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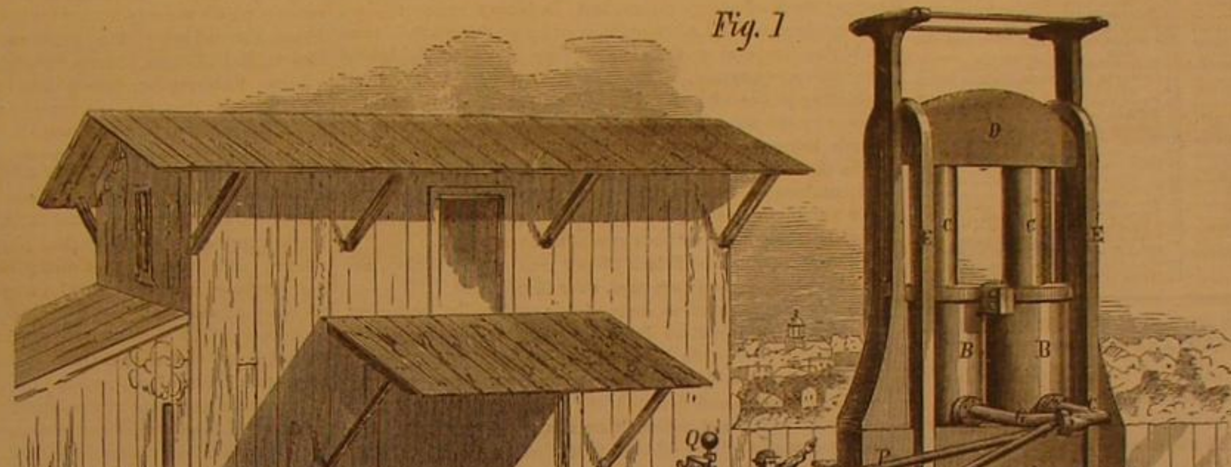
DIRECT ACTING STEAM AND HYDROSTATIC PRESS.

A valuable and ingenious application of steam to the hydrostatic press is illustrated in the accompanying engravings. The power is transmitted to the oil, water, or other liquid in the press from the pistons of two steam cylinders, which act upon the platen alternately, one imparting the initial and the other the finishing pressure. The latter is operated by live steam from the boiler, and the former is actuated by the exhaust. The steam is thus used twice over on the compound principle, thus effecting no inconsiderable saving of fuel.

Our large engraving, Fig. 1, represents the entire apparatus set up and in action. Fig. 2 shows the steam cylinders in plan, broken to exhibit the attachment, and Fig. 3 a section of the check valve. A, Fig. 1, is the hydrostatic press, adapted for pressing cotton or other substances. B B are hollow cylinders inclosing the solid rams, C C, which, communicating with the cross-head, D, raise the links, E E, and consequently the platen, F; G G are branched pipes through which the liquid enters the cylinders, B B. H and I, Figs. 1 and 2, are the steam cylinders, equal in size. J and K are chambers in which work the solid plungers which, at the same time, are the piston rods of the cylinders, H and I. The plunger in J, it will be noticed, is much smaller in diameter than that in the chamber, K.

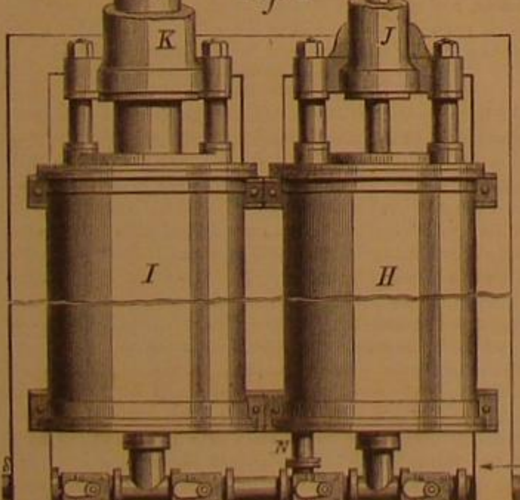
Fig. 1



TAYLOR'S DIRECT ACTING STEAM AND HYDROSTATIC PRESS.

Previous to the pressing operation, live steam is admitted (in the direction of the arrow, on the right of Fig. 2) which, the valve, L, being open, enters the cylinder, H, and forces the piston ahead against the pressure of the liquid which is contained in the press cylinders, B B, the

Fig. 2



chamber, J, and one of the connecting pipes, P. The valve, L, is then closed, steam pressure is thus cut off, and the piston, acted upon by the liquid pressure, returns to the rear of the cylinder, forcing out the steam contained therein. Meanwhile the valve, M, is opened, and the steam, having no other exit, passes through the same and into the pipe connecting the valve chambers of the two cylinders. As the inlet valve, O, of the second cylinder is closed, the steam enters the pipe, N, and is thereby reconducted into the cylinder, H, the said pipe passing along the outside of the cylinder to its front end, when it communicates therewith, and the steam fills the whole space in front of the piston. The object of the proceeding is to thoroughly warm the cylinder, H, so that it may less condense the live steam that is subsequently admitted into it.

In commencing the pressing, the valve, O, is first opened. The steam, which we have above alluded to as having entered in front of the piston in the cylinder, H, now returns through the pipe, N, and becomes the motive steam in the cylinder, I, continuing to flow from one cylinder to the other, until the pressure on the two pistons is equalized. The valve, O, then closes by its own weight, and any steam which may remain in front of the piston, in cylinder H, may be allowed to escape through a pipe (not shown) in connection with the exhaust, S. The steam, entering through O, pushes forward the piston in cylinder, I, and the ram in chamber, K, thus displacing the fluid, forcing it underneath the rams, C C, and thereby lifting the platen, F. As soon as the motion of the piston stops, either by its reaching the end of its cylinder, or being arrested by the opposition of the liquid, a check valve, Q, at the front end of chamber, K, which has been opened by the passage of the fluid as it is forced through, closes automatically by its own weight, thus preventing a return of the current. The arrangement of this valve with the forward portion of its containing chamber is clearly shown in section in Fig. 3.

The valve, L, is next opened, and live steam admitted to the piston, in cylinder H, which, by means of the ram in J, drives a second current through its connecting pipe of the pair, P, under the rams, C C, and so completes the pressure of the material between the platens. The bale being properly tied, the valve, L, is closed, and the valve, M, opened. The weight of the platen acting on the liquid forces the piston in cylinder, H, back, the steam in the rear of the latter once more passes by the tube, N, to the front, and the operation, as already explained, is repeated. The various valves alluded to are governed by convenient and suitable mechanism, which need not here be described, and are controlled by the hand levers, as shown in the large illustration. The initial pressure upon the platen not requiring so great an application of power as the finishing pressure, it is evident that, by the increased diameter of the ram, K, and the reduced action of the exhaust steam, a quicker though less effective force is obtained. But the ram, J, being of smaller sectional area, and receiving also the full force of the live steam, is, as may be mathematically shown, necessarily capable of exerting an enormous pressure. Moreover, this ram is constructed less in diameter than the press rams, C C, in order that the pressure upon the latter may be in proportion as their diameters are the greater. It is evident, therefore, that this portion of the invention is excellently devised for imparting the concluding powerful impulse to the platen.

The inventor informs us that two of these presses are in operation in Charleston, S. C. One having two rams, each 16 inches in diameter and 44 inches travel, steam cylinders of 48 inches, and stroke 7 feet, with 86 pounds of steam, gives a pressure of 1,200,000 pounds, on the material in the press, or 14,117 pounds for every pound of steam. The other, with 22 inch rams, 56 inch cylinders, and 8 foot stroke, with 80 pounds of steam, affords 2,138,640 pounds pressure, or 26,733 pounds per pound of steam. The operation of these machines is stated to be in every way satisfactory.

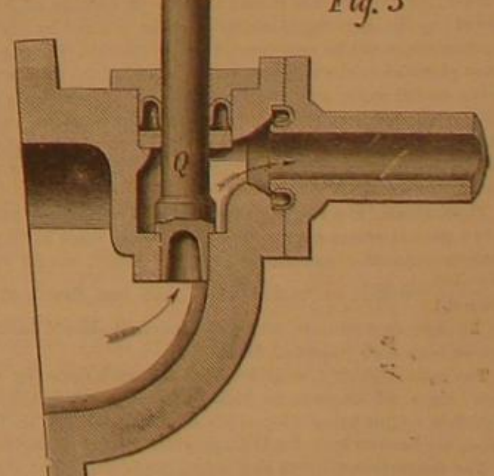
Patented February 28, 1871. Reissued through the Scientific American Patent Agency, April 2, 1872. For further information, address the patentees, Messrs. John F. Taylor & Co., Phœnix Iron Works, Charleston, S. C.

Disinfection of Air of Sick Rooms.

The three best agents for accomplishing the disinfection of air after smallpox or other contagious diseases, are sulphurous acid, iodine, and carbolic acid. The best method of employing sulphurous acid is to scatter a little flowers of sulphur upon a heated shovel and carry it about in the room or rooms which are to be disinfected.

Iodine may be used by simply placing a little in an open glass or earthen vessel, and it vaporizes readily at the ordinary temperature of a house. Carbolic acid may be employed by sprinkling a weak solution of it on the floor of the room, or cloths wetted in such solution may be hung about the roo ms. A simple apparatus for using this acid is to have a bro ad band of cotton passing over two wooden rollers over a dish filled with a solution of the acid. As the upper half of the band dries, give the

Fig. 3



rollers a turn, and the lower half of the band, wet with the solution, takes its place uppermost.

A PHILADELPHIA manufacturer is preparing a plan for a column 1,000 feet high, to be constructed entirely of iron, in open work, from the summit of which the grounds of the Centennial Exposition are to be illuminated by means of a Drummond light. If adopted, it will be the loftiest monument in the world.

A CORRESPONDENT tells us that corn is now selling at Topeka, Kansas, for from 14 to 18 cents a bushel. The price is usually 40 to 50 cents per bushel.

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NEW YORK, SATURDAY, JANUARY 11, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

LOSSES OF POWER IN THE STEAM ENGINE. WHERE IT MAY BE IMPROVED AND TO WHAT EXTENT.

The mechanical equivalent of heat, as we have had frequent occasion to state, is reckoned at 772 foot pounds per thermal unit—that unit being the quantity of heat necessary to raise one pound of water one degree in temperature The fact is so very important that we shall be excused, however frequently we may present it.

A pound of pure carbon yields, in burning, 14,500 units of heat, equivalent to $14,500 \times 772 = 11,194,000$ foot pounds of energy. A pound of good coal containing 91 per cent carbon, as shown in the report of the committee of the American Institute testing steam boilers in 1872, produces about 13,200 units of heat, and its mechanical equivalent is $13,200 \times 772 = 10,190,400$ foot-pounds of work.

The very best classes of modern steam engines very seldom consume less than two pounds of coal per horse power per hour, and it is a good engine that works regularly on three pounds. A horse power raises 1,980,000 pounds one foot high per hour. Consequently, a pound of coal, in our very best engines, developes but $\frac{1980000}{2} = 990,000$ foot pounds instead of the 10,190,400 which it would give us were there no loss of power.

The first-class steam engine, therefore, yields less than 10 per cent of the work stored up in good fuel, and the average engine probably utilizes less than 4 per cent.

A part of this loss is unavoidable, being due to natural conditions beyond the control of human power, while another portion is, to a considerable extent, controllable by the engineer, or by the engine driver.

Scientific research has shown that the proportion of heat, stored up in any fluid, which may be utilized by perfect mechanism, must be represented by a fraction, the numerator of which is the range of temperature of the fluid while doing useful work, and the denominator of which is the temperature of the fluid when entering the machine, measured from the "absolute zero"—the point at which heat motion is supposed to cease entirely—461° Fahr. below the zero of the common scale.

Thus, steam, at a temperature of 320° Fahr., being taken into a perfect steam engine, and doing work there until it is thrown into the condenser at 100° Fahr., would yield $\frac{320-100}{320+461} = 0{\cdot}28+$, or rather more than one fourth of the 10,190,400 foot pounds of work which it should have received from each pound of fuel.

The ratio, $\frac{990000}{2853312} = 0.34 = \frac{1}{3}$, of the work done by our best class of engines, to this possible performance of a perfect engine using 75 pounds of steam, shows us how much we have to hope for in improving the steam engine.

