley & Russell M'f'g Co. See adv., p. 204.

NEW BOOKS AND PUBLICATIONS.

THE STEAM ENGINE AND ITS INVENTORS. By Robert L. Galloway. London: Macmillan & Co. 12mo, cloth.

An admirable historical sketch of the origin of the cylinder and piston engine, the application of steam to it as a motive power, and the development of the steam engine during what may be called its germinal period, closing with Watt, Stephenson, and Fulton.

LIFE HISTORY OF OUR PLANET. By William D. Gunning. New York: R. Worthington. 12mo, cloth.

It is a rare thing to find a book of this class which is at once entertaining in style and strictly scientific in matter, method, and spirit. Mr. Gunning is obviously well informed with regard to the later results and tendencies of biology, paleontology, and geology; and he has displayed in these lectures not a little skill in grouping and describing in plain English the more significant facts and laws of the evolution of life forms through the geologic ages. The intelligent reading of the book, however, presupposes an amount of scientific knowledge not likely to be possessed by the average "popular" reader.

IS DARWIN RIGHT? OR, THE ORIGIN OF MAN. By William Denton. Wellesley, Mass.: Denton Publishing Company. 12mo, cloth.

Twenty-five years ago Mr. Denton was widely known as a champion of "advanced" notions with respect to geology and human history. During his career as a popular lecturer he has undoubtedly done good work in combating the older unscientific traditions of the multitude. But the cast of his mind is essentially unscientific, and his knowledge would appear to have been gained mainly by reading. His book is interesting and suggestive; but it betrays throughout the incompetence of the author to grasp the exact conditions of the problem he attempts to answer.

BENJAMIN PEIRCE. A MEMORIAL COLLECTION. By Moses King. Cambridge. Sq. 12mo, paper.

Contains a portrait of the late Professor Peirce, of Harvard, a biographical sketch by Dr. Thomas Hill, several obituary and editorial notices from public prints, funeral discourses, and other memorial matter. Mr. King's work has been neatly done.

COMMERCIAL RELATIONS OF THE UNITED STATES. Reports from Consuls. No. 2. November, 1880. Washington: Government Printing Office.

One of the most commendable acts of the late Secretary of State was the organization of a system of reports from our consuls abroad touching the commerce, manufactures, etc., of their districts, with special reference to opportunities for increasing the foreign commerce of the country. The practical value of such reports is greatly enhanced by their early publication; and it is to be hoped that the new administration will not allow this useful publication to be neglected.

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) E. W. R. writes: 1. I have a large white clam shell on which I wish to paint. The inside is covered with a roughness that looks like lime. Will you kindly tell me what will clean the inside of this shell? A. Use a soft piece of cloth moistened with dilute aqueous solution of oxalic acid; rinse thoroughly, dry, and finish with a little fine whiting moistened with oil. 2. What will clean bronze and take off fly specks? A. Use a sponge moistened with warm wine spirit; go over the surface quickly.

(2) J. D. R. asks: 1. How do you make red and green lights? A. For colored fires see answer to A. M. G. (23), page 155, No. 10, current volume. 2. What will make a dense white smoke that one may throw a shadow on? A. Sulphide of antimony (powdered) burned with niter gives a thick white smcke. It should not be used indoors, as it is very pernicious. The vapors of heated muriatic acid and strong ammonia water when brought into contact also produce dense white vapors. This is less objectionable than the antimony.

(3) C. K. H. writes: 1. In SUPPLEMENT of September 23, 1876, I find receipt for black ink: 1 part soluble nigrosine in 80 parts water. Will ink made in this manner spoil or fade in bottles by age? A. No. 2. What can be added to this ink or to crystal black aniline ink that will give a glossy appearance? A. Add a suitable quantity of sugar and gum arabic.

(4) J. C. writes: I wish to know how to mix lead and zinc—a cheap process. A. Mix the fused metals well together; stir until cooled nearly to the point of solidification; then cast. If the casting is large, so that the alloy does not chill at once, the metals are apt to separate somewhat unless the mould can be reversed or moved about.

(5) W. A. H. asks: Will iron, etc., draw from a magnetic compass needle its magnetic properties if placed near it for a length of time? A. No; it will rather tend to strengthen it.

(6) J. P. C. asks: 1. Were the tests made by government engineers on boilers printed? A. No. 2. How can I calculate the amount of water thrown by a lift pump in an hour: the cylinder 3½ inches diameter, length of stroke 32 inches, number of revolutions 28 per minute? A. Multiply the area of the piston in inches by the stroke in inches, deduct 5 per cent for losses; the result is the number of cubic inches per stroke, which multiply by the number of strokes per minute.

(7) A. W. asks: Are there more miles of railway in the United States than there is in the rest of the world? Has Siberia or China a railroad? A. There are about 98,000 miles railroad in Europe, 93,000 in the United States, and 27,000 in the rest of the world. Siberia has a few miles of the commencement of a road. China had a short road, but it has been taken up.

