SCIENTIFIC AMERICAN

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

Vol. XXVIII.—No. 4. [NEW SERIES.] | NEW YORK, JANUARY 25, 1873. | [$3 per Annum, IN ADVANCE.]

COMPOUND METALLIC COLUMNS AND CONNECTIONS.

This invention systematizes the construction of iron structures where permanence and general stability are required, admitting, at the same time, of great variety in treatment.

The following references will explain the various details of the illustrations:

Fig. 1 is an elevation of columns and section through floors; Fig. 2 a vertical section through columns; Fig. 3 a section on A B of Fig. 1, showing four different modes of bracing; Fig. 4 a section on C D, of Fig. 1; Fig. 5 a top view of the connection casting; Fig. 6 a vertical section of the same; Fig. 7 a top view of the connection casting, showing the skew backs for arches; Fig. 8 a vertical section of the same; Fig. 9 a horizontal section of the junction casting, on the line E F; Fig. 10 the same on line G H; Fig. 11 a horizontal section of connection for a hexagonal column, showing different methods of bracing and attaching girders; Fig. 12 a horizontal section of connection for a ten sided column, showing connections for girders: this can be slotted for ties if required; Fig. 13 a modification, in cases where beams are not required, showing shackle loops for securing ties; Fig. 14 a connection entirely of wrought iron; Fig. 15 an elevation of connection casting, showing the coupling bands, shackle loops, and ties.

Figs. 1 and 2 of the illustration show sections of a portion of a building, and demonstrate that it is applicable to various architectural styles, while the unity of construction is preserved. The main features consist in building, to any required number of tiers or stories in hight, a continuous column, so arranged that the beams supporting the various floors are connected in the simplest manner to their bearings, the provision for springing arches at any point desired, without detriment to the stability of the columns, and the system of both lateral and vertical ties being provided for.

The columns and connections may be all wrought iron, all cast, or a combination of both. The central shaft may be surrounded by any desired number of colonettes, breaking joints where necessary and coupled together with appropriate bands or connections.

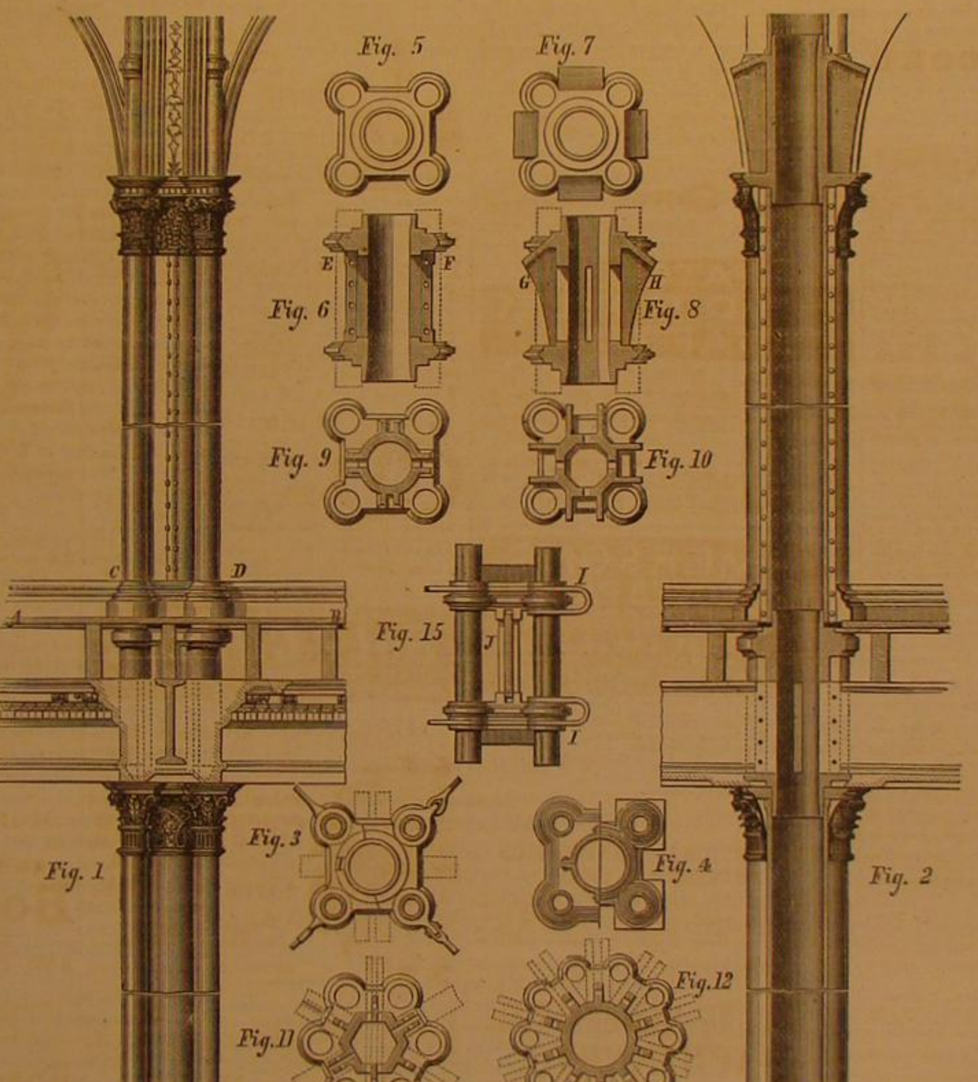
A succession of junctions can be used one above the other, with or without skew backs for arches, as the number of tiers in the structure may require. The skew backs can, if desired, be applied to all, and can be made to spring from any face of a column, irrespective of the number of its sides and angles.

Wrought iron coupling plates, I, can be introduced both above and below the connection casting, J, and provided with openings corresponding in position and diameter to those in the casting. These plates afford an extra security against the contingency of damage from extreme cold, or the effects of the sudden throwing on of water during a fire, either of which might fracture the cast lug and liberate the wrought tie.

The different arrangements shown in the various illustrations as to the modes of attachments, bracing, tying, coupling, etc., will apply to any form of column, whether wrought or cast, which it may be desirable to use for the special purposes required.

The above system has been patented by Mr. John A. Kay, Principal Assistant Engineer, Western Department, Baltimore Bridge Company, and any information can be obtained by addressing that gentleman at St. Charles, Mo. Dates of patents, August 15, 1871, and August 20, 1872.

A carefully constructed set of tables, for strength of these columns, etc., deduced from formulæ based upon the best American experience, has been prepared by the inventor, but its length prevents our publishing it in the present connection. Copies in pamphlet or circular form can doubtless however, be obtained on application to Mr. Kay.



COMPOUND METALLIC COLUMNS AND CONNECTIONS.

Chinese Building.

In China, when a contractor engages to build a house, he encloses the premises and sets up cooking apparatus to supply his hired workmen with regular meals at the most economical rate. Having taken breakfast, they work till noon, rest one hour, and leave off at 5 P. M., and return to their homes. On leaving, each takes a ticket which admits him next morning. These tickets are daily vouchers of the artisan's presence. Counted up at any time, a true account is rendered.

A man on the ground throws several bricks to another ten feet up, and he to another still higher. Thus the masons are supplied as they ascend with the wall. Instead of carrying mortar in a hod, it is thrown by a shovelful from one story to another to any required elevation, without spilling a particle, so expert are they by continual practice.

HOW TO TEST FOR VANADIUM, AND WHAT WE KNOW OF THE METAL.

The metal vanadium, although discovered a long time ago and known to be associated with iron and lead in many ores, is still very little employed in the arts, and there are scarcely any books that show us how to test for it if we suspect its presence in any slags and ores. Mr. Apjohn has been investigating the subject and, as the result of his labors, proposes the following method as the simplest and best for procuring small quantities of vanadium: Eight grammes of the ore are fused with four times the weight of carbonate of soda. The fused mass is mixed with saltpeter and once more fused; it is then pulverized, covered with water, the aqueous solution boiled with carbonate of ammonia, filtered with the filtrate acidulated with hydrochloric acid, evaporated to diminish bulk, and subjected to a current of sulphureted hydrogen gas. The precipitate produced by the sulphureted gas in the acid solution—lead, copper, etc.—is removed, and sulphureted hydrogen is again passed through after the filtrate has been neutralized with ammonia. If the ammoniacal filtrate shows a claret red color, this will indicate the presence of vanadium. The red liquid is to be saturated with hydrochloric acid, and the precipitate which will then be produced will be found to consist of sulphur and sulphide of vanadium; this is to be dried, heated, and fused with saltpeter; the product will be vanadate of potash, from which the chloride and other salts can be subsequently prepared. As there is a close analogy between the vanadates and phosphates, they ought to be subjected to comparative tests to discover if one set of compounds could not be substituted for the other. The vanadates in nature are generally tribasic, which would indicate that they were formed at high temperatures. Some of them might prove valuable as pigments, and we therefore subjoin a list of the colored precipitates produced by soluble orthovanadates: Ferric salts, a light brownish yellow; ferrous salts, a dark gray precipitate; manganous salts, brown yellow; zinc salts, white; cobalt salts, brown gray; nickel salts, canary yellow; copper salts, apple green; mercuric salts, orange yellow.

Considering the possible uses of some of these compounds, it would be well to test the trap and basaltic rocks of the United States to see if vanadium is not contained in them in appreciable quantity, as it is in the basalts of the Rhine and other European localities. A proper place to look for it would be in the slags of iron furnaces, and in many iron ores. Roscoe's researches on vanadium have considerably enriched our knowledge of the subject, and have laid the foundation for further study. It appears from Roscoe's efforts to prepare pure metallic vanadium that the task is a difficult one, and that no one has hitherto accomplished it. He reduced vanadium chloride free from oxygen in hydrogen gas, and obtained a shining crystaline mass, having a strong silver-white luster. The reduced metal absorbs oxygen with so much avidity at a red heat that it must be cooled in a current of absolutely dry hydrogen. When cold it does not oxidize or tarnish in the air, nor does it decompose water at 212° Fah. The specific gravity is 5·5, but as Roscoe was unable to fuse the metal into a compact mass, this determination must be corrected by further experiments.

The metal will probably prove to be somewhat heavier. As vanadium, in its chemical relations, closely resembling arsenic, antimony and bismuth, it may prove valuable in alloys, if not for the electro-plating of other metals. Its physiological properties ought also to be more carefully studied. The salts of vanadium have been used in the manufacture of a fine black ink.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
CLUB RATES { Over ten copies, same rate, each	2 50

VOL. XXVIII., No. 4. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, JANUARY 25, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

THE PROMOTION OF SCIENTIFIC RESEARCH.

Much is nowadays said and written about the promotion of scientific research, and although everybody is convinced of the importance of doing something, no one is agreed upon the ways and means. It is certainly important to do all we can to help on the progress of invention and discovery; but how to do this, in a way that will not result in more harm than good, is a problem by no means easy of solution. We do not set out with the expectation of being able to settle the question, but our experience with this class of topics entitles us to do a little talking on the subject.

We should say that protection by patents must stimulate the inventive talent of the country. No one would make special effort to perfect a machine or apply a new principle unless he was tolerably certain of reaping the reward of his labors. It is with invention as with the acquisition of wealth; unless the law protects us in the enjoyment of both, anarchy prevails and society can make no progress. It is a well known fact that in Germany a vast number of philosophical principles and mechanical laws have been worked out, but they have remained unapplied for the reason that the government failed to afford any protection from the immediate appropriation of them by any one who chose to apply them. Other nations have seized upon the matured ideas and have put them to practical use, and Germany has lost the benefits that a wiser legislation would have secured to the country.

Another way in which scientific inquiry can be promoted is by the dissemination of correct information upon the commonest affairs of life. There must be sufficient intelligence in a community to offer sympathy and not opposition to the pioneer in new enterprises. A knowledge of common things is indispensable to the growth of scientific ideas. The soil must be well tilled before the seed can take root, and this tillage must be done by teaching, books and journals. The history of invention affords abundant proof of the slow growth of important discoveries in communities where persons in authority have been too ignorant of the first principles of science to understand or appreciate the efforts of some genius who was far in the advance of his age. We can cite the steam engine in illustration. Papin, a French refugee, while residing at Cassel, in Germany, invented a steam pump and steam engine, which he applied to the propulsion of a boat down the river Fulda as far as the ancient town of Munden, in Hanover, where the river Weser begins. Before going any further, it was necessary for him to obtain the permission of the Hanoverian authorities, and he made application in due form, and also wrote to the celebrated philosopher, Leibnitz, to aid him in the matter. Leibnitz, with the keen intuition of the man of science, at once understood and appreciated the importance of the wonderful invention, and made every effort at court to secure the favorable consideration of Papin's application, but his labor was in vain; the minister of foreign affairs could see no good likely to arise from the introduction of steamboats and he sent an order prohibiting the new invention from sailing on the waters of the Hanoverian kingdom. The river boatmen at Munden, hearing of this decision, got up a mob and destroyed the boat, and Papin himself was driven out of the country. This illustration of the importance of general information may be said to be an extreme case, but it is nevertheless true and goes to show what a baleful influence an ignorant minister can exert upon the destinies of a country. We came very near having a similar misfortune in our own country. It is within the memory of many persons now living how violently some of the members of Congress opposed all appropriations in aid of Morse's telegraph. Some of them threw great ridicule upon the project, and proposed to extend the wires to the moon. It required years to disseminate sufficient information on the subject to inspire the faith and confidence of moneyed men in this strange enterprise. These illustrations will suffice to prove the importance of sowing the seeds of knowledge broadcast as a means of promoting scientific inquiry. The question whether it is wise and expedient to grant Government or individual aid to promote investigation is not so easy of decision. It is a delicate responsibility to say that, if a certain course of investigation were to be pursued, it would inevitably lead to important practical results and that therefore the State ought to come in and help the needy inventor. The liability to abuse and the doubt as to the constitutional right of the State to help individuals would seem to put a veto upon this method of aiding science. Individuals can, however, do as they please, and we have numerous instances of money being left by men of fortune to afford aid to scientific men in one form or another. Prizes, medals, fellowships, rewards and pecuniary assistance have been the methods pursued to accomplish the will of the donor. There has been a good deal of curious experience in reference to the effect of this way of encouraging scientific inquiry. The University of Oxford in England is notorious for the immense endowments it has received, and is equally as famous for the small results achieved. It is stated by Sir Benjamin Brodie that $600,000 per annum are expended by the colleges of Oxford in subsidies to students and for the endowment of fellowships. And he very pertinently asks: What return does the State receive for this vast expenditure of money? The unfavorable result of endowments in England has set Parliament at work to investigate the whole business, and it may well occasion some anxiety to ourselves. We have imitated the example of the mother country, and would perhaps do well to proceed with a little more caution. Is there, then, really no practical way in which to promote scientific research? We shall not attempt to answer the question but can make a suggestion. Suppose we organize a society for the promotion of scientific research, to consist of a board of trustees, who shall have the entire management of the property, and who shall give aid when they think it will be judiciously employed. Such a board of trustees must consist of scientific men, not lawyers or merchants, or clergymen, such as make up the majority in all college boards, but the best known scientific men of the city. They would be excluded from voting to each other any of the income, but must use the money to aid pure science where they see that it can be used to the best advantage. It often happens that an endowment is made of a professorship in a college because the incumbent is an investigator and first class scientist, but it does not follow that the successor will be equally eminent; on the contrary, it generally happens just the other way. If the money had been put in the hands of a separate board of scientific men, they would not pay out the income to the incompetent successor, but would search out some other institution where the proper individual was to be found. Here is an idea for our scientific men to work up, and we should be glad if it leads to something practical and useful.

GOVERNMENT PAP FOR AUSTRIA.

The appropriation for the Vienna Exposition, as stated in the bill which recently passed the House of Representatives, and is now awaiting the action of the Senate, is one hundred thousand dollars; and this, we learn, the Governors of the New England States have requested Congress to largely increase It would perhaps be more advisable if these gentlemen, before using their valuable influence to procure further disbursements from our far from replete Treasury, would inform themselves as to the amount set aside by England, a nation far more interested in this show than the United States, for a similar purpose. The sum above mentioned is already more than three times the English appropriation. Thirty thousand dollars is all that Parliament has seen fit to devote to the benefit of British exhibitors; and although the smallness of the amount has been made the subject of adverse comment in many quarters, it has not been augmented, nor does there appear to be any chance of such being the case.

It should be remembered that, in addition to this pecuniary aid, two Government vessels are fitting out as free transports for American goods to Vienna, thus entailing an additional expense upon the country of at least eighty thousand dollars. It seems to us that Congress has evinced unusual liberality in this matter, more so than is warranted by the state of the national finances. It will be far more beneficial to the nation if, instead of listening to these requests for increased appropriation, the Senate will reduce that already specified, or even adopt a wiser course, and abolish it altogether.

THE TEMPERATURE REQUIRED FOR IGNITION.

Everybody knows that combustible substances require varying degrees of heat to ignite them; but, even among the best informed scientists, the knowledge of the amount of heat, or the exact temperature at which such substances will take fire, is very imperfect, for the simple reason of the want of data. Extensive experiments have been made to determine the melting points of solids, the boiling points of liquids, even the temperature of flames and the units of heat produced by the combustion of given quantities of different fuels; but with regard to the temperature required to cause the ignition of different substances, experiments have thus far been few. The late fires, and the resulting controversies about their origin, have now given great importance to this branch of investigation; we have therefore judged it opportune to collect some information upon this subject, taken partly from reliable data of some prominent investigators, and partly from original investigation. We give the following table, commencing with substances combustible at the lowest temperatures, and ending with those least inflammable:

TABLE OF THE TEMPERATURES REQUIRED FOR THE IGNITION OF DIFFERENT COMBUSTIBLE SUBSTANCES.

Name of Substance.	*Temperature of Ignition.* Fah.	*Remarks.*
Phosphorus	140°	Melts at 110°.
Bisulphide of carbon vapor	300°	Boils at 113°.
Fulminating powder	374°	Used in percussion caps
Fulminate of mercury	392°	According to Leygue and Champion.
Equal parts of chlorate of potash and sulphur	395°	
Sulphur	400°	Melts at 230°; boils at 850°.
Gun cotton	428°	According to Leygue and Champion.
Nitro-glycerin	494°	" "
Rifle powder	550°	" "
Gunpowder, coarse	563°	" "
Picrate of mercury, lead or iron	565°	" "
Picrate powder for torpedoes	570°	" "
" " muskets	576°	
Charcoal, the most inflammable willow, used for gunpowder	580°	According to Pelouse and Fremy.
Charcoal made by distilling wood at 500°	600°	" "
Charcoal made at 600°	700°	" "
Picrate powder for cannon	716°	
Very dry wood (pine)	800°	
" " (oak)	900°	
Charcoal made at 800°	900°	
" " 1800°	1100°	
" " 2400°	1400°	
Aluminum	1832°	
Iron	about 2000°	

The most interesting feature shown in this table is that even the most combustible substances, usually considered very dangerous, will only ignite by heat alone when the heat reaches a considerable figure; and that, for their prompt ignition, a spark is required, which is in fact a temperature of 900° or 1,000° applied to a very minute spot of the mass.

As the heat of superheated steam ranges from 300° to 500°, it is only able set fire to such substances as sulphur, gun cotton, and nitro-glycerin; it is perhaps able to fire gunpowder, but it certainly cannot ignite wood. It is only when well dried wood, sawdust or rags have been made a source of spontaneous combustion, by the presence of any drying oil or its equivalent, that (by oxidation of this oil, presenting a large surface to the agency of the air) the temperature may be indefinitely raised, and finally reach 400°, 500° or more degrees, and so the point of inflammability may be attained. This may happen in buildings not heated at all; but it must be acknowledged that the heat of summer, and, still more, the heating of buildings with hot air or otherwise, favors this heat production, which is of a purely chemical nature, and is, oftener than the heating arrangements, the cause of fire.

We have stated, on a former occasion, that it is usually very difficult to determine the cause of a fire, as it often destroys all evidence; but it is strange that some minds persist in attributing every fire, originating in a building heated by steam, to superheated steam; and, in order to give an apparently reasonable explanation, they go even so far as to assert that, during the night, when the fires are banked or even withdrawn, there would be heat enough left in the bricks of the furnace to raise red hot steam. It is an absurd theory that the result of the fire should have a more powerful effect than the fire itself, and the true method which Mr. Norman Wiard and Fire Marshal McSpedon should pursue, in order to come to the truth, if this be their desire, is to try, by practical experiment, if they can make steam hot enough to set wood work on fire. This would be more convincing than the diagrams on the black board with which they recently attempted in vain to convince the members of the Polytechnic Club of the American Institute.

THE MYSTERY OF THE INJECTOR.

The steam boiler injector, invented by Henri Giffard, is one of the most beautiful among all known applications of the genius of man to the utilization of scientific principles. Its wonderful simplicity of construction and its effectiveness, when properly proportioned and well made, command the admiration of every intelligent person, as well as of the engineer and the man of science. At the first glance, however, its action seems to contradict the teachings of both science and common sense.

The instrument, which is now in general use on locomotives, and frequently elsewhere, consists, simply, of a slender central tube through which steam passes from the boiler, emerging at its inner end within another tube, concentric with the first, and which latter tube conducts a current of water from a supply pipe into the body of the instrument. Opposite the mouth of this second pipe, but detached from it, is fixed a third tube, open at the end, facing the water supply tube and leading from the instrument to the boiler feed pipe. The steam and water supply tubes are fitted with stop valves and the feed pipe with a check valve. This simple piece of apparatus being attached to the boiler, steam enters it through the little steam pipe, rushes out of the extremity of this pipe into the enveloping current of water, and, picking up the whole stream, leaps across an open space, fairly hissing through the air, and plunges with its burden at a tremendous velocity into the open end of the feed pipe. It thus returns to the boiler, and carries back with it many times its weight of water. Not a drop of water is lost, nor is a particle of steam wasted; all that leaves the boiler returns to it. If there was ever an example of perpetual motion, this would seem to be it.

In the earlier form of this instrument, openings were made in its sides, through which could be seen the jet of mingled steam and water in its passage across the space between the two nozzles, looking like a solid rod of glass, and frequently leading the observer to suppose that the stream was there carried in a glass tube. The loud hissing noise and the readiness with which the finger or a penknife could be used to interrupt the current and send it flying out of the sight holes promptly dispelled that error, however.

The principles of mechanics upon which the action of this instrument is based, mysterious as they appear to the casual observer, are very simple. They have been frequently referred to in the columns of the SCIENTIFIC AMERICAN, and many of our readers are sufficiently familiar with them to follow us as we describe their application in this elegant device. If an opening were made into the steam space of the steam boiler, the steam would rush from it with a velocity which would be just sufficient, could its direction be reversed without loss of motion, to carry it back into the boiler again. Could the whole force of the stream be concentrated upon a smaller area than that of the opening made for its egress, the resisting pressure which could be overcome by the stream might be correspondingly increased. The resisting pressure remaining the same, the stream might not only re-enter the boiler when thus condensed, but might carry with it a considerable additional weight.

Steam leaving a boiler under a pressure of 60 pounds per square inch occupies, when condensed, a space of but $\frac{1}{358}$th of its original magnitude, and would concentrate its force upon a correspondingly decreased resisting area. A pound of such steam occupying 5½ cubic feet condenses into 27½ cubic inches of water; and, were it not retarded by friction, it would have sufficient energy to take back into the boiler a weight of water more than sufficient to condense the steam. The velocity with which such steam flows into the atmosphere is about 1,500 feet per second, and although it is undoubtedly greatly retarded, in all cases, by friction, the fact stated gives some idea of the immense velocity with which the stream may flow. The Giffard injector is simply an instrument in which these principles are usefully applied. The stream of steam from the boiler, flowing through its central tube and plunging into the current of water which surrounds the steam adjutage, is condensed by it, and, taking it up, carries it all forward with immense velocity, overcoming all frictional resistances, and reënters the boiler with it. It thus acts as both feed pump and heater.

The amount of surplus energy sometimes obtained, by thus concentrating the force of the issuing stream by condensing it, is very great, as is shown by experiments in which steam taken from one boiler has been made to feed another boiler containing steam of nearly double the pressure.

A moment's thought will make it evident that the water supplied to the instrument cannot be highly heated. It must be sufficiently cold to condense the steam without making the quantity of injection water so great as to overload the apparatus and thus prevent the stream from forcing its way into the boiler. Where the feed water is to be heated to a temperature higher than 120° or 150° Fahrenheit, it should be done by carrying it through a worm heater of large heating surface, after leaving the injector.