The proportion of work that a non-condensing, but otherwise perfect, engine, using steam of 75 pounds pressure, could utilize, would be $\frac{320-212}{320+461} = 0{\cdot}14 = \frac{1}{7}$; and, while the perfect condensing engine would consume two thirds of a pound of good coal per hour, the perfect non-condensing engine would use $1\frac{1}{3}$ pounds per hour for each horse power developed, the steam being taken into the engine and exhausted at the temperature assumed above. Also, were it possible to work steam down to the absolute zero of temperature, the perfect engine would require but 0·19 pounds of similar fuel.

We may therefore state, with a close approximation to exactness, that, of all the heat derived from the fuel, about seven tenths is lost through the existence of natural conditions over which man can probably never expect to obtain control, two tenths are lost through imperfections in our apparatus, and only one tenth is utilized in even good engines.

We have intended to include boiler and engine when writing of the steam engine above. In this combination, a waste of probably one third at least of the heat derived from the fuel takes place in the boiler and steam pipes, on the average, in the best of practice, and we are therefore only able to anticipate a possible saving of $0{\cdot}2 \times 0{\cdot}75 = 0{\cdot}15$, about one sixth of the fuel, now expended in our best class of engines, by improvements in the machine itself. This is a most important fact to ingenious and enthusiastic but uninformed inventors.

The best steam engine, apart from its boiler, therefore, has 0·85, about five sixths, of the efficiency of a perfect engine, and the remaining sixth is lost through waste of heat by radiation and conduction externally, by condensation within the cylinder, and by friction and other useless work done within itself. It is to improvement in these points that inventors must turn their attention if they would improve upon the best modern practice by changes in the construction of the steam engine.

To attain further economy, after having perfected the machine in these particulars, they must contrive to use a fluid which they may work through a wider range of temperature, as has been attempted in air engines by raising the upper limit of temperature, and in binary vapor engines by reaching toward a lower limit, or by working a fluid from a higher temperature than is now done down to the lowest possible temperature. The upper limit is fixed by the heat-resisting power of our materials of construction, and the lower by the mean temperature of objects on the surface of earth, being much lower at some seasons than at others.

In the boiler, the endeavor must be to take up all the heat of combustion, sending the gases into the chimney at as low a temperature as possible, and securing, in the furnace, perfect combustion without excess of air supply.

The best engines still lack 15 per cent of perfection, and the best boilers, as an average, over 30 per cent.

This is not as much as some of our readers had supposed. We know of instances in which they are wasting time, money and energy, in the confident anticipation of making one pound of coal do the work that now requires ten, and we have endeavored here to show them what is the amount of actual waste and where it occurs, in order that they may detect the fallacy which has misled them, as well as in order to instruct and interest the general reader.

GOVERNMENT TELEGRAPHY.

We have observed the progress of the efforts that are now being made in Congress to place the institution of telegraphy, like that of the mails, in the hands of the general government. In theory, the idea is pleasing and on the whole popular. Sooner or later, doubtless it will be done. But if any one expects that messages will be transmitted any cheaper, quicker, or better than at present, we think they will be disappointed. Then, in the matter of damages suffered, individuals will have no remedy against the government, whereas, with the telegraph in private hands, the courts hold the companies to the strictest accountability for their blunders or neglect. The interests of the companies are thus made to depend in a very great degree on the promptness and accuracy with which they transact their business. But in government hands, no such incentives will exist. The courts could not then punish the stockholders, and the telegraph, like all other government machines, would be conducted in a slow and comparatively careless manner.

Then as to cost, under the existing *régime* those who use the telegraph pay the expenses. But when we place the lines in the hands of the government, the people at large will be taxed to pay for the purchase and make good the inevitable annual deficiency. In England and other parts of Europe, the telegraph is operated by the governments, and the statistics show that messages are not so promptly delivered, and cost quite as much or more than in this country under the present arrangements, and that the receipts fail to meet the expenses. Our Postmaster General, Mr. Creswell, has become quite a strenuous advocate for the postal telegraph, and in an official report made upon the subject he presents a variety of information; but unfortunately it is full of inaccuracies which impair its value, and will be apt to perplex those who attempt to deduce practical instruction therefrom. For example, he estimates that for about twelve millions of dollars the government could build telegraph lines equal in extent to all now in use in this country, or one hundred and seventy-five thousand miles in total length. Singularly enough, this estimate is adopted on the evidence of Mr. Chester, who put up the fire telegraph in this city, six hundred and twenty-six miles in length, and charged the authorities eight hundred and fifty thousand dollars therefor. At the rate of Mr. Chester's price for New York city, the cost to the government for the postal telegraph would be over two hundred millions of dollars.

We earnestly hope that Congress will move deliberately in this matter. Our present telegraph system works exceedingly well; indeed, no other country is better supplied. Let well enough alone is a safe rule. But if we must have a change, Congress ought first to procure, for the information of its own members and the people, the most full and accurate estimates of the cost, and the advantages, if any, which would be likely to ensue. We think that a special Congressional committee might be appointed, charged with the duty of collecting and arranging the real facts in the matter. Such an investigation, honestly conducted, would be approved by the public.

THE NEW YORK INDUSTRIAL EXHIBITION.

Quite a number of wealthy citizens of New York city have, for some time past, been considering a plan of establishing a permanent industrial exhibition building in some convenient locality in the metropolis. At a recent meeting a committee was appointed to examine into the subject, from the lately published report of which we glean the following particulars regarding the scheme: The Industrial Exhibition Company is a regularly organized corporation under the State laws. It has contracted to purchase a piece of land lying between 98th and 102d streets, and Third and Fourth avenues, in this city, consisting of eight blocks of ground, for the sum of $1,700,000. $200,000 of this has been paid. The estimated cost of a suitable building and ground improvements is seven million dollars. A proposition has been made by a New England firm to construct a dome over the court, which dome shall be the largest and most magnificent in the world. The estimated cost of this structure is $3,000,000, but all the builders ask in payment is a perpetual lease of it above the spring of the arch. Finally the hope is expressed that Congress will favor the idea of the World's Fair being opened in this building in 1876. It is not proposed to interfere with Philadelphia's "Centennial," but, as the committee state, "we, New Yorkers, cannot but feel that we may celebrate in our own way so important an occasion."

The report was adopted, and committees were appointed, among which we may notice the names of Messrs. Samuel Sloan, Richard Schell, Paul Spofford, Wm. B. Astor, Wm. M. Evarts, R. H. Pruyn, Francis Skiddy, E. L. Tiffany, and many others. Subscription papers have been prepared and freely circulated, so that the enterprise thus fairly launched bids fair to be rapidly pushed forward to a successful completion.

CORN AS FUEL.

A curious state of affairs exists in the West. Farmers are not only burning corn for fuel at the present time, but laying in supplies to serve for that purpose during the coming winter. It is asserted that corn gives a better heat for cooking purposes than any wood excepting hickory, while, for economy of consumption, it is cheaper. Hard wood on the spot costs $7.50 per cord, corn, $5.60. As compared with coal, it is estimated that three tuns of corn will give heat equal to one tun of coal, while in economy of use, it is equal to one and a half tuns of the latter.

That this is an unpleasant commentary upon our facilities for transportation cannot be denied. The cost of food here in the East is notoriously large, and it is equally true that living expenses have in but a small degree decreased since the darkest period of the war. Yet, such are the rates of freight or the fewness of carrying lines that it seems a better paying operation to burn food than to send it to Eastern markets for sale.

A cotemporary aptly suggests that evidence is here afforded of the gradual diminution of our forests, a serious fact to which we have frequently adverted. There are strong efforts being made by the National Bureau of Agriculture, as well as by State societies, to protect the growing timber, and suggestions from these sources should be heeded and acted upon. If, as the burning of grain implies, the woodland in the neighborhood of the corn-producing districts in the West has become so sadly depleted, it is time that protective means were adopted and effective measures inaugurated which will at least supply the deficit to future inhabitants of the country. Corn may make excellent fuel for future generations, but it will scarcely answer as a material from which houses or furniture can be constructed.

Another idea worthy of consideration is that of raising a cheap variety of maize which will yield a maximum of woody or combustible fiber with a very light consequent exhaustion of the soil. There are varieties which will thrive in northerly climates, and can be cultivated at the rate of seventy-five bushels per acre. It is swift of growth, as it contains more oily than starchy qualities, and is well adapted for fuel.

THE HENDERSON IRON PROCESS.

We have heretofore chronicled the progress of this new improvement in the manufacture of iron, and are happy to be able to say that the recent tests to which it has been subjected, which have been many and thorough, have fully confirmed the great value and importance of the invention. It promises to revolutionize the art of manufacturing iron; greatly economizing in the labor and vastly improving the quality of the metal produced. The invention is by James Henderson, of New York, who for the past year has been engaged in England, in developing the merits of the discovery where it has attracted the greatest attention.

The Henderson process consists in the application of fluorine, in the form of fluor spar, and of oxygen in the form of oxide of iron to the molten cast iron. The ingredients mentioned are thrown into the puddling furnace and the cast iron is then poured in upon the mixture, which remains at the bottom. The iron is then allowed to boil for about half an hour, then rabbled for ten minutes, when the metal is balled up. The time occupied is an hour for each charge. The fluorine and oxygen remove the phosphorus and other impurities within a few minutes. The discovery is applicable to the production of wrought iron and steel of the best qualities. From cinder pig and the common brands of cast iron, a wrought iron having very great toughness is produced. Mr. Kirkaldy certifies that steel made from the Henderson wrought iron derived from common Scotch pig, gave a tensile strength equal to steel made from the best Swedish iron, and, in the form of tools, stood the wear equally well The analyses of Dr. Noad show that the Henderson process removes every impurity from the iron. The *Mechanics' Magazine* states that, by the Henderson process, iron in England can be made equal in purity to the best Swedish, and substituted for the Swedish in making the highest classes of steel.

FRICTION OF JOURNALS.

A correspondent writing from Columbus, Ohio, asks whether the friction of a large journal is greater than that of a small one, the length and character of bearing being the same in both cases, and the number of revolutions the same, the only difference being in the diameter of the journal.

The friction on any surface, whether plane or cylindrical, is proportional to the weight resting upon it and is not at all affected by the area of the rubbing surface, provided the pressure is not so great, on the one hand, as to change the character of those surfaces, nor so light, on the other hand, as to make the resistance principally that of viscosity of the lubricant rather than that of true friction. In the former case, the friction may increase immensely in consequence of the cutting of the surfaces; and, in the latter, the increase of frictional resistance will be approximately proportional to the increase of area.

The work done in any given time, that is, the power wasted in turning any journal on its bearings, is, where the frictional resistance is the same, proportional to the speed of the rubbing surfaces, since it is measured by the product of the resistance into the distance through which that resistance is overcome. Therefore, it follows that a very large journal absorbs a larger proportion of the driving power of a machine than does one of small diameter, and in designing machinery we should make journals of as small diameter as possible without danger of breaking the shaft, or of causing abrasion of the rubbing surfaces.

Again, the tendency of a journal to heat is the greater the greater the pressure per square inch of longitudinal section of the journal, and it is increased by increasing the speed of the rubbing surfaces. Therefore, to make journals safe against heating, make them of as small diameter as safety permits; and having thus reduced their absorption of power to the lowest limit, secure bearing surface by giving them ample length. If they are, however, made so long that the shaft can spring in the journal, heating may occur from that cause; in line shafting, this will, of course, not happen. The best practice gives line shafting for mills a length of journal equal to four times the diameter of the shaft.

There are rules, known to engineers, for properly designing journals, which are based on the principles above stated. The earliest of which we have knowledge is that of Professor R. H. Thurston, which was based upon observation of the action of crank shafts of naval steamers in 1862. A somewhat similar rule, based on locomotive practice, was published by Professor W. J. M. Rankine in 1865. The first is expressed as follows:

$l = \frac{PV}{60000\,d}$; and $\frac{P}{ld} = \frac{60000}{V} = p$. The second is, $\frac{44800}{V \text{ plus } 20} = p$; and, when reduced to the same form as that of Professor Thurston, becomes $l = \frac{P(V \text{ plus } 20)}{44800\,d}$.

Here l = length of journal in inches; P = total pressure on journal; p = pressure per square inch of longitudinal section; V = velocity of rubbing, in feet per minute; d = diameter of journal in inches.

In no case in general practice should the pressure, on even the slowest moving journals, be allowed to exceed 1,000 pounds per square inch of longitudinal section with steel journals or about 600 on iron, running in well worn boxes in each case.

Special care should always be taken to provide for effective lubrication.