(8) J. M. F. asks (1) for recipe for a good ink powder. A. Ink powders.—*a*. Reduce best quality of soluble nigrosin to impalpable powder by grinding. The powder dissolves in water, forming an excellent ink. *b*. Pure crystallized sulphate of iron, 2 lb.; tannic acid, 1 lb.; indigo carmine, 2¼ oz.; reduce all to powder and triturate well together; gradually add ¾ oz. crushed cloves. These proportions will produce something over a gallon of very fine ink (fluid) when mixed with enough warm water. 2. A receipt for silver soap or scouring soap for cleaning all kinds of metals, etc. A. Tallow or grease, 100 lb.; rosin, 80 lb.; silicate of soda, 15 lb.; fine silicious sand, 12 lb. Saponify the grease by boiling with about 15 lb. of caustic soda, dissolved in water to form a lye of about 15° B. Saponify the rosin by boiling with 4 gallons of soda lye at 30° B., and add to it the silicate of soda. Having separated the grease soap mix it at boiling by beating with the resin soap and water glass and the silica. Stir while cooling in the frames.

(9) G. C. S. writes: Will you please state through the columns of your paper the thickness of the heaviest iron armor plating made and in use on naval floaters or turret ships to withstand the heaviest guns? A. 14 inches in a single thickness. 2. What thickness of iron the heaviest of the improved modern guns have pierced? A. About 12 inches.

(10) A. H. C. writes: 1. I have made a Blake transmitter which works to perfection with the single exception of an occasional cracking noise. I use four cells of Leclanche battery instead of one, as I find the transmitter works louder. The cracking noise does not come from the main line, nor from the transmitter, as I have proved by tests. Does it come from the battery, and if so can it be remedied? A. The noise referred to is probably made by the combustion of the carbon due to the passage of the battery current. Where this occurs it speedily destroys the efficiency of the instrument. 2. Should the carbon in transmitter be of the hardest kind, and why? A. To obtain the best results the carbon should be hard and well polished.

(11) C. R.—The diameter of each of the four cables of the great suspension bridge between New York and Brooklyn is 15¾ inches. Each cable is composed of 19 strands of No. 8 galvanized steel wire (about an eighth of an inch in diameter), 280 wires to the strand, or 5,320 wires each cable. In other words, the bridge floor is suspended on 21,280 one-eighth inch steel wires, each 1,600 feet long between the granite towers.

(12) C. W. B. writes: 1. I have 2 oz. of No. 36 silk covered wire. Please state dimensions for making the largest induction coil, that I may use all my wire. A. Make the core 3 inches long and ⅛ inch in diameter. Wind it with three layers of No. 18 wire, then fill your spool with the No. 36 wire. 2. Will the above coil light one gas burner, with one cell of the Smee battery (plates 3x4 inches)? A. If well made and a condenser applied it will light gas. 3. Would this be too strong for shocks? A. No, providing the cone be made movable, so as to regulate the current.

(13) R. D. asks: What metal is best to use on push buttons, switches, etc., to give good connections? I have been using German silver, but it don't answer the purpose well. A. Use copper or platinum.

(14) J. B. asks (1) how I can obtain a good permanent red color on cotton yarn by dyeing with Brazil wood or Cochineal? We have tried several methods, but we do not succeed in getting a fast color. A. The following are practical receipts: For 50 lb. cotton: 1. Mordant with 15 lb. sumac and 10 lb. alum. Dye with 6¼ lb. cochineal. Leave 24 hours in the sumac; lift, make up the solution of alum hot. Winch in this for 2 or 3 hours; lift, wash in two waters; boil the cochineal; put off the boil; enter and winch till full enough, then wash and dry. 2. Mordant with 16 lb. sumac and cotton spirits 3° Twad.; dye with 24 lb. lima wood or Brazil wood; sumac 24 hours, lift and winch in spirit tub, and wash out. Boil the wood, decant the clear liquor, enter, and winch 30 minutes; raise with alum. Cotton spirit may be prepared by dissolving in 1 lb. of a mixture of 4 parts muriatic and 1 part nitric acid 3 oz. fine tin; reduce with water.

(15) H. F. G. asks: Who first invented the governor for regulating the speed of engines? A. James Watt.

(16) N. B. M. asks: 1. Will the galvanized steel wire such as is used for fencing make a good lightning rod? A. Yes if ten or fifteen are twisted together to form a single rod. 2. Does the coating on the wire affect its conducting power? A. No.

(17) H. H. K. asks what it is that the Chinese use in making their wash glossy. A. They are said to moisten the starched linen with raw starch water containing a little blood albumen. The gloss is developed by hard rubbing with a small polishing iron.