We trust that we have made plain the principles of operation of this beautiful and wonderfully ingenious invention. Although as simple as those which are applied in the driving of a nail, and, indeed, somewhat similar, their very simplicity and the lack of complexity in the apparatus itself only the more forcibly command our admiration and our commendation.

THE GREAT SEWING MACHINE JOB BEFORE CONGRESS.

The Sewing Machine Ring, composed, as our readers are aware, of the Singer, Howe, Grover & Baker and Wheeler & Wilson Companies, failed to induce our last Congress to sanction their modest attempt to fasten their overgrown and unjust monopoly upon the people of the United States for another seven years. One defeat and the strongly expressed disapprobation of popular opinion for their cause are, it seems, not enough to dishearten them; consequently their efforts are to be redoubled, and whatever influence, political or pecuniary, that can be brought to bear will be unhesitatingly wielded during the coming spring in one last grand endeavor to force the job through the Forty-second Congress.

The patent, which has already expired and on which a third term is asked, is that of Allen B. Wilson for the "feed" motion. The claim is very broad and the owners of the right, up to the expiration of the patent, November 12, 1871, have governed and will, if the present measure be passed, again rule the entire sewing machine trade of the country, rendering it tributary to the co-partners in the above mentioned proprietary combination. Not only is this the case with established concerns, which are taxed for the payment of large royalties, but thousands of inventors, who have devised improvements of great practical value, are subject to the mercy of this Ring, which may in its supreme pleasure see fit to buy their inventions or else drive them from the market and deprive the public of as good machines at cheaper rates. It is estimated, and the fact, although previously alluded to in these columns, will bear repetition, that nearly four hundred thousand dollars has been expended by inventors on sewing machine improvements since the grant of the Wilson patent. If now, the latter be extended, before the seven additional years can elapse many of these smaller patents will expire, and thus meet with practical confiscation.

The indirect object of the patent laws of this country is to benefit the people. The object of granting a patent is to enable the inventor to manufacture and present his device in the best possible form, and by distributing it throughout the country to so instruct the public in its nature, uses and construction as that, after this secured term shall have expired, the people can produce it for themselves. Secondary to this is the policy of stimulating invention, the beneficence of which is well shown in comparing the relative conditions of countries in which patent laws do and do not exist, so that new and improved ideas shall be constantly brought forth. This our patent laws effect by throwing protection around the patentee for a limited period, jealously guarding his rights so that he may peaceably carry on his manufacture, and at the same time affording him a monopoly which, if the invention be valuable, yields him an ample remuneration for his thought and labor. If, in the case of a new device of great or unusual merit, the inventor fails in producing the same in such a manner as to gain an adequate reward within the space of time granted, such period may with justice be extended; but if the invention be thoroughly presented to, understood and appreciated by the people, and the originator obtain a competent return during the lifetime of his patent, we can see no argument tending to carry conviction in favor of continuing the monopoly. More especially, we think, does this view hold true in the instance of a mere modification of an original machine, as is the case with the Wilson patent. Here a simple alteration or improvement in a portion of a machine and not the original invention is made the subject of a right which locks up in the hands of a few individuals a power, the vastness of which may be judged from the fact that it brings them in a yearly profit of several millions. The original Howe patent was extended but once, and a second application was deemed impolitic, so expressed in the opinion of the Commissioner, and therefore denied. This rule, we insist, is equally applicable to the present case, and the precedent thus formed is one which, founded on justice and in harmony with true public policy, cannot be slighted. If it is to be evaded, the benefit should be given to the heirs of Howe, the original inventor of the eye-pointed needle and shuttle, and not to a combination which, from investments trivial in amount, have amassed enormous wealth.

The actual cost of a sewing machine is from \$5 to \$7, or all complete with table, etc., from \$10 to \$30. The American public pays from \$60 to \$125 for the same article, at retail, and the difference is clear profit. To still further prove the enormity of the injustice to our people, the same companies, in spite of our high tariff on cast steel and Swedish and Scotch pig iron, import both metals crude, manufacture them into sewing machines, export the finished goods back, and sell them in Europe at prices less than those for which the articles could be there made even at the cheap existing rates of labor. In fact, the people across the Atlantic pay, for the same machines, only about one half the price charged to our own countrymen.

The strongest argument in opposition is suggested by the thought of the classes from whom this vast wealth has been, and, if the extension be granted, will be, extorted. It is from the wretched earnings of the sewing girl—from the daily pittance which is doled out to the working women who wear away their lives in our great cities—from the meager savings and scanty means gained by the manual work and unending drudgery of the wives and daughters of farmers and mechanical laborers, that the greater portion of this revenue is abstracted. The oppression and cruel injustice of the measure will not be felt by the rich in any very appreciable degree; but the poor, to whom the sewing machine is as necessary as the roof which covers their heads, the thousands of families whose sole dependence for their daily bread rests on untiring labor with the needle, these are they against whom the efforts of this gigantic ring are directed.

We urge upon Congress the denial of the application, and we sincerely believe that, in view of the true state of the case, no influence that wealth can bring or specious argument that political power can carry will cause those to whom the honor and prosperity of the country is committed to give their assent to a measure so oppressive and calamitous to the entire nation.

THE USE OF ARSENIC COLORS.

The most common arsenic colors are the Schweinfurt green, a compound of acetate and arsenite of copper containing about 58 per cent arsenious acid, and Scheele's green, which is an arsenite of copper with 55 per cent arsenious acid. Notwithstanding their poisonous characters, they are largely employed in consequence of the elegance of color and low cost. One establishment in England reported that they consumed 4,500 pounds of arsenious acid every week, and the total annual consumption for Great Britain has been set down at 1,500,000 pounds. The chemical test for arsenic green can be easily made. Plunge the article in warm aqua ammonia; a blue color will betray copper, and a drop of the blue ammoniacal liquid on a crystal of nitrate of silver will show a canary yellow coating if arsenic be present. The articles which are frequently colored with arsenic are the following:

1. Artificial flowers and fancy goods. Imitation flowers are usually cut out of colored material; the pigment is prepared by rubbing up the green powder with gum arabic to make it adhere to the cloth. As no mordant is used, the color is merely on the surface. It is often applied with the hand until uniformly distributed over the surface, and is dried on frames. In this way the workmen are exposed to the dust flying about the room, and their hands and faces are often smeared with the mixture. Unless they hold cloths before their mouths and are very careful to wash themselves thoroughly before meals, they soon contract a variety of dangerous symptoms and have to abandon their work.

The quantity of arsenic that a single artificial flower will hold is sufficient to poison several persons. Hofmann found on one branch 6 decigrammes of arsenious acid, enough to prove fatal to a number of persons who might carelessly breathe the dust arising from it. It is notorious that all persons engaged in the manufacture and sale of this class of goods are frequently disabled by the evils attending the handling of colors that are only externally applied.

Certain light fabrics, such as tarlatan, are frequently superficially dyed with Schweinfurt green applied with dextrin; and in some instances it has been found that one half the weight of the stuff was due to the coloring matter, and an ordinary ball dress would hold three ounces of arsenic. The sale of such goods has been prohibited in England and France, and hence they find their chief market in the United States. We have known of serious cases of poisoning arising to dress makers and to persons wearing green tarlatan in this country, and it would be well if the sale of such goods were everywhere absolutely prohibited.

2. In candies and toys the employment of arsenic green has met with such opposition, and is so easy of detection, that it is rare that any one knowingly uses the obnoxious color. Formerly there were numerous cases of poisoning from this source, but they are fortunately rare at present. The chief danger now arises from the highly ornamental pieces of confectionery which are not intended to be eaten but are made for decoration. They are sometimes broken up and the fragments, falling into the hands of children, occasion much mischief. There is an instance on record where 18 persons in one family were seriously endangered by such carelessness. In the case of toys and paints for children, so much has been said and written on the subject, and so numerous have been the cases of poisoning, that every mother takes care not to expose her children, and the manufacturers are compelled to be on their guard.

The covers of toy books, however, especially in England, are too frequently impregnated with the dangerous green. We have long been in the habit of tearing off the covers of such primers before allowing them to be handled by our children.

3. The employment of arsenic green in oil paint has frequently been noted, and in dwelling houses and sleeping apartments, the consequences have been of the most serious character.

Bakers' shelves, the interior of boxes, wire gauze for bird cages, basket willow, and fly catchers have frequently been painted with arsenic colors.

4. In the coloring of paper to be employed for wrappers, cards, labels, lamp screens, and ornaments, there is the freest possible expenditure of arsenic green. This is perhaps the most dangerous and subtle use of the poison. The utmost vigilance cannot prevent paper of this character from finding its way into every household. It comes in the form of envelopes around chocolate, as a label, and very commonly as a screen to cover a lamp, in which case the heat often volatilizes the arsenic and the air of the room is filled with the dangerous fumes. It is very common for children to cut ornaments out of the polished green paper and to put fragments into the mouth, by which they are unconsciously poisoned.

5. The use of arsenic wall paper has been the fruitful source of disease and death in many instances without the possibility of accounting for the origin of the malady. Professor Gmelin, in 1843, was one of the first to call attention to the danger of occupying rooms decorated with paper colored with arsenic green, and since his time numerous instances have been recorded to confirm the importance of the warning uttered so many years ago. Notwithstanding the accidents that have happened, we constantly see rolls of paper put upon our walls that encase the occupants of the room in a poisoned wrapper and, with absolute certainty, render life a burthen to them by the chronic symptoms which the subtle gases arising from the decomposed pigments occasion. In a room which is kept closed for a few hours, the walls of which are covered with arsenic colors, the peculiar smell of arseniuretted hydrogen is at once perceptible to any one familiar with the garlic odor that this gas gives off. A damp wall is certain to extricate this gas, and on no account ought a room to be covered with such a dangerous preparation. The misfortune is that in most instances the evil effects are not perceived until it is too late. It has been found that the dust which gathers on the furniture is contaminated with arsenic, showing that, in addition to the gas, there are often solid particles floating through the room.

6. Arsenic in carpets and hosiery is of more modern introduction, and hence requires that we should put our readers on their guard to prevent imposition. We were recently shown some carpeting in which the red color, having been put in with aniline dyes prepared by means of arsenic, was said to have poisoned a family. The subject is under investigation and the statement may prove to be erroneous; but as red stockings have produced ulcers and skin diseases analogous to those occasioned by arsenic, it may be well for the protection of all persons concerned to avoid colors that have been suspected of causing the mischief. In the fact that arsenious acid is an incidental product in several metallurgical operations, and its production on a vast scale puts the price at such an exceedingly low figure as compared with other chemical compounds, is to be found the key to its enormous consumption in the manufacture of colors. It is a great misfortune that a substance so deleterious should be so widely disseminated, and it is only by reiterated warnings and the most stringent police regulations that the community can be protected from the insidious danger. Our market is crowded with the cast off and abandoned arsenic goods of other countries, and it is a question whether the urgency of the subject does not demand the interference of the Board of Health.

THE tobacco crop of Missouri this year is estimated at 30,000 hogsheads.

SUBMARINE DIVING.

Loaded with a weight of over one hundred and forty pounds, under a pressure of nine atmospheres, beneath a hundred feet of fluid, two minutes' existence in which is impossible, and in depths where no ray of light has ever penetrated, man cannot only live but work. Not only can he labor but, remaining submerged for hours with impunity, perform operations which require skill; placing the explosives which are to tear up sunken reefs, leveling unequal bottoms or plunging into the holds of wrecks, with marvelous intrepidity he can force the sea to yield up its buried treasures.

Probably no calling necessitates more personal risk. Out of the number of professional divers in the United States, in all thirty or thereabouts, the average yearly mortality is four, though so large a percentage is due more to the recklessness of the men in the face of danger to which they become inured than to mere accident. The armor in which the diver is incased, in comparison with the weight of which that worn by the knights of old is as nothing, is well represented in our engraving. It consists of body, collar piece, helmet, and shoes. The body is composed of one thickness of rubber between two of cloth, and covers the man from his neck to his heels, being closely strapped into the shoes at the bottom and snugly held about the wrists by rubber cuffs. The helmet looks very like an immense copper pot, and when put on is connected with the body by means of the collar piece, which fits closely about the shoulders and is fastened to the helmet and the body by thumbscrews, rendering it perfectly air-tight. There are glasses at the front and sides of the helmet, the piece in front being constructed to open. This is never closed until the man is ready to descend, when it is tightly screwed up, and from that moment the air pump must never cease working even for a single instant, lest the diver suffocate. The air forced to him from above reaches him by means of a rubber hose which, leading from the air pump and passing under his left arm, connects with the back of the helmet, the air passing over his head and down in front of his face. The foul air escapes through a small valve in the back of the helmet, and the rapidity with which it goes is regulated by the preference of the man in the dress. The shoes are soled with an inch or two of lead, and over the shoulders, slung by cords, are two enormous leaden plates, one on the back and one on the breast, thus giving the diver sufficient weight to descend. A life line is fastened about his waist, by means of which he communicates his wants to those above. One pull on the line signifies more air is needed, two, that the pumps are sending him too much and he is liable to float up, and three pulls indicate that he desires to be hauled to the surface.

Mr. George W. Fuller, of Norwich, Conn., one of the most scientific and accomplished divers in the country, has probably done more to improve diving apparatus than any other inventor. He employs a four cylinder pumping engine to supply air to the submerged workers, which is a remarkable piece of ingenious mechanism. The packing of the plungers, while pressing against the walls of the pump cylinders so lightly that any plunger will descend by its own weight, is still so absolutely tight that not the slightest leak can be detected under the heaviest pressures. The same gentleman has greatly improved the construction of the shoes, and has devised a lantern which is fed by air through a tube from the pumping engine above. As the diver descends the flame becomes brighter and brighter until, at the depth of a hundred feet, it glows with the whiteness and brilliancy of a calcium light. This result is due to the condensation of the air, which increases the amount of oxygen contained in a given volume.

Our second illustration, for which, with the one above referred to, we are indebted to the *Christian Weekly*, represents the divers of the Coast Wrecking Company at work. They were employed some time since in raising the contents of a government vessel wrecked off the coast, and after a long and toilsome search, succeeded in finding nearly all the bags of silver ore composing the cargo. More recently divers have visited the old Spanish huiks which, two or three centuries ago, found their way to the bottom off the West India Islands. We were lately shown by Mr. Fuller a large number of ancient silver coins, with their dates and inscriptions perfectly preserved, that had been recovered from these vessels.

The greatest danger to a diver is, that he may get his air pipe entangled in something and thus stop his supply of air. A man could not live two minutes should this happen. He usually descends with

SUBMARINE DIVING APPARATUS.

the hose in one hand and the signal line in the other, taking good care that these articles remain at a safe distance from any projection of rock or any portion of the wreck he is working upon, before he lets go to use his hands.

In constructing the new docks around this city, divers are largely employed to place the concrete on the bottom so as to form a bed for the heavy foundation stones. During the course of the blasting operations at Hell Gate and Diamond Reef, in New York harbor, divers guide the drills worked by the machinery above, insert the nitro-glycerin, and arrange the electric fuses and wires by which the charges are exploded. In raising wrecks, men are first sent down to cover with canvas, or plank, the holes made by the sharp rocks in the timbers of the vessel. This must be done before she can be raised. After the leaks are stopped, the steam pumps make short work of driving out the water. The divers then re-descend, pass chains under the hull, and carry the ends to powerful floating derricks, which hoist the vessel to the surface.

PROFESSOR TYNDALL'S FOURTH LECTURE IN NEW YORK—POLARIZED LIGHT.

In mechanics, we have the composition and resolution of forces and of motions, extending to the composition and resolution of vibrations. We deal with the luminiferous ether in accordance with the rigid laws of mechanics; and, from the composition, resolution, and interference of its vibrations, we deduce all the phenomena displayed by crystals or polarized light.

To illustrate, let a vibration cross a crystal of tourmaline obliquely to its axis; we have seen, by experiment, that a portion of the light will pass through. How much, we determine in this way: Draw a straight line representing the amplitude of the vibration before it reaches the tourmaline, and from the two ends of this line draw two perpendiculars to the axis of the crystal; the distance between the feet of these two perpendiculars will represent the amplitude of the transmitted vibration.

THE INTERFERENCE OF RAYS.

Professor Tyndall next proceeded to explain what occurs when a film of gypsum is placed (as described in the preceding lecture) between the Nicol prisms. It will be remembered that, where two plates of tourmaline were crossed, no light passed through; but when a film of mica was introduced between, the darkness at the intersection disappeared. In certain positions, however, the interposing film has no power to abolish the darkness, because, in the gypsum, there are two directions, at right angles to each other, which the waves of light are constrained to follow; and when rotated to such positions, one of these directions is parallel to one of the axes of the tourmaline, and the other parallel to the other axis. If we cross our Nicol prisms and introduce the film, on its emergence from the first prism or polarizer the light is polarized; and in this particular case, its vibrations are executed in a horizontal plane. The two directions of vibration of the gypsum are oblique to the horizon. The polarized ray, then, where it enters the gypsum, is resolved into two ethers, vibrating at right angles to each other. In one of those directions of vibration, the ether is more sluggish than in the other; subsequently the waves that follow this direction are more retarded than the other. Here, then, the system of waves may get half a wave length or any number of half wave lengths ahead of the other, and interference is evidently possible. But as long as the vibrations are executed at right angles to each other, they cannot quench each other, no matter what their retardation may be. The analyzer or second prism, however, recompounds the two vibrations emergent from the gypsum, reducing them to a single plane, where, if one of them be retarded by the proper amount, extinction may occur. Consequently, when the longer waves have been withdrawn by interference, the shorter ones remain and confer their colors on the film of gypsum. Conversely, when the shorter waves have been withdrawn, the thickness is such that the longer waves remain. Where the direction of vibration of prisms and gypsum encloses an angle of 45°, the colors are at their maximum brilliancy. Following out rigidly the interaction of the two systems of waves, we find that all phenomena of colors, obtained when the planes of vibration of the two Nicols are parallel, are displaced by the complementary phenomena when their Nicols are perpendicular to each other.

RETARDATION OF HALF WAVE LENGTHS.

Supposing that a certain thickness of gypsum produces a retardation of half a wave length, twice this thickness will produce a retardation of two half wave lengths, and so on. Now where the Nicols are parallel, the retardation of half a wave length, or of any odd number of half wave lengths with it, produces extinction; in all thicknesses, on the other hand, which correspond to a retardation of an even number of half wave lengths, the two beams support each other when they are brought to a common plane by the analyzer. Placing a wedge-shaped circular film of crystal, thickest at the center, between the prisms and using red monochromatic light, Professor Tyndall showed the interference rays with great distinctness. The dark bands, he stated, occurred at thicknesses which produced retardations of one, three, five, &c. half wave lengths; while the light bands appeared between the dark ones. On employing blue light, the rays were also seen; but as they occurred at thinner portions of the film, they were smaller than those obtained with the red light. By using white light, therefore, as the red and blue fall in different places, iris colored rings were produced. The lecturer then alluded to the chromatic effects of irregular crystallization, and said that a plane of glass covered with frost crystals and placed between the Nicol prisms would produce the most beautiful colors. A film of horn or shell also yields brilliant hues under polarized light. As a general rule, organic bodies act in this way, but their architecture involves an arrangement of the ether which causes double refraction.

EFFECT OF POLARIZED LIGHT ON BODIES UNDER PRESSURE.

It is possible to confer, by strain or pressure, a temporary double refracting structure upon noncrystaline bodies, such as common glass. Introducing a glass bar between the crossed Nicols, Professor Tyndall bent it slightly, keeping its length oblique to the direction of vibration of the prisms. Instantly light flashed out upon the screen. The two sides of the bar were illuminated, the edges most, for here the strain and pressure were greatest. In passing from strain to pressure, said the lecturer, we cross a portion of the glass where neither is exerted; this is the so-called neutral axis, and along it appears a dark band, indicating that the glass along this axis exercises no action upon the light. Subjecting a square of glass to increased pressure in a vise, its image in light appeared upon the screen. Every pair of the adjacent luminous spaces, which appeared separated by the dark bands, is in opposite mechanical conditions. On one side, the dark band is strain, on the other, pressure. By tightening the vice, the colors appeared more brilliant, taking curvilinear forms which, adding to their beauty, sprang outwards from the two points of pressure. Afterwards, glass prepared by differences in annealing so as to present their colors in various figures was exhibited. The irregular annealing had fixed the particles of glass in a state of permanent strain or torsion.

CHROMATIC CHANGES CAUSED BY HEAT.

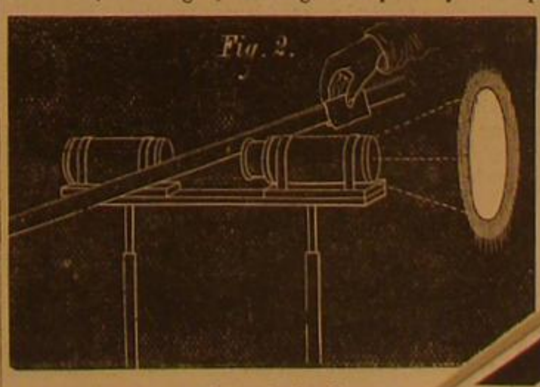
We know that bodies are expanded by heat and condensed by cold. If one portion of a solid be heated and the other not, the expansion of the heated portion produces strains which reveal themselves under the scrutiny of polarized light. Professor Tyndall first exemplified this fact by introducing a square of common window glass between the Nicols and slightly heating it by a spirit lamp. Light at once appeared on the screen, and spaces of strain, divided by neutral axes from spaces of pressure, showed as before. A small square of glass was then employed, into an orifice in the center of which a heated copper wire was introduced. A beautiful black cross, inclosing four luminous quadrants, appeared, the latter growing up and becoming gradually black by comparison on the screen. In this case, the heat spread from the center of the square outwards.

POLARIZED LIGHT AS AN ANALYZER OF MOLECULAR CONSTRUCTION.

Taking a strip of glass some six feet long, the lecturer swept a wet woolen rag over one of its halves. An acute sound due to the vibration of the glass was heard. What is the condition of the glass during the existence of this sound? Its two halves lengthen and shorten in quick succession, and its ends, therefore, are in a state of rapid vibration. But in the center, the pulsations from the ends alternately meet and retreat; and between their opposing action, the glass at the center is kept motionless. On the other hand, it is here alternately strained and compressed. This may be illustrated by Fig. 1, which represents the strip of glass, with

equidistant waves marked upon it; and the point in the middle, where the pressure or expansion of the waves strains or compresses, is shown in white.

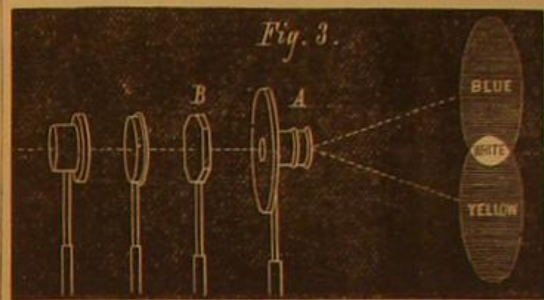
Professor Tyndall then placed the strip of glass between the Nicols, as in Fig. 2, fastening it in place by a clamp.



As the woolen rag, as shown in the diagram, w[illegible]as swept over one end of the glass, a loud sound, like [illegible] that obtained by running the wet finger along the edge [illegible] a goblet, was given forth and simultaneously a circle [illegible] of light flashed on the screen. At every moment of [illegible] compression, continued the speaker, light will flash thro[illegible]ugh; at every moment of strain, light will flash through [illegible], and these states of strain and pressure follow each othe[illegible] so rapidly that we may expect a luminous impression [illegible]n the eye.

MECHANICAL VIBRATIONS SIMILAR TO THOSE OF LIGHT.