PATENT BUSINESS IN CONGRESS.

The Congressional bureau for patent business is now in full blast, and the reports of a single day's proceedings, connected with such matters, occupies an entire page of one of our largest newspapers. It appears from these proceedings that every man who has been dilatory in applying to the Commissioner for an extension of his patent, as the law requires, may readily get a special law passed for his relief by applying to the Committee on Patents of the House of Representatives. Mr. Meyers, from that Committee, stated the other day to the House that in all such cases the Committee unanimously recommended that the petitioner should be relieved, and that Congress had never refused relief. Such being the feeling of Congress, it seems to us that members might save themselves the loss of much valuable time by passing a general law authorizing the Commissioner to hear dilatory petitions.

In the following cases, wherein the parties failed to put in their petitions for extensions within the time specified by law, Congress has, by special enactment in each case, authorized the Commissioner to hear and decide as to the propriety of extensions, namely:

Patent of Joseph Fox, for an Improvement in machinery for making Crackers. Patented February 1, 1859.

Patented by Thomas Warker, for an Improvement in apparatus for Generating Acid Gas. Patented April 27, 1858.

Patent of James C. Cooke, for an Improvement in Manufacturing Webbing. Patented January 4, 1858.

Patent of Nicholas G. Norcross, for an Improvement in Planing Machines. Patented June 22, 1852. In this case it was shown that the patentee was deceased and that his son, Frederick W. Norcross, who now applies for the extension, was, at the time of the expiration, in the service of his country as a lieutenant and had distinguished himself for gallantry and bravery. In consequence of his occupation in the service he was unable to apply for the extension within the time required by the law, and now comes before Congress, asking that the Commissioner of Patents may be authorized to hear and act upon his petition, the same as though there had been no legal lapse.

The bills for the extension of the following important patent monopolies were then discussed:

WOODBURY'S HORSE POWER PATENT.

Application of Daniel Woodbury for a revival of his Horse Power Patent. Originally granted in 1846. Expired in 1860, at which time the applicant made strenuous efforts to get the patent extended by the Commissioner of Patents, who, for good and sufficient reasons, refused an extension. Three years ago Woodbury applied to Congress for an extension, but the bill failed to pass. He now appears again, his patent having rested among the dead for twelve years. The Committee made a long report on the subject adverse to the revival of the monopoly, and so the patent sleeps.

MARCHER'S COMPOSITION PATENT.

Rebecca A. Marcher. Being an application for a second extension of the patent of her late husband, Robert Marcher, originally granted October, 1851, for a machine for applying semi-liquid composition to picture frames, producing ornamental work thereon, etc. Extended seven years by the Commissioner of Patents, which extension expires October 21, 1872. This is an important patent and is in very extensive use. The Committee, in consideration of the fact that the petitioner was a widow in indigent circumstances, with three minor children to provide for, recommended a further extension for seven years from October 21, 1872, and the bill was passed.

THE HAYDEN BRASS KETTLE PATENT.

The great Hayden Brass Kettle case was then considered. This was the patent granted to Hiram W. Hayden, December 16, 1851, for machinery for making kettles and analogous articles. Extended for seven years by the Commissioner of Patents, which extension expired December 16, 1872. The patentee asks Congress to give him another extension of seven years.

It was shown that this patent formed one of the largest patent monopolies ever granted. For the last twenty years it has been held by the Waterbury Brass Company, who are understood to have grown immensely wealthy from the profits on the patent. The patent covers, broadly, the right to make kettles and other articles by what is known as the spinning process. It was shown that the Waterbury Company had driven out of market all other kinds of kettles and possessed the exclusive monopoly of the business.

It was shown in behalf of the inventor that, even if his assignees had grown wealthy, that he himself had not received any adequate remuneration; but he probably would be able to compensate himself if the further extension now asked were granted.

Mr. Kellogg, speaking in behalf of the applicant, made the following interesting remarks:

"This is an invention which completely revolutionized the manufacture of brass kettles; it created a new art. Instead of being an invention to be sneered at as worth but little, it is one of the most wonderful inventions ever made in the process of working metals. It consists in what is called spinning metal. A flat disk of brass is taken, and by means of machinery the metal is spun, so that the particles are changed, while still maintaining their adherence and force. Before this invention, kettles were pounded or battered or stamped by hand—a process so laborious that no man even in those days could work at this occupation more than eight hours a day; and even then the kettles were so made that they would be thinnest at the bottom and the edges, where the fire came; so that two kettles made in this way would not last any longer than one made by this new process by spinning. By this process of spinning metal this inventor, Mr. Hayden, produced kettles of double thickness at the places where the fire comes; and according to all the evidence before the committee, one of these kettles will outlast two of the old kind. In proof of this I may mention that, when this invention had come into use, kettles manufactured by the old process were driven entirely out of the market. The evidence also shows that at least a million and a half of dollars have been saved by this invention on the single article of kettles.

"This article of manufacture is comparatively less used in this country than formerly. This inventor not only introduced a new art, but he opened up a new branch of commerce with some of the European nations and Africa. A great part of the kettles manufactured under his invention have been exported. Thus this invention is helping every day to keep the balance of trade in our favor.

"I am aware that he has received a little more than $1,500 a year from the invention; but it is an invention which took him years to perfect. He was a poor mechanic at the outset, and this paltry sum is a small compensation for so valuable an invention."

The House divided, 60 ayes, 64 noes, so the bill was defeated, and the Brass Kettle Monopoly comes to an end.

ART TREASURES FROM CYPRUS---ENGLISH CRITICISM ON THEIR DESTINATION.

There are two journals published in London which may be considered the organs of that exclusive class of British society who, whether from choice or from indolence to obtain the commonest information, possess and cultivate the most profound ignorance, not to say stupidity, regarding everything in anywise pertaining to the United States. We allude to the *Saturday Review*, which, in classical English and faultless rhetoric, gravely puts forward the most extravagant absurdities, and the *Pall Mall Gazette*, which, if we remember rightly, especially distinguished itself during our late war by systematically publishing false reports of every Federal victory, and, with other rebel-sympathizing papers, revelled in predictions of grass growing in the thoroughfares of New York, and the untamed buffalo roaming over the ruins of the national Capitol. Both of these journals are the legitimate objects of the editorial scissoring of the balance of the London press, and, following the general example, the *Building News*, with a strange lack of discrimination, has culled from the valuable pages of the *Pall Mall Gazette* an article entitled "Art Treasures from Cyprus," which is a scholarly description of the collection of Greek and Phœnician antiquities, made by our late consul, General Di Cesnola, among the ancient ruins of that island. These relics were exposed for sale for some time in Europe, but met with no purchaser, owing to the high price set upon them. Recently, however, and in a late number of our journal, we adverted to the fact that they were bought by the management of the Metropolitan Museum of Art, and in proper time will be permanently located in that institution in New York city.

Now, if some obscure German principality had taxed its few inhabitants to the full extent of their incomes to purchase these works of art, and had entombed them in the dingy recesses of some out-of-the-way university where no one could possibly be benefited by them, save a few fossil professors, all might have been well. But unfortunately they are to go to America—and worst of all to New York—and there "waste their sweetness on the desert air" of barbaric and benighted Yankees. No wonder, then, that the learned pundit of the *Pall Mall Gazette*, whose whole æsthetic nature has been thus ruthlessly harrowed up, bewails their loss in the following manner: "And where are these materials going to for their final lodgment? Where, indeed? To New York, U. S. America. That seems a strange destination for a collection of antiquities which is not one representative of beautiful and popular forms of Greek or Greco-Roman work . . . and invaluable as the supplement of existing museums in centers of organized scholarship and research. The shipment of these things to New York means simply, for the present at any rate, mystification to the New York gaper, and sea sickness for the European archæologist. For the most intelligent New Yorker can get but moderate advantage out of the antiquities of this collection taken apart from their historical place in relation to antiquities of other schools and another aspect; and specimens of these last he does not possess and has little chance of coming by."

The first response to the foregoing remarks is the question which naturally occurs: "Why were not these inestimable treasures bought during the long period they were offered abroad?" But this aside, we perhaps may venture humbly to suggest to the above erudite authority that the American public, and especially the citizens of New York, are educated to a far higher standard of art criticism, and can appreciate the value of such relics in a degree somewhat superior to the cockney visitors, who would flatten their noses in something more than mere "mystification" against the glass cases of the South Kensington Museum, in London, did the collection find its way to that celebrated edifice. And further, we may add for the information of our cotemporary, that our metropolis contains gentlemen who are as familiar as the writer of the above with the galleries and museums of Europe, and consequently as thoroughly able to reap the advantages of comparison and kindred knowledge as any foreign "sea sick" archæologist that may deign to visit our shores.

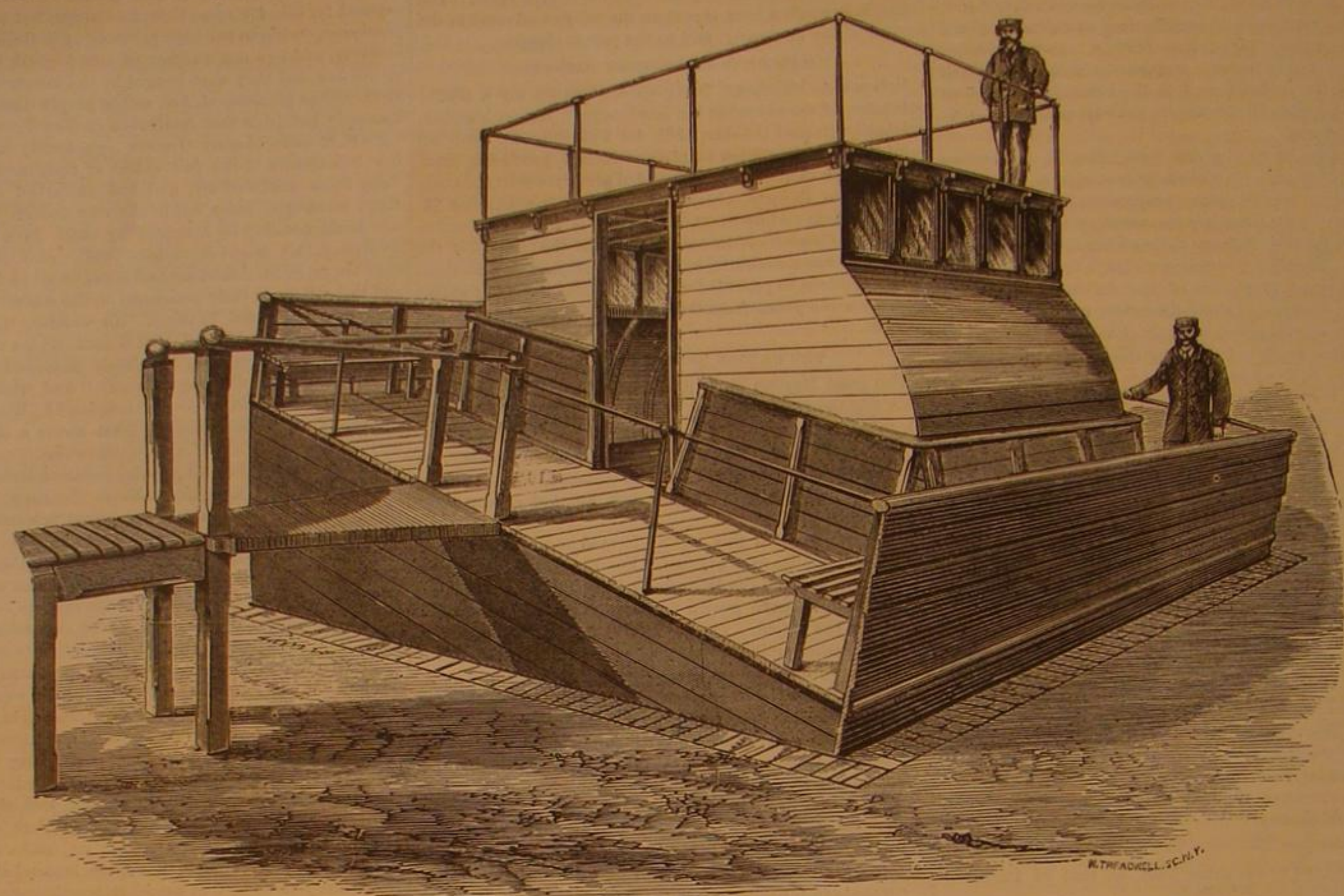
It is about time that America and the Americans were better understood by the English public, who still persistently cling to the extravagant representations of the country supplied by Dickens and Mrs. Trollope. The public of New York, Boston, and, indeed, every other of our cities, appreciate scientific and artistic subjects with a zest unknown to the people of Europe. The English journals well know that Professor Tyndall, for example, justly celebrated as he is, could not command $1,000 a night for a course of lectures in any city in the United Kingdom, and that no foreign operatic manager would listen to such prices, demanded and received among us by such musicians as Rubinstein, Lucca, or Nilsson. Our native artists, painters, and sculptors find in their own country patrons, in private citizens, who supplement their efforts with a munificence unheard of abroad; while, on the other hand, it is but recently that the European papers were regretting the fact that many of the finest gems of ancient art were crossing the Atlantic simply through the lavish expenditure of American connoisseurs. The fact of our being destitute of the great museums and galleries, such as are found in the cities of foreign countries, requires no other explanation than the youth of the nation. The need for such valuable aids, in the education of popular taste, is fully appreciated, and throughout the different States wealthy and public spirited citizens are laboring to found repositories of the choicest specimens afforded by science and art.