(18) I. P. writes: 1. I want the best and simplest process of embalming human bodies. Can you give me the information I need? In SUPPLEMENT, No. 266 (Feb. 5), page 4237, top, is a method. Is there a better one? Give particulars of process for practical use, or refer to where to find process. A. See page 813, SUPPLEMENT, No. 51; also pp. 371, 117, 103, and 391, vol. xxxvii., and 139 (5) vol. xxxix., SCIENTIFIC AMERICAN. 2. What is the best dye to color whiskers and hair brown or black? A. The expressed juice of the bark of green walnuts is said to be one of the best.

(19) A. J. S. writes: I have a row of ground glass window panes that I would like to have transparent one third at the top. Can you tell me of a varnish or anything of the kind that will make them so? A. Varnish will not do it; the glass must be polished.

(20) C. A. H. asks if zinc will do to line a fresh water tank. The tank is 26 feet long, 6 wide, and 4 high. Will it last ten years? A. If the water is not to be used for drinking or cooking purposes, yes. Under favorable circumstances it will last ten years. The wood of drinking water tanks may be preserved by coating it with genuine asphaltum, purified by melting it over a fire and stirring it occasionally for six hours. Apply to the dry wood and let it stand several days before wetting. It is better to run off the first water.

(21) J. L. D. asks: How can I make a black preparation with linseed oil to make thin cloth waterproof and yet pliable? A. Add half a pound patent drier per gallon of oil, and enough lampblack to color. Heat the oil, apply with a brush, and dry at 100° Fah.

(22) W. E. S. & Co. ask (1) where to obtain marine glue. A. Address any large dealer in philosophical goods. 2. How is it prepared? A. See receipts for marine glue, page 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(23) F. D. H. writes: I have seen at hotels in New York articles of porcelain and glass ware that had been broken and mended, by placing what appeared to be small copper "dogs" or staples across the line of fracture, the ends of which appeared to be cemented into holes drilled into, but not through, the material. Can you inform me how this is done, how the holes are drilled, and what cement is used? A. Holes may be bored in porcelain by means of an ordinary machine drill. The drill is kept moist with oil of turpentine, and caused to revolve rapidly by taking one twist of the string of a bow about it and drawing the bow quickly backward and forward, after the manner of using a saw, while the head of the drill is held in position by a loose oiled brace. Use the waterproof cement described at the bottom of page 2510, SUPPLEMENT, No. 158, article on cements.

(24) G. A. N. asks: 1. Are type metal castings made heavy, suitable for small engine castings, say 1x2 cylinder? A. They would answer, but are not so good as steam metal or iron. 2. Of what material are the steam way cores for such small castings made, and how are they removed from the casting? A. Generally of composition or brass. 3. Is there an electric motor in the market of sufficient power to practically operate a sewing machine? A. Edison's motor will do this.

(25) G. C. S. asks: 1. Should the cutters in a milling machine be lubricated for milling common

yellow brass? If so, with what? A. For soft brass we think no lubrication necessary other than a solution of soap, to keep the work cool. For hard brass lubricate with good oil. 2. What should the velocity of the periphery of cutters be for milling brass? A. The speed may be considerably greater than for iron, say 80 to 100 feet per minute.

(26) W. W. asks: How can I make a liquid stove polish to be applied with a woolen cloth, and get the same luster, as the old style with brush, water, and carburet of iron? A. Reduce good graphite, by milling with water, to a degree of fineness that will cause it to remain suspended in water for some time. Water holding in suspension a large quantity of this powdered plumbago may be used as a liquid stove polish.

(27) C. C. S. asks: 1. What can I use to make linen white—something that will do the work quick, so that it can be used in a laundry, and that does not injure the clothes? A. Boil in hot soda, rinse, and wring out; handle in a moderately strong clear solution of fresh chloride of lime, wring out, and handle in clear water to which has been added about one per cent of sulphuric acid; wring out and rinse in clear water, then steep for ten minutes in water containing about one per cent of bisulphite of soda, rinse in clean water again, wring out, and dry.

(28) W. H. W. writes: Of late I have a great deal of trouble with my work and cannot tell the cause. My work is mostly on brass. The common yellow brass I do not have any trouble with; but when I have red brass to plate I am unable to make it hold, although I clean it in the same manner as the yellow brass. In this way, I first polish the work, then boil it in crude potash, rinse, then dip in a solution of cyanide of potash, rinse again, then into the bath. The nickel seems to take all right; but after it has been in the bath about half an hour it peels off while in the bath, and I cannot account for it. My work leaves the bath nice and bright, but I can see before I commence to finish it that it will be bad. A. Your trouble may be due to imperfect cleansing of the work, or too low a quantity of current as compared with the strength of bath—probably the former. Rinse thoroughly from the potash, and scour with fine pumice stone moistened with the cyanide, rinse, and put in circuit at once. Use larger cells in the battery, or arrange as indicated in article on nickel plating, page 153, No. 10, vol. xliii.