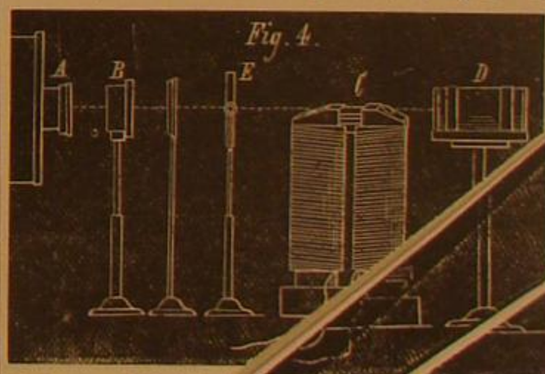
If, while a pendulum is oscillating past the middle part of its excursion, a shock be imparted to it, tending to drive it at right angles to its course, the two impulses compound themselves into a vibration oblique in direction to the former one. But the pendulum oscillates in a plane. If the rectangular shock be imparted to the pendulum when it is at the limit of its swing, then the compounding of the two impulses causes the suspended weight to describe an ellipse; and if the shock be competent in itself to produce a vibration of the same amplitude as the first one, the ellipse becomes a circle. These gross mechanical vibrations exactly resemble those of light. A plate of quartz cut from the crystal perpendicularly to its a[illegible] possesses the extraordinary power of twisting the plane of vibration of a polarized ray to an extent dependent on the thickness of the crystal; and the more refrangible the light, the greater is the amount of twisting, so that where white light is employed, its constituent colors are thus drawn asunder. Placing the quartz between the prisms and turning the analyzer in front from right to left, Professor Tyndall showed a series of brilliant colors. Specimens of quartz have been found which require the analyzer to be turned from left to right to produce the same succession of colors. Crystals of the first class are therefore called right handed, and of the second class, left handed, crystals. Fresnel showed the action of these crystals to be due to the circumstance that, in them, the waves of ether so act upon each other as to produce the condition represented by one rotating pendulum. Instead of being planely polarized, the light is circularly polarized. Two such rays, transmitted along the axis of the crystal and rotating in opposite directions, when brought to interference by the analyzer, are demonstrably competent to produce the observed phenomena. Substituting a piece of Iceland spar, A, Fig. 3, for the analyzer, and introducing the plate of quartz, B, be-



tween the polarizer and the spar, we have an image of the aperture on the screen in the shape of two colored circles, which will always be of colors complementary to each other. Here we can show that, although the mixture of blue and yellow pigments produces green, the mixture of blue and yellow lights produces white. By enlarging our aperture, the images are caused to overlap; and although one is blue and the other yellow, the place where they are superposed is white.

THE MAGNETIZATION OF LIGHT.

In Fig. 4, A is the electric lamp, B the polarizing prism, C an electro-magnet, from pole to pole of which is placed a cylinder of heavy glass, first made by Faraday, and called Faraday's heavy glass. D is the analyzer in front. If we excite the magnet, instantly light appears upon the screen. On examination we find that, by the action of the magnet upon the ether contained within the heavy glass, the plane of vibration is caused to rotate and thus get through the analyzer. The speaker then inserted a plate, one half of which consisted of a right handed and the other half of a left handed crystal in front of the polarizer, E, Fig. 4. By



turning one of the Nic[illegible] common circular i[illegible]is, both halves of the plate showed a [illegible]age of puce color. This is an exceedingly sensitive m[illegible]eans of rendering the action of a magnet upon light vi[illegible]sible. By turning either the polarizer or the analyzer t[illegible] color [illegible]hrough the smallest angle, the uniformity of the d[illegible] disappeared, and the two halves of the quartz show different colors. The magnet produces this effect; exciting the magnet, one half of the image becomes suddenly red, the other half, green. Interrupting the current, the two colors fade away and the primitive puce is restored. The action depends upon the polarity of the magnet, or, in other words, on the direction of the current which surrounds the magnet. Reversing the current, the red and green reappear, but they have changed places. This experiment, however, long remained rather as a scientific curiosity than as a fruitful germ.

NEW INSANE ASYLUM IN CALIFORNIA.—The commissioners appointed for the purpose by the Legislature of California have selected a site near Napa City for a branch insane asylum. The estate comprises 208 acres of land, with fine sites for buildings, and good facilities for water supply, sewerage, etc. The State has appropriated nearly $800,000 for the erection of buildings.

THERE was recently discovered near Staunton, Virginia, a large deposit of red hematite iron ore, probably thirty feet wide and extending several miles.

Correspondence.

Cheap Buildings.

To the Editor of the Scientific American:

About fifteen of my neighbors and myself intend building dwelling houses on our farms next spring. We have often exchanged views as to the best and cheapest building materials. As we have lake sand (costing nothing), some insist that artificial stones made of sand and cement would be the best and cheapest; on this point, my neighbors wish me to ask your experience. By answering the following questions you will give us what we wish to know on the subject:

1. In what proportion are the sand and cement to be mixed? 2. How are the stones molded? 3. Can the stones around the windows and doors be molded in such a way as to require no wooden window or door frames, and how is it done? 4. Could not the stones be molded with a smooth inside surface and laid so compactly as to look like a plastered wall, and so require no plastering? The wall could be painted any color. 5. How are we to prevent possible dampness? 6. I have heard of a method of running up walls in liquid mortar (sand and cement) without molding the stones; how is it done? 7. What will such a building cost, comparatively to wood, brick and stone? 8. I have seen the following articles advertised in your paper: Asbestos roofing, roofing and sheathing felt, asbestos boards, asbestos paper, asbestos asphaltum etc.; what is it and what merits has it as a building material? 9. As it is often expensive and inconvenient to make alterations after a house has been built, I would kindly ask your opinion of the different heating apparatus, with regard to cheapness, health, and comfort. By answering the above questions in your valuable paper, you will oblige many friends and patrons of the SCIENTIFIC AMERICAN.

Cleveland, O. P. S. K. MAIERS.

REMARKS BY THE EDITOR.—We would not advise you to attempt to construct your homes of artificial stone, as, aside from the difficulty of its manufacture by unskilled labor, there will be more or less want of facility in fitting the blocks to the dimensions of the walls and piers in their erection, and much doubt as to its permanency. You are more likely to be successful with concrete construction, which requires no particularly skilled labor, and has been proved to be permanent, beyond a peradventure. To make concrete, prepare a plank floor under a shed; take four barrels of broken stone—no piece larger than an egg and diminishing in size to that of a walnut—and spread it out over the floor so that it will not be more than two inches deep in any part of it; then take three barrels of sand of sharp grit, entirely free from loam, and sprinkle it in among the stone so as to fill up all the interstices of the stone with an even distribution over the whole; now, take half a barrel of lime and sprinkle this also equally over the whole; finally, take half a barrel of best cement and in the same manner distribute it over the lime. With a coarse rake incorporate all these materials thoroughly in a dry state, and then apply enough water to saturate the whole. Let it stand long enough to allow the lime and cement to slacken thoroughly, and then it will be ready for use. Build your foundation sixteen inches and your wall about twelve inches thick; lay the wall one foot high at a time between two planks, kept in place by side buttons and braces at top. Let it stand three days to set well, then remove the plank boxing and let it stand a week before you put on the next layer. The window frames may be set at once, four inches back from outside, and a rough frame made, four inches in width of jamb to form the corners of the opening on the outside, which could be removed after the work becomes hard. A similar frame will be required for the doors, but of 12 inches width of jamb. The wall may be made hollow by having a series of upright blocks, say 1½ by 6 inches and 4 inches apart, suspended from the upper side of the boxing, and with the lower end slightly reduced in size to avoid friction in withdrawing them. When the wall is all up, employ a mason to finish the exterior with a coat of cement, "rough cast," and it will look like stone. The interior plastering may be also finished in one coat.

If your roof is to be flat, cover it with good charcoal tin; but if steep, use slate or good rived shingles. Heat with a good warm air furnace in cellar, or two fireplace heaters in first story, which may be more economical.

To Purify a Room.

To the Editor of the Scientific American:

"A room full of close foul air can be made perfectly sweet and pure without opening the windows. A pitcher of cold water will do the work effectually. It is dangerous, therefore, to drink water which has been long standing. Set a pitcher of water in a room, and in a few hours it will have absorbed all the respired gases in the room, the air of which will become purer but the water perfectly filthy. The colder the water is, the greater the capacity to contain the gases. At ordinary temperature, a pail of water will contain a pint of carbonic acid gas and several pints of ammonia. The capacity is nearly doubled by reducing the water to the temperature of ice. Hence, water kept in a room awhile is always unfit for use. For the same reason, the water in a pump should always be pumped out in the morning before any of it is used. Impure water is more dangerous than impure air."

The above item is being extensively published by the daily and weekly press; and I should like to know if it is true. G.

REMARKS BY THE EDITOR.—The item is full of errors and ought to be arrested in its onward march through the press. It would be dangerous for anyone to close a room and rely upon a pitcher of water to purify the air. The fact that standing water becomes foul is due to the germs that fall upon it or are contained in it; these undergo decomposition and decay, giving rise to bad gases and foul smells. Organic matter in water is the great source of mischief, and hence the necessity of pumping out all that has been standing during the night in contact with the wood. Good ventilation is the best remedy for foul air in a room.

Polar Mutations.

To the Editor of the Scientific American:

Among the facts developed by the geological survey of Ohio, are:

1. The surface of the State was once much higher than it is now. Then one vast *mer de glace* covered the region just north of the Great Lakes, and flowed by various channels, in large glacial rivers, to the sea.

2. Succeeding this elevation was a corresponding depression, so that one great inland sea extended from the Alleghany to the Rocky Mountains, while, here and there, the more elevated portions of the continent peered above the prevailing waters.

3. This submergence of the land was followed by a second elevation, which second elevation is supposed to be still going on.

4. During the first elevation of the land, channels of drainage were deeply carved by various eroding forces.

5. While the submergence was progressing and during its continuance, those channels of drainage were silted up by the arresting in still water of the material borne down by rivers and by depositions from superincumbent waters.

6. Upon the emergence of the land, the surface drainage sought, and mainly found, its old channels and began the work now in progress of clearing them out.

Now what has caused this elevation and depression? I answer, polar mutation, change of position of the earth's axis, a change by which the pole travels through, either in a straight or curved line, many degrees of arc. It is accepted as a demonstrated fact that the equatorial exceeds the polar diameter of the earth by twenty-six and one half miles, and that this oblate spheroidal form of the earth is due to the loss of weight in the particles of matter by the centrifugal force of rotation requiring a greater number of particles as you approach the equator to produce equilibrium with those at the poles. Now this equatorial afflux of water, well nigh cutting the continent in two at Darien and Suez, ever follows up, and keeps at right angles to, the earth's axis. Conceive now that in the remote past the north pole traveled direct, retrograde, or otherwise, until it reached the intersection of the eightieth meridian west longitude and forty-fifth parallel north latitude, bringing with it its eternal allies of change, frost, snow, icy seas, and glacial rivers, and you have a state of things commensurate with that which existed during the first elevation of the northern division of the Western Continent. The oceanic waters, following the equator, submerge Patagonia, parts of Africa, the south table lands of Asia, and, towering up the Himalaya Mountains, reduce to archipelagoes portions of both continents. Let the pole travel on with its geologically measured tread till it passes through ninety degrees of arc, say to forty-five degrees north latitude and ten degrees east longitude; this would bring the equatorial afflux of water across the northern division of the Western Continent, submerging most of it. Let the pole tarry not but move onward till it arrives at its present position, and we have the things of to-day, the second elevation, and if still going on the pole is coming upward. This change, slow but sure, requiring hundreds of thousands of years to complete a circuit, tears and levels down, in turn, by glacial action, earth's rugged surface, to be further smoothed over by a long season of iceberg-harrowing and dredging preparatory to the donning of its coats of marine deposits from tropical seas and lagoon products. Indeed the line of mutations may never return to the same again, but, as the fair moon, waltzing around her consort earth, ever cleaves etherial space anew, so may the normal condition of the things of to-day never return. Thus the all-change-producing panorama rolls on, stratifying, mixing, distributing, *ad infinitum*.

J. ARNETT, C. E.

London, Ohio.

A Natural Curiosity.

To the Editor of the Scientific American:

There is, in this neighborhood, a tree with a large stone imbedded in it in a very curious manner. The tree is a gray birch, and its circumference at base is 4 feet. The stone, which has 10 inches horizontal thickness and 14 inches vertical thickness, projects from the tree 2 feet. The singularity is that a stone, weighing some 200 lbs., is solidly grown into the living wood of the tree; but this may be accounted for by the fact that, some time ago, a large tree was blown up by the roots, lifting the stone up to where it now is and holding it there. Soon this sapling birch shot up from the top of the mound of earth thus elevated, and its roots went down and surrounded the stone. As the mound of earth and rotten roots of the old tree receded by the action of frost, the roots of the young tree grew downward and stronger, forming themselves into a continuance of a trunk of the new tree, and holding the stone in their embrace. As the growth continued, the stone is now entirely inclosed in solid wood.

Something like this may be found on a smaller scale, elsewhere; but the instance of so large a stone being imbedded in a tree at such an elevation cannot, I think, be paralleled.

L. PENNELL.

West Stockbridge Center, Mass.

Cotton Spinning and Other Industries in the Southern States.

To the Editor of the Scientific American:

It is estimated that, could the cotton crop be converted into yarns in the South, the increased value would be at least one hundred and fifty millions of dollars annually. In a report to the Agricultural Convention held at Charleston, 1869, Colonel J. B. Palmer, President of the Saluda Mills in this State, gave the following figures as to the comparative cost of No. 20 yarns, with cotton at 20 cents per lb.: At the English mills, 35·5 cents; and at the Saluda mills, 29 cents, which, with freight, etc., 1·5 cents, makes 30·5 cents leaving a difference of 5 cents. At the northern factories, 34·8 cents; at the Saluda mills, 29 cents, which, with freight, etc., ·8, makes 29·8 cents, leaving a difference of 5 cents, showing an advantage of 16 per cent in favor of the South.

There are tens of thousands of cotton gins, scattered throughout the South, already provided with some kind of power—horse, water, or steam. Could a simple machine be constructed to work with these gins and convert the cotton into yarns before it is pressed, there would be a still greater saving.

The margin of profit which would be afforded by spinning the cotton where it is raised and before the fiber is injured by compression, thus saving cost of packing, wastage, transportation, commissions, profits of middlemen and other incidental expenses, would be no inconsiderable sum. The mechanical genius who could, like Arkwright, Howe, McCormick, and other successful inventors, design a machine which would operate practically in connection with and by the same power now used in ginning cotton, would be certain of a colossal fortune. The difficulties to be overcome are not greater than those already conquered in other inventions. The fleecy staple, as it comes from the gin, is in the best possible condition for being worked; and factories in distant countries would purchase the yarn in preference to the loose cotton to work into fabrics. Then let some of your readers turn their thoughts in this direction, and see if they cannot win the prize.

Near this place are immense quarries of burr stone, which is said by experts to be equal to the French. In the sparsely settled southern countries, where plantations are distant from water mills, a small mill which could be attached to the power which is used in ginning cotton is a great desideratum; and these quarries afford a rare opportunity for some enterprising man to build up a lucrative business.

There are also beds of the finest kaolin, for making crockery ware. As a proof of the quality of the clay, thousands of tuns are annually shipped to northern factories. I recently visited a farm, three miles from Aiken, on which the quantity was simply incomputable, and could be bought at the current price of adjacent lands—say $5 per acre.

The reputation of Aiken as a health resort is increasing each year. Already many who were here last year and the year before can be seen on the streets, and they report that the crowd will be larger than ever this season. Connected as it is with the commercial centers of the South, and noted for its superb climate, Aiken presents many advantages for those seeking homes in the South, and especially for enterprising mechanics who may have sufficient capital to start small factories. NEKIA.

Aiken, S. C.

Shifting Belts and Pulleys.

To the Editor of the Scientific American:

It is a well known fact that, in every manufactory where machinery is used to any extent, a large amount of time is consumed in shifting pulleys and cutting belts, thereby causing many stoppages and costing a large sum of money. For instance, a company that employs one hundred men have occasion to change the size of a pulley on a counter or main line, thereby necessitating the shortening or lengthening of the belt. To do this, we will say it takes ten minutes to get the length of the belt and to get the engine under headway; and as all hands are at work, sixteen and two-third hours at 30 cents per hour will be wasted. This will be $5, which, by a simple rule, can all be avoided. The rule I made some sixteen or eighteen years ago, and have tested hundreds of times since on almost every sized pulley from three inches to five inches (and it has never failed me), is: Take three times half the difference between the diameter of the pulleys, and the result will be the length of belt to take out or put in. For instance, if you wish to change from a sixteen inch to a twenty inch pulley, the difference is four inches; that half of four is two, and twice three is six inches, the length of belt required. In case the belt wanted tightening before, make the necessary allowance on the piece and all will be right. You can mend your belt and put it on without stopping. I hope that mechanics will give this a trial. J. B. DOOLITTLE.

Wallingford, Conn.

The King Snake and the Moccasin.

To the Editor of the Scientific American:

Of the following I was an eye witness:

During the late war, the regiment to which I belonged, the Fifty first Massachusetts, was stationed at Newbern, North Carolina. There was in our regiment an odd genius, an adept at almost anything, and one of his favorite amusements was catching snakes and bringing them into camp. He was not partial as to varieties; he would as soon undertake to bring a moccasin into camp, alive and squirming, as any other kind. One day he brought in two snakes; one was a lively king snake, the other, a moccasin of about the same size, with the difference that the king snake was a trifle the slenderer of the two. Four boards, eight or ten feet long, were procured, and a hollow square formed by placing them on edge on a level spot; and many gathered round to witness the programme. When the two snakes were set free in the enclosure, the moccasin seemed stupid and only on the defensive, while the king snake very soon took up the aggressive. He commenced by slowly approaching his enemy, and, when sufficiently near, struck him on the back of the neck; but, probably missing a firm grip, he quickly moved away to strike again, with the same result. He soon succeeded in getting his jaws firmly fastened on the neck of his adversary and immediately twisted himself around his entire length. After squeezing him for a few minutes, he relaxed his jaws, and, placing his head a couple of inches from that of the moccasin, he appeared to listen or watch if there were any signs of life. Probably not being quite satisfied with the symptoms, he at once resumed his grip and firmly held for a few minutes more; then, letting go and listening for a moment as before, he began slowly to unwind himself till completely separated from his victim, who was dead. This may seem a very prosy affair to your readers, but the poetry is yet to come. Immediately after uncoiling himself, he seemingly ordered a change of base, and began prospecting about the body of his victim, calculating its dimensions and the feasibility of making some important disposition of it. Having satisfied himself of his being capable of undertaking the job, he at once began to swallow the moccasin by placing its head in his mouth; and after giving a few spasmodic jerks of the body, a few minutes having elapsed, he accomplished the job in a prompt and workmanlike manner. He did not seem conscious of having done anything unusual; and strange to say he appeared but a trifle larger in size than when just placed in the enclosure.

The above account is given as near as I can remember it, and I think it is wholly correct. As there were many members of the Fifty-first Massachusetts present at the time, I am ready to stand corrected if there be any error in the above.

C. A. Hoppin.

Worcester, Mass.

Specimen Boiler Inspection.

To the Editor of the Scientific American:

I, in common with numerous other steam users of the state of New York, would like to be posted, through the medium of your valuable journal, in regard to a matter which is to many rather obscure. I refer to that portion of the laws of this State relating to steam boiler inspection.

On the 18th day of last month, a gentleman presented himself at my mill and informed me that he was the deputy inspector of steam boilers for this district, and that I must immediately prepare to have my boiler inspected. I told him that I was ready to have the boiler examined but that there was no water in it, and that the water pipes were frozen so that I could not immediately fill it, and, the manhole being open, he could examine it inside or out as much as he pleased or wait until I could fill it. He stated to me that, although the law required a hydrostatic test, he had authority from the Governor to test it by water, steam, or the hammer. I asked him to enlighten me a little in the law, when he proceeded to read me an extract from the laws of the State of New York, according to which all boilers in use must be subjected to a hydrostatic test, etc., for which the user was to pay five dollars and the expenses of the inspector.

"Well," said I, meekly, "I suppose the law is for our good, and you may proceed to inspect the boiler," which is thirty feet long and forty-six inches in diameter, with three twelve inch flues. He requested me to take off the cover of the opening opposite the middle flue, which I did; he then carefully looked into the flue, turned around and gravely informed me that that boiler was all right, and proceeded to fill out a certificate, stating that the boiler had been subjected to a hydrostatic test of one hundred and twenty pounds to the inch, and was, in all respects, right according to law. For which, under the circumstances, he would only charge me six dollars, although he had charged everybody else seven dollars and a half. The result is, that I have a document, costing me six dollars, signed by the Deputy Inspector and certified by the Inspector in Chief of steam boilers, which you will perceive is a virtual lie.

Now, Mr. Editor, what does this mean? Who is this law intended to benefit or protect, unless it is steam users and their employees? What benefit to me or mine is this paper covered with the seal of the Bureau of Steam Boiler Inspection? Suppose the boiler should burst after this tremendous test, who would be blamed, and who would be responsible? Would it not as usual be attributed to incompetency or neglect on the part of the user? Then I would say again, what good does this law do the steam user, except to periodically lighten his purse of some of its loose change for the benefit of numerous useless sinecurists? Tell me, if you can, what becomes of the money thus collected, and in what way it is used to mitigate the horrors of steam boiler explosions or prevent them, and you will confer a favor on a numerous class of readers and admirers of your paper. It seems to me, for one, that this system of steam boiler inspection, as now conducted, presents a good opening for civil service reform.

Cyrus Cole.

Havana, New York.

Remarks by the Editor.—This letter indicates that the official charged with the inspection of his boiler was either incompetent or willfully neglected his duty, and, if clear proof of the facts stated were to be presented to the Governor, doubtless it would result in the prompt removal of the offender. We can assure our correspondent that, if the boiler were to explode in consequence of defects which the owner could have rectified, the owner would be especially blamed, and perhaps the inspector also. Inspection or no inspection, the owner must inform himself about the condition of his boiler. Nothing will save him from the consequences of his neglect to do so. A boiler owner cannot be allowed to plead ignorance as to the state of his own property.

Variation of the Magnetic Needle.

To the Editor of the Scientific American:

While making some land surveys last October, in Fauquier county, Virginia, I had occasion to re-establish an old line of some length which was defined only by partially obliterated landmarks at long intervals apart. The original and only survey of said line was made in 1748, about one hundred and twenty-four years ago, and the bearing at that time was north 38° east. It was necessary, of course, to make a correction of the old bearing for variation, but the question was what correction ought to be made.

It is ascertained from early recorded observations that the secular movement of the needle in 1748 was to the east, and it is equally as certain that its motion is now westerly. From repeated observations which I have made in this section of Virginia, the annual movement of the needle is about 4'. Taking Gillespie as my authority for the change (in the secular motion from east to west) having occurred about the year 1810, the correction for the easterly motion from 1748 to 1810 was, for this period of sixty-two years, to be subtracted from the old bearing; but again the correction for the westerly motion, which must be added to the bearing in 1810, was for the same interval of time, bringing us back to the original bearing. I set the instrument at north 38° east and struck the line. I have written an account of this only because it is a coincidence which does not often occur in an engineer's experience.

D. Gardie.

Warrenton, Va.

Canal Navigation Prize.

To the Editor of the Scientific American:

Permit me to make a few remarks on the Erie canal navigation. I have carefully examined every invention proposed, and I am convinced that, if another twelve months were given to inventors for the $100,000 prize, there would be boats invented incomparably better than those already in being. I, for one, have invented a boat which will travel eight miles an hour without washing the banks; it will carry 300 tuns freight, and is propelled by a twelve horse power Baxter engine. I have made working models on both the Mahan and Goodwin principles, before I knew they were in existence, and abandoned both for practical reasons. If the commissioners of the award would, or could, extend the time for competition for the prize for another twelve or eighteen months, I think they would profit by it.

R. H.

Utica, N. Y.

GLEANINGS IN SCIENCE AND ART.

Scientific Piscatory Ingenuity.

An English missionary to China, the Rev. George Smith, says that, on one of his aquatic excursions, he saw some Chinese fishermen at their vocation in a way to quite astonish him. They had a model of a fish made of bright tin, which was slowly dragged along at the end of a line fastened to the boat. The fish in all directions swam towards the decoy. It seemed to possess a peculiar fascination. Far back in the rear was another boat, carrying a net; when it was judged there were fish enough congregated about the object of their attraction, the oarsmen slacked a little while the net men approached and dropped the seine, widely extended; they then gradually brought the extremities together, and generally made a successful haul.

Those same people with long hair practice another adroit method of fishing, which might be practiced here with equal advantage. They hang a highly bright varnished strip of board along the outside of the gunwale of a boat, at an angle about that of the roof of a house. When ready on the fishing ground, torches are lighted. The varnished board intensifies the light and throws it at an angle far off into the water. Curiosity, or some other sentiment, prompts the fish to follow up the rays. They rush on with such speed that when they see the boat, which seems to be an obstruction, they leap over the rowlocks inside, just where they are wanted.

Another method practised, which the observant missionary often saw, was by trained cormorants. They dived down from the boat and rarely failed to bring up fishes in their bills. To prevent them from swallowing the captured prey, each had a metallic ring on its neck, through which nothing could pass. Occasionally it was removed that the birds might be encouraged with a few morsels of food.