Such slurs upon the American public and upon our distinguished scholars, as are cast by the *Pall Mall Gazette*, will fail to influence the liberal-minded or progressive in any part of the world, while they serve to fully exhibit the narrowness, intolerance, and ignorance of the mind by which they were conceived.

THE description of a device for opening window blinds from within the casement, recently sent to us by a correspondent, occupies sixteen foolscap pages and the drawings sixteen additional pages, or thirty-two pages in all. It is well written and clearly described, every part of the device being illustrated in every possible position, the whole forming a curious example of exactness and prolixity. Most persons could have sketched and described the thing with sufficient clearness in the space of a single page.

THE ANTI-SEA-SICK SHIP.

We last week gave a description of the proposed anti-sea-sick steamer of Mr. Henry Bessemer, and the experimental apparatus lately erected by him on the grounds of his residence at Denmark Hill, England. We give herewith an illustration of this apparatus from *Engineering*. Our cotemporary states that the prospectus for a proposed company, entitled "The Bessemer Saloon Steamboat Company," has appeared, capital $1,000,000. The proposition is to build a large vessel to run across the English Channel, between England and France. Mr. Bessemer is to have for his patent 20 per cent upon the charges made to passengers who use the swinging saloon, and 10 per cent upon all sales of rights to other constructors. The arrangement consists of a



SALOON OF BESSEMER'S ANTI-SEA-SICK SHIP.

twenty foot length of the hull of a vessel of twenty foot beam sunk in a brick pit and carried on a longitudinal axis. In the ship is a saloon suspended as above described, and connected with it is a curved spirit level, with a graduated scale and pointer, the latter of which the steersman always keeps at the zero point. An oscillatory motion is given to the hull by a small engine connected to it with suitable gearing. This motion amounts to 14° each way, representing a total roll of 28°, with ten oscillations per minute, but notwithstanding this the cabin does not indicate a deviation of more than from 1° to 1½° from the horizontal. Mr. Bessemer considers his idea but the germ of what may be thought out, and frankly admits that some other brain than his own may push on the work he has initiated.

The difficulty of pitching is overcome by increasing the length of the vessel so as to insure longitudinal stability. The principle of the saloon is, in fact, carried out in a vessel designed by Mr. E. J. Reed, for the channel passage. She will be 350 feet long, with 65 feet beam over her paddle boxes, and 7 feet 6 inches draft of water. The saloon will be placed amidships, in the position generally occupied by the engines. The latter will be of 750 horse power, nominal, and are expected to drive the vessel twenty knots per hour. The ship will be double-ended so as to enable her to enter and quit existing harbors, and at each extremity will be provided with a very low free board, so that she may cut the waves instead of rising to them.

In the SCIENTIFIC AMERICAN for May 21, 1870, our readers will find an engraving of Lorenzo D. Newell's swinging saloon, which antedates Mr. Bessemer's device, and in some respects may be considered preferable.

NEW THEORY OF THE AURORA.

The *English Mechanic* publishes the views of Dr. Wolfert, a German observer, on the nature and origin of the aurora borealis, which, it will be noticed, are based on speculations which do not connect the phenomenon with a magnetic or electric source. Dr. Wolfert says: "The sun's rays, falling on the earth, are variously reflected according as they fall vertically or at an angle more or less obtuse. The earth being conceived as a large mirror, many of the obliquely incident rays will be reflected to a part of the celestial vault on the night side of the earth." The zodiacal light he ascribes to the irregular reflection of sunlight from water, and similarly the vast fields of ice in the polar regions, he considers, may be regarded as an imperfect mirror irregularly reflecting the incident light. The rays which fall most obliquely are the most abundantly reflected; and as the quantity of reflected light increases with the angle of incidence, adds the author, we may see how the reflected sunlight illuminates in the highest degree the night skies of the region nearest the pole; further, the great similarity of the incipient light of the aurora to moonlight is thus explained, the latter being also sunlight reflected.

The rays falling on the ice at an angle of 40° are, however, dispersed as well as reflected. It is commonly said that the point of origin of the aurora is indicated by the direction of the magnetic needle. More correctly, according to Dr. Wolfert, a line drawn from the sun at right angles to the horizon and prolonged would be the middle line of the phenomenon. On this supposition an advance of the central part of the aurora to the north is explained.

The grounds on which Dr. Wolfert rejects the ordinary hypothesis of the aurora may here be briefly stated. The strongest reason given for supposing a magnetic origin of the aurora is that the phenomenon seems to originate in the quarter to which the needle points. It is replied that in expeditions to Boothia Felix and Melville Island, the needle has in these places taken a vertical position and even at times pointed southward, while the aurora appeared in the north as usual. If the aurora consisted of a streaming of electricity from the magnetic pole, it would be difficult to explain how an observer at the pole always sees the light beyond the horizon as at other places. When lightning strikes a ship, the compasses become irrecoverably useless. But ships have ventured in the midst of these (supposed) currents from the pole, and their compasses have been but temporarily disordered. Neither man nor beast suffer from such currents nor do sensitive electrometers show any change in atmospheric electricity when the phenomenon occurs.

It is said that the needle shows irregularities before the aurora. But this is by no means a constant occurrence. The polar light and the electric (disturbing) currents may have a common cause. Heat also diminishes the attractive force of magnets, and this might account for the variation of the needle. If the phenomena were electric it would be difficult to account for their punctual regularity of appearance and disappearance in northern regions. This is explained, however, when we connect them with the sun.

In recent times, it has been supposed that the sun spots are in some way connected with the aurora. The recurring frequency of the latter every ten or eleven years is found to coincide with the periodic maxima of the former. Dr. Wolfert suggests the following as a possible explanation: If it be true that the spots diminish the solar radiation, the cold winters that recur in these periods may be thus caused. Now cold winters imply an extension of the polar ice southwards, and therewith an enlargement of the reflecting surface in the same direction.

An Iron Boomerang.

A locomotive lately exploded at Lafayette, Ind., and the *Journal* of that city says that a large piece of iron, weighing about a hundred pounds, in the shape of the segment of a circle, was projected from the wreck, and struck the wall of Levering and Abernathy's saw mill about three feet from the ground, going through that and a partition within, lodging against the inside north wall, and playing sad havoc with the contents of the office through which it passed. The distance from where the locomotive stood was three hundred feet. The course taken by the mass of iron was most peculiar—first upward in a curve, going in a south-westerly direction until it had passed over the saw mill, then suddenly changing when near the ground to directly north, and going in a direct line through the walls. The erratic movements of the mass of iron can only be accounted for by its peculiar shape, being not unlike the boomerang of the Australian aborigines.

Petroleum Wells in Ecuador.

The English *Oil Trade Review* publishes the report of the Government Engineer of the Republic of Ecuador, in which we find it stated that petroleum has been found in that country in large quantities. On a surface of about four square leagues from the sulphurous springs of San Vicente to the sea shore, wells have been sunk and the bituminous matter obtained in a liquid state. At the upper part of many of the wells, it is found in hard compact masses. The crude petroleum is of a dark brownish color, which gets darker with the greater consistence of the oil.

The manner of working the wells is exceedingly primitive as the inhabitants have neither the knowledge nor the implements required. Pits from ten to twelve feet deep are dug in the sand till clay is reached, and when the oil, which oozes from all sides, has filled them it is dipped out. Near the wells are rude furnaces built with sun-dried clay on which are open iron boilers. The bituminous matter is thrown into these vessels and cooked until all the volatile products disappear and leave a thick pitch.

"To Whom it may Concern."

Mr. D. D. T. Moore, publisher of the *Rural New Yorker*, closes his volume for 1872 with the following sensible announcement:

"The editor and founder of this journal hereby announces his retirement, as speedily as possible, from all business enterprises, offices, etc., not connected with its management. Having during the past twenty years permanently invested, for the ostensible benefit of individuals and the public, through the persuasion of friends, various small and large amounts—and meantime held sundry time-absorbing and otherwise expensive offices of trust and honor (but not one sinecure), our ambition is amply satisfied, and the decision now made and recorded "means business." Therefore all persons wanting to borrow money, place us in office, or make us rich by the use of "only a trifle" of our currency, time or influence, are advised that we are "not at home" to or persuadable by any such applicants. In fact we cheerfully forego all such chances for fame and fabulous wealth as seductive speculators and systematic swindlers have aforetime beguiled us with, and notify each and all of like proclivities that we shall in future not only believe in but be guided by the wise proverb which saith "all labor is profitable, but the talk of the lips tendeth only to penury." And, moreover, all who have designs upon us will find said proverb posted, in plain print, upon the walls of our office and sanctum."

THE big pig of Connecticut for 1872, killed in December, weighed 720 lbs. dressed. Stratford enjoys the honor. Piggy was fed on pork rinds during his youth; but for the last four months the diet was corn meal.

PROFESSOR TYNDALL ON LIGHT--SECOND LECTURE.

THE PROCESSES OF SCIENTIFIC THOUGHT.

What is this thing which, under the name of "light," we have been generating, reflecting, refracting and analyzing? The question cannot be considered, much less answered, without transporting oneself to a world which underlies the sensible one and out of which, in accordance with rigid law, all optical phenomena spring. To realize this sub-sensible world, the mind must possess a certain pictorial power; it must visualize the invisible. The imagination must be exercised, and the magic of its art consists, not in creating things anew, but in so changing the relations of sensible things as to render them fit for the requirements of the intellect in the sub-sensible world. As an illustration of this subject, the case of Newton may be cited. Before he began to deal with light, he was intimately acquainted with the laws of elastic collision. With this previous knowledge, the material for theoretic images, he had only to change the magnitude of conceptions already in his mind to arrive at the emission theory of light. He supposed light to consist of elastic particles of inconceivable minuteness shot out with inconceivable rapidity from luminous bodies, and that such particles, impinging upon smooth surfaces, were reflected in accordance with the law of elastic collision. Dropping vertically downward toward the earth's surface, the motion of a body is accelerated as it approaches the earth. The particles of light Newton believed were acted upon in a similar manner, and he supposed that, on approaching a surface obliquely, they were drawn down upon it exactly as a projectile is drawn by gravity to the surface of the earth. This deflection, according to Newton, was refraction, and he imagined that differences in color were produced by particles of different magnitudes impinging upon the retina.

The verifications of physical theory occur in the world fo sense. Laying the theoretic conception at the root of matters, we determine by rigid deduction what are the phenomena which must of necessity grow out of this root: If the phenomena thus deduced agree with those of the actual world, it is a presumption in favor of the theory. If, as new classes of phenomena arise, they also are found to harmonize with theoretic deduction, the presumption becomes still stronger. If, finally, the theory confers prophetic vision upon the investigator, enabling him to predict the existence of phenomena which have never yet been seen, and if those predictions be found on trial to be rigidly correct, the persuasion of the truth of the theory becomes overpowering.

After alluding to the supporters of Newton's theory, among whom were Laplace, Malus, Biot and Brewster, the lecturer proceeded to explain the

UNDULATORY THEORY OF LIGHT AND ITS ORIGIN.

The conception of an ether was advocated by Huyghens and the mathematician Euler, but it was reserved for Thomas Young to discover the resemblances which exist between the phenomena of light and those of wave motion. Professor Tyndall paid an earnest tribute to the genius of this philosopher, placing him on a level but little below that of Newton, and then proceeded to describe the general theory of wave motion:

The propagation of a wave is the propagation of a form, and not the transference of the substance which constitutes the wave.