(29) O. R. asks why adding water to sulphuric acid makes the mixture hotter. Is there any combination chemically? A. Water and sulphuric acid unite chemically. The heat is developed by the condensation which takes place. One volume of strong acid and one of water mixed make less than two measures of dilute acid.

(30) H. H. L. asks how the engineers in charge of the proposed tunnel under the English channel get the bearing in order that they may excavate from both sides and have the excavations meet beneath the channel. If they could see across the channel it would all be plain to me, but as they cannot, I can't see how it is done. A. We believe it is possible at times to see across the channel. The bearings are probably obtained by aid of the magnetic needle.

(31) T. G. asks: Can you inform us in what way to use nitric acid to cut hard steel? A. Mix strongest nitric acid with three times its weight of hydrochloric acid, and warm before using. 2. I have learned from a jeweler that salt added to nitric acid will leave a spot on gold if alloyed, even as little as coin. Is this so? A. Any liquid containing chlorine will attack gold. The mixture of salt (chloride of sodium) and nitric acid especially, if warmed, contains free chlorine. A better solution is the nitro-muriatic acid (aqua regia) alone.

(32) W. H. P. asks how to clean copper specimens, also silver specimens, so that they will stay clean and not turn black. A. Clean with a strong solution of cyanide of potassium and a stiff brush, rinse in cold, then in hot water, and as soon as dry coat thoroughly with colorless shellac varnish thinned with alcohol, otherwise the metals will soon tarnish again.

(33) H. C. C. asks: Can a varnish be made of pure amber, and how? A. Amber varnish is prepared as follows: Six pounds fine picked very pale transparent amber is fused in a suitable copper pot over a moderate fire, and mixed with two gallons of hot clarified linseed oil. The mixture is boiled until it strings very strong, when the pot is removed out of doors and the contents gradually mixed with four gallons of oil of turpentine.

(34) G. F. R. asks: Do you know some means to prevent the absorption of water by glycerine used in glue? A. Add a small quantity of chromic acid or bichromate of potash to the glue glycerine composition. Exposure to sunlight will make the surface insoluble in water.

(35) J. E. F. asks how the panels are japanned for panel painting. A. Have the work dry and warm, and give it two coats of a solution of 4 oz. seed lac in 1 pint of alcohol. Harden in an oven at about 250° Fah. Then lay on four coats of the following varnish, hardening each in the oven, before the next is applied: Fine shellac, 2 oz.; alcohol, 1 pint; dissolve by digestion and agitation, and add ivory black previously moistened with spirit and ground very fine, enough to color. Finally give it five or six coats of the clear alcoholic shellac (without the black), harden in the oven, and polish with a piece of felt dipped in pumice stone or tripoli in finest powder. Toward the end a little oil may be used with the tripoli or pumice, and when the surface appears sufficiently bright rub with oil alone to clean and finish.

(36) A. C. M. asks: What is the quantity of each ingredient used in silvering mirrors, as published in your issue of December 13, 1879? A. For details of the silvering process see SUPPLEMENT, No. 105. The potassio-mercuric cyanide solution may be prepared by dissolving in a small quantity of water half an ounce, of mercuric chloride, and stir into it gradually, until the precipitate at first formed is just redissolved, a strong aqueous solution of pure cyanide of potassium. Filter the solution, and dilute it with pure water to one gallon for use. 2. Is the fine zinc dust used the same dry zinc such as painters use? A. No. Use metallic zinc in fine powder, such as filings.

(37) W. S. H. writes: I notice in the SUPPLEMENT, No. 261, a description of an improvement in the Bunsen battery, and the experiment was carried on with the salts of ammonia, but it does not say what kind of salts, whether nitrate, sulphate, or some other salts. A. The salt referred to is ammonium chloride—sal-ammoniac.

(38) E. J. M. asks: Can you inform me whether the asbestos roofing is durable? I have been told that it will not last over two years. A. So far as we know, we incline to a favorable opinion of asbestos roofing. The manufacturers of this species of roofing claim that it forms a smooth, water and air tight surface, which is a good non-conductor of heat, and is practically a resistant of fire; that it is adapted to all climates, and is durable. We do not know of any facts to call these claims into question, and certainly would not hesitate to say so if we knew the material to be worthless.

(39) A. B. & B. write: 1. We wish to know of a substance to impregnate wood with, that will prevent it from swelling and shrinking. It must not be affected by spirits or acids, and must not be poisonous. A. Try the following: Paraffine, 1 lb.; benzole, 2 gals.; dissolve; digest the wood (dry) in this solution for several days, dry in the air, then heat to about 250° Fah., in an oven. 2. Will the Thilmanny process answer for this? A. It is not intended for this kind of work. 3. Is sulphite of baryta soluble in spirits or acids, and is it poisonous if used for vessels to measure vinegar or spirits? A. It dissolves in water and in dilute spirit, and is decomposed by acids.