Both science and art are recognized in these bland and childlike piscatory processes.

Bone Fertilizing.

Enormous quantities of bones are imported into Scotland from Russia expressly for enriching the land. Mr. Stepenoff, a St. Petersburg merchant, has been dealing for upwards of forty years in dry bones, sending abroad annually 70,000 pounds, which are collected on the banks of the Volga. They are purchased there at the rate of three silver copecks a poud, and sold in England at fifty copecks the poud—a profit worth having. Notwithstanding that it is well known what excellent crops are raised where the bone dust is used, the Russians have looked with perfect indifference at the loss of an article quite as much needed at home as in any part of Europe. We have seen an immense collection of bones in upper Egypt—the skeletons of camels and wild animals, all imaginable prowlers of the deserts—gathered by Bedouin Arabs for the refining of sugar. But the golgothas of dry bones on the Libyan and Arabian sands are so exceedingly extensive, far beyond the requirements of the Pasha's sugar works, that a splendid business might be inaugurated by bringing bones to the United States. The long ones would pay well as ivory for cutlery handles and brushes.

An establishment at Newark, N. J., has been in operation for one or two years, and manufactures a splendid fertilizing material from miscellaneous city bone gatherings, deserving the patronage of farmers.

The phosphate of lime is the food our cultivated crops crave most. Fruit trees, too, thrive delightfully when fed occasionally with bone dust. A perfect cast of the bones of Roger Williams, the great man of ancient Rhode Island, was made by the embracing rootlets of an apple tree which found a feast of phosphate in his decaying coffin; and it is now a cabinet curiosity illustrative of the fertilizing influence of phosphates on vegetable growth.

This bone matter is an important department of agricultural science, and should have the helping hand of capitalists.

Preservation of Human Skulls.

At the convent of San Sabi, located on the margin of a horrible mountain gorge between Jerusalem and the Dead Sea, supposed to be the wilderness where John the Baptist preached, there is an immense collection of skulls, piled up like cannon balls in a navy yard. That has the reputation of being the oldest convent in that part of the world, and those stacks of heads are those of monks who lived and died there in the course of thirteen hundred years.

The next extraordinary collection of the remains of humanity exists about four miles from Folkestone, in the town of Hythe, Kent, England; it is traceable to a bloody battle, fought between the Anglo-Britons and an invading army of savage Danes, in the reign of Ethelwulf, A. D. 843. The Britons triumphed and thirty thousand were left dead on the field of slaughter. Being too weary to bury the bodies, they left them to whiten in open air. When quite dry and white the bones, principally skulls, were gathered and placed in a stone crypt, prepared for them 1389 years ago. These skulls indicated men of large size, and were corroborated by bones of the limbs, superior to those of their lineal representatives in England. Their teeth were sound and strong but worn down short, indicating a hard kind of food, habitually. The native skulls are easily recognized.

Perhaps on this continent astounding discoveries are to be made respecting races that preceded the Indians. Skulls of the mounds clearly prove a higher type than is recognized in what are called aboriginal skulls dug up from Indian groves. Phrenology and craniology are sciences that deal exclusively with facts, hence it is probable that curious developments through their agency in regard to a remote antiquity may be anticipated in the progress of events.

Irritability of the Frog's Heart.

Taken all in all, the batrachians are marvelous beings. Besides being obliged to pump air down into their own lungs, which explains why the gular membrane underneath the under jaw is so elastic, acting on the volume of inhaled air in the cavity of the mouth on the mechanical principle of bellows, they catch game with the point of the tongue, drink through the spongy texture of the skin on the back, and live months in succession concealed in the mud bed of a pool without respiring; and yet the systole and diastole, or in plainer words the contraction and expansion of the heart, is not suspended. Their vitality is remarkable, since the small amount of oxygen introduced into the arterial blood when making the final plunge in autumn keeps the spark of life alive till emerging from the water in spring. If the heart of a frog is cut from its connections within the pericardium and placed on a table, it will pulsate and throb energetically for some minutes. When apparently quiescent, the point of a needle will rouse it again into spasmodic energy. Finally, by the touch of irritants, its irritability is completely exhausted. After experimenting full half an hour in that manner, we were struck with the lively vaultings of the frog from which the heart had been taken. Certainly it was conscious of its relations, for it avoided many cautious attempts, to capture it, on the part of the operator. It was some hours before death closed the scene.

The vital tenacity of reptiles, particularly batrachians and chelonians, which takes in the tortoise family, are remarkable and worthy of more extended scientific investigation.

Cathedral Restoration.

Chester, about twenty miles from Liverpool, the only walled town in the kingdom, fortified in that manner by the Romans about eighteen hundred years ago, has within its rural inclosure an ancient dilapidated cathedral. From one century to another it has been patched, partitioned, bedaubed and ostensibly improved, according to the whims or vulgar caprice of those who have had charge of it, till the original character of the interior was well nigh destroyed. Fortunately, the present dean of Chester, the Very Rev. Dr. Howson, a gentleman of culture and refined taste, is re-revolutionizing the grand old antiquity. Defacements are being removed, and modern masonry that concealed splendid arches has been taken down, bringing into view the chaste designs of the original architect. When completed, it will be worth a special pilgrimage to Chester to gaze on the venerable structure. In a rude tower on the wall, still standing, Charles I. sat and witnessed the defeat of his army, which shipwrecked the throne. There are other cathedrals in England very imposing, but none more complete in its antique appointments and solemn beauty than Chester Cathedral in its restoration.

We are prone to underrate and undervalue the attainments of our predecessors, as exhibited in remains of art or science. But every age has its representative men in all departments, in which brain force is recognized as superior to all other forces.

BRIDLE.

It is difficult to imagine a more simple or more cheaply constructed bridle than that which Mr. J. H. Wilson, of Nashville, Tenn., has recently patented. A glance at our engraving renders description almost unnecessary. A single strap passes around the horse's neck, and its two parts are

fastened together just behind the animal's ears and over its face. Branching at the latter points, the separate portions of the straps pass down each cheek to a loop or ring in the bit, and thence extend, in the manner of the reins, over the back of the neck, where they join together.

A single piece of cord or strap constitutes the entire bridle' nothing further being necessary than to pass it, as above described, through the loops and buckles, and adjust it by moving the buckle over the nose, up or down, as may be required. For rights to manufacture address Mr. Wilson, as above.

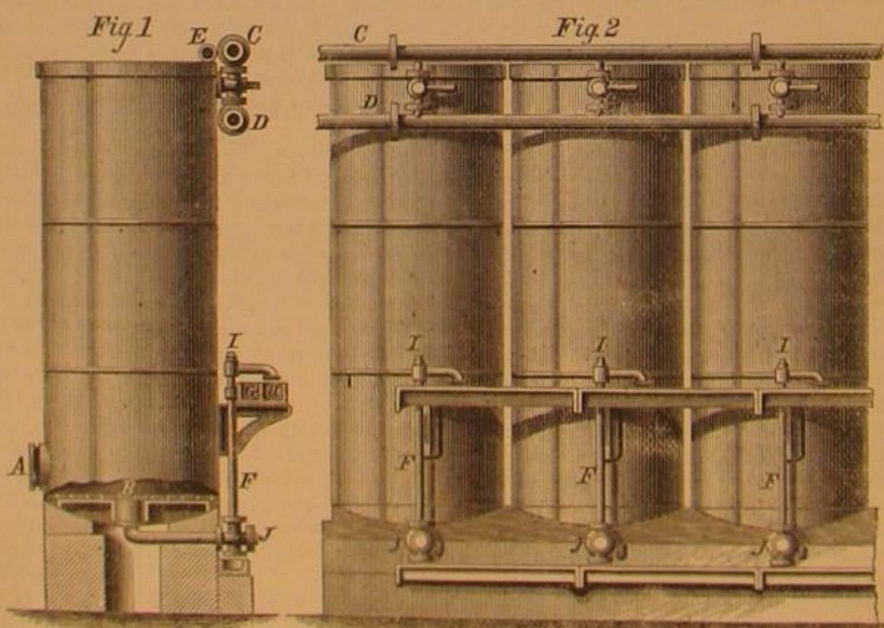
ANIMAL CHARCOAL AND ITS USE IN THE REFINING OF SUGAR.

It is on the process of filtration through animal charcoal that the refiner relies for transforming the scorched and blackened sugars, which he but too often receives from the planter, into the white crystals which he offers to his customers. Animal charcoal is prepared by calcining the bones of animals in vessels closed so as to exclude the air. The ordinary method is just to extract all fatty matters by boiling, and afterwards to place the bones in iron or fire clay pots ranged in a furnace. When the gases cease to be evolved, the calcination is complete. After cooling, the bones are passed through a mill to reduce them into a coarse powder and then sifted, so that the grains of the same size may be kept together.

A new process for this manufacture has lately been introduced in France by MM. Dunot and Bougleux, in which special regard is paid to the recovery of the by-products. The bones are first sorted, freed from bits of iron and stone, then crushed between rollers, and boiled with water under the application of steam. The fat hereby obtained, remelted and bleached in the light, is sold at the rate of $18 per 220 lbs. The boiled bones are piled in heaps so that, at a heat of 60° or 70° C., they undergo a species of fermentation and are then sifted; the portions which pass through the sieve are utilized as bone meal and reduced to various degrees of fineness. This meal is used for manure and contains on an average 4 per cent of nitrogen and 40 per cent of phosphate of lime. The carbonization process consists in employing retorts, of similar construction to those used in gas making, and cooling the distillation products in the same way as in gas manufacture. The gases and vapors escaped from the retorts in use ascend and descend in vertical pipes that are cooled from the outside. At last the gases pass through a holder where they meet a stream of water and are at length burned in the fire of the retorts. About 8,800 pounds of bones yield 34 cubic feet of ammoniacal water, containing an empyreumatic oil which is decanted. The water is conducted to a cistern and pressed into a Mallet apparatus for recovering the ammonia by means of lime. From the ammonia, together with impure carbonic acid, sulphate of ammonia is obtained. The total production of bone charcoal made by this process is annually some seven million pounds.

The charcoal filters employed by the planter are usually about ten feet high and four feet in diameter. They are generally open at the top. Near the bottom is a grating of iron; a piece of filter cloth is laid upon this, and then the vessel is filled with charcoal up to about a foot from the top. In the accompanying engraving, three of these filters are shown. A is the main hole, and B the grating on which the filter cloth is spread. When the filter has been filled with fresh charcoal, sirup will first be run into it by the pipe, C, and it will be supplied with this until its decolorizing power is very nearly exhausted. The supply of sirup will then be shut off and the filter will be used for some time to filter cane juice, which enters by the pipe, D, fresh from the defecators. As the power of the charcoal has already been exhausted, it acts upon this simply as a mechanical filter. The sirup is driven out as the cane juice enters. After the filter has been used for some time in this way, the supply of cane juice is shut off and pure water run in through the pipe, E. This in its turn drives the cane juice before it and continues to flow until it no longer carries away with it sufficient saccharine matter to pay for concentration. It is essential to have several filters at work, in order that, while one is filtering sirup, a second may be filtering cane juice, and the third may have pure water run over it for emptying and refilling.

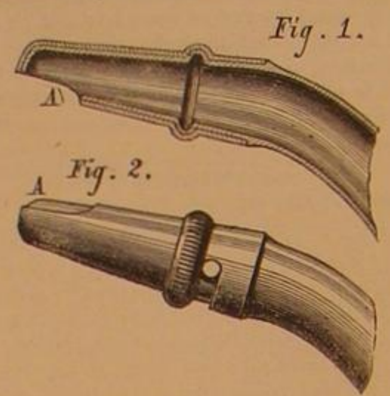
The side view, Fig. 2, shows more clearly the arrangements whereby the liquor and juice are drawn off through the pipe, F, which discharges into the gutters, G and H, through to the swivel joint, I. The water is discharged through the cock, J, into the gutter below.



SUGAR FILTERING APPARATUS.

VALVED OIL CAN NOZZLE.

Mr. E. J. Durant, of Lebanon, N. H., has recently devised the ingenious arrangement for the spouts of lamp-filling oil cans represented in our illustration. It is simply a peculiarly shaped cap fitting over the spout. The end of the latter is closed and an opening formed on its under side. A similar aperture, A, is made in the cap, which is secured in place by swaging from the inner side of the spout an annular groove of sufficient depth to extend into the cap.



To allow of the flow of oil, it is only necessary to turn the device so that the two orifices shall be coincident, as in Fig. 1; while the end of the spout may be tightly covered by simply revolving the cap until the aperture is in the position shown at A, in Fig. 2. This little invention will be of use in preventing the escape of the contents of the can by evaporation or by the accidental upsetting of the vessel.

A Burning Hill in Ohio.

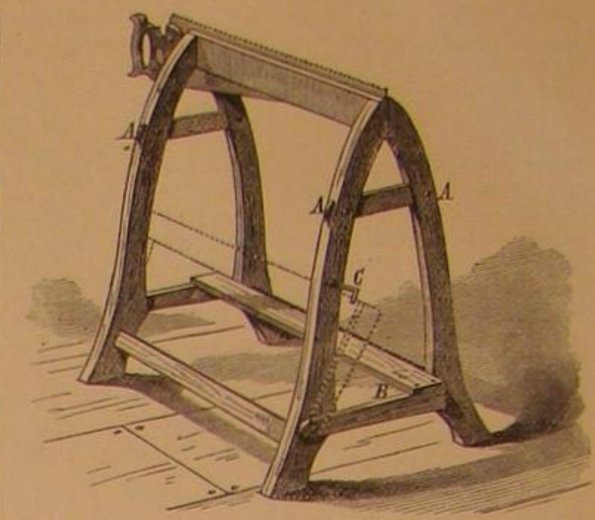
Three miles from Bainbridge, Ross county, Ohio, is located a hill of considerable altitude, known as "Copperas Mountain." Out of the top of this mountain, says the *Circleville Herald*, issues a constant stream of smoke, while on its summit and general surface the vegetation has withered and died until the whole hill presents a barren, sterile and desolate aspect, blasted as if by a whirlwind of fire. It is believed that the entire interior of the hill is a mass of ignited combustible matter, and that the fire is and has been spreading with considerable rapidity. The theory presented to account for it is that, on or about the 1st day of last October, the party to whom the land belongs was burning brush on the hillside, and that the flames communicated to inflammable matter, probably crude oil, coal or other combustible substances, contained in the geological formation of the hill.

THE durability of asphalt as flooring has been tested in the Northampton (Eng.) cattle market and the decision is against it. It was found that the treading of the cattle soon wore it away, and that it would speedily become necessary to replace it. It was accordingly decided to lay the floor of the market with brick in place of the asphalt. A flooring of hydraulic cement, we believe, would be better and more enduring than either asphalt or brick.

SAW CLAMP.

To mechanics, who frequently find it necessary to file their saws, the accompanying device will prove a useful acquisition. It is a portable saw clamp, so constructed that the tool is held along its entire length with a force proportioned to the power of the lever purchase.

The apparatus consists of two frames, as shown, connected by the short bars pivoted in mortices at A A. B is a horizontal frame serving as a foot piece which, when raised, is in the position of the dotted lines and held by the hook, C. The jaws can then be opened by bringing the feet of the device slightly together. After the saw is inserted, the foot piece, B, is brought down to a horizontal position, thus forcing the frames apart, closing the jaws, and holding the tool firmly during the subsequent filing. The portability, as well as the simplicity of the device, allowing it to be shifted to any desired point in order to obtain the best possible light, renders it of especial convenience. The patentee is Mr. T. L. Kenworthy, of Collinsville, Ohio.



The Difference between English and American Workmen.

A prominent English manufacturer says:—"I think the difference between the way in which the American workman will turn out an article that is wanted, and the way that an English workman will turn out an article that is wanted, is to be described in this way: The Englishman has not the ductility of mind and the readiness of apprehension for a new thing that is required; he is unwilling to change the methods which he has been used to, and if he does change them he makes demands of price by trade rules which actually oppose the change of the article, or certainly attach to it something in the shape of a fine or an extra demand beyond a fair price for the making of an article. An American readily produces a new article. This last year, having made an extensive tour in the United States of 7,000 miles, by land, not so much for my immediate business purposes as for the sake of obtaining general information connected with the comparison of the manufactures of the two countries, as well as upon other social subjects, I have come to this complete opinion: that the cause of the whole difference between us is to be found in the education of the workmen on the two sides of the water. On one side, in fact, there is an almost total absence of education, and that is the main difference. There should be an improvement in the primary education of the English workman, and also given to the working men. The scientific education and the primary education are but parts of one whole. We must have the whole building in order to get what we want. I think, as a matter of fact, that which is most wanted is primary education, or rather a general liberal education, beginning at the bottom. I think if we could get that we should find that those parts of the edifice which come at the top would be arrived at more easily; but we should have those parts of the edifice too. And I do not conceive that we should be doing a work of supererogation or what would not really help us in the right direction, should we at once promote the scientific education of all those who were ready to receive it.

The American workman has received considerable scientific education; he has it chiefly by his own study. He has received, to begin with, a liberal education, something quite different from what we call primary education in this country, an education that puts him on a level with persons in a higher position than we call the lower middle class, on a level, indeed, with almost the upper middle class. And with his mind so trained, he readily applies himself to acquire scientific education."

DUST RESPIRATORS.—Good service is being done in England by calling attention to the great prevalence of lung diseases among the operatives in dust-abounding factories, such as those where cotton, iron, china, flax, lime, etc., are worked. A simple and effective respirator, consisting of a light, flexible frame work lined with a filter of cotton wool, is used. The protection afforded by this apparatus is effectual, and it is simple and cheap.

NEW TUNNEL UNDER THE HARLEM RIVER, NEW YORK CITY.

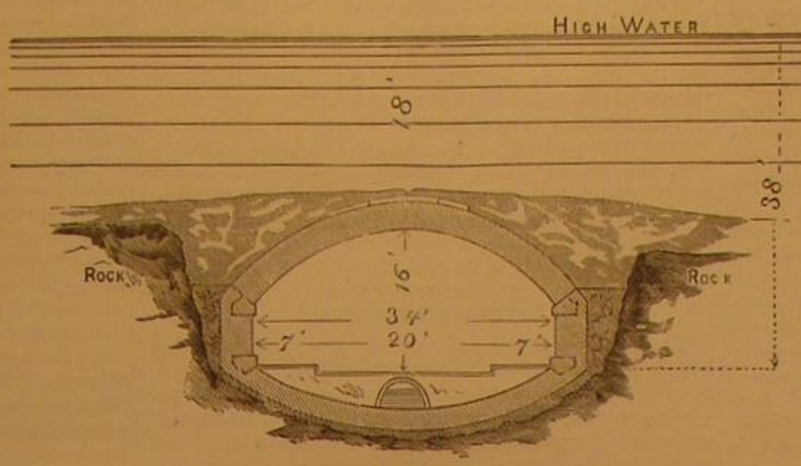
Among the public improvements, now in process of construction in New York city, is a tunnel and roadway under the Harlem river, at the northerly end of the city. This important work will form a continuation of the elegant thoroughfare known as Seventh avenue, which, by means of this structure, will be carried under the river into Westchester county.

We herewith present elevated and sectional views of the work, for which, together with the following particulars, we are indebted to the New York *World:*

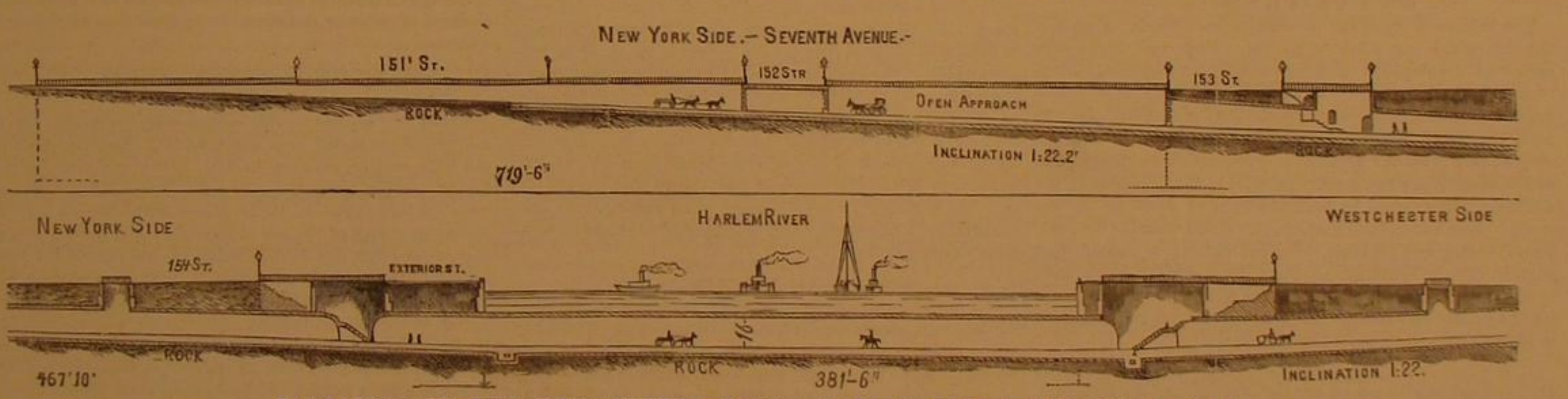
This new tunnel is run under the Harlem river at the head of Seventh avenue, the approach on the New York side beginning at 150th street, four blocks from the river shore, and the Westchester approach beginning at 163d street, at about the same distance from the water's edge. The length of the tunnel from one extreme to the other will be 2,641 feet.

At 150th street the road bed and sidewalks on Seventh avenue begin to gradually descend, the sides being built up with handsome blue granite. 151st street will be closed, at least for the time being, but at 152d street the tunnel will have reached a sufficient depth to allow a bridge to be thrown across on a level with the natural ground surface of Seventh avenue. At the beginning of the next block the tunnel will be entirely closed overhead, while the descent continues until the river is reached and the water is found to be directly overhead. At this point the tunnel is built through the solid rock, in order to leave a sufficient depth of water overhead for the navigation of large vessels. As soon as the opposite side of the river is reached, the tunnel ascends until the level of 163d street is reached.

The tunnel, when completed, will be simply a well made street, with two sidewalks, each seven feet wide, and a carriage way twenty feet in width. Just above 153d street there is to be a large square opening for foot passengers. A staircase, fourteen feet wide, leads down to the top of the tunnel, where there is a landing from which two stairways descend, leading to both sides of the street below. Between 154th street and the river will be another opening forty-eight feet in diameter, with similar stairways leading down to the tunnel.



SECTIONAL ELEVATION OF THE NEW TUNNEL UNDER HARLEM RIVER.



ELEVATION OF THE NEW TUNNEL UNDER HARLEM RIVER, NEW YORK CITY.

The next opening for passengers is near the shore, on the Westchester side. Near Sedgwick avenue, a short distance beyond, there will be another small round opening for passengers. There are also four more openings, at intervals, to admit air and light. The tunnel does not run under the river in a straight line with Seventh avenue, but turns to the right at 155th street, and crosses at right angles with the river, in a direction almost due northeast.

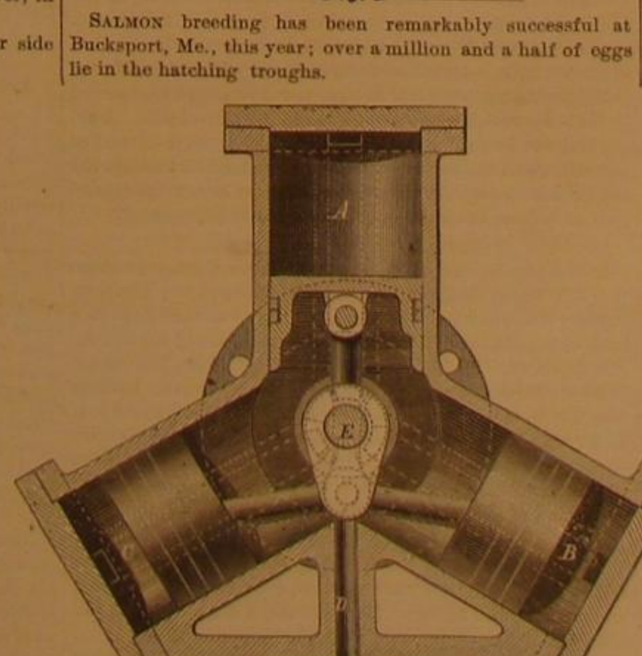
In our engravings, the approach on the Westchester side of the river is omitted.