The length of the wave is the distance from crest to crest, while the distance through which the individual particles oscillate is called the amplitude of the oscillation. You will notice that in this description the particles of water are made to vibrate across the line of propagation. Picture two series of waves intersecting each other and proceeding from two centres of disturbance. The motion of every particle of water is the algebraic sum of all the motions imparted to it. If crest coincide with crest, the wave is lifted to a double hight; if furrow coincide with crest, the motions are in opposition and their sum is zero.

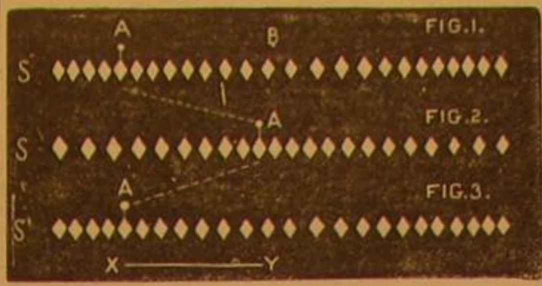
THE ANALOGY BETWEEN SOUND AND LIGHT.

Young's fundamental discovery was the principle of interference applied to light. We can imagine the air of a room to be traversed by a series of sound waves, and that a second series be propagated, so related to the first that condensation coincides with condensation and rarefaction with rarefaction. The consequence would be a louder sound than would be produced by either set of waves singly. But we can also imagine a state of things where the condensations of the one system fall upon the rarefactions of the other, when the two systems neutralize each other, and thus by adding sound to sound we produce silence. Now, in a similar manner, by adding light and light together, we may obtain darkness. There is, however, a fundamental

DIFFERENCE BETWEEN LIGHT AND SOUND WAVES.

Could we see the air through which sound waves are passing, we would observe every individual particle of air oscillating to and fro in the direction of propagation. Could we see the ether, we would also find every individual particle making a small excursion to and fro; but here the motion above referred to would be across the line of propagation. The vibrations of air are longitudinal, those of ether, transversal.

To illustrate this point, Professor Tyndall threw on the screen a line of light dots as at Fig. 1, representing air particles in a wave of sound. At A is a condensation, at B a rarefaction. These were drawn upon a blackened glass disk and placed in the lantern. When the disk was rotated, the dots that were closed at A separated, and those that were separated, as at B, closed, the motion being kept up along the whole line. From Fig. 1, combined with Figs. 2 and 3, the motion of a particle of air acted upon by sound may be determined. Let A be such a particle in Fig. 1, in the midst of the condensed portion of the wave. In Fig. 2 the wave of condensation has become one of rarefaction, and the particle A has travelled along half a wave length, or to the center of



the rarefied wave. In Fig. 3 this same particle has returned to its former position. It has consequently made an excursion to and fro over the length, X Y, oscillating, in other words, throughout this distance.

An undulation, X Y, Fig. 4, composed of a series of par-

ticles in spiral shape, then appeared upon the screen. By rotating a disk similar to the one above described, these waves alternately appeared as in X Y and X' Y'. Now, bearing in mind the example of a wave in water, we may understand how an undulation may progress while the particles of fluid simply oscillate up and down. Let us consider *a c* as two particles on the crest of the undulations X Y, and *e g* as other particles in a furrow. Imagine these waves to roll on in the direction of the large arrow until a furrow is substituted for a crest and *vice versâ*, or until the medium takes up the undulation X' Y'. Then the particles *a* and *c* will have descended to *b d* and the particles *e g* ascended to *f h*. Consequently the particles will not advance longitudinally (as we explained those in Figs. 1, 2 and 3 did on the line X Y), but will simply rise and fall on the vertical lines *ab*, *cd*, *fe*, etc.

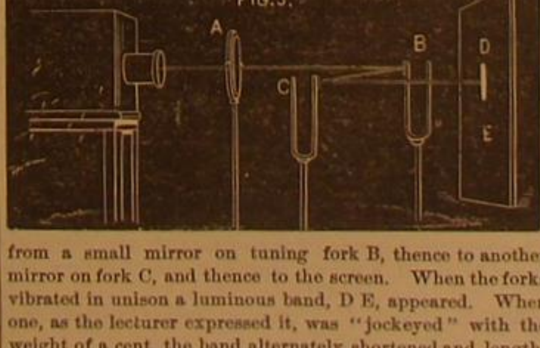
INTERFERENCE.

The most familiar illustration of the interference of sound waves is furnished by beats in music, which are produced by two musical sounds slightly of tune. Professor Tyndall here brought forward two large tuning forks tuned in unison, and swept a bow across each. A loud musical note filled the air. He then attached a cent to one of the forks, which somewhat retarded its vibrations. He explained that if, for instance, the difference between the forks now were such that while one fork made 100 vibrations the other made 101, it would result that at every hundredth vibration the wave would combine to form the highest wave, that is, the loudest sound, and half way between these the crest of one wave would meet the furrow of the other, making the least wave and the lowest sound. This effect of increasing and decreasing sound was very plainly audible. The speaker then put another cent on the loaded fork and the differences of sound succeeded each other with greater rapidity.

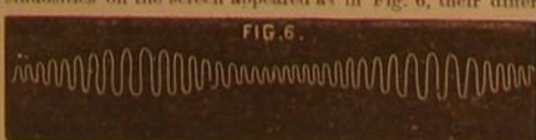
To show these facts optically, the light was reflected from a small mirror on the prong of a tuning fork to the screen, appearing as a small luminous circle. By vibrating the fork the circle lengthened out into a line, by reflecting which from a looking glass and sweeping the same rapidly about, a luminous scroll appeared, showing by the depth of its sinuosities the amplitude of the vibrations.

OPTICAL DEMONSTRATION OF INTERFERENCE.

Fig. 5 shows the apparatus used for this purpose. The ray from the lantern passes through the lens A, is reflected



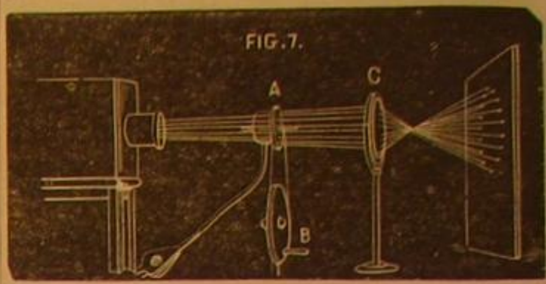
from a small mirror on tuning fork B, thence to another mirror on fork C, and thence to the screen. When the forks vibrated in unison a luminous band, D E, appeared. When one, as the lecturer expressed it, was "jockeyed" with the weight of a cent, the band alternately shortened and lengthened. By reflecting this from a looking glass, as before, the sinuosities on the screen appeared as in Fig. 6, their differ-



ing depths expressing the intensity of the alternate increase and diminution of the sound.

PITCH.

The pitch of a sound is wholly determined by the rapidity of the vibration, as the intensity is by the amplitude. To show the rise of pitch by the rapidity of the impulses, Professor Tyndall explained a form of siren shown in Fig. 7. At A is a perforated disk rotated by the wheel B over a cylinder. In the end of the latter against which the disk revolves are orifices similar to those of the disk, so that coincidences occur. Air is forced into the cylinder from the bellows. When the apertures in the disk coincide with those in the cylinder, a puff escapes; and when these puffs succeed each other so as to form a musical sound, the more rapid the rotation of the disk is, the quicker are the impulses and the



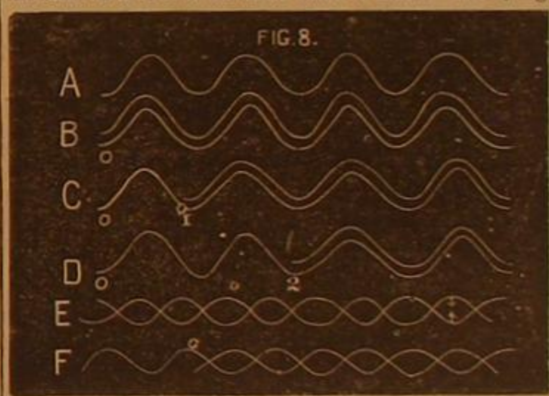
higher the pitch of the note. By this means any number of vibrations due to a sound may be determined. Passing the light through the cylinder and lens, the perforations appeared on the screen as shown. Then by forcing in air and rapidly revolving the disk, producing a dismal species of caterwaul, the lecturer reflected the luminous dots on the screen from a hand mirror. On vibrating the latter the most curious undulatory sinuosities appeared—circles interwoven with each other wonderfully intricately, besides other singular combinations of form.

PITCH IS THE ANALOGUE OF COLOR.

The waves of light have been measured, and it has been found that the more refrangible the light, the shorter are its producing waves. The shortest are those of the extreme violet, the longest, those of the extreme red. The length of a wave of the latter is such that it would require 36,918 placed end to end to cover one inch; of the former, 64,631 would be needed to occupy a similar space. The number of shocks on the retina corresponding to red is four hundred and fifty-one millions of millions, to violet, seven hundred and eighty-nine millions of millions. All space is filled with matter oscillating at such rates, and in ether, just as in water, the motion of every particle is the algebraic sum of all the separate motions imparted to it.

WHAT IS DARKNESS?

The principle of interference applies to the waves of light the same as it does to waves of water or sound. Let A, Fig.



8, be a wave of light. Suppose that two series of these light waves start from a common origin, B. Then their parts correspond and the systems blend together in double amplitude. Suppose they start as at C, one wave a whole wave length ahead of the other; again they coincide and we have increased luminous effect. At D the second wave starts two wave lengths ahead; the result is still the same. But if one system start half a wave length in advance as at E, one and a half as at F, or an odd number of half way lengths, then the crests of one system fall upon the sinuses of the other. Opposite forces, indicated by the little arrows in E, are brought into play. Stillness of the ether is the result of their joint action. This quietude is darkness and corresponds with a dead level in the case of water.

CONDITIONS FOR THE GENESIS OF COLOR.

If we have in interference an agency by which light may be self extinguished, we have in it the conditions for the production of color. Whence, then, are derived the colors of the soap bubble? Imagine a beam of white light impinging on a bubble. When it reaches the first surface of the film, a known fraction of the light is reflected back. But a large portion of the beam enters the film, reaches the second surface and is again in part reflected. The waves from the second surface thus turn back and hotly pursue the waves from the first surface. And, if the thickness of the film be such as to cause the necessary retardation, the two systems of waves interfere with each other, producing augmented or diminished light, quadrupling it, or totally extinguishing it, as the case may be. But, inasmuch as the waves of light are of different lengths, it is plain that, to produce self-extinction in the case of the longer waves, a greater thickness of film is necessary than in the case of the shorter ones. When, therefore, the red is quenched, the blue and green are not quenched; hence the production of color in the case of thin plates.

Various beautiful experiments illustrating this theory were then made. The colors of a thin layer of oil on the surface of water were projected upon the screen. Also, the hues derived from a thin film of air, compressed between two pieces of glass; and lastly, reflected light was thrown through a soap bubble, covering the screen with the most gorgeous prismatic tints.

NEWTON'S RINGS

were then carefully explained, and on curved flat surfaces being pressed together, the curves were beautifully apparent when thrown by the lantern upon the screen. The interference of the waves caused by the varying thickness of the film of air was described and the colors produced pointed out. Then tinted glasses were interposed, and by the monochromatic light the number of rings was greatly increased, so that the whole light circle given by the instrument seemed to be covered with a ripple of alternate light and darkness.

Professor Tyndall then entered upon a lengthy explanation of Newton's method of accounting for the above phenomena in connection with the emission theory. The reference to

OTHER COLORS DUE TO INTERFERENCE

concluded the lecture.

Fine scratches drawn upon glass or polished metal reflect the waves of light from their sides; and some, being reflected from opposite sides of the same furrow, interfere with each other and quench each other. But the obliquity of reflection which extinguishes the shorter waves does not extinguish the longer ones, hence the phenomena of color. These are called the colors of striated surfaces. They are well illustrated by mother-of-pearl. This shell is composed of exceedingly thin layers, which, when cut across by the polishing of the shell, expose their edges and furnish the necessary small and regular grooves. The most conclusive proof that the colors are due to the mechanical state of the surface is to be found in the fact that, by stamping the shell carefully upon black sealing wax, we transfer the grooves, and produce upon the wax the colors.

Correspondence.

Certain Properties of the Solar Rays.