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

D. Y. H.—The limestone contains much galena—lead sulphide, some copper, and a trace of silver. See Hints to Correspondents.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

March 15, 1881,

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.

Abdominal supporter, M. T. Linquist 238,794
Agricultural implement, combined, H. M. Keith 238,788
Amalgamator, J. Wilkins 238,825
Annunciator, automatic electric, A. Bradford 238,756
Arm rest and book leveler, combined, O. Smith 238,979
Auger, earth, J. H. Gould 238,888
Axle box, anti-friction, W. Miller 238,949
Axle box, car, A. L. Anderson 238,830
Axle, carriage, L. Provancher 238,964
Axle lubricator, car, G. J. & S. J. Shimer 238,813
Bale band and tie, R. S. Jennings 238,910
Bale tie fastening, C. B. Morse 238,962
Bark mill, H. Kullman 238,923
Barrel head fastening, S. B. Ladd 238,790
Bed bottom, adjustable spring, H. A. Scott 238,974
Bed, invalid, E. J. Morgan 238,799
Bell, call, J. P. Connell 239,013
Bell, electric call, A. G. Bell 238,833
Belt, signalman's, T. M. King 238,919
Bleaching yarn, wool, etc., apparatus for, J. Scharr 238,973
Book binding, H. M. Hoyt 238,782
Boot or shoe, B. F. Whitney 239,005
Bottle and other hollow glassware, C. B. Van Syckel 238,995
Bottle stopper, E. L. Lloyd 238,938
Bottle stoppers, tool for removing rubber disks from internal, R. Otten 238,958
Bramble cutting device, H. M. Clements 238,854
Bridle bits, machine for rolling mouthpiece blanks for, P. & W. B. Hayden 238,779
Buckle, harness, C. W. Garrett 238,884
Buggy valance, Adkins & Bogenschutz 238,751
Burglar alarm and door bolt, combined, R. M. Patchin 238,805
Button hole cutter, Quinby & Cornell 238,965
Button, sleeve, T. W. Feeley 238,772
Candy cabinet, H. H. Hershey 238,901
Cap or head covering, Finster & Simonson 238,878
Car basket rack, R. E. Goodrich 238,886
Car brake, J. Askins 238,831
Car, cattle, D. Keethler 238,786
Car coupling, R. De Lan 238,866
Car coupling, L. Poh 238,962
Car, dumping, P. M. Womble 238,827
Car, stock, L. E. Wilson 238,826
Cars, lighting the platforms and steps of railway, W. S. Rogers 238,969
Cars, ventilation of railway passenger, Fox & Kinsey 238,777
Carburetor, A. M. Brainard 238,757
Carburetor, W. W. Walmsley 238,818
Carding machines, tooth for cleaning rollers of, T. Kershaw 238,918
Carpet stretcher, A. Mitchell 238,951
Carriage clips, machine for making, Bulley & Moore 238,848
Cart, locked dumping, F. H. Trenholm 238,817
Chalk lines, self-chalking holder for, C. Wing 239,009
Cider mill, W. M. Williams 238,824
Cigarette paper package, N. V. Randolph 238,966
Clock striking mechanism, H. J. Davies 238,863
Clothes wringer, Crooker & Eyer 238,764
Condenser, surface, I. R. Blumenberg 238,754
Corset, T. C. Bates 238,832
Corset, M. W. Henius 238,899
Corset, A. F. Loomer 238,795
Cotton stalk puller, J. C. Wilson 238,825
Cradle, C. C. Lenz 238,923
Crib, child's, F. H. Brown 238,843
Crucibles, etc., manufacture of plumbago, S. A. Peto 238,806
Cultivator, L. K. Tipton 238,989
Cultivator, D. Unthank (r) 9,607
Cultivator, Van Sickle & McConaughy 238,994
Cultivator, wheel, F. B. Manly 238,943, 238,944
Curtain fixture, B. Landon 238,925
Dental plugger and burr, H. S. Miller 238,950
Dentistry, J. E. Low 238,940
Draught equalizer, W. Anderle 238,828
Draughting instrument, T. Tostevin 238,990
Dredging apparatus, vacuum, H. C. Sears 238,975
Duplicating press, H. S. Norse 238,956
Dust pan, G. Macardle 238,942
Ejector for steam machinery, oil, Verniaud & Cabbell 238,996
Electric cable, T. A. Watson 238,999
Elevator, G. W. Clayton 238,762
Elevator bucket, W. P. Myer 238,801
Engraving machine, A. E. Francis 238,882
Expansion joint, W. Forman 238,775
Explosive compound, F. C. Keil 238,916
Eyeglasses, nose piece for, F. Terstegen 238,985
Eyelet blanks, machine for cutting, G. O. Schneller 238,810
Faucet, J. Clifford 238,855