THREE CYLINDER ENGINE.

At the recent Smithfield Club Show, England, a three cylinder engine, by Messrs. Brotherhood & Hardingham, was exhibited, which is thus described in *Engineering:*

In this engine, three cylinders are disposed round the crank shaft at an angle of 120° to each other, each cylinder being provided with a deep but light piston, from which a connecting rod is led to the crank, common to all. One of the connecting rods has a single eye at the crank end, while the two other rods are forked at that end, the fork of the one being wide enough to take hold of the pin outside the other, so that the center lines of the rods are all in the same plane. The cylinders are all open at their inner ends, and when the engine is at work the steam from the boiler has free access to the central space, so that it tends to force the three pistons outwards uniformly. The admission of the steam to, and its release from, the outer ends of these three cylinders is effected by a single revolving slide valve. This valve works against a face at one side of the central chamber, as shown in our engraving, being carried round with the crank shaft.

As there is necessarily some throttling in the steam passages, particularly when the engine is running fast the pressure of the steam at the outer ends of the cylinders never equals that in the central chamber, and hence the pistons are always forced outwards, the strain upon the connecting rods being always a tensile one, but varying in amount according to whether the steam is being admitted to or exhausted from the outer ends of the cylinders. In the engine shown in our engraving, the direction of motion would be that indicated by the arrow, the cylinders A and C being exhausting, and that marked B being receiving steam. The steam inlet is at D, all steam for the supply of the cylinders passing through the central chamber; while the exhaust nozzle is at E, in a line with the crank shaft. Owing to the strain on the connecting rods and joints being always in one direction, there is no back lash, and it is possible to run the engine at extraordinary high speeds without inconvenience; in fact, the makers state that they have run it at over 2,000 revolutions per minute without experiencing any difficulty even with the joints of the rods purposely made very loose fits. Of course, if the connecting rods were subjected to an alternate pull and thrust, and if reciprocating slide valves (with the consequently alternating strains on the eccentric rods) were employed, this result would be impossible after a little wear had taken place. As it is, the engine is well adapted for driving fans, centrifugal pumps, etc., and similar machinery requiring high speeds, and for such purposes it appears to us far superior to any rotary engine which we have yet seen. Messrs. Brotherhood and Hardingham are applying this engine to driving Messrs. Boulton and Imray's helical pump, and the arrangement they employ is a very neat one. The makers are also, we believe, contemplating the construction of this class of engine in larger sizes for general purposes.



THREE CYLINDER ENGINE.

SALMON breeding has been remarkably successful at Bucksport, Me., this year; over a million and a half of eggs lie in the hatching troughs.

New Mode of Pivoting Teeth.

I prepare the root as usually performed for ordinary pivoting, says S. Davis, in *Dental Times*, then ream the pulp chamber in a funnel shape to about the depth of a quarter of an inch, and in this cut anchorages. The root is frequently decayed in this shape.

A plate tooth is then taken, and ground to fit the prepared root. It is then backed with gold plate. A portion of the sides of the tooth and backing are then ground off, leaving the labial surface the original size. A pivot is then soldered to the backing, and the frame is cut to the proper length, to allow the crown to leave a space of about a line between it and the root. Then prick the backing and pivot with a sharp instrument, and apply some oxychloride of zinc in the pulp chamber, and force the crown and pivot into position. Gold is then packed into the anchorages, and built up around the pivot, bringing it well up on the backing.

When the crown and pivot are in position, there are but two thin edges, about a line distant from each other, with plenty of space left at the palatine and proximal surfaces of crown for packing gold.

The greatest obstacle in the way is the inflow of saliva; but I think this canbe prevented in most cases.

Honor to Inventors.

Inventors are a class—*sui generis*—and their rewards, in lifetime, are mostly *nil*, their honors posthumous, says the London *Mechanics' Magazine*. They are, moreover, cosmopolitan, and in general their labors, when successful, benefit not one class or nation alone, but mankind at large.

As it is therefore fitting that in some shape or form honor should be given where honor is due, we have learnt with much interest and pleasure that the Commissioners of the New York Central Park have allotted a portion of their domain for the erection of memorials to the inventors of all nations, and it is now proposed to erect one of these memorials in honor of Elias Howe, the inventor of the sewing machine.

The good fortune to confer equal benefits on mankind is reserved to few inventors, and while this invention is the world's common inheritance, a large share of the legacy has fallen to Englishmen, who have never yet been found wanting in gratitude to their benefactors. This object appeals directly to the sympathies of the inventive class, of which Mr. Howe was an illustrious representative; and there will, doubtless, besides be many a cheerful giver among the humble users of sewing machines.

The influential committee organized in America to provide the memorial funds will, we learn, be aided by a committee recently formed in this country, which comprises Bennett Woodcroft, F. R. S., David Chadwick, M. P., Donald Nicoll, Esq., Thomas Webster, Q. C., F. R. S., George Haseltine, LL. D., P. Le Neve Foster, M. A., and Theo. Aston, Q. C., of London; William Clarke, Esq., of Glasgow; Sir William Fairbairn, Bart., James Stuart, Esq., William Muir, C. E., William Batty, Esq., Ernest Reuss, C. E., and Mayor Booth, of Manchester. We believe also that Mr. Siemens, President of the Society of Telegraph Engineers, and other eminent gentlemen, have promised their hearty coöperation and material aid. The committee have elected Mr. Woodcroft, of the Great Seal Patent Office, chairman, Mr. Nicoll, St. Paul's Churchyard, treasurer, and Dr. Haseltine, of Southampton Buildings, honorary secretary.

The London and County Bank and John Stuart and Co., bankers to the committee, will receive subscriptions. The estimated cost of the memorial is fifty thousand dollars—ten thousand pounds—and a unique design has been submitted to the committee by an eminent sculptor, a personal friend of the inventor.

The composition of the committee indicates a very general interest in the movement, and is an earnest of its success. Truly the victories of peace are greater than the victories of war, and the due and fitting recognition and veneration of the heroes of these beneficent victories is at once the ornament and illustration of modern civilization.

THE GOVERNMENT SUBMARINE WORKS AT HELL GATE.

A group of detached rough wooden buildings, a few heaps of stone, two or three tall derricks stretching out their giant arms, and here and there a cloud of ascending steam: such is the quiet exterior that marks the site of that great work of modern engineering which is to double the advantages of the port of New York, to shorten the voyage to Europe by many scores of miles, and, from a narrow tortuous and dangerous channel, to produce a broad and open harbor in which the largest vessels may ride in safety.

Near the extremity of Hallett's Point, on the Long Island side of the East River, is sunk the great shaft, thirty feet deep and one hundred and five feet broad at its widest part. A strongly built coffer dam protects it from the inroads of the tide, while into its precipitous sides are hewn ten immense caverns, which, radiating at different angles, extend for hundreds of feet under the bed of the river. These again at about every twenty-five feet of their length are traversed by seven nearly semi-circular galleries, so that, for want of better illustration, the work reminds one of a giant cobweb honeycombed in the solid rock.

We may safely presume, from the many histories and descriptions of the undertaking which, during the past two years, have appeared in our own as well as other columns, that with its general details the reader is reasonably familiar. It was with this conviction that our recent visit was devoted to the eliciting of such information from the directors of the work as would indicate the most recent progress made toward its completion, and the results obtained from the machines, processes, etc., in daily employment. The accompanying map, constructed on an accurate scale of 1 to 3,000, will convey a good idea of the

PRESENT STATUS OF THE EXCAVATIONS.

It is proposed to carry the various headings out until they reach a point above which the depth of water at mean low tide is 32 feet; this is the last contour indicated on our map. The next irregular line marks a depth of 28 feet. Seven headings have already reached the proper length: others are being rapidly pushed forward. Grant, or No. 7, heading has now attained a distance of 230 feet. In Farragut, or No. 1, which when finished will reach 270 feet, there is yet 70 feet to pierce. The solid piers between the cuttings serve to support the roof of rock, ten feet in thickness, together with its immense superincumbent weight of water. Altogether, about 4,000 feet of excavation have been completed, leaving some 2,000 feet more to be done. The average monthly advance is 250 feet, although these figures have been exceeded during the past five months.

HOW THE ROCK IS PIERCED.

The bottom of the river is composed of strata of gneiss, through which run veins of quartz. Here and there thin layers of decomposed mica have been encountered, often causing serious leakage, but the rock generally is of great hardness (as comparatively expressed by geologists, about 6) rendering rapid boring a matter of much difficulty. The bed slopes away from the shore at a considerable declivity, and as the tunnels are necessarily parallel to the inclination, the drills are often placed to work at angles as great as 45 degrees. Excavations are made in the usual manner by continued boring and blasting, one tool cutting a tunnel just high enough to accommodate the miners, while a second drill some forty feet in the rear, removes stone from the roof until the gallery or heading has reached its proper hight of twelve or fourteen feet. The principal

DRILLS

that are or have been used are the Burleigh and the Diamond. The latter, however, has been found unsuitable for the work in small tunnels, and although two machines have been purchased by the Government, they have not been used since last July for tunneling purposes, and now lie idle.

In justice to the Diamond drill, it may be stated that its work at first was satisfactory. There is no doubt that, as a prospecting tool and for deep boring, it is of much utility, but the actual results, as determined by the work of the drill upon the hard rock at Hell Gate clearly indicate that, in the present instance at least, its competitor, the Burleigh, has a manifest advantage. The average work of the Diamond was, for a period of four months, 14·4 feet per shift of eight hours, at a cost of $1·16 per lineal foot; that of the Burleigh, 26 feet at from 42 to 43 cents per similar distance. Four Burleigh drills, from the months of October to April last, completed 20,000 feet; two Diamond drills for the same period, less two months, accomplished 7,000 feet. An average of 5½ Burleigh in one month pierced 7,300 feet. The opinion of the workmen and of those directly in charge of the operations is in favor of the last mentioned machines, eight of which are employed, six in the tunnels and two in the shop as substitutes. The cost of repairs for the six is about $27 per month; that of the steel expended was, for December, $27, for 451 pounds.

As regards the Diamond drills, from all accounts the hardness of the material formed the great obstacle, and we were informed that the machine rarely ran for more than forty-eight consecutive hours without a breakdown. Its cost for repairs was remarkably large, reaching, for the machines used, including replacing of a number of diamonds, etc., in a single month as high as $700. Including stoppages from various causes, shifting from tunnel to tunnel, etc., the average work of the drill was 1·8 feet per hour; that of the Burleigh is 3·5 feet. All of the above facts, we may add, were obtained directly from unprejudiced government officials, and in no case from an employee of either manufacturing company, or from any one having interest in the machines. The former gentlemen state that it is their desire to obtain the best possible tools, and that they will freely afford every facility for testing the same of any maker by applying them to actual work, side by side with the drills now in use.

THE COST OF THE WORK

as it is now conducted under Government auspices is strikingly less than that of preceding operations of a similar nature which from time to time have been attempted in the same locality. When let out on contract, the expense per cubic yard of stone removed, obtained by Maillefert in his workings in Pot Rock, was $44.25. At the present time, $6.42 is the corresponding expenditure at Hallett's Point, and this is about one third of the price asked by contractors. The land on which the buildings, etc., are erected belongs to private parties, to whom two thirds of the stone excavated is given as ground rent. About one hundred and twenty men are now employed. Power is supplied to the drills and to the blacksmith shop by five Burleigh air compressors, which work in winter in oil and in summer in water. All articles for use are made on the spot. An old boiler, otherwise useless, was with considerable ingenuity repaired, mounted on a carriage and, with a small steam engine, makes an excellent dummy, serving to draw away the dumping cars as fast as they are filled with the loose material taken from the headings, thus saving the labor of six men.

ENGINEERING NOTES.

We select from the Reports of Committees and from other papers, submitted to the Railway Master Mechanics' Association during its convention at Boston last summer and recently published, the following items of general interest to engineers:

BOILERS.

The Committee on Boilers and Boiler Materials consider that a necessity exists for better combustion and greater economy in the use of fuel, in furnaces of coal-burning engines, than can be obtained by any known device. The use of the fire brick arch or water table is recommended in furnaces of all passenger locomotives burning bituminous coal.

The wagon top in preference to the straight boiler for locomotives is advocated, especially where impure water is used. It affords greater steam room and larger water surface over the furnace, and it decreases the liability to foam if the water is bad. The admission of air above the fire and two inch flues for wood or coal-burning engines are recommended. American iron for furnace sheets is not considered as free from lamination and liability to blister as Low Moor and kindred brands of English iron. After careful experiments, the Committee advises drilling the rivet holes for longitudinal seams of boilers: the circular seams are not subject to so great a strain and may be punched. Three quarter inch rivets, 1¾ inches between centers, should be used for all seams in boilers of $\frac{5}{16}$ inch iron, as the ⅝ rivet is too small to resist the strains. The exclusive use of hollow stay bolt iron is strongly urged, so that if a stay bolt breaks, partly or entirely, the fact will be discovered. The objection that too much cold air will thus be admitted to the furnace may be avoided by driving suitable plugs into the inner ends of the holes in the stay bolts. Experiment has shown that the strength of ⅞ inch hollow stay bolts is more than sufficient to resist the strains to which they will be subjected if placed 4½ inches from center to center.

MERITS OF THE WAGON TOP BOILER.

Mr. H. A. Towne communicated a letter on the merits of straight and wagon top boilers, pointing out the advantages of the latter. As regards strength, a wagon top has never blown off nor even given way under pressure so as to endanger its safety; on the contrary, whenever an explosion of this kind has taken place, the cylinder part of the boiler has in every instance given out first. The extra cost of a wagon top over that of a straight boiler of the same size will not exceed the cost of ordinary domes.

THE SELF-ACTING SLIDE LATHE.

Mr. Coleman Sellers, in a paper on this machine, gives the following as the readiest method of bringing the centers in line after the back head has been set over out of line, in adjusting the centers in the first place or in testing the correctness of a new lathe. A bar of round iron carefully centered is turned up a short distance on one end. This turned end being placed next the live head center, a turning tool clamped to the slide rest is made to just touch the turned part. Taking out the bar, the tool is moved to the poppet head end of the lathe, and the bar replaced with its turned end next to the poppet head center, when, if the tool just touch the turned part as before, the lathe may considered in adjustment.

PURIFYING WATER FOR BOILERS.

In this report, various opinions are given tending to show that it is impracticable to get the impurities out of water by heating it at stations. Experiment proved as follows: In a tank of suitable size, a two inch worm pipe was placed to the full depth of the tub and live steam used to heat the water. With a consumption of 3,000 pounds of coal every twenty-four hours, it was found impossible to heat the quantity of water used during that time—twenty-six thousand gallons—enough to make any possible difference in the appearance of the boiler or flues of an engine which used this water exclusively and of those which used it one day or not at all.

LAP AND LEAD OF SLIDE VALVES.

In regard to balanced slide valves and valves working on rollers, the Committee have received reports from nine roads which have used rollers. Six have taken them out and the other three give no result of their performance. Eight roads have reported using balance valves of different makes with good results.

PACKING FOR STUFFING BOXES.

Of over thirty roads heard from, the majority prefer hemp. It takes a high degree of heat to char it enough to harden it. Steam at a pressure of one hundred and fifty pounds per square inch has only a temperature of 343°, while hemp will easily stand 500°. Soapstone of various kinds gives good results and has its advocates, who say that its first cost over hemp is counterbalanced by its longer use and less friction, consequently wearing the valve rods less. Metallic packing has been used by many, and its use abandoned by nearly all, the result not bearing out its first cost and needed repairs.

THE USE OF FUEL.

Mr. Gordon H. Nott says as follows: All practical trials prove that the fuel, during its preparation for making steam, must be kept away from all parts of the boiler protected by water surfaces, as, for some distance from the actual contact, there will be a constant partial condensation of the fuel. In the plain fire box, the products of an imperfect combustion are thrown, with much force and intensity, against the center of the tube sheet which is the very part where there should be uniformity of action. Here we find a weak part of the boiler subject to an immense heat and imperfect combustion. A remedy that will apply, in the central part of the fire box, to the mixture of the fuel and gaining of time in combustion must serve to modify the force of this column against the tube sheet. The accumulated experience of locomotive railway engineers is that time for a thorough mixture must be gained, whatever may be the size of the fire box—less for a long than a short one. In the use of a long fire box, there is a gathering of injurious gases when the tubes are reached; with a small one, this gathering is not so large, but the mass of the products of poor combustion is more.

BOILER INCRUSTATION.

The Committee consider that to boil sufficient water to supply a locomotive for one year, running 31,200 miles, would require an extra expenditure of $236.25 for fuel. The use of pure water will absolutely prevent all manner of explosions, ruptures and leaks arising from incrustations, besides saving a large proportion of repairs and also supplying pure dry steam free from grit or sediment. The introduction into a boiler of any so-called remedies, be they batteries, powders or any other nostrums, can hold no comparison to this one reliable remedy. Railway companies should be aware of the fact that in the Middle and Western States the expense due to impure water and incrustation would amount to $75,-000 a year for every hundred locomotives.

Judging from experiment, it seems hardly possible that any apparatus of filters or series of plates can be got on to an engine of sufficient capacity to purify the large amount of water required for a locomotive boiler. The Committee consider that a series of exhaustive experiments should be instituted in order to definitely determine this important requirement.

THE BEST METHOD OF SECURING DRIVING AND TRUCK BRASSES.

Thirty-five reports on this subject were received. On the use of Babbitt metal, four use gibs with Babbitt; four use the solid octagon without Babbitt; seven use octagon with Babbitt; seven use half round solid brass without Babbitt; four use half round in three pieces with Babbitt, and one makes no report of the use of Babbitt. All, with one exception, report that the Babbitt metal should extend the entire length of the journal and should be put on in strips ¾ to 1½ inches wide, at a point between the top and the front and back points of the journal bearing; one inserts it by drilling holes in the brass and then filling in with the metal. The Committee have observed that, in engines of from thirty-two to thirty-five tuns weight, the half round brass does not give as good results as in lighter engines. Good results may be obtained from a hexagon-shaped brass if properly fitted. The brass will wear until it is cut through into the cast iron. The recess in the top of the brass is of advantage also as a reservoir for oil; and as there is less bearing at that point, the brass wears away and the shaft beds itself into the brass, so that there is no lost motion or pounding between the shaft and the brass. The Committee is of opinion that the use of Babbitt metal is advisable.

NASCENT ELEMENTS AS FERTILIZERS.

A correspondent starts the inquiry as to the relative value of elements as food for plants when prepared in different ways. For example, is the potash derived from the ashes of wood more easily assimilated by plants than the same agent obtained from salt mines? Or is the silica of green sand more readily absorbed than that obtained from quartz? The topic is an important and fruitful one, and has been discussed by many writers on agriculture. There is no doubt that silica derived from infusoria and diatoms of green sand, tripoli, etc., is more soluble and, hence, more available for the growth of plants than the sharp sand of decomposed quartz; and it would also appear that potash obtained from wood was more available than that from a mineral source. We should, however, hardly call these *nascent* elements, as that word is used to describe chemical substances just liberated from their compounds, as nascent hydrogen from decaying organic matter, or nitrogen from a similar source. Potash and silica are not elements but compounds.

NEW INSANE ASYLUM IN CALIFORNIA.—The commissioners appointed for the purpose by the Legislature of California have selected a site near Napa City for a branch insane asylum. The estate comprises 208 acres of land, with fine sites for buildings, and good facilities for water supply, sewerage, etc. The State has appropriated nearly $800,000 for the erection of buildings.

STUDY the past if you would divine the future.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE EFFECTIVE PRINCIPLES OF COFFEE.

Although it is known that coffee and tea contain the alkaloids caffeine and theine, it is not known what percentage of loss of the caffeine occurs by roasting the coffee, or how much of it and other substances are, by that process, extracted; nor is it known whether, aside from the principle mentioned, there are no other effective ingredients in coffee. With a view of settling these questions, Mr. Aubert has carried out some experiments, from which we condense the following: When the coffee was roasted until it assumed a bright brown color, no caffeine was discovered in the collected vapor; but by roasting it until it became almost black and assumed a fatty luster, the alkaloid could readily be found. The loss occurring in this wise amounted to 0·927 per cent. On the other hand, the extract from strongly roasted beans is poorer in caffeine than that produced from the less roasted. With regard to the physiological effects of caffeine upon animals, it produces, in sufficiently large doses, increased excitability and even tetanus, and thus acts like strychnia. And another similarity to this poison consists in that the action ceases as soon as respiration is sustained artificially, five minutes' respiration being sufficient to make even large doses inoperative. With regard to the question whether the effects of the extract of coffee are dependent upon its amount of caffeine, M. Aubert has discovered that an infusion of coffee, from which this principle had been separated, produced different but not less characteristic effects upon animals. However, it seems to be not yet decided to what ingredient coffee owes the invigorating effect to which its extensive use is due.

REMEDY FOR A COLD IN THE HEAD.

Dr. Hager recommends for this purpose a mixture of five parts carbolic acid, six parts sal ammoniac of specific gravity 0·960, ten parts distilled water and two parts alcohol. This fluid is poured into a glass with a wide neck, one half full of pulverized feather alum. It is applied by pouring a few drops upon blotting paper and inhaling the vapor, with closed eyes, through mouth and nostrils, and repeating the operation once every two hours.

IMITATIONS OF MARBLE.

Most marble imitations consist of glue and gypsum or chalk, of paper pulp and gypsum, or of lime and glue. Pichler in Vienna has published the following account of another imitation, said to be peculiarly adapted for plastic decorations of all kinds: Take one pound of good glue and boil it down so that it will be quite thick, add then half a pound of resin or, better still, Venice turpentine, and mix well. Prepare a mixture of fine chalk and such mineral colors, finely pulverized, as are required for certain imitations. The less the ingredients are mixed, the better will be the imitation. The paste formed by blending the two mixtures is then kneaded until of the proper consistence. A few drops of Provence oil may be added to it. This mass can be immediately used, and becomes hard like stone. If desired to be kept for a while, it is only necessary to wrap it in a moist cloth.

WHITE PAINT FOR METALLIC PURPOSES.

When oil paints are used for metallic surfaces that are subjected to heat, they turn yellow and brown from the burning of the organic portion of the paint. If, instead of oil, soluble glass be used, there will be no organic or combustible substance to brown it. Zinc white mixed with soluble glass of from 40° to 50° B., to the consistency of ordinary paint, forms a beautiful and permanent color that will stand any required heat, without browning and blistering, and can only be removed by mechanical means. A not very large quantity should be mixed at one time, as a chemical change takes place and the paint hardens.

SIMPLE FIREPLATING FOR IRON.

By rubbing the surface of iron or other metals with soda amalgam, and then pouring over it a concentrated solution of chloride of gold, the gold is taken up by the amalgamated surface, and it is only necessary to drive off the mercury with the heat of a large lamp to obtain a fine gilded surface that will bear polishing. By writing or drawing a design on the iron, the drawing will be reproduced in pure gold. Silver and platinum salts are said to act in a similar manner to the gold.

A DRYING OIL OF A LIGHT COLOR.

Put about 25 lbs. genuine linseed oil in an enameled iron pot which will hold about twice that weight and put it over a quite hot charcoal fire, and heat to the boiling point for about half an hour. In the meantime, a second person triturates 2 ozs. genuine hydrated oxide of manganese in linseed oil. This is now dropped carefully into the boiling oil, stirring with a wooden spatula. When the oil foams and swells up, the dropping in of the manganese is suspended until the tumultuous action subsides, and then the remainder is added, and the dish containing it is rinsed out with oil which is also added. It is now boiled for an hour, or, if a very rapidly drying oil is required, for 1½ or 2 hours. When taken from the fire, it is closely covered, let stand for 24 hours, and then decanted from the sediment that settles. The pure oil is put in bottles and bleached by exposing it to the action of the sun and moonlight. Mr. Gromann, the inventor, thinks it bleaches more rapidly in the light of the moon than in that of the sun. Whether moonlight really bleaches it better than sunlight, we cannot say.

DETECTING STRYCHNIN.

P. Bert has found another useful and remarkable property of carbolic acid, namely, that it dissolves the salts of strychnin, and may be used in detecting its presence. If 0·2 grain of hydrochlorate of strychnin be dissolved in 100 grains of water, and then shaken up with a few drops of carbolic acid, an emulsion is formed of the acid and alkali. By filtering, all the strychnin is obtained, and this is then separated from the carbolic acid by shaking it with ether and water. Separated in this way from decaying animal tissues, it can be tested in the usual manner.