To the Editor of the Scientific American:

I thank you for giving insertion in the SCIENTIFIC AMERICAN (November 16) to my paper on the solar rays, and also for recently calling attention to the importance of the inquiry. Having myself often derived pleasure and instruction from your editorial articles on the higher branches of physics, I may be permitted to express my sense of the great value, as well as of the enlightened spirit pervading its columns, of the influential organ of scientific information over which you preside.

With respect to the repetition of my experiments, you will, I am sure, agree with me as to the indispensable necessity, in any such steps, of reproducing carefully and fully the essential conditions present when the original observation was made. It would hence obviously be quite useless to attempt to obtain here, in the midst of a freezing December, illustrations of solar power equal to those witnessed last July and August, when the thermometer at noon was seldom under 90°, and when people were every day prostrated by heat in the streets of New York.

My latest experiments, those with albumen, were performed at the end of September, when the sun's power had considerably declined, and within a month I placed at the disposal of a scientific journal, circulating throughout the civilized world, a simple statement of the chief facts noticed, and of the conditions under which the observations were made, authenticating this statement by attaching to it my name and professional status in England. I really do not see that I could have done more.

In taking this course, I expected and hoped that my experiments would speedily be repeated and verified. For among the numerous readers of the SCIENTIFIC AMERICAN, many doubtless reside in tropical districts, where conditions similar to those existing here last midsummer continue throughout the greater part of the year. The experiments are so simple (merely requiring an ordinary lens such as those used for examining photographs) that any person can repeat them. If any of your readers, thus favorably circumstanced, should be willing to perform this service in the cause of science, it would be a satisfaction to me to know the results, positive or negative, the actual conditions present as to season, place, temperature, clearness of atmosphere, etc., being detailed; or, if more agreeable, these communications can be addressed to you editorially.

If, in experimenting, any more minute directions should be required, I shall be glad to give any information in my power in reply to letters addressed to me, post office box No. 2,622, New York.

It will be observed that the experiments arrange themselves into three groups, namely: 1. Those on living animal tissues under water. 2. Those with albumen. 3. Those on the penetration by the sun's rays of certain opaque and other media. And, as a general rule, the solar power required to produce satisfactory results in each group follows the same order.

In reference to my mode of experimenting, I may observe that an eminent telegraphic engineer in India has successfully employed the nerves of the finger and tongue to detect the escape of electricity from badly insulated wires, and has found this plan preferable in practice to any artificial test. Neither should it be forgotten that an apparently trivial physiological observation was the seed from which sprung the sci nce of galvanism with all its ubiquitous and magnificent associations.

Nor are my experiments on the penetrating power of the sun's rays at all inconsistent with the facts observed by various eminent philosophers, or with the legitimate inferences from these facts Thus Melloni found that the penetrating power of rays of heat, emanating from various artificially heated bodies, as tested by different media, was directly proportioned to the actual temperature of the body from which those rays proceeded. What then can be more natural than that the concentrated rays of by far the hottest body known to us—the sun—should possess an extraordinary power of penetrating even many opaque media? The truth is that the facts of nature are always in harmony with each other. It is only man's reasonings and speculations on these facts that are liable to change and error.

In one respect you have slightly misunderstood the purport of my paper. I "claim" nothing but to have performed certain experiments, under certain specified conditions and with certain uniform results. I merely alluded to one or two possible explanations of the phenomena described, but expressly reserved any definite conclusions until more facts bearing upon the question should be accumulated, either by myself or others. And in the concluding sentence I referred pointedly to the obscurity still surrounding the subject, and to the necessity for its further systematic investigation.

In employing this guarded language I had in view chiefly the physiological relations of the solar forces, a field of research yet almost untrodden, but of the highest importance both to science and to humanity. For while every practical physician and every student of hygiene feels compelled to recognize the great influence which the solar emanations exercise upon the human body in health and disease, how little do we know of the rationale or conditions of their action! It has often seemed to me remarkable that, notwithstanding our boasted modern progress, the ancients actually knew more or at least made more practical use in the arts and in medicine of the heating and stimulating effects of the sun's rays than we do.

The whole subject demands extensive experimental examination, for the range of the inquiry is immense. Each sunbeam may indeed be regarded as a little world, peopled by a host of active forces, so intimately commingled and united that the utmost ingenuity of man has not yet succeeded in thoroughly unraveling and clearly individualizing a single thread of that mystic cord.

What do we know positively of the nature of light or heat or actinism, or of their relations to each other and to electricity and to the vital forces?

In conclusion, I need scarcely say that it will be very gratifying to me if the rude, desultory observations, commenced amid the fogs of the east coast of England, should obtain even a partial fruition under the more potent sun and brighter skies of America.

New York city. GEORGE ROBINSON, M. D.

Are not the Elements Molecules?

To the Editor of the Scientific American:

One of the tenets of the modern atomic theory, namely, that no compound can exist where the valences of its component elements are not all satisfied, is universally acceded to by writers on chemistry; but in the very face of this statement, they nearly all rush into what appears to the writer to be a rank absurdity and inconsistency, and perhaps on the very next page they will assert that certain elements, for instance tin, antimony, platinum, etc., are endowed with the extraordinary faculty of behaving as dyads, triads, tetrads, or pentads, indifferently, according to circumstances. A convenient and full explanation occurs to me, by which this apparent inconsistency may be accounted for. *Imprimis:* To me it appears just as irrational to assert that an element can exist where its valences are not all satisfied as that a compound can. What then becomes of the other two valences of the tetrad tin, in the case of stannous chloride, $Sn\,Cl^2$? or of the other two, in the case of antimonious chloride, $Sb\,Cl^3$? My answer to these queries is, not that the valences have vanished, but that they are fully active in satisfying those of another similar molecule, or, in other words, the respective formulæ for the above salts are

$$\begin{array}{c} Sn^{IV}\ Cl^2 \\ | \\ Sn^{IV}\ Cl^2 \end{array} \quad \text{and} \quad \begin{array}{c} Sb^{V}\,Cl^3 \\ | \\ Sb^{V}\,Cl^3. \end{array}$$

And now for the deduction from the following facts: If antimony be dissolved in HCl, the trichloride, $SbCl^3$, is only obtained, and in the case of tin, the bichloride, $SnCl^2$, whereas, by projecting powdered Sb into chlorine gas, the pentachloride, or, of tin, the tetrachloride, is obtained. My deduction is that tin, antimony, or any other element, as a single atom, cannot exist, but that every atom, in the uncombined state, is bound by all its valences to one of its own number. Antimony, then, is

$$\begin{array}{c} Sb^{V}, \\ | \\ Sb^{V} \end{array}$$

and when acted on by HCl, where the negative affinity of the Cl is in a measure masked by the H, it is only capable of separating three of the Sb valences, and

$$\begin{array}{c} Sb\,Cl^3 \\ | \\ Sb\,Cl^3 \end{array}$$

results. Project antimony, on the other hand, into Cl gas, and now the powerful negative affinity of the Cl, not being diluted by the H, is capable of cutting apart all five of the antimony valences, and $Sb\,Cl^5$ is obtained. The same is true of tin, and, in fact, instances might be added *ad infinitum*; but is not the above sufficient? My conclusion, then, is, that the elements are constant in their saturating power, and under all circumstances are endowed with the maximum number of valences which they show under any circumstances. R. D. W.

Well Equipped Railroads.

To the Editor of the Scientific American:

The instances of great railroad corporations being completely equipped with all the latest improvements, to render their patrons and employees secure and add to their comfort, are so rare that I request a small space of your valuable, most widely circulated, and carefully read paper to give publicity and due credit to a great line of travel to the far west, embraced in three roads, the Chicago, Burlington and Quincy, Hannibal and St. Joseph, and Kansas Pacific. These have tried all the real improvements offered and have adopted the best, consequently the air brakes, jointed rails, self-couplings for cars, a complete arrangement for heating and ventilating; smooth, well ballasted road bed, and efficient system of signals are adopted by them; these, with a well paid and consequently a good class of conductors, engineers and brakemen, who, feeling that the spirits administering these lines mean to excel, are to a corresponding degree inspired to exert greater care and attention to their duties, render these roads great public benefactors.

By publishing this, you may wake up some of the managers of the dormant roads, who can never see the benefit derived from making improvements. JOHN WHITEFORD.

Detroit, Mich.

Lieutenant Wheeler's Expedition.

To the Editor of the Scientific American:

I was a member of a party which, for the purposes of exploration, was fitted out last July at Camp Douglas, Utah, and left on the 28th of that month for Eastern Nevada and Northern Arizona. The expedition was divided into two main bodies, one intending to take a line south as far as Beaver, the other to go to Nevada, and thence to Beaver, and to explore all the country between the first party and the Nevada State line. From Beaver, we divided ourselves into four sections, and continued south. The country was found to be very rich with silver, coal, and iron, and may be described as a good field for the geologist and the artist. The scenery is beautiful, and there is every variety of stone, limestone, sandstone, and granite being very plentiful. There are diamonds as good as in Arizona to be found in Utah, within 100 miles of Salt Lake city. The great drawback to the locality is poor water and no rain in summer. There is now being constructed, southward from Salt Lake city, a railroad of which about 35 miles is complete. It will run to or near St. George, which is a lively Mormon settlement. Here cotton, castor beans, peaches, grapes, and all fruits needing a warm climate, grow in abundance. Cotton and woolen mills are scattered through the country. The whole of the party will have arrived back in Camp Douglas, by December 20, except one man who was drowned.

Utah Territory. A. F. M.

Explosions produced by High Notes.

A large portion of the explosives known to chemists contain more or less nitrogen. The simplest, and one of the most unstable, of these is the compound of iodine with nitrogen. The iodide of nitrogen, as it is called, is very easily prepared by dissolving finely powdered iodine in concentrated ammonia and filtering. The filter paper is removed from the funnel while wet, and is torn in small strips, which are spread around to dry. Although entirely harmless while moist, as soon as it is dry the compound explodes by the slightest touch with a loud report. What seems most remarkable is that it may be exploded by certain high notes and sharp sounds.

The following interesting experiments with this substance were recently made by Champion and Pellet: Two long glass tubes 13 millimeters in diameter and 2·4 meters in total length were joined by a strip of paper, and pieces of paper with 0·03 grammes iodide of nitrogen placed in each end. Upon detonating one of these with a hot wire, the other also exploded. That the explosion was not occasioned by the pressure of the air was proved by placing a small light pendulum in the tube, and this pendulum was not swayed by the explosion any more than it would be by blowing into the tube with the mouth. Small quantities of the iodide of nitrogen were fastened on the deep strings of a contra-bass, bass viol and violin, and the string caused to vibrate. The deep tones produced no explosion, but a loud one instantly followed when the vibrations exceeded 60 in number. The very high notes produced by touching the strings between the bridge and the tail piece also exploded the iodide.

Experiments tried with Chinese tamtams gave the same results; the bass instrument failed to explode it, but the more rapidly vibrating one, which gave a higher note, always caused the explosion. Two parabolic concave mirrors, 20 inches in diameter, were stationed 8½ feet apart, and paper containing a few grammes of iodide of nitrogen placed in the focus of one mirror and half way between the mirrors. In the focus of the other mirror a drop of nitro-glycerin was exploded, which caused the explosion of the iodide in the focus of the first mirror but not of that half way between the mirrors. Although other explosives fired off in the focus of the second mirror will produce a like effect, yet this is not due, as might be claimed, to the heat, since 0·03 grammes of nitro-glycerin, which produces no more heat than 0·9 grammes of gunpowder, will produce an explosion requiring 8 to 10 grammes of powder. The mirrors were then obscured with smoke, when 10 grammes of powder were unable to explode the iodide, but, even under these conditions, 0·03 grammes of nitro-glycerin sufficed to accomplish the result.

A MAN out West wants a patent on an invention calculated to prevent the bungling method of executing criminals, that has now grown so common. In case the vertebræ of the condemned are not scientifically dislocated at the first fall, the rope instantly lowers the victim safely to the ground, lassoes the sheriff and his assistants, jerks them fifty feet into the air and drops them on the nearest picket fence This device is known as the "Automatic Avenger."

Printing Presses.