Feed water apparatus, G. Westinghouse, Jr 239,000
Fence, portable, J. M. Irwin 238,783
Firearm, breech-loading, A. E. Whitmore 238,821
Firearm, magazine, F. W. Tiesing 238,988
Floating cooler, J. Schafhaus 238,809
Fracture apparatus, C. R. Gorgas 238,887
Fuel, device for feeding fine, A. Greiner 238,891
Funnel for use in canning fruit, etc., J. A. Fletcher 238,774
Garment, reversible, H. Marks 238,945
Gas making apparatus, J. W. Boland 238,837
Gas valve, Druckleb & Fels 238,768
Gate, I. L. Landis 238,924
Glass building block and building, C. W. McLean 238,797
Glass pipes, apparatus for the manufacture of, E. B. McIntosh 238,796
Glove, time, L. P. Juvet 238,913, 238,914
Governor for vulcanizing apparatus, W. E. Gwyer 238,894
Grain binder, M. G. Hubbard, Jr 238,904
Grain cleaner, L. Gathmann 238,885
Grain drill, H. L. Brown 238,845
Grain drill, S. B. Hart (r) 9,604
Grinding mill, W. N. Cosgrove 238,859, 238,860
Harvester, A. Burd 238,937
Harvester binder, S. D. Locke 238,939
Harvester chain rake, W. N. Whiteley 239,003
Harvesters, conveyer chain for, W. W. Burson 238,849
Harvesting machine, W. N. Whiteley 239,004
Hat and cap adaptable to heads of different sizes, M. Davis 238,865
Hat shaping machine, J. P. Farmer 238,771
Head rest for invalids, adjustable, Hopkins & Higgins 238,780
Heater and muffler, combined, G. C. Fink 238,773
Heel restorer, D. F. McKitrick 238,946
Hinge, gate, E. J. Bowen 238,840
Holdback, G. W. Thorp 238,986
Hoop making machine, barrel, E. E. Thresher 238,987
Horse detacher, B. W. Sparks 238,814
Horseshoe nail clincher, F. Wierwille 238,822
Horseshoe nails, machine for forging, L. S. Parré 238,804
Horseshoeing machine, A. G. Humphrey 238,906
Hose patch, J. A. Fairbanks 238,770
Hub, vehicle wheel, N. J. Houk 238,781
Hodrant valve, J. Flanagan 238,879
Hydrocarbon, burning, D. Church 238,852
Inhaler, A. J. Leslie 238,793
Kettle, H. Friedman 238,883
Lamps, manufacture of carbons for incandescent electric, T. A. Edison 238,868
Lasting machine, R. C. Lambert 238,791
Lathe, L. H. Sanderson 238,971
Lead and crayon holder, H. Harris 238,897
Lemon squeezer, R. H. Daley 238,765
Letters and figures for signs formed of celluloid, etc., M. C. Lefferts 238,928
Liquid cooling apparatus, E. J. Petit 238,961
Loom stop motion, Shaw & Meyner 238,812
Lumber boom, I. W. Norcross 238,954
Lumber trimming machine, E. H. Stearns 238,815
Mandrel, J. A. Wilde 239,006
Mattress, J. T. Elwell 238,873
Mechanical movement, J. Bond, Jr 238,839
Microphone transmitter, G. L. Anders 238,829
Middlings purifier, J. A. Kister 238,921
Milk cap, P. J. Huber 238,905
Miter clamp, F. J. Steinborn 238,981
Monument, iron corner, T. Wagner 238,997
Motive power engine and generator, H. Davey 238,767
Mower and reaper, M. D. Farnham 238,874
Nut making die, W. Gray 238,890
Oil, petroleum illuminating, H. V. Draper 238,867
Packing, piston, W. J. F. Liddell 238,935
Paddlewheel, McLennan & Owen 238,947
Paper, etc., ornamenting, W. H. R. Toye 238,991
Pen holder, E. R. D. Meusel 238,948
Pencil, lead, J. W. Hyatt 238,908
Pianofortes, stringing, A. F. Helwig 238,898
Picture hanger, K. Phillips 238,807
Pipe wrench, J. J. Carmody 238,761
Plow attachment, W. P. Brown 238,846
Plow, etc., combined, C. E. Sackett 238,970
Plow, revolving, M. A. & I. M. Cravath (r) 9,603
Plow, riding, C. Van De Mark 238,993
Plow, sulky, H. L. Daniels 238,766
Plow, sulky, S. G. Pomeroy 238,808
Potato digger, H. M. Keith 238,787
Power press stop, W. Lang 238,926
Presses, etc., knuckle joint action for, M. Stonehouse 238,983
Printing, photo-mechanical, T. C. Roche (r) 9,608
Pump bucket, chain, A. Johnston 238,911
Pump, rotary, L. Benson 238,834
Quilting machine, F. P. Canfield 238,760
Rails, machine for cutting and drilling, W. M. Sheesley 238,976
Railway signal, Cox & Soule 238,861
Railway switch, G. H. Knapp 238,922
Reclining chair, T. Harding 238,896
Refrigerator, J. H. Forshay 238,776
Ring, bracelet, etc., F. Wallach 238,998