REDUCING SILVER SOLUTIONS WITH PHOSPHORUS.

The silver residues of the photographer are readily precipitated by common salt or muriatic acid, and the chloride formed is sold as such, or reduced by zinc and sulphuric acid or in any other convenient manner. The chemist, however, has many other silver residues besides the nitrate and the haloid salts; and, in mixing all his waste silver compounds, curious chemical reactions take place in the waste jar, so that the question of recovering the silver is far more complicated with the chemist than it is with the photographer. Many of these salts of silver are not decomposed by muriatic acid, but all are decomposed by phosphorus. The phosphorus is used in the form of phosphoric ether; a suitable amount is added and well shaken; a black precipitate at once separates, the liquid remaining more or less yellow or brown in color. If the precipitate contains little bright specks, the silver is not yet converted completely into the phosphide of silver, and more phosphoric ether is added until the precipitate acquires a uniform black color. It is then filtered, and the precipitate is washed and afterwards boiled with caustic potash. The metallic silver is then at once obtained in a powder. If it is desirable to obtain the silver in a solid mass, it is done by fusing pure potash in a crucible and gradually dropping into the fused potash small portions of the dried precipitated phosphide of silver, which is thus both reduced and fused in the same operation, at a much lower heat than that required for melting silver, since the inventor of the process, Julius Krüger, informs us that the heat of an ordinary stove or furnace suffices for the process.

A TENACIOUS COLLODION FILM.

A collodion film of considerable strength may be prepared by making a concentrated solution of gun cotton in equal volumes of ether and absolute alcohol, and adding to it a small quantity of balsam of copaiba. This collodion solution, when largely diluted with ether and alcohol, may be used for rendering linen and cotton fabrics waterproof.

SCIENTIFIC AND MECHANICAL POSSIBILITIES.

In our great desire to increase and add to the comforts of life, we must not lose sight of prolonging life and youthful vigor.

Year by year, the laws of health are better known and observed. We are learning that disease is generally caused by misconduct; by avoiding the causes, we escape the consequences. Hence, in nearly all civilized countries, the average duration of life is steadily increasing. In Geneva, accurate registers have been kept of the yearly average of life since 1560, which was then twenty-two years six months; in 1833, it was forty years and five months. Thus, in less than three hundred years the average duration of life is nearly doubled. In the fourteenth century, the average mortality in Paris was one in sixteen; it is now about one in thirty-two (or, rather, it was before the Franco-Prussian war). In England, the rate of mortality in 1690 was one in thirty-three, now, about one in forty-two. Yet even now, millions all over the world prematurely die. If it is true that people lived in the so-called patriarchial days to be hundreds of years old, why not now, if strict obedience to the laws of our being is observed for successive generations? Some theologian may reason that man's days were afterwards appointed at three score years and ten; but as science pays very little attention to theological notions of this character but aims at a much higher proof, that of undisputable facts, we will embrace her as our standard, and confidently look forward to that glorious epoch, when science will have conquered all absurd and theological whims, when the human mind will be loosed from the galling chains of superstition. Is it not possible that science may yet show the necessity of chnaging the expenditure of our churches and theoretical gorgious teachings and training to that of common life education? Has not scientific enlightenment opened our public parks and libraries on Sundays, when the body may be invigorated and the mind improved and enlightened? Science marches steadily onward and upward, always victorious. As mechanism perfects the weapons and means of destruction, war becomes more dreaded, and no doubt it remains for the work of science and mechanism to stop human butchery. But "Oh," asks some one, "what is to be done with such a mass of people as will accumulate on the earth?" Why, the fact is that the earth is not one twentieth peopled now. Talk about the overcrowded population of Europe. England itself is not one fourth populated at the present time, and there is not the least call for emigration. I travelled twenty-five miles one day in England through what is called the "dukeries." These are held by law without a shadow of title that they can show, and all of this vast tract of land is not one twentieth part cultivated, and what is cultivated is not producing one fourth which it might even by present knowledge, and this one tract of which I speak is but a very small portion of the vast tracts that are in similar deplorable condition. The Crown lands, of which the New Forest, so called, contains 30,000 acres of forest, all may yet be made to produce like the fancied garden of Eden.

Science is yet to teach man all of the blasting influences of the deadly poisonous uses of intoxicating drinks, and of tobacco, which adds nothing to man's bodily vigor, nothing to his mental ability. Just for one moment think of the corn, potatoes and apples, worse than wasted and used to make whiskey.

Hundreds of thousands of acres of the very best and highest cultivated lands are set apart to raise the most despicable, filthy and vilest of all weeds that grow—I mean tobacco—which lawyers, doctors, parsons, judges and statesmen roll in their mouths—which is as poisonous as the venom of the copperhead. In the beautiful light of the day that is dawning, these vile demons must vanish from the earth.

Our own Dismal Swamp, that in my schoolboy days was pictured with alligators and reptiles, by the glorious light of modern science is being made to blossom like the rose. There is no land so poor that intelligence and industry cannot enrich it.

The Chinese carry earth up the mountains and deposit it on the bare rocks, on which they succeed in raising valuable crops. The very lands that have been cursed by man's ignorance and wickedness, like portions of Virginia, raising slaves and tobacco, may become the orchards of America. Palestine may yet be, what it was once represented as being, "a land flowing with milk and honey," the great valleys of the Tigris and Euphrates be regenerated and be repeopled by a greater population than Nineveh or Babylon ever knew, with free governments that, like our own glorious land, will guarantee to men the fruits of their labor, and, above all, with communities using their capital and intelligence for the welfare of all. J. E. E.

A TYPO-STATUE TO HORACE GEEELRY.

The printers of New York are uniting in a movement to erect a statue of Horace Greeley at Greenwood Cemetery, near this city, where his remains have been placed. It is proposed to cast the statue in type metal, which from its known tendency to expand a little in solidifying, gives a sharp and definite outline. All printers in the United States are invited to contribute a pound of old types that have been worn out in the service of teaching the people. Printers in all parts of the country are also requested on February 3, 1873, to set up and give the proceeds resulting from the setting up of 1,000 ems towards the object, the money to be sent to the President of the New York Typographical Union, 22 Duane street, New York city.

THE CHINESE FOOT.—The Chinamen, to appear in easy circumstances, are in the habit of wearing ridiculously long finger nails, from one or two inches to half a foot, which require shields to protect them from injury.

Very few barefooted persons are to be seen in Pekin. The beggars, devoid of everything else, are seldom destitute of shoes.

Long toe nails are impossible. They must be pared even to the quick, to prevent injury and severe pain from the shoe, the continued pressure and friction of which often cause serious troubles, suppuration, and even destruction of the bones.

The Chinamen admit the absurdity of their small shoes, but custom, fashion, and the dread of innovation are too strong even for celestials.

ATTACHING SLATES.—A Boston architect says he has been in the habit for many years of bedding his roofing slates in hydraulic cement, instead of having them nailed on dry in the usual way, which leaves them subject to be rattled by the wind and to be broken by any accidental pressure. The cement soon sets and hardens, so that the roof becomes like a solid wall. The extra cost is ten or fifteen per cent, and he thinks it good economy, considering only its permanency and the saving in repairs; but besides this, it affords great safety against fire, for slate laid in the usual way will not protect the wood underneath from the heat of a fire at a short distance.

PROGRESS OF THE HOOSAC TUNNEL TO JANUARY 1, 1873.—Opened from east end, westward, 13,196 feet, and from west end, eastward, 8,706 feet, making the total length opened 21,902 feet. There is 3,129 feet remaining to be opened, being 391 feet less than two thirds of one mile.

FROM scientific pursuits a certain dignity and grandeur result. True, they demand sacrifices, but every good must first be won by labor and energy.

PATENT OFFICE DECISIONS.

SIFTING SHOVELS.—P. A. SABBATON.—EXTENSION REFUSED.

LEGGETT, *Commissioner:*

The substitution of malleableized cast iron for the ordinary sheet metal material does not constitute invention.

IMPROVEMENT IN FRUIT CANS.—W. W. LYMAN.—EXTENSION REFUSED.

THACHER, *Acting Commissioner:*

When a patentee slept upon his right to such an extent as to utterly disregard, for ten years, the general infringement of his claims: Held, that it constituted financial laxity and want of due diligence.

SPRING SEAT FOR WAGON.—J. G. AND J. S. ARMSTRONG.—APPEAL.

LEGGETT, *Commissioner:*

Where parts are dispensed with and other devices employed in their places, rendering necessary certain additions to meet new aspects of the case: Held, that here is presumptive proof of invention, as distinguished from that form of skill which manifests itself in a mere change of expedients, such as the substitution of mechanical equivalents.

The decision of the majority of the Board reversed, and the patent allowed.

IMPROVEMENT IN SOLDERING APPARATUS.—CUTTING vs. KAYLOR.—INTERFERENCE.

LEGGETT, *Commissioner:*

An amendment to a preliminary statement setting up an earlier date than that originally stated and established, will not be regarded.

IMPROVEMENT IN HATS AND BONNETS.—KENDALL & TRESTED vs. SCRYMGEOUR.—INTERFERENCE.

THACHER, *Acting Commissioner:*

A case where an exhibit, relied upon by one party to prove an invention as having been made at a certain previous time, fails to show the feature of the invention as specifically described in and limited by the claims of each of the parties litigant.

A hat, made of a piece of shaped fabric covered with a film of pulp and then pressed so that the materials are intimately united, differs essentially from one in which a piece of woven fabric has been placed as a lining within a pulp hat previously formed.

Facts for the Ladies.—Mrs. A. K. Brown, Galesburg, Ill., has used her Wheeler & Wilson Lock-Stitch Machine since 1857, and it is now in good running order, the first ten years making bags for a flour mill, averaging fifty-five bags a day, besides the sewing for a family of sixteen. See the new improvements and Woods' Lock-Stitch Ripper.

Recent American and Foreign Patents.

Lubricating Journals.

Joseph R. Morris, Houston, Texas.—The invention consists in providing the oil box on the end of journal bearings with a concave distributor, attached to extremity of axle and revolved so as to raise the oil at each revolution and throw it on a shelf, from which it trickles slowly but continuously upon the journal.

Bed Lounge.

Samuel Kennedy, Allegheny City, Pa.—This invention consists of a lounge provided with a large hollow arm or reclining support, which is hinged to the end and closes down on the mattress to conceal the pillows, but swings over from the mattress to make room for the head of the bed, when used as such.

Spring Seat for Chairs, Cars, etc.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring seat for chairs, cars, etc., which shall be simple in construction, strong, durable, very elastic, and not liable to get out of order; and it consists in a combination of elastic blocks or springs with inclined bars hinged at the top and bottom to the seat, and a bottom plate or frame.

Umbrella Stand for Church Pews.

Elbert Snedeker, Brooklyn, N. Y.—This invention has for its object to furnish a neat and simple umbrella stand for church pews or public halls, which shall be so constructed that when not required for use it may be turned up out of the way. To the floor in the forward corner of the pew is secured a small trough of metal, provided with a short pipe, leading down through the floor to conduct off the water that may drip from the umbrellas. The drip or waste water may be led away. The inner end of the plate has a downwardly projecting flange formed upon it to guide the water into the trough. The upper surface of the plate has ridges formed upon it to prevent the ends of the umbrella from slipping around. To the under side of the outer part of the plate is attached, or upon it is formed, a flange or feet, of such a hight as to raise the outer end of said plate a little higher than its pivoted end, so that the water may flow from it freely into the trough. When not required for use the plate is turned up along the end-board, where it is secured in place by a button. A strap or rod, either elastic or non-elastic, flexible or rigid, is secured at one end to the back. When the holder is flexible, it may be hooked upon a hook or other catch. When the holder is rigid, its free end needs no support. A holder is arranged to receive and secure the upper parts or handles of the umbrellas while standing upon the plate.

Wash Boiler Attachment.

William Tinner and John C. Tregear, Stockton, Pa.—This apparatus is a device to be placed within an ordinary wash boiler for creating the desired currents of water through the goods. This inserted device consists of an oval rim of such size as to fit the ordinary wash boiler when placed within the same. This rim holds two bottoms, the lowermost of which is about an inch or more above the bottom of the ordinary wash boiler that contains the device. Above the upper bottom is arranged a sort of rack upon which the clothes to be cleansed are placed. From the ends or sides, or either, of this device project vertical tubes or hollow pillars, which have apertures at their upper parts. The upper bottom is funnel shaped, and open in the middle, so that the water on top of it may flow down into the space which is formed between the two bottoms. This space communicates with two boxes that are arranged beneath the lower bottom. Openings in the sides of these boxes are or may be closed by means of valves. These valves, it will appear, are at the sides of the space which is formed between the bottom of the containing boiler and the bottom of the inserted boiler. The water in the space, becoming overheated to create steam, will, by its pressure of expansion, first close the valves. The steam will then ascend in the hollow pillars with the hot water and cause a constant stream of such heated water to be brought through the tubes upon the clothes on the rack. As quick as the pressure within the chamber is diminished, the valves will be opened by the pressure or weight of the water from within the boxes. In this manner circulation will constantly be going on; but it will be seen that the water poured upon and through the clothes always passes in one direction, thus taking away all impurities.

Car Axle.

George W. Miltimore, Janesville, Wis.—This invention has for its object, principally, to furnish a railway car axle so constructed as to have less friction of the bearing surfaces, to secure greater freedom from torsion occasioned by curves or irregularities of the track, and less liable to injury from the concussion and wear and tear than is incurred under the usual system, while it is likewise adapted to prevent access of dust, etc., to the bearings, and to have its several parts readily taken apart for any purpose. To this end it consists, first, in so combining a revolving sleeve with a solid and stationary axle, and forming annular and other oil reservoir spaces and passages between them, as to maintain a circulation of oil when the car is in motion, whereby it is delivered in a cool, constant stream on the bearings; second, to the arrangement of oil and waste reservoirs in such relation to each other and the bearings that the oil is fed from the former to the latter in a small stream, and thence to the bearings by supplementary passages; third, to so arranging the waste chamber that, when the supply of oil in the reservoir proper is exhausted, the bearings will continue to be lubricated as long as any oil remains in the waste chamber, thus adapting the axle to make a good "run" without the aforementioned supply or circulation of the lubricant; fourth, to providing the oil reservoir with two supply passages or apertures, one being formed in the sleeve, and designed to be utilized when the reservoir requires refilling at long intervals, or at the termination of a long run, while the other is formed in the ends of the solid axle, and communicates directly with the waste chambers, so as to be utilized as conditions may require; fifth, to the construction of the bearing blocks with reference to excluding dust from the friction surfaces; sixth, to employment of a hardened bearing plate and journal boxes for taking the wear, the latter being removable so as to admit of renewal when necessary; seventh, to other features and details of construction. This relates to a very important invention, portions of which were secured under previous patents, and when it has been fully secured in foreign countries, engravings will be executed and produced in the Scientific American.

Spinning and Drawing Frame.

Hugh McEntee Ward, Loop Bridge Mills, Ballymaconaghy, Ireland.—This invention consists in machinery for spinning and twisting fiberous substances. The object of the invention is to stop the supply of sliver or material to be twisted or spun to the top or feed rollers when the sliver or thread breaks. To this end is provided for each pair of feed rollers an arrangement of mechanism, which, on the breaking of the sliver or thread, will be set in action and will push the sliver out of the bite of the rollers, and will hold the broken end securely until the attendant pieces the broken thread or sliver and the mechanism is restored to its normal position.

Portable Balcony.

Elizabeth Balmforth, Danbury, Conn.—This invention consists in the peculiar construction of a portable balcony, provided with a folding and hinged railing. The platform consists of two stringers, connected together by the floor, made of slats. On this floor is a railing, in three sections, so as to inclose the front and ends of the floor. The end sections are hinged to the floor so that they may be folded down on to the floor when the balcony is not in use. The front section is hinged to a base piece, which raises it so that it folds down on to the end sections. When the balcony is in use, the sections of the railing are confined together by hooks. The platform is placed on the bottom casing of the window, and supported on the outer edge of the sill by means of small blocks, or a strip of wood laid loosely on the sill. The stringers extend inside and are provided with a series of holes, by means of which the platform is adjusted to walls of different thicknesses. Ordinarily a simple pin through the holes will be found sufficient. The foot of each brace is shod with rubber, gutta percha, or similar material, to add to its adhesiveness on the wall.

Die for Forming Basils of Lockets.

Heinrich Henrich, New York city, assignor to himself and Henry Henze, of same place.—This invention has for its object to furnish an improved die for forming locket, stud, and button basils with inwardly inclined sides and inwardly projecting base flanges, enabling the basil to be formed quickly and accurately and in one piece; and it consists in a die, in the face of which is formed a groove having its inner side vertical and its outer side inclined.

Spring for Furniture, etc.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for furniture, such as chairs, sofas, lounges, mattresses, etc., for doors and vehicles, and for other purposes; and it consists in an improved spring formed by connecting rubber blocks and rigid blocks with each other alternately by means of flexible connections. The arrangement of the connectors with the blocks depends upon the use to which the spring is to be applied. One or more sets of the springs may be arranged in connection with each other as the purposes for which the springs are intended may require. For instance, by placing two of the springs back to back a double spring will be produced suitable for a door swinging in both directions, each part of the spring acting in turn, and both bringing the door quickly and surely into a closed position.

Wheel for Vehicles.

William H. Trenwith, Brooklyn, N. Y.—The object of this invention is to provide means whereby the burden of a vehicle and its load may be utilized as an aid in advancing or retarding the progress of the vehicle: and it consists of a movable wheel arranged within a revolving traction wheel of larger diameter, and provided with a diametrical slot in which is a movable axle that supports the body of the vehicle in the usual manner.

Lock.

Joseph Keath, Ash Grove, Ill.—This invention consists of a series of bolts in two parts arranged for being separated after they are shot by a peculiar detaching apparatus, so that the parts of the bolts whereon the keys act may be moved without affecting the parts by which the door is secured, and the bolts cannot be withdrawn till the two parts are connected again. The invention also consists of a regulator combined with the bolts in a manner to readjust the bolts after being disarranged and confused to prevent the picking of the lock.

Carriage Prop Blocks.

Charles H. Davis, Syracuse, N. Y.—The object of this invention is to furnish a prop block for carriages, which shall be in itself durable while it affords a cushion for the bow of the carriage top to rest upon; and it consists in a tubular piece of iron flanged out at each end, and with a longitudinal slot in which is confined a flanged piece of rubber, which is held by an arm up in the slot and has wings that bear against the under side of said tube.

Elevator.

William Eighmie, Beekman, N. Y.—This invention furnishes an improved elevator for ice or other substances. It consists of a horizontal windlass with trucks or carrier blocks operating on inclined planes for elevating ice. Two elevator ropes are wound in reverse directions upon the windlass and connected with the elevator trucks, so that by revolving the windlass, through suitable mechanism, the trucks are caused to alternately descend and ascend the inclined planes for receiving or discharging the load. At the lower or receiving end of the inclined plane is located a hinged or pivoted plate or switch, which operates to guide the carrier truck in rear of the material to be elevated, when by means of the windlass the truck is caused to engage the ice drawing it up the plane, the switch being automatically raised by the truck passing over the same. A hinged open vise applied to the end of the power shaft, connected with the same by means of a revolving iron or collar, furnishes a devise for hitching a horse to said power shaft for moving the same in opposite directions.

Jewelry.

Shubael Cottle, New York city.—The object of this invention is to make, out of a single piece of gold, the bases for buttons, studs, and settings. The blank is placed over and carried down by a male die into a female die. The effect of this operation is to form a blank with bottom and upright barrel, but rounded at the corner. This blank is then inserted over a head of the mandrel, while a ring is placed over the blank. While the blank is held in this position and the mandrel rotated in a lathe, the burnishing tool is applied to the rounded corners and pressed thereupon until the bottom and barrel are at a sharp angle to each other. The base for the stud or setting is then finished and ready to be used for its intended purpose.

Ash Sitting Shovel.

George W. Dean, New York city.—The invention consists in forming shovel sieves of flexible wires, hooked to the body by bending the ends after passing them through holes at the front and rear of the shovel. It also consists in a peculiar arrangement of holes whereby the wires may be spaced to suit various sizes of coal.

Saw.

Alfred P. Sproul, Cherryfield, Me., assignor to himself and George H. Coffin, of same place.—This invention consists in a transverse slot at each end of the saw for the bolt, by which the strap, bar, or other device is connected for attaching the saw to the gate so that the saw can be readily shifted forward or back on the said connections to alter the strain or overhang of the saw.

Machine for Scouring and Polishing Wire.

George Broomhead, Paterson, N. J.—This invention consists in a machine for scouring and polishing wire, by means of which a scouring and polishing cloth, or similar substance or material, is given a reciprocating motion on the wire while the wire is drawn through the said scouring and polishing substance or material and wound upon a spool drum or cylinder

Ditching Machine.

Lewis W. Fisher, Rockville, Ind.—This invention consists of a frame adapted to drag along the ground, with a ditching spade arranged to be adjusted lower for each successive cut, and to force the earth raised by it up to the surface in front of a diverging portion of the frame, which spreads the discharged earth upon each bank of the ditch.

Musical Transposing Index.

Joseph Low Ober, Beverly Farms, Mass.—The invention consists in combining, with a sliding index plate and natural scale, a sharp scale and a flat scale on separate plates that are hinged together and notated so that the two scales can never appear simultaneously to the eye of the learner.

Spark Arrester for Locomotives.

Roswell D. Grant, Beardstown, Ill.—This invention relates to a mode of arresting sparks from locomotive and other steam boiler chimneys, and consists in a perforated or wire gauze tube at the bottom of the smoke stack within the smoke box, and in a conical flange around the tube, and in a slip joint at the top thereof, and connected with the exhaust tubes at the bottom.

Saw Setting Device.

Alexander Greeley, Stephensville, Wis.—The object of this invention is to furnish an apparatus for setting the teeth of saws. When a saw is placed upon the plate, a clamp bar is forced down to the saw plate by turning round a lever and screw. The teeth of the saw will strike a guide or gage, and the plate may be so adjusted that the point only of the tooth will receive the jaw. The saw set is therefore adapted to very fine as well as coarse toothed saws. The teeth of the saw are set or bent by raising the cam lever, and forcing down a suitably arranged jaw.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 13 to December 19, 1872, inclusive.

Artificial Fuel.—E. F. Loiseau, Mauch Chunk, Pa.
Car Heater.—W. C. Baker, New York city.
Car Wheel.—J. A. Woodbury, Boston, Mass.
Deodorizing, etc.—J. J. Craven, Jersey City, N. J.
Governor.—O. Marland, Boston, Mass.
Making Needles.—Mallett Manufacturing Co., New Haven, Conn.
Setting Carbon Points.—T. W. Baxter, Chicago, Ill.
Ship's Ventilator, etc.—J. Reilly, New York city.
Stereotypes.—G. Lauder, Pittsburgh, Pa.
Wood Pavement.—E. P. Morong, Boston, Mass.

NEW BOOKS AND PUBLICATIONS.

The Unity of Law, as exhibited in the Relations of Physical, Social, Mental, and Moral Science. By H. C. Carey. $3.50. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This last emanation, from an author very popular among his own school proposes to demonstrate a unity of law as a necessary complement, in the moral world, to the unity of force, now universally accepted by students of physical science. It is a handsomely printed volume.

Electric: A Treatise on Electric Phenomena, the Laws governing the same, and Lightning Rods and their necessary Application to Buildings for Safety. By John M. Mott. Chicago: Rand, McNally & Co., 108 West Randolph Street.

This little book contains much information, expressed in the simple and lucid manner appropriate to an elementary work.

Manual of Land Surveying, with Tables. By David Murray, A.M., Ph.D., Professor of Mathematics in Rutgers College. New York: J. W. Schermerhorn & Co.

This is a valuable and exhaustive treatise on the surveying of land, and bears, on every page, the impress of the hand of a master of the science. It is eminently a book for the practical man and the student, and is replete with formulæ and tables of the highest value to the surveyor and engineer.

A Manual of Microscopic Mounting. By John H. Martin. Illustrated with 118 engravings, lithographs, etc. Philadelphia: Lindsay and Blakiston.

This book is more than its title indicates. It gives a description of the apparatus necessary for microscopical research, as well as the methods of preparation and preserving the various objects. It is a complete and well illustrated work on its subject, which is daily becoming more valuable to the scientist and more cultivated as an elegant and interesting study.