Probably the machine which attracted the most attention at the London International Exhibition, last year, was the Walter press, used for printing the *Times*, representing, as it does, what may be termed a revolution in newspaper printing, and being also exhibited for the first time to the public. It is constructed on a principle which it is now seen is the only road to progress in the designing of fast printing machines—namely, a continuous roll of paper continually being brought between the impression cylinders. Hoe's machine, which was a great improvement in this direction, is completely eclipsed by the Walter, which saves an enormous quantity of labor, and delivers the papers, printed on both sides, at the rate of about 12,000 an hour. The American Hoe 10 feeder, by an arrangement of flyers, dispensed with takers off, but required ten persons to lay on the sheets. The Walter, on the contrary, requires neither layers on nor takers off, but, as a matter of fact, two persons attend the sheets as they are laid down by the machine, in order to avoid any hitch in the process or any delay to the progress of the work. [The Walter machine is a modification of the new American machine known as the Bullock press, largely used in the United States.] In the Hoe, at each of the places for delivery of the printed sheets, a frame work of laths was provided, which, actuated by cams, moved through the space of a quarter of a circle. When this flyer stood at right angles to the delivery board, it was in a position to receive the sheet from the tapes which brought it from the printing cylinder. Having obtained its burden, it commenced the descent, deposited the sheet on the heap, and returned for another. This operation was, or rather is, for the machine is still used by some morning papers and *Lloyd's*, performed with such regularity that takers off were dispensed with, all that was required being the removal of the heap when a certain number of papers had been deposited on it. The Walter, on the other hand, while preserving this feature in a modified form, dispenses with layers on. The paper is supplied in an immense roll, containing generally some 6,000 sheets, and is mounted at one end of the machine. The end is passed through an arrangement of four rollers covered with blanket, one of which dips into a trough of water, so that the paper is equally damped, while the pressure exerted by the others—the grip being necessary to insure the advance of the web and the unrolling of the cylinder of paper—also secures the requisite uniformity of dampness in the substance of the paper. The paper thus damped passes to the printing cylinders, four in number, placed one above another, the upper and lower of which carry the stereotype plates, and the two inner being the impression cylinders proper, pressing the sheet between their blanket covered surfaces and the face of the type. From the printing cylinders the paper, now printed on both sides, passes to the dividing rollers, where the web is cut up into newspapers. These rollers consist of two blank cylinders, the circumferences of which are equal to the breadth of the open sheet of the *Times*. Between these the printed web of paper is passed on its way from the printing cylinders to the tapes by which it is to be distributed. In one of these blank cylinders is a deep fluting parallel to the axis; this is a sheath into which the edge of the knife enters. In the other cylinder is a projecting knife having on each side of its entire length a copper guard held in projection by springs. If pressure is exerted on these copper guards, they are depressed and the knife exposed. When the pressure is removed, the springs recover their position. When the guard approaches the deep fluted roller, it is depressed, and between it and the upper roller the web of paper is held for a very small fraction of a second. With a rapidity too great for the powers of vision the knife acts, the other side of the cut being held by the other spring. But the separation is not yet complete, The knife is not one continuous blade, but is formed of long angular projections; these perforate the paper so that the sheets are nearly, but not quite, separated, a narrow strip being also left unperforated at each margin to preserve the integrity of the sheet till the web has entered between the endless tapes. These tapes pass over two rollers, the sheet being gripped between, and as they are revolving at a higher velocity than the web is traveling, the sheet is separated and conveyed to the distributing frame slightly in advance of the succeeding sheet. This frame consists of a flyer, working backwards and forwards between uprights. The sheets pass over a roller at the top of these uprights, and are laid down by the flyer alternately on either side, the distance traveled over by the frame, or flyer, being sufficient to deposit the newspaper in a place of safety, and to afford time for the next paper to advance so far that it is deposited on the other side by the return motion of the flyer.

Metallic Manganese.

Although manganese is one of the most abundant metals, possessing great hardness, and, from its close resemblance in many respects to iron, we might expect to find it of great use in the arts, its reduction from its ores has been so difficult and expensive that metallic manganese is to-day a curiosity found only in the college collections and metallurgical museums. Mr. Hugo Tamm has recently succeeded in inventing a flux, or rather two fluxes, which seem to solve the problem and promise to give us cast manganese in large quantities at reasonable prices.

A white flux is first made from: Pulverized glass (free from lead), 63·0 parts; quick lime, 18·5 parts; fluor spar, 18·5 parts. Of this white flux he takes 34 parts and mixes it with 5·5 parts lampblack or soot and 60·5 parts good pyrolusite or black oxide of manganese. When fused in a suitably protected crucible, he obtains 17·5 parts of crude manganese and a beautiful olive green slag, which is pulverized and used for reducing more of the ore, under the name of green flux.

A crucible which will withstand a white heat for hours is then lined with a mixture of 3 parts graphite and 1 part fire clay stirred up with water to a thick dough. This lining protects the crucible from the action of the flux, which at that high temperature would destroy even a graphite crucible.

When about to begin the operation of reducing the ore, 91 parts of good soot or lampblack are intimately mixed with 1,000 parts of pyrolusite, after which 635 parts of the green flux above mentioned is slightly mixed with it, and enough of any sort of oil added to moisten the mass. The charge is next pressed into the crucible and covered with a thick, round, wooden cover, which is, of course, charred in the fusion, and thus protects the contents. Over this is placed a cover of graphite or clay, an opening only being left for the escape of the gases generated during fusion.

The crucible and contents are first heated gradually as long as gases are given off, then the heat is rapidly increased by a blast up to a white heat and kept there several hours, the time depending on the size of the charge. When the reduction is completed, the heat is lessened and the crucible allowed to cool before the contents are removed. The olive green slag is ground up and used again, mixed with about one tenth its weight of white flux.

The manganese obtained in this way contains about 3 per cent of impurities, principally iron, aluminum, silicon and carbon. The contaminations being similar to those in cast iron, Mr. Tamm proposes to call it "cast manganese." It may be refined according to Berthier's method, by fusing in a fire clay crucible with one eighth its weight of carbonate of manganese, a wooden cover being used to prevent oxidation.

The value of Mr. Tamm's discovery becomes evident when we compare the simplicity and cheapness of his process with those previously employed. Brunner obtained it by reducing the chloride or fluoride with sodium, after the method of Deville in preparing aluminum. It had also been obtained in small quantities by repeated fusions of the protoxide with charcoal and oil. The happy thought of adding to this some ground glass and fluor spar renders a single fusion sufficient to reduce a native ore, instead of requiring several fusions and much trouble in preparing a protoxide from the carbonate.

Metallic manganese has somewhat the appearance of cast iron. It is hard enough to scratch steel and cuts glass like a diamond. It has the effect of rendering steel itself harder and better. In the Bessemer process, manganese is introduced into the converter in the form of spiegeleisen. This property of its hardness will, no doubt, render it very valuable in the preparation of alloys. In its pure state, we cannot expect to use it extensively, owing to its oxidizing so readily that specimens of it require to be kept in closely stopped bottles or under naphtha. It decomposes water like sodium, but less rapidly, and does not reduce metallic salts like the last named metal.

It is only fusible in the strongest heat of the blast furnace, and this refractory property is communicated to its alloys. When heated, it shows a play of colors at different temperatures, like steel, and is covered with a brown film of oxide. It is about as heavy as iron, for which it would be mistaken by the careless observer, but the difference would be easily detected on applying a magnet, by which it is but slightly attracted, if at all. The truth is we know very little about the properties of manganese, as it has never been prepared pure in large quantity. Manganese and copper afford an alloy very similar to German silver.

How a Yankee Boy made a Meteor.

The Springfield *Republican* tells rather a flighty story of a well kept secret, which suggests that some of the modern meteors, which are constantly being discovered, may be accounted for in similar manner. The story goes that a boy, well back in 1811, made a kite and attached a lantern to it, in which he put a candle and arranged it so that, when the candle had burned out, it would explode some powder which was in the bottom of the lantern. He kept the secret entirely to himself, and waited for a suitable night in which to raise his kite. The boy got his kite into the air without being discovered, for it was so dark that nothing but the colored lantern was visible. It went dancing about in the air wildly, attracting much notice, and was looked upon by ignorant people as some supernatural omen. The evil spirit, as many supposed it, went hobbling around for about twenty minutes, and then exploded, blowing the lantern to pieces. Next morning all was wonder and excitement, and the lad, who had carefully taken in his kite and hidden it after the explosion without being found out, had his own fun out of the matter. The people of Brattleboro' never had any explanation of the mystery until nearly sixty years afterward, when the boy who had become quite an old gentleman published the story in a Brattleboro' newspaper.

The Manufacture of Carbon.

About a year ago Mr. Haworth, a gentleman from Boston having heard of the burning well at Cumberland, Md., tested the quality of the gas, and was satisfied that he could put into operation a scheme or plan of his own for the manufacture of carbon from the gas. Accordingly, the well was leased or purchased by Mr. Haworth and others, known as Lamb and Co., and a patent obtained for the manufacture of carbon, according to the plan of Mr. Haworth. A building was constructed and the manufacture of carbon commenced about six months ago. There are now in operation six hundred and sixty burners, each burner consuming eight cubic feet per hour. The gas is allowed to burn against soapstone plates, on which the carbon is deposited in the form of soot. By a very neat mechanical arrangement, the soot is scraped off and deposited in large tin boxes about three feet long, and a foot and a half wide, and a foot and a half deep; scrapers are passed along the soapstone plates every twenty minutes, and the boxes are filled on their fourth passage. A large building is now in course of construction, twice the size of the present one, and will have in use thirteen hundred and twenty eight-feet gas burners. The present consumption of gas amounts to about one twelfth of the whole quantity escaping from the well. When the new building is completed and the burners put in operation, the total consumption of gas, by the burners of both buildings, will be one fourth of the whole.

The carbon is used for the manufacture of ink, and these works, we believe, are the only ones of the kind in the world.

Patents in Germany.

Although the various states of Germany are united in one confederation for certain purposes, such as defence, commerce, etc., in relation to patents they are separate, and each State has its own patent laws. Some twenty patents are required to cover all the German states. The project of establishing a general patent law has been under consideration for some years, and there is now every probability of an early reform; however, there is considerable diversity of opinion on the subject. Some chambers of commerce, notably that of Leipsic, are in favor of the total abolition of patents: but the majority of competent authorities appear to favor the scheme of proposals put forward by the Association of German Engineers, of which the following are the details:

1. The patent system of Germany shall be unified and centralized:
2. A patent shall confer upon the inventor or his assigns the exclusive right and title in his discovery:
3. There shall be no preliminary examination:
4. As regards the novelty and priority of the invention, an inquiry shall be instituted only when exceptions have been taken and objections made within a definite period; the invention shall be made known immediately upon the application for a patent, subject and entitled, however, to provisional protection:
5. A commission composed of judges and experts shall be summoned to take cognizance of the objections, and to hear all persons interested:
6. There shall be an appeal to a superior court:
7. The following shall not be fit subjects for, or capable of, being patented, namely:

a. Purely scientific principles, without any definition or description of the mode of application;

b. Things prejudicial to public order, and contrary to law and propriety:

8. The duration of the patent is fixed at 15 years:
9. The patentee shall not be obliged to develope and carry out his invention:
10. The patent, though gratuitous for a certain number of years, is thereafter subject to a progressive tax:
11. The patent shall become void at the end of 15 years, or in default of due payment of the imposts:
12. Foreigners shall be fully entitled to obtain patents in the Empire:
13. The State may appropriate any patent, duly indemnifying the patentee:
14. Every patentee may work and develope the object of his patent throughout Germany in whatever way he may think fit.

These are liberal propositions, and, if a corresponding law is enacted, it will greatly add to the prosperity of Germany.

A Conflict with a Wheelbarrow.

The following must have emanated from a person who had experience in tumbling over a wheelbarrow (and who has not?) to have enabled him to so graphically describe the sensation:

If you have occasion to use a wheelbarrow, leave it, when you are through with it, in front of the house with the handles toward the door. A wheelbarrow is the most complicated thing to fall over, on the face of the earth. A man will fall over one when he would never think of falling over anything else. He never knows when he has got through falling over it, either, for it will tangle his legs and arms, turn over with him and rear up in front of him, and, just as he pauses in his profanity to congratulate himself, it takes a new turn and scoops more skin off him, and he commences to evolute anew, and bump himself on fresh places. A man never ceases to fall over a wheelbarrow until it turns completely on its back, or brings up against something it cannot upset. It is the most inoffensive looking object there is, but it is more dangerous than a locomotive, and no man is secure with one unless he has a tight hold of its handles, and is sitting down on something. A wheelbarrow has its uses, without doubt, but in its leisure moments it is the great blighting curse on true dignity.