Rod, coupling, I. L. Haldeman 238,895
Rolling car axles, roll for, T. S. Cook 238,857
Rotary engine, A. Noteman 238,802
Rotary engine, W. C. Pooley 238,963
Sash fastener, H. Fellows 238,876
Saw filing machine, E. P. Ellis 238,872
Saw handle, H. W. Peace 238,960
Saw handle, crosscut, W. E. Brooke 238,758
Saw mill head block, W. J. F. Liddell 238,936
Sawing, grooving, and planing machine, combined, G. M. & N. Fay 238,875
Scale beams, magnetic support for, S. H. Brackett 238,841
Scholar's companion, A. Daul 238,862
Seeding machine, force feed, N. A. Wheeler 238,820
Self-opening gate, E. J. B. Whitaker 239,002
Sewing machine, R. Eickemeyer 238,871
Sewing machine, lamp attachment, M. D. Strait 238,816
Shafts, clutching and releasing device for, J. Bond, Jr 238,838
Shipping can, C. L. Betts 238,835
Shovel, C. W. Hubbard 238,903
Shuttle for weaving wire cloth, C. K. Sawyer 238,972
Shuttle for weaving wire cloth, G. F. Wright 239,011
Sickle grinder, G. M. Brown 238,844
Sieve, grain and seed, O. R. Morris 238,800
Smoke consumer, D. C. Kellam 238,917
Smoke consuming furnace, Buschick & Van Allen 238,759
Snap hook, Norton & Merchant 238,957
Soda and mineral water fountain, C. Jackson 238,909
Spittoon, automatic, G. M. Edwards 238,769
Spooling machine thread guide, C. G. Trafton 238,992
Spring fitting machine, C. Lewis 238,934
Station indicator, railway, G. M. Guild 238,893
Stays from celluloid, etc., manufacture of, M. C. Lefferts 238,927
Steam chest for hot air drying, A. Winward 239,010
Steam supply system, Haxteen & Foote 238,778
Steam trap, G. Westinghouse, Jr 239,001
Stove board, A. I. Griggs 238,892
Stove cone attachment, J. H. Egan 238,870
Stove, gas or vapor, J. Swarts 238,984
Stove, oil, J. McConnell (r) 9,606
Sulky, Chandler & Williams 238,851
Sulphur and sulphides, manufacture of metallic compounds from, J. B. Spence 238,980
Surveying of land, process of and device for establishing section corners, etc., in the, C. A. Begle 238,752
Telegraph, automatic, W. A. Leggo 238,929
Telegraph key, W. A. Leggo 238,932
Telegraphic circuit, O. Lugo 238,941
Telegraphy, automatic, W. A. Leggo 238,930, 238,931
Telephone exchange switch, A. H. Palmer 238,803
Telephone lines, chronometric signaling apparatus for, H. D. Sisson 238,977
Telephone systems, shunt for speaking, F. W. Jones 238,912
Telephone transmitter, G. M. Hopkins 238,902
Telephones, carbon contact for, J. H. Irwin 238,784
Thill holder, P. Grant 238,889
Tiling, cement illuminating, J. M. Cornell 238,858
Tiling for roofs, etc., J. J. Williams 239,007
Tobacco cutting machine, N. H. Borgfeldt 238,755
Tool handle, adjustable, S. B. Parker 238,959
Truck, car, W. H. H. Sisum 238,978
Truss, Norris & Sweet 238,955
Twist drills, manufacture of, P. D. Nicols 238,953
Umbrella and sun shade, J. T. & F. S. Liley 238,937
Vacuum pan, J. G. Reed 238,968
Valve gear, steam engine, P. Breen 238,842
Valve seat for steam cylinders, H. Watkeys 238,819
Vehicle platform gearing, B. C. Shaw 238,811
Vehicle running gear, P. Herdic 238,900
Vehicle spring, G. G. Buckland 238,847
Vehicle wheel, J. B. Clement 238,853
Velocipede, H. Karlss 238,915
Vessels, jib traveler for, C. Jensen 238,785
Vise, reversible combination, Forsaith & Hildreth 238,881
Wagon gear, H. L. Kingsley 238,920
Wagon jack, S. Langford 238,792
Watch case, T. C. Comstock 238,856
Watch case spring, J. Canne 238,850
Water closet, A. F. Blesch 238,836
Water wheel, turbine, J. J. Collins 238,763
Weather strip, C. L. Bell 238,753
Weather strip, J. C. Fiester 238,877
Weaving wire cloth, G. F. Wright 239,012
Webermeter, T. A. Edison 238,869
Whip socket, R. Windgassen 239,008
Wind wheel, J. F. Ford 238,880
Windmill, F. W. Krogh 238,789
Window bead fastener, F. Miller 238,798
Window screen, J. Reardon 238,967
Wire, etc., coil holder for, I. E. Palmer (r) 9,605
Wire fabrics, fastening for woven, J. N. Stevenson 238,982
Wool washing machine, J. T. Davis 238,864