A Treatise on the Construction and Operation of Wood-working Machines, including a History of the Origin and Progress of the Manufacture of Wood-working Machinery. Illustrated by Numerous Engravings, showing the Modern Practice of Prominent Engineers in England, France and America. By J. Richards, Mechanical Engineer. Price, $6. E. & F. N. Spon, Charing Cross, London, and 446 Broome Street, New York.

This is a most valuable and useful book, and, emanating from the pen of the head of the well known firm of Richards, London, and Kelley, of Philadelphia, will need little commendation as a practical and trustworthy treatise. Important, especially in the United States, as is woodworking as a national industry, no complete history and description of the various mechanism employed has heretofore been attempted. The work before us is profusely illustrated with views of the best machines of America and Europe, and it forms a valuable contribution to the mechanical literature of the day.

The Great Events of History, from the Creation of Man till the Present Time. By William Francis Collier, LL.D., Trinity College, Dublin. Edited by an Experienced American Teacher. New York: J. W. Schermerhorn & Co., 14 Bond Street.

This book may be called a skeleton history, and in it an account of the principal events occurring in the world is laid before the reader in a manner simple and clear, and calculated to leave an impress on the memory. It is somewhat in the style of Ince's "Outlines," but is an improvement on that popular school book.

The American Builder for January appears for the New Year in admirable style. Excellent architectural illustrations, convenient form, elegant print. Published at 23 Murray St., New York. Monthly. $3 a year.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

1.—Which is the easiest way to manufacture paints from ochreous earths?—R. M.

2.—How can I combine gum shellac and tallow so that they will not separate on heating?—E. S.

3.—How can I work a blue color into soap? I have tried several times, but the blue turns green.—M. H. B.

4.—How is dynamite exploded, and what force, relatively to that of gunpowder, does it exert?—D. T.

5.—Can any one tell me who is the best author on pyrotechny?—P. L.

6.—What is the best way to wash or otherwise clean a Panama hat, making it look new?—S. L. A.

7.—F. E. A. asks: What is the best method of straightening a circular saw when it gets sprung?

8.—E. S. S. asks: Why is it that the warm water pipe in my house always freezes first? What should I do to repair it?

9.—J. F. asks: How can I prepare bone for manufacturing purposes after it has been boiled by the fat melter?

10.—H. T. S. asks:—What are the materials and processes for staining and varnishing violins?

11.—G. S. T. asks: How can I make a good slate paint? What is silicate paint?

12.—H. B. asks: How can I prepare and apply the varnish to ferrotype pictures?

13.—J. C. asks: How can I make and use the insulating material called kerite?

14.—A. H. asks: In tanning skunk skins, how can I get rid of the disagreeable smell?

15.—J. B. asks: Will some one describe the process by which marble and slate are colored in imitation of colored marbles?

16.—What will take the stains out and renew the color of ivory knife handles, discolored by putting them in water, etc.?—J. S. H.

17.—N. A. K. asks: What are the smallest dimensions for a canvas boat to carry two persons, and will common paint do to waterproof it with?

18.—D. A. asks if Mallet's method for oxygen is patented in the United States, and the probable cost of the machinery described in the SCIENTIFIC AMERICAN of December 28, 1872.

19.—Is it practicable to run a two foot millstone by friction gear? I have never seen a stone run in that way, but from the information contained in the SCIENTIFIC AMERICAN, I cannot see why it will not do.—W. W. St. J.

20.—I should like to know how to tin iron pins, or other small iron pieces, cheaply in large quantities. Can they be tinned in the same manner as brass pins?—I. H. B.

21.—I have a steel square, which I have kept oiled for the prevention of rust, using common machine oil. The steel has lost its spring and will remain bent. Does the oil affect the temper?—S. L. A.

22.—Two boilers are connected by a ⅜ inch steam pipe, each of them having a separate fireplace. A gage on the pipe, midway between the boilers, shows a pressure of 60 lbs. How much pressure is there in each of these boilers?—J. W. L.

23.—S. R. G. asks: Is soluble glass (liquid silex) to be relied on as a cheap and durable paint to apply to the outside of buildings? What is the best way to apply it? Of what, and by what process is it manufactured? Will it cover as much surface per gallon as lead and oil? On the whole, is it as economical, taking into consideration the prices of both, as lead and oil?

24.—A. G. C. asks: How can I temper taps? I can temper dies right every time by drawing the temper on a hot plate, but I cannot draw the temper of taps in that way; and if I draw it in the blaze of a fire, they will be so black that I cannot see when the color is right. I want some one to tell me how I can do it right every time.

25.—H. C. K. asks: Is there any rule for laying off wooden axles, so as to give the wagon the right track and the wheels the correct gather and set? What should be the length and taper of the spindle, if it is, say, 3½ inches at the butt? And should the length be increased proportionately to the diameter?

26.—Having heard it asserted that if the key note of a suspension bridge be sounded (say by a fiddle) dangerous undulations occur, imperiling the safety of the bridge, and further, that a pair of horses keeping time might strike the key note of a suspension bridge, producing alarming vibrations, I would ask you if these assertions are correct, and if so, for a brief explanation of them.—T. P.

27.—S. R. G. says that three inventions are wanted. First, a common sense lard press for family use, made strong, durable, and so simple that any woman can understand and use it. The second is a process for extracting the salt from sea water by some simple and very cheap means, so that a half cargo of fresh water need not be taken to sea with every vessel. The third is a universal need in nearly every family. It is a potato parer, as simple as a common apple parer. If so made it would bring a sure fortune to the lucky inventor.

28.—R. B. M. says: The heat of the street gas lamps, separated from the light and conducted to the base inside of the iron post, would be worth saving for the purpose of clearing sidewalks, preventing the bursting of the hydrants, service pipes, etc. Wire gauze and asbestos may be used to conduct and retain the heat. I have a clumsy apparatus from which these results seem to be attainable—but if experiments could be made on a larger scale, I doubt not valuable consequences would ensue. Now is the time to experiment. I should like to hear from Professor Tyndall on this question through your journal.

29.—C. A. de S. says: I am preparing a work in which a vast quantity of indexing, strictly alphabetical, is required. To do this in the ordinary manner requires an enormous amount of labor. Has there been no mechanical aid invented by which this labor may be lightened? If so, will you state where it can be found?

30.—J. D. B. asks: 1. Can a rack, coarse or fine, be cast in a chill so as to be as true as if worked up by machinery? The danger in casting in sand is that the teeth break for the reason that one or two of them have to sustain all the strain, while others do not touch each other. 2. Can a square thread, 1, 2 or 3 inches deep, be chilled into a block of casting so that a set screw or a clamping screw from 2 to 4 inches long and from ¾ to 1½ inches diameter will work in the same as satisfactorily as if the thread were cut by a tap or a lathe tool? 3. Can such screws be cast in a chill and be afterwards true when steelified? I fear that the castings will be difficult to remove from the chill and will be full of flaws and porous, and thus they would be unfit to take the place of good wrought iron. 4. Which is the best metal for chills, cast iron, wrought iron, or steel? 5. Can malleable iron castings be annealed after being cast in a chill, as is done after casting in sand? 6. What is the tensile strength of wrought iron and of malleable iron?

Answers to Correspondents

H. W., of N. Y., says: I have a swinging circular saw, the two boxes or journals being 16 inches from centers. One journal will be cool all day, and the other will heat up in an hour and get quite hot. Each has an oil cup attached which feeds the oil well. The shaft is plumb and in line, and level with its corresponding or counter shaft. There are six journals or boxes on the shafts, and five of them will remain cold while the other heats. I have tried different methods to stop it, but they are of no avail. The saw has been running about seven months, and appears to be getting worse. What is the cause of it? The saw makes 1,200 or 1,300 revolutions per minute. Answer: The troublesome journals may be out of line, the boxes may be untrue, or there may be defects in the rubbing surfaces. Our correspondent can determine the cause most readily by a careful examination of brasses and journals. If the defect remains undiscovered, use a little sulphur in the lubricating oil until an opportunity can be found to lengthen the journal giving trouble. Where possible, always use self-adjusting boxes and obtain a journal three or four diameters long, or calculate the proper length, where data are obtainable. Keep the oil holes free and always smooth up the journal with a fine file where it has heated and cut.

W. L. L. asks why frost on the windows assumes such beautiful forms of vegetation. Answer: It is not certainly known, but it is supposed that each atom of matter in ice and other crystals is endowed with a sort of magnetism or polarity, in obedience to which the atoms arrange themselves in the various forms we observe; just as the particles of iron filings will, in the presence of a magnet, always arrange themselves in certain curves, floral in appearance, called the curved lines of magnetic force.

G. W. J. speaks of having seen a lunar rainbow, distinct, with one of the colors of the spectrum plainly visible.

W. H. W. asks: What is the proper mixture for plugs of fusible metal? Answer: Bismuth, 8, lead, 5, tin, 3 parts. Increase or diminish the bismuth to make it more or less fusible, respectively.

E. N. asks: What are the respective areas of Philadelphia, London, and Paris? Answer: The municipality of Philadelphia now covers an entire county, area 120 square miles. London and her suburbs have an area over 200 square miles in extent. Paris, inside the fortifications, contains about 38 square miles, but many Parisians live outside the barriers.

Z. D. asks how to tan cat and wood chuck skins with the hair on. Answer: Wash them in cold suds, then dissolve pulverized saltpeter and alum in hot water, add cold water, and soak the skins in it all night; hang them over a pole to drain; when dry, sprinkle with powdered saltpeter and alum; fold the flesh sides together, lay them where they will not freeze, turn every day till dry, then scrape the flesh side with a blunt knife and rub with pomice stone and the hands.

F. G. W. asks: How much less will a boiler sustain, in the direction of its circumference, on account of the pressure on its heads? Answer: See replies to earlier correspondents. No evidence of such weakening action as is indicated by the last question has been detected by experiment or pointed out by theory.

J. L. J. asks: What is crystallized alcohol? Answer: There is no such thing as crystallized alcohol. Alcohol has not been frozen by the most intense cold that chemists could artificially produce; it was rendered a little thick at 180 degrees below zero, but not crystallized.

W. L. L. says: Can some one inform me when the next comet will appear? I mean a comet visible to the naked eye, as the 1858 comet was. Answer: No one can foretell the appearance of a comet which has not been seen, as observations upon the visible path of a comet are necessary to predict its return. The comet of 1858 is supposed to have a period of about 2000 years.

W. P. P. says: Can I produce a gas or vapor that will take fire immediately on being exposed to or mixed with atmospheric air? Answer: Phosphuretted hydrogen has the remarkable property of taking fire spontaneously in atmospheric air or in oxygen gas. It is generally prepared by heating fragments of phosphorus with a strong solution of hydrate of potash or with cream of lime, taking care that all of the air is expelled from the flask or retort in which the experiment is made. A phosphide of lime has been prepared to be attached to life preservers: when the salt water comes in contact with the preparation, phosphuretted hydrogen gas is liberated, which takes fire immediately and thus indicates the position of the person who may have taken hold of the life preserver. There is another spontaneously combustible gas which does not possess such a disagreeable odor as the above, concerning which very little is popularly known. It is a compound of silicium and hydrogen, called the hydride of silicium or siliciuretted hydrogen. It may be obtained by electrolysis, or by the decomposition of silicide of magnesium, by weak hydrochloric acid. This latter compound is prepared by fusing together magnesium and silicium, also by mixing intimately 40 parts of fused chloride of magnesium, 35 of dried silicofluoride of sodium and 10 of fused chloride of sodium, with 20 parts of sodium in small fragments, and heating cautiously in a Hessian crucible. The slag resulting from this operation, if thrown into weak hydrochloric acid, at once liberates the spontaneously combustible hydride of silicium. It affords one of the most instructive and beautiful class room experiments within the range of chemistry, and was discovered a few years since by Professor Woehler of Goettingen.

A. C. R. says: Why do you encourage the cultivation of fish in your paper? Is there anything in fish as food to nourish the brain? Answer: Fish culture is one of the most important industries recently introduced into the United States. It is regarded of so much importance that commissioners have been appointed by the governors of many of the States to superintend and protect the business. There is a traditional notion that there is not so much iron and phosphorus in the meat of fish as in the flesh of animals; and hence, in Lent and times of fasting, the Papal Church allows its followers to partake of such food. Chemical analysis confirms a part of this theory, but the doctrine of inferior nourishment appears to find few adherents, as every one is fond of fish and will eat it, iron or no iron. We encourage everything that looks to a cheaper supply of food; it is hard work for the poor mechanic to earn his daily bread, and we favor reducing the price of all articles of nourishment, not excepting fish.

C. E. E. asks: What book is best adapted to the beginner in chemical analysis? Answer: There are no books equal to Fresenius' "Qualitative and Quantitative Chemical Analysis." They are large and expensive, but the investment, once made, will prove a permanent one. They will serve for reference during many years, and it is better to start with accurate and complete instruction than to encumber the memory with incorrect methods. Great mischief has been occasioned in trials for poisoning, in examining for precious metals, and in determining the value of composts, by following old and abandoned methods. It is better to start right; even if it costs more money at the outset, it will prove cheaper in the end to procure the large and exhaustive works of Fresenius.

R. A. R. asks: What is the probable value of a bed of cannel coal twelve feet thick, at a depth of one hundred and eighty feet? Are the veins usually extended, or does it lay in pockets only? What is its value compared with bituminous coal? Answer: Cannel coal is bituminous coal; it occurs in beds and seams; and its value depends upon ease of mining and proximity to market.

J. E. D., of Fishkill, N. Y., says: We have lately erected a school house in this village, and have trouble with our chimneys. Our building is of brick, about 65 by 36 feet, with heater in cellar and register in each of three rooms. Four chimney flues, 8 inches square start from the cellar, in the rear (end) wall, about 20 feet apart, rise perpendicularly about 20 feet, then converge at an angle of about 30° till about 4 feet apart, then at an angle of 60° or 70° till they meet, when they are carried up parallel, but separate, three or four feet through the roof, and are capped with a stone with 8 inch holes, and finished with two *terra cotta* tops about 4 feet high, with openings about a foot in diameter. Our heater pipe runs to one of these flues, and recently we have put up a stove, the pipe of which enters the same flue. We connected our heater with the other flue by another pipe but as the draft appeared less we disconnected the latter. Sometimes the flue draws well, and both heater and stove burn briskly, and at other times the fire only smolders. Our chimney is at the rear end of the ridge, and no high object is near except the tower at the other end of the building. Air in abundance is supplied to the cellar, around the windows, and down the stairs in the tower. We have tested the flue by letting down a brick with a string and find it clear. Answer: The difficulty arises from the fact that your flue is altogether too small. Eight by eight inches is the size usually given to flues intended for an ordinary grate fire in a room about fifteen feet square; but when you come to warm a school house, you must have a flue proportionately increased in size. The reason is evident; the greater the extent of the combustion, the more oxygen, and consequently the more air, you require to feed it. But a free supply of fresh air is only possible where an unobstructed outlet is provided for what may be called the burnt air, or that from which the oxygen is extracted. The friction in a small flue is too great to admit of a free discharge of the air, when no exterior force, such as the pressure of the wind, is present to overcome it. No flue should be the outlet for two fires: besides your stove pipe may enter the flue so far as to close it. The remedy is to enlarge the flue to eight by sixteen inches, or build one on the exterior of the wall of that size.

Will you tell me how long the tunnel under the river Thames is?—J. P. G. Answer: The Thames Tunnel is 1,200 feet between the shafts for ingress and egress. There is another tunnel, called the "Sub Way," which is higher up the river, and is 1,320 feet in length between the shafts, although the Thames is there somewhat narrower.

S. C. T. asks: Which makes the best starch, wheat, corn or potatoes? How many pounds to the bushel are there in each? Answer: Wheat flour contains 56 to 66 per cent, corn, 65 to 68 per cent, potatoes, 16 to 22 per cent, of starch. The economy of the manufacture of starch must depend upon the original cost of material and methods of production. Corn is largely used, as it is cheap and can be employed in a damaged state. Potatoes are extensively used in Germany. Wheaten flour unless damaged, is too valuable for bread to be generally recommended for starch.

C. F. F. says: With friction you can heat iron or other metal red hot, and you can burn wood. Could you heat a liquid by friction, by forcing it throug a pipe or hole or by stirring it very rapidly? Answer: Yes.

O. A. B. asks: Can you inform me of any simple test for the purity of commercial bromide of sodium? Answer: Bromide of sodium is soluble in both water and in alcohol; any insoluble residue would be suspicious. The solution ought not to yield a precipitate with reagents that throw down potash.

In answer to A. A. O., query 1, page 362, I would say that for stuffing birds a mixture of grated bread crumbs, egg, pepper, sage, salt, etc., is the best. Press well into the cavities. Cure by placing them in a hot oven, for a longer or shorter time according to the age of the birds.—S. E. B.

COMMUNICATIONS RECEIVED.

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Inventor's Task. By W. F. R.

On the Means of Preserving the Richness and Salubrity of the American Continent. By T. S.

On the Cooling of Dwelling Houses. By W. C. D.

On the November Meteors. By J. H.

On Polar Mutations. By J. A.

On the Direction of Storms. By O. P. B.

On Sundry Problems. By W. K. G.

On the Prevention of Conflagrations. By D. H. W.

On the Employment of Marine Camels at the Bar of the Mississippi. By C. W. S.

On Certain Forces in Nature. By J. A. C.

On the Squaring of the Circle. By C. R.

On the Utilization of Waste Heat as a Preventive of Leaky Roofs and the Snow Nuisance. By R. B. M.

On the Need of Turbine Wheels. By J. R. R.

On the Importance of a Knowledge of Astronomy. By D. P. T.

On the Qualities of Water in Motion. By J. B. R.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

December 24, 1872,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

Animal matter, treating, A. Broadnax, (r) 5,195
Auger, earth, H. C. Stouffer 134,324
Awl, G. K. Mellor 134,214
Axle skein, steel, A. J. Alston 134,188
Axle skein, malleable iron, A. J. Alston 134,189
Baggage check, L. O. Cottle 134,257
Barrel, ash, T. H. Kane 134,145
Basin, wash, F. Imhorst 134,285
Bath room, H. G. Covel 134,258
Bearings, lubricating shaft, J. Haas 134,272
Bedstead, sofa, E. Lord 134,210
Belt tightener, J. Pinnell 134,309
Bench, folding wash, G. King 134,149
Billiard register, M. McCay 134,211
Boats, coupling and steering, I. J. Wistar 134,341
Boiler, steam, A. Wigzell 134,322
Boiler, steam, F. A. Huntington 134,254
Boiler, sectional steam, D. Renshaw 134,165
Boiler furnace, steam, E. F. Griffin 134,270
Boiler furnace, steam, Bell & Friend 134,243
Boiler, wash, H. B. Comer 134,255
Boiler attachment, wash, A. Schloesser 134,318
Bolt, T. A. Davies 134,262
Boot and shoe, R. Sommerville 134,225
Boots, making, Chandler & Ware 134,252
Boots, nailing, H. F. Wheeler 134,231
Bottles, drip cup for, W. R. Miller 134,302
Box, tare, J. B. Slawson 134,321
Box, etc., coal, A. F. Tripp 134,230
Bridge, lift draw, S. Whipple 134,338
Bridges, pier for suspension, J. Gray 134,269
Bridles, band for, F. Meinberg 134,213
Brush, J. Hayman 134,273
Bung and bushing, A. D. Behan 134,242
Car axle, Braymer & Lyman 134,247
Car coupling, L. Kenworthy 134,148
Car coupling, C. Gallagher 134,199
Car coupling, J. A. Thompson 134,329
Car coupling, railway, H. L. Fidler 134,135
Car coupling, link for, G. Stillson 134,173
Car, grain, S. W. Wood 134,191
Car, stock, A. Welch 134,335
Car washer, E. W. Leavens 134,236
Carbureter, J. D. Averell 134,240
Carriage, folding, T. G. Stagg 134,226
Carriage step, G. A. Keene 134,291
Caster for furniture, C. B. Sheiden 134,223
Chlorine, producing, L. E. Aubertin 134,230
Cigar tuck cutter, L. G. Schofield 134,222
Clock calender, J. E. Seem 134,219
Clock case, C. W. Roberts 134,163
Coal scuttle, H. C. Clark 134,251
Coal breaking machine, R. A. Wilder 134,233
Coal conveyer, R. A. Wilder 134,234
Coffin, sheet metal, W. S. Wood 134,182
Cooler, beer, E. Kraft 134,208
Couch, hospital, J. Keck 134,147
Cover, book, W. L. Burlock 134,249
Cultivator, E. D. & O. B. Reynolds 134,166
Cultivator, H. C. Buckley 134,248
De k, school, J. F. Field, (r) 5,199
Drain tile, laying, L. Stripe 134,238
Drill, C. H. Amidon 134,237
Drill chuck, A. F. Cushman 134,279
Drilling machine, Peace & Cox 134,307
Drilling rock, J. North 134,305
Drinks, mixing, W. Harnett 134,274
Eaves trough support, J. D. Pierce 134,163
Elevator, C. Whittier 134,179
Elevator, M. Hanford 134,273
Elevator hatchway, J. Wayland 134,334
Engine, rotary, E. S. Bennett 134,123
Engine, rotary, W. C. Bibb 134,345
Engine, steam pumping, J. B. McConnell 134,212
Engine water purifier, Draper & Covington 134,263
Envelope, Huffington and Buckman 134,142
Excavator, S. B. Alger 134,187
Fence, picket, J. Willhite 134,225
Fence bars, bracket for, P. Cope 134,253
Fire arm, breech loading, F. Gucury 134,300
Fire arms, loop for, J. Rider (r) 5,200
Fires, extinguishing, M. Dunn 134,132
Fork, horse hay, B. Field 134,265
Fruit crate, H. and E. W. Humphreys 134,325
Furnace for evaporator, M. P. Hayes 134,277
Furnace, puddling, L. S. Goodrich 134,268, 134,138
Furnace, iron heating, W. F. Maharg 134,151
Fuse, blasting, S. H. Daddow 134,124
Gage, lamp wick, T. A. Paddock 134,161
Game, J. Brandl 134,125
Gas compressing machinery, W. A. Royce (r) 5,201, 5,202
Gas, converting waste, B. Todd 134,333
Gearing, extension, H. C. Minot 134,304
Governor, hydraulic, S. T. Thomson 134,238
Grain binder, band tuck for, J. Beall 134,192
Grinding machine, G. W. Libbey 134,296
Harrow teeth, D. France 134,137
Harvester, corn, J. and W. Carrothers 134,251
Harvester, cotton, O. P. Myers 134,157
Hasp and staple, O. J. Smith 134,322
Hat body, G. Johnson 134,206
Hatchway, S. I. Russell 134,169
Hoisting apparatus, J. Hoffman 134,141
Hoisting device, J. J. Doyle, (r) 5,204
Horse power, D. Richardson 134,167
Horses, breast strap for, C. P. Holmes 134,283
Hose coupling, Condon and Jeffers 134,195
Hose and pipe connection, G. E. Nutting 134,158
Insect destroyer, C. R. Dudley 134,130
Ink stand, G. R. G. Jones 134,144
Iron, manufacturing wrought, P. E. Jay 134,288
Iron from ore, making cast, P. E. Jay 134,239
Irons, chill for smoothing, J. F. Bless 134,193
Jibs, etc., hank for, W. A. Pratt 134,164
Key for locks, A. A. Stuart 134,325
Kiln, brick, J. Blaisius 134,124
Kiln, lime, D. Keeports 134,292
Lamp, argand, Hinrichs and Knopp 134,281
Lathe tool holder, I. P. Richards 134,219
Lathe centers, grinding, W. S. Jarboe 134,237
Lathe, C. Rahsskopff 134,213
Locomotive for burning soft coal, A. C. Rand 134,214
Loom picking mechanism, E. W. Moffatt 134,153
Marble, artificial, G. H. Mellen 134,300
Marble, artificial, G. A. Frear (r) 5,236
Medical compound, D. Davis 134,129
Medical compound, F. J. Oswald 134,217
Meter, water, W. Parks 134,336
Music leaf turner, G. Robb 134,221
Nut lock, W. P. Horton 134,204
Oil, testing lubricating, R. H. Thurston 134,229
Oil, etc., drawing, P. Noyes (r) 5,198
Oil well cutter, Patterson and Mitchell 134,162
Oil well drill, rotating, G. A. Hinckley 134,280
Oil well cutter, Luther and Stephenson 134,150
Oiler, C. B. Wood 134,342
Ore crusher, W. P. Hammond 134,201
Paddle wheels, feathering, J. C. H. Stut 134,226
Pail, dinner, J. T. Sturtevant 134,175
Paint compound, F. Staling 134,223
Paper bag, L. D. Benner 134,244
Paper holder, T. Orton 134,160
Pen holder, J. C. Mullett 134,156
Pencil, lead, W. A. Morse 134,215
Piano, T. Winans 134,240
Piano agraffe, C. F. Chickering 134,191
Pin package, G. Fowler 134,136
Pipe elbow, making, L. C. Goodale 134,267
Pipe tongs, adjustable, W. Kearney 134,207
Planer, tool holder for, J. S. Eltenborough 134,198
Planter, corn, J. Hildebrand 134,279
Planter, corn, J. K. Welter 134,336
Plow, J. R. Harris 134,275
Plow, E. Rood 134,316
Post for horses, hitching, T. Garrick 134,266
Pruning shears, E. L. Yancey 134,185
Pulley, differential, T. A. Weston 134,337
Pulley, loose, W. W. Carey 134,250
Pump, rotary, Lamb and Lavens 134,294
Railroad rail joint, A. B. Stone 134,174
Railroad spark conductor, H. D. Ohlsen 134,159
Railway rail joint, A. McKenney 134,298
Railway signal, circuit for, R. K. Boyle 134,246
Railway snow plow, S. W. Hemenway 134,202
Rake, horse hay, O. B. Austin 134,239
Rake, etc., combined horse, H. Cousins 134,127
Rake teeth, tempering, J. A. Ferson 134,264
Receptacle, T. H. Kane 134,146
Refrigerator, W. M. Baker 134,191
Rod, conducting, J. F. Haskins 134,276
Roller, land, R. Provost 134,311
Rule and square, W. H. Walker 134,323
Sash holder, J. R. Adams 134,186
Saw setting device, C. T. Shoemaker 134,320
Saw teeth, insertable, N. Johnson 134,290
Sawing spokes, J. V. Woolsey 134,184
Sawing veneers, J. McGrew 134,297
Seeder, broadcast, C. F. Kneisly 134,293
Sewing machine, J. H. Mooney 134,154
Sewing machine, J. D. Lawlor 134,209
Sewing machine, shoe, W. J. B. Mills 134,303
Shoe shanks, making, J. Hyslop, Jr., (r) 5,197
Spark arrester, D. B. Dennison 134,261
Spark arrester, N. H. Mendenhall 134,301
Spokes, sizing, J. V. Woolsey 134,123
Spokes, setting up, A. Danison 134,260
Steam and air brake, G. Westinghouse, Jr. 134,177, 134,178
Steaming vegetables, R. D. Jacobus 134,143
Stereotype, paste, S. Crump 134,196
Stone, finishing, A. F. Davis 134,197
Stove board, A. D. McMaster 134,299
Stove, cook, N. A. Boynton, (r) 5,233
Stove, cook, Smith and Selkirk 134,172
Stove grate, A. J. Arnold 134,238
Stove pipe fitter, G. Scott 134,170
Suspenders, R. H. Eddy, (r) 5,196
Telegraph, electric, H. Highton 134,140
Toy, whistling, G. F. Pfeiffer 134,308
Trimmings, ruffled, W. Murray 134,216
Truck, dumping, I. S. Tatom 134,327
Urinal, A. W. Robinson 134,315
Valve, safety, D. H. Chamberlain 134,126
Valve balance slide, H. Hendrickson 134,203
Valve, balanced slide, H. F. Colvin 134,254
Valve, operating slide, P. Peartree 134,218
Valve for air brake, exhaust, W. Riley 134,220
Vehicle wheel, D. H. Marston 134,152
Vehicle wheel, W. Beers 134,341
Vehicle wheel, J. P. Grosvenor 134,271
Vehicle wheel, F. H. Holman 134,282
Vehicle wheel, W. F. Marston 134,155
Vehicle hold back, E. Wilson 134,286
Velocipede, I. Weishaar 134,176
Wagons, running gear of, T. H. Prushaw 134,312
Wagons, loading and unloading, R. Threlfall 134,330
Warping machine, L. H. Toble 134,331
Washing machine, J. W. Pratt 134,310
Washing powder, R. Guenther 134,139
Water wheel, turbine, J. C. Scribner 134,171
Weeder, hand, H. B. Sherwood 134,224
Wheel polishing, R. J. Edwards 134,134
Whiffletree, etc., R. R. R. Stewart 134,227
Winding mechanism, G. O. Wickers 134,180
Wrench, B. F. Sawyer 134,317
Wringing machine, E. Dummer 134,131
Wood, preserving, C. J. Eames 134,133
Wood, etc., splitting, W. L. Williams 134,339
Wood for buttons, R. H. Isbell 134,266