As the buckwheat season is upon us, the following substitute for greasing the griddle is recommended: Take a turnip, cut in half, rub the griddle with the inner side, and, it is said that, the cakes will come off nice and smoothly, and the housekeeper will be rid of the disagreeable odor of burning fat.

There will be an Exhibition of Science and Art in Bombay, in February, 1873.

THE LYONS EXPOSITION ELEVATED RAILWAY.

During the recent Exposition in the Park of the Golden Head, in Lyons, France, the curiously constructed elevated railway, shown in our illustration, was built to convey visitors from the Bridge of Morand to the gate of the Park. The mode of propulsion, it will be noticed, is very nearly the same as that first introduced in the Greenwich street railway, in this city. It consists simply of endless wire rope passing over drums at either extremity of the route, and actuated by powerful engines. The car is supported on trucks running on the single upper track, and of course can be readily disconnected from or attached to the constantly moving rope whenever it is required to arrest or resume its motion.

THE LYONS EXPOSITION ELEVATED RAILWAY.

This form of railroad, we learn, worked with satisfactory esults over the short distance it was required to traverse. Its safety is plainly apparent, the entire weight of car and load being entirely beneath the wheels, so that no accident can happen except by the track giving way. The single upper rail is strongly made of wood, bolted together with heavy bolts and stays; the lower rail, acting as a guide for the car, is similarly built, and also serves as a brace for the upright pillars. The car was constructed to accommodate from sixteen to twenty people, and made in two sections, the openings being, as shown, in the sides.

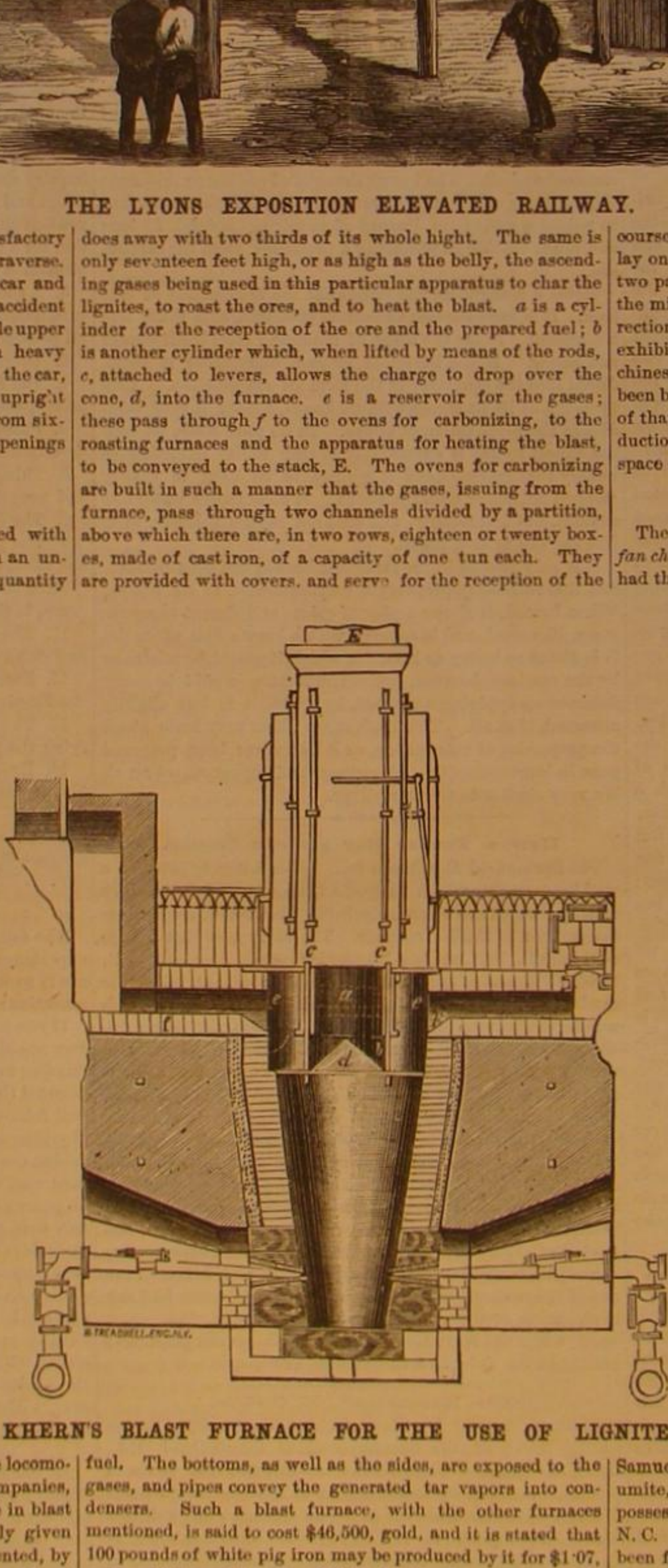
IMPROVED BLAST FURNACE.

The utilization of brown coal or lignite, unmixed with other fuel, for the blast furnace, has thus far been an unsolved problem, it having been used at most in the quantity of one fourth or one fifth of the charge, the remainder being charcoal or coke. When used in larger quantity, it did not produce a sufficiently high temperature, and since it crumbles readily into fragments, its application for the production of iron has thus far been only a limited one. Turner, we believe, first pointed out the necessity of smelting under a high pressure, with hot blast and a larger addition of lime. Mr. A. Eilers, of this city, in a paper read before the American Institute of Mining Engineers, "On the Metallurgical Value of the Lignites," expressed substantially the same ideas. "To burn that material in the blast furnace," he said, "cylinder blasts are required, and perhaps it would also be necessary to close the top of the furnaces, in order to smelt under a high pressure, which may be regulated by the damper in the flue. The extraordinary results thus obtained, in producing high temperatures, by Bessemer are too new to require recalling. Nothing of this kind has, however, yet been tried in the West, but I hope that, during the present year, this subject will be thoroughly investigated."

The subject under consideration is evidently one of immense importance to the great West and Southwest. It is well known that those districts which abound in valuable iron ores are essentially barren, containing but little wood except cotton woods and willows; moreover they are devoid of either anthracite or bituminous coal. Yet there occur vast beds of lignites or brown coal. This coal is mostly of a black color and a resinous luster, and is streaked with brown, but is devoid of any wood structure. According to Professor Newberry, these lignites underlie not less than 50,000 miles in the Great Basin and along both flanks of the Rocky Mountains. At present a great deal of this fuel is being used on the locomotives of the Union Pacific and Central Railway companies, where no high temperature is required; but the use in blast furnaces, for the reasons referred to, is now virtually given up. If a method was discovered, or a furnace invented, by which this fuel could be directly used, namely, without the employment of costly gas generators, it would be of the utmost importance, for the railroad companies could then produce their own rails, and the various industries of those regions, depending on the use of iron, would receive a fresh impulse.

We herewith present an illustration of a blast furnace, invented by Mr. Khern, of Austria, which is said to fulfil all requirements. It is not stated where it is in operation, but should it prove successful, it cannot fail to be of great service to the manufacturer.

The following is a translation from a late number of the *Illustrirte Gewerbezeitung*, relating to this furnace: "Assuming that, in the higher zones above the belly, no alteration of the ores takes place, but that reduction and carbonization only commence in the latter, Mr. Khern accomplishes the preparation of the materials outside of the furnace, and this does away with two thirds of its whole hight. The same is only seventeen feet high, or as high as the belly, the ascending gases being used in this particular apparatus to char the lignites, to roast the ores, and to heat the blast. *a* is a cylinder for the reception of the ore and the prepared fuel; *b* is another cylinder which, when lifted by means of the rods, *c*, attached to levers, allows the charge to drop over the cone, *d*, into the furnace. *e* is a reservoir for the gases; these pass through *f* to the ovens for carbonizing, to the roasting furnaces and the apparatus for heating the blast, to be conveyed to the stack, E. The ovens for carbonizing are built in such a manner that the gases, issuing from the furnace, pass through two channels divided by a partition, above which there are, in two rows, eighteen or twenty boxes, made of cast iron, of a capacity of one tun each. They are provided with covers, and serve for the reception of the fuel. The bottoms, as well as the sides, are exposed to the gases, and pipes convey the generated tar vapors into condensers. Such a blast furnace, with the other furnaces mentioned, is said to cost $46,500, gold, and it is stated that 100 pounds of white pig iron may be produced by it for $1·07, gold, which would make $23·96 for the long tun of 2,240 pounds.



KHERN'S BLAST FURNACE FOR THE USE OF LIGNITE.

In conclusion, we would remark that Mr. Brunner finds the hight of the furnace too low for the complete reduction and carbonization of the ore, but states that coked lignite was used in Austria in the quantity of one third of the charge of charcoal with complete success.

The Marinoni Press.

At the London Internation Exhibition was exhibited a six feeder Marinoni, printing the *Echo*, which is an improvement on Hoe's, and prints both sides of the paper at the rate of about 10,000 sheets per hour, or 20,000 copies of the newspaper, as the *Echo* is worked in duplicate. In its general features, it is similar to Hoe's, but the impression cylinders are, of course, doubled to obtain the printing on both sides of the sheet. The arrangement of flyers for taking off of course dispenses with labor, but six men are necessary to lay on the sheets. Each sheet represents, as we have said, two papers, which are divided by a rotating circular knife in the middle line of the machine, cutting the paper in the direction of its travel. Both this machine and the "Walter" exhibit a very great advance in fast working printing machines, but while the principle of the former has probably been brought as near to perfection as possible, the application of that of the latter is only in its infancy as regards the production of vast numbers of newspapers in an incredibly short space of time.

Twenty Dollar Tea.

The greatest dainty that the palate of a Chinese craves is *fan chow*, the flower of tea. A San Francisco *Chronicle* man had the opportunity, a few days ago, to sip the imperial tea bloom, the priceless beverage of celestial extravagance. Learning that the enterprising firm of Castle Brothers, 213 and 215 Front street, had samples of a very rare tea, he visited the counting room of that firm, was shown the samples, and directed to Tuck Chong & Co., Chinese wholesale merchants, at 739 Sacramento street, for information. Tuck Chong, an urbane Chinese, received the reporter kindly, listened to his request to be shown the imperial leaf, and brought in the priceless luxury in a small and highly ornamental box of sandal wood. The slide lid was pulled out, and six alternate layers of perfumed rice paper and silk were carefully lifted.

Beneath all this covering was a gilded square piece of sandal wood. This also was lifted, and the tea blossom was displayed. Rolled in balls, twisted into tiny, flame-shaped rolls an inch long, twisted very small, tied in little bunches, like cigarettes, at one end and whipped into shreds at the other, was the tea flower, packed in loose petals of its own kind, to preserve its fragrance.

"This," said Tuck Chong, "is a tea that only mandarins of highest rank ever get a chance to drink in China. It is grown on the plantation of a very rich mandarin, in the province of Foo Chow, and can only be gotten from him or his agent in Pekin. There was once a law forbidding its export, but even an American can now buy and drink it. It costs $10·50 in China. My brother brought back a few pounds on his last visit to China. I have none for sale, but it could not be sold in San Francisco for less than $20 a pound."

Flexible Stone.—We are indebted to Mr. Samuel J. Blume, of Nazareth, Pa., for a specimen of itacolumite, or flexible stone, a curious mineral, of which he is in possession of several samples obtained by him in Stokes Co., N. C. In Brazil and the Ural mountains, diamonds have been found in the itacolumite rocks; but, in general, the diamonds are obtained from the soil in the vicinity of the above rocks.

A spring of naphtha has been discovered at Caserta, Naples.

THE GREAT LAXEY WATER WHEEL.

Probably the largest water wheel in the world is that represented in our illustration. It is located at Laxey, Isle of Man, in which village are extensive mines which have now been worked for several centuries, and which are noted for their richness in copper, lead, and silver ores. The deepest workings extend 1,380 feet below the surface, and are drained chiefly by the powerful pumps operated by this immense motor.

The wheel was erected by Mr. Casement, a Manx engineer. It is known as the "Lady Isabella," after the wife of a former governor of the island, and was started September 27, 1854. It is of about 200 horse power, and can pump 250 gallons of water per minute from a depth of 400 yards. Its diameter is 72 feet 6 inches; circumference 217 feet 6 inches. Its breadth is 6 feet, and it has a crank stroke of 10 feet. The water for driving it is brought from a reservoir on a neighboring hill. The wheel and its fittings are, as represented in our engraving, supported on