DESIGNS.

Bottle, L. E. Keeley 12,187
Carpet, H. Horan 12,185, 12,186
Carpet, J. B. Neil 12,188
Pitcher, cream, H. J. Smith 12,189

English Patents Issued to Americans.

From March 11 to March 15, 1881, inclusive.

Fog bell, International Fog Bell Co., Bangor, Me.
Globe holder, A. W. Crocket, New York city.
Governors for vulcanizing apparatus, W. E. Gwyer, New York city.
Lathe, O. Jones, Philadelphia, Pa.
Packing material, R. H. Thompson et al., Brooklyn, N. Y.
Paper perforating machinery, Automatic Music Paper Co., Boston, Mass.
Piston, H. Waterman, Brooklyn, N. Y.
Press, baling, P. K. Dederick, Albany, N. Y.
Railway switch, E. W. McDonald, New York city.
Telegraphy, W. A. Leggo, Hartsdale, N. Y.
Tiling for roofs, floors, etc., J. J. Williams, Fairhaven, Vt.
Water closet, A. Edwards, Philadelphia, Pa.
Webermeter, T. A. Edison, Menlo Park, N. J.

Let There Be Light

A SECOND INVITATION.

A committee of the Legislature appointed to investigate the manufacture of OLEOMARGARINE OIL AND BUTTER, and to ascertain whether those products, and not the reeking filth and rotting garbage left by the street-cleaning authorities in the public streets, are the cause of New York's increased mortality, has been in session in this city.

The Commercial Manufacturing Company, consolidated, invited the Committee to visit their factory at Forty-eighth Street and North River, to obtain light, and to see of what materials and by what methods the oleomargarine products are made. They embraced in the invitation the City Authorities, the Board of Health, and the public generally.

The Committee chose to go *first* to the Dairy Cheese and Butter Exchange, to listen to the false statements of interested dealers, market hucksters, salt speculators, and penny a line Bohemians, regarding the manufacture of an article they have an interest in destroying or *blackmailing*, rather than to investigate, examine, and judge for themselves.

Only *two* of the *eleven* committeemen paid a flying visit to the factory. A daily journal seeks to justify this course by implying that the manufactory was prepared and fixed for the visit, and could not be seen in its real condition and in its ordinary operation.

The Commercial Manufacturing Company NOW INVITE and SOLICIT visits from the City Authorities, the Board of Health, and the people of New York, at any hour of the day or night, or any day in the week, except Sunday, to their factory on Forty-eighth Street and North River.

Any visitor is at liberty to go over the premises and to examine the material used and the processes of manufacture, whether the officers of the company are present or absent, and to ascertain for themselves whether the statements made by interested parties and *strikers* as to the impurity of the products are true or false.

The Company desire that the products be judged on their merits, and to be protected in its rights, and to expose and brand the conspiracy to break down a great industry which gives to the people of this country and of Europe a cheap and wholesome article of food, and which is destined to drive from the market of the world the rancid stuff sold in such large quantities under the name of dairy butter.

The following article from the editress of "Food and Health," unsolicited on our part, speaks for itself:

OLEOMARGARINE.

To the Editor of the Sun:

Sir—Surely the women ought to have something to say as to the merits or demerits of oleomargarine. Called to-day to testify before the Assembly Committee which has been sitting to inquire into the manufacture of oleomargarine, I was surprised to find that the very men who eagerly heard the attacks upon it appeared unwilling to receive any argument in its favor except with a smile of incredulity or positive disfavor.

Now let us have fair play in this matter. Science, the highest science, has given us oleomargarine, which is not only a healthy food, but one which, if properly manufactured, will work great good for the health of large classes.

If dairymen can take their fat from milk, let oleomargarine men take their fat from beef, for the value of beef fat as a heat producer has yet to be acknowledged in our food economy. Oleomargarine can be bought for twenty-five cents a pound, and good butter cannot.

The dairy interests of this country are not endangered by this product, if they will keep up with the times and produce a good article at a fair price, and not give us, as they do, a large per cent. of their whole production in the shape of inferior butter.

Let any one who doubts my statement visit the groceries in the poorer neighborhoods, and test the quality of the butter for sale.

France, which has prohibited the sale of American pork, has not prohibited the importation of American oleomargarine, and the British Parliament has refused to take action against it.

Let oleomargarine be sold as such, and butter be sold as such, and let the consumer be at least permitted to judge for himself, and not be scared from using a valuable food product.

AMELIA LEWIS,
Editress of *Food and Health.*

Commercial Manufacturing Company,
CONSOLIDATED,
West 48th Street and North River,
NEW YORK.

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 head 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.