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

23,344.—Fastening Skates.—E. Behr. March 12, 1873.
23,399.—Harvester.—I. S. & H. B. Russell. March 12, 1873.
23,416.—Sausage Stuffer.—J. Wagner. March 12, 1873.
23,425.—Rolling Machine.—H. B. Comer. March 12, 1873.
23,642.—Felt Fiber.—J. F. Greene. March 26, 1873.

EXTENSIONS GRANTED.

22,337.—Cleaning Rice.—W. Ager.
22,027.—Printing Press.—C. Montague.
22,216.—Hay and Cotton Press.—H. Barnes.
22,439.—Locomotive Axle Bearing.—D. Matthew.
22,130.—Manufacture of Starch.—S. T. Stratton.
22,443.—Corset.—A. S. McLean.

DESIGNS PATENTED.

6,320.—Can Bracket.—H. R. Frisbie, Chicopee Falls, Mass.
6,321.—Bottle Stopper.—W. R. Green, London, Eng.
6,322.—Parlor Stove.—L. W. Harwood, Troy, N. Y. city.
6,323.—Suspending Brace.—G. W. McGill, N. Y. city.
6,324.—Coffin Handle.—W. H. Smith, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,089.—Stoves.—P. D. Beckwith, Dowagiac, Mich.
1,090.—Chewing Tobacco.—J. Brown & Co., Detroit, Mich.
1,091.—Tonic Bitters.—A. Littlefield, Boston, Mass.
1,092.—Oils.—Cary & Co., New York city.
1,093.—Canned Goods.—J. F. Mallory & Co., Baltimore, Md.
1,094.—Toilet Perfume.—Lanman & Kemp, N. Y. city.

A NEW NOVEL,

BY A FAVORITE AUTHOR.

"HARD TO WIN."

BY

JOHN FREDERICK SMITH,

AUTHOR OF

"MINNEGREY," "STANFIELD HALL," "AMY LAWRENCE," "WOMAN AND HER MASTER," "TEMPTATION," "THE WILL AND THE WAY," ETC., ETC.

Few writers of fiction have commanded the interest of the reading people so uninterruptedly and successfully as J. F. SMITH. His novels, almost all issued in serial form, have been read by millions on both sides of the Atlantic. His fertile imagination, dramatic construction of plot, and artistic management of his subject, afford the novel-reader all that can be desired in a pure work of fiction of the higher order, true in character, society, and descriptions, elevating in tone, and eminently interesting; equal, in fact, to any of those on which his reputation rests.

The character of Ellen Lumley is a charming creation of the novelist. Her intriguing and unscrupulous aunt, Mrs. Barton Lumley, is, unfortunately for poor human nature, a character far from impossible. The young Americans are what they should be—high-minded, full of true and noble impulses.

The flavor of the supernatural adds attractiveness to the story without shocking the probabilities or exciting distrust.

This remarkable novel will commence in

FRANK LESLIE'S CHIMNEY CORNER,

No. 396,

WHICH WAS ISSUED MONDAY, DEC. 16,

with a Fine Art Supplement—"Fishing"—a beautiful steel engraving, worth $10, reproduced by photography.

FRANK LESLIE'S

CHIMNEY CORNER,

with the ablest writers in the language, with artistic engravings never approached by the periodical press, is a paper that can enter an AMERICAN HOME only to exercise the best and highest influence.

The Stories are unsurpassed in a literary point of view, and the more serious topics are treated with freshness, originality, and ability.

It is a perfect encyclopædia of amusement and instruction for a family.

Subscription, $4 a year. Single number, ten cents.

Subscriptions can begin at any time, and as we begin a Serial almost monthly, the interest is always maintained.

Address subscriptions to FRANK LESLIE, 537 Pearl street, New York.

☞ Housekeepers wishing to obtain a copy of

BEETONS,

a perfect Cyclopædia of Cookery and Family Requirements, lavishly illustrated with chromo-lithographic plates and wood-cuts in the text, can have this book, which sells for $3.50, and the Chimney Corner for a year for $5, by addressing amount to

FRANK LESLIE,

537 Pearl street, New York.

Iron City and Siberian Iron Works.
ROGERS & BURCHFIELD,
MANUFACTURERS OF
Refined Charcoal and Best Bloom Sheet Iron, Brands Apollo and Siberian. Specialties: Stamping, Button, Trunk, Lock, Shovel, Tea Tray, Show Card, Tagger, and all other kinds of fine Sheet, from 12 to 40 gauge. Cut to size, as required by the trade. Equally to any imported Office and Warehouse, 108 Water St., Pittsburgh, Pa.

FOR SALE—A second hand Hewes & Phillips Steam Engine, 13 in. cylinder, 36 in. stroke; will be ready for delivery 20th Dec.; previous to which time may be seen running at the Singer Mf'g Co's Silk Mill, Bank St., Newark, N. J.

RISDON'S IMPROVED
Turbine Water Wheel

Is Cheap, simple, strong and durable; upon a test has yielded over 86 per cent at full gate, and over 78 per cent at eight-tenths gate.
Send for circular to
T. H. RISDON & CO.,
Mount Holly, New Jersey.

NEW PATTERNS.
MACHINISTS' TOOLS—all sizes—at low prices. E. & R. J. GOULD, 97 to 113 N. J. R. R. Ave., Newark, N. J.

BURDON IRON WORKS.—Manufacturers of Pumping Engines for Water Works, High and low Pressure Engines, Portable Engines and Boilers of all kinds, Sugar Mills, Screw, Lever, Drop, and Hydraulic Presses, Machinery in general. HUBBARD & WHITTAKER, 10 Front st., Brooklyn, N. Y.

WOOD-WORKING MACHINERY.
New and improved Woodworth's, Daniel's, and Dimension Planers, Moulding, Mortising, Tenoning, Sawing, Boring, Upright Shaping Machines, etc. Machine Chisels and Augers, Moulding Cutters and **Farmer's Celebrated Patent Matcher Heads and Cutters**, constantly on hand and made to order.
R. BALL & CO., 36 Salisbury St., Worcester, Mass.

Andrew's Patents.
Noiseless, Friction Grooved, or Geared Hoisters, suited to every want.
Safety Store Elevators. Prevent Accident, if Rope, Belt, and Engine break.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS & BRO.,
414 Water Street, New York.

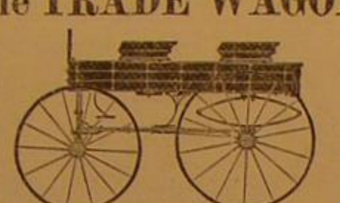
L. & J. W. FEUCHTWANGER
CHEMISTS & IMPORTERS.
Address 55 CEDAR ST NEW YORK
SOLUBLE GLASS & SILICATES,
OXIDE OF MANGANESE FOR STEEL,
GLASS & PATENT DRYERS,
FLUORSPAR, FELSPAR, FLINT,
NICKEL-SALTS, ASBESTOS,
BLACK LEAD, METALS, &C &C.
PUBLISHERS OF TREATISES ON "GEMS",
"SILEX" AND "FERMENTED LIQUORS".

100 YEAR ALMANAC. FOR 50 CENTS we send POSTPAID an Almanac giving every Year, Month, Week and Day of the Century, also a Pocket Calendar for 1873. Extra inducements to Agents. Address
GEORGE A. HEARD & CO., Boston, Mass.

$425 Upright Engine and Tubular Boiler (4) HORSE POWER, with all Trimmings—ALSO, (10) HORSE POWER. Send for circulars. VARIETY IRON WORKS COMPANY, Cleveland, Ohio.

CINCINNATI BRASS WORKS—Engineers and Steam-fitters' Brass Work. Best quality. Send for Catalogue. F. LUNKENHEIMER, Prop.

The TRADE WAGON.



A WAGON INTENDED FOR GENERAL PURPOSES.
WEIGHS BUT 400 POUNDS.
Is finished ready to paint and trim. Inquire of your carriage maker, or the ONLY manufacturers,
S. N. BROWN & CO., OF DAYTON, OHIO.

Machinery,

Wood and Iron Working of every kind. Leather and Rubber Belting, Emery Wheels, Babbitt Metal, &c.
GEO. PLACE & CO., 121 Chambers & 103 Reade Sts, N.Y

Machinists' Tools.

The largest and most complete assortment in this country, manufactured by
NEW YORK STEAM ENGINE COMPANY,
121 Chambers & 103 Reade Streets, New York.

Cold Rolled Shafting.

Best and most perfect Shafting ever made, constantly on hand in large quantities, furnished in any lengths up to 24 ft. Also, Pat. Coupling and Self-oiling adjustable Hangers.
GEORGE PLACE & CO.,
121 Chambers & 103 Reade Streets, New York.

Sturtevant Blowers.

Of every size and description, constantly on hand.
GEORGE PLACE & CO.,
121 Chambers & 103 Reade Streets, New York.

WILDER'S
Pat. Punching Presses

For Railway Shops, Agricultural Machine Shops, Boiler Makers, Tinners, Brass Manufacturers, Silversmiths, &c. Warranted the best produced. Send for Catalogue, &c.
NEW YORK STEAM ENGINE CO.,
121 Chambers & 103 Rea de

BRICK PRESSES For Fire and red brick manufactured at No. 309 S. 5th St., Philadelphia. Established 1844. S. P. MILLER.

MATHUSHEK PIANO MF'G CO. The most durable pianos. The most powerful tone. The finest touch and action. The purchasers delighted. The pamphlets sent free.
New Haven, Conn.

J. H. WHITE, Newark, N. J., Manufacturer of Tin, Zinc, Brass and Copper Spun Bottom Oilers, Children's Carriage Trimmings, Cowell Pat. Door and Gate Spring, &c. &c. Stamped, Cast and Spun Metal Work, Dies, Tools, and Patterns to order.

SILICATE OF SODA
Liquid Silex—Soluble or Water Glass—manufactured by L. & J. W. FEUCHTWANGER, New York.

WOOD WORKING MACHINERY

MOLDING, MORTISING,
TENONING & SHAPING
MACHINES;
BAND SAWS,
SCROLL SAWS,
Planing & Matching
MACHINES, &c.,
For RAILROAD, CAR, and AGRICULTURAL SHOPS, &c.,
☞ Superior to any in use.
J. A. FAY & CO.
CINCINNATI, Ohio.

RUBBER STAMPS, Steel Letters, the Little Gem, Stencil Dies, &c., U. S. M'f'g Co., 97 W. Lombard St., Baltimore. $10 a day to Agents.

SAFETY FUSE Best quality, Cotton, Hemp, and Water proof. Manufactured by F. M. ALFORD, Avon, Conn.

WANTED
50 MACHINISTS used to first class work. Steady, reliable men can find good pay and steady work at Passaic, N. J. Address NEW YORK STEAM ENGINE COMPANY, Passaic, N. J.

$5 to $20 per day! Agents wanted! All classes of working people, of either sex, young or old, make more money at work for us in their spare moments or all the time than at anything else. Particulars free. Address G. Stinson & Co., Portland, Maine.

WHALEN TURBINE. No risks to purchaser. Pamphlet sent free. SETH WHALEN, Ballston Spa, N. Y.

1832. SCHENCK'S PATENT 1871.
WOODWORTH PLANERS
And Re-Sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK'S SONS, Matteawan, N. Y. and 118 Liberty St., New York.

WOOD-WORKING MACHINERY GENerally. Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Nos. 24 and 26 Central, corner Union st., Worcester, Mass.
WITHERBY, RUGG & RICHARDSON.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address Carnegie, Kloman & Co, Union Iron Mills, Pittsburgh, Pa.

HINKLEY KNITTING MACHINE
The Simplest, Cheapest, and Best in use! Has but one needle! A Child can Run It. AGENTS WANTED IN EVERY TOWN. Manf. Florence S. M. Co. Send for circular and Sample Stocking, to
HINKLEY KNITTING MACH. CO., Bath, Me.

WOODBURY'S PATENT
Planing and Matching
and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, 91 Liberty street, N. Y.;
Send for Circulars. 67 Sudbury street, Boston.

BUY BARBER'S BIT BRACE.

FELT. Cheapest, best, and most durable non-conductor known. BOILER FELTING WORKS, 46 Courtlandt St., New York.

MACHINERY, NEW and 2d-HAND.— Send for Circular. CHAS. PLACE & CO., 60 Vesey st., New York

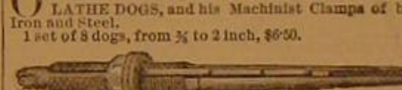
GALT FOUNDRY AND CANADA NUT Works for Sale. Foundry and Machine Shop 30 years established, doing an extensive business. Nut Department—Three Machines constantly employed. Motive Power Water. Splendid opening. Terms liberal. LUTZ & CO., Galt, Ontario, December, 1872.

INVENTORS' NATIONAL UNION. E. H. GIBBS & CO., 178 Broadway, New York. Patents Sold on Commission. Send for Circular.

OTIS' SAFETY HOISTING **Machinery.**
OTIS, BROS. & CO.,
NO. 348 BROADWAY, NEW YORK.

MACHINERY, of all kinds. S. C. HILLS 51 Courtlandt St., New York.

GREAT REDUCTION IN PRICES
OF LE COUNT'S PATENT HOLLOW LATHE DOGS, and his Machinist Clamps of both Iron and Steel.
1 set of 8 dogs, from ⅜ to 2 inch, $6·50.



His expanding Mandril is a first class tool which has long been needed by every Machinist.
Send for latest circular.
W. LE COUNT, South Norwalk, Conn.

FOR SALE—An established manufacturing (Wood working) business, in one of the best towns in Iowa. Capital required, about $15,000. More can be successfully used. For particulars, inquire of
W. W. WALKER, 61 Liberty St.,
New York, Room 19.

FOR SALE, F. L. DELFER'S Patents on Axle Nuts and Wrench. The wrench grasps the nut in a manner that it cannot slip from it, and thus it is made impossible for people to soil their hands with dirty, sticky wagon grease, in greasing a wagon. It is believed that nobody who owns a wagon or buggy will do without this kind of an axle nut. You can throw the wrench, with the nut in it, over a house and it cannot fall out. The wrench is as plain as the nut, and is adjusted in an instant. Patents just granted. I will sell both patents, in whole or State rights, on liberal terms, or give licenses. F. L. DELFER, Box 4790, New York.

JUDSON'S
PATENT LATHE CHUCK.
The strongest Chuck made of the same size and weight. Constructed on entirely new principles, each jaw being independent in action, and so arranged that the pressure of the screw towards the center also presses the jaw firmly against the face of the Chuck, holding the work more securely than any other Chuck now in use with the same power expended on the screw.
DWIGHT ROBERTS, Manufacturer,
Cor. Wythe Ave. & Hewes St., Brooklyn, N. Y.

PROTECTION AGAINST FIRE.
HALL BROTHERS
Are prepared to introduce their "System of Sprinklers" into Mills, Factories, &c., at short notice. Call and see a practical operation of same at their works,
36 CHARDON STREET,
BOSTON.

WOOD AND IRON Working Machinery Gage Lathes, Cabinet Makers' Machinery, Shaping Machines, Band Saws, Shingle and Stave Machinery, Band Saws, Cable and Sheaves for transmitting power Engine Lathes, Upright Drills, Key Seat Machines, etc. Illus. Catl. free. T. R. BAILEY & VAIL, Lockport, N. Y.

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for all large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK, P. O. Box 1,057 Boston, Mass.
N. B.—This detector is covered by two U. S. Patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

RICHARDSON, MERIAM & CO. Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash and molding, Tenoning, Mortising, Boring, Shaping, Vertical, and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st, New York. 17 1

SHINGLE AND BARREL MACHINERY.—Improved Law's Patent Shingle and Heading Machine, simplest and best in use. Also, Shingle Heading and Stave Jointers, Stave Equalizers, Heading Planers, Turners, &c. Address TREVOR & Co., Lockport, N. Y.

PORTABLE STEAM ENGINES, COMBINing the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **900** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address
J. C. HOADLEY & CO., Lawrence, Mass.
Liberty st., New York.

RIVERVIEW Military Academy, Poughkeepsie, N. Y. A thorough-going school for boys.

Niagara Steam Pump.
CHAS. B. HARDICK,
23 Adams st., Brooklyn, N. Y.

P. BLAISDELL & Co.,
MANUFACTURERS OF FIRST CLASS MACHINISTS' TOOLS. Send for Circulars. Jackson st., Worcester, Mass.

Milling Machines.

STANDARD, UNIVERSAL, INDEX, CAM-CUTTING and PLAIN, in every variety, of unequalled design and first-class workmanship. Send for Illustrated Catalogue to the BRAINARD MILLING MACHINE Co., 11 Pemberton Square, Boston. Works at Hyde Park.

FOOT LATHES.—T. SHANKS, Baltimore, Md.

You ask WHY we can sell First Class 7 Octave Pianos for **$290**? We answer—It costs less than **$300** to make any **$600** Piano sold through Agents, all of whom make **100 per ct.** profit. We have no Agents, but ship direct to families at Factory price, and warrant 5 Years. Send for illustrated circular, in which we refer to over **500** Bankers, Merchants, &c. (some of whom you may know), using our Pianos, in **44** States and Territories. Please state where you saw this notice.
U. S. Piano Co., 865 Broadway, N. Y.

Reynolds'
TURBINE WATER WHEELS.
The Oldest and Newest. All others, only imitations of each other in their strife after complications to confuse the public. We do not boast, but quietly excel them all in staunch, reliable, economical power. Beautiful pamphlet free. GEO. TALLCOT, 96 Liberty Street, New York.
Gearing. Shafting.

IMPROVED FOOT LATHES, Slide Rests, Hand Planers, Scroll Saws. Superior to all others. Selling every where. Catalogues free.
N. H. BALDWIN,
Laconia, N. H.

12 Samples sent by mail for 50 cts., that retail quick for $10. R. L. WOLCOTT, 181 Chatham Square, New York.

Purchasers of Saw Mills

are notified that we have commenced suits in the U. S. Circuit Courts against COLE, BUGBEE & Co., Lebanon, N. H., LUKE BUZZELL, St. Johnsbury, Vt., and F. C. CANDEE & Co., New York, (selling agents of Belknap, Ely & Co., Northfield, Vt.) for infringements of patents granted Dennis Lane for improvements in Circular Saw Mills. The public is cautioned against buying Mills or Set Works manufactured and sold by the above named parties, or any other, in violation of our rights, as we shall prosecute infringers to the full extent of the law, and hold purchasers of infringing Mills or Set Work responsible for the use of the same.

Our patents cover improvements in head-blocks generally, setting devices, dogging devices, tapering devices, and frictional set works.

Descriptive pamphlets sent to any address, and copies of Lane's patents furnished upon request.
LANE, PITKIN & BROCK,
Montpelier, Vermont.

LATHE CHUCKS—HORTON'S PATENT from 4 to 36 inches. Also for car wheels. Address E. HORTON & SON, Windsor Locks, Conn.

An deutsche Erfinder.

Diese große und thätige Classe unsrer Bevölkerung machen wir besonders darauf aufmerksam, daß unsre Firma durch ihre Verbindung mit Washington und den europäischen Hauptstädten, besondere Vortheile zur Erlangung von in- und ausländischen Patenten bietet.

Jeder Erfinder, gleichviel welcher Nationalität angehörig, ist durch die liberalen Patentgesetze der Vereinigten Staaten zum Patentschutz für Erfindungen berechtigt. Unsre Firma ist bereit, gestützt auf 26jährige Erfahrung, deutsche Erfinder jeder Zeit zu berathen und zu mäßigen Preisen rasch und pünktlich Patente zu erlangen.

Die Deutsche Section ist in den Händen fähiger deutscher Ingenieure, welche in der Office persönlich mit Erfindern verkehren werden.

Der „Scientific American" wird in seinen Spalten die bedeutenderen Erfindungen besprechen.

Correspondenz erbeten und prompt beantwortet. Pamphlete in deutscher Sprache werden auf Verlangen franco zugesandt.

Adressire:

Munn & Co.,
„Scientific American" Patent Agentur,
37 Park Row,
New York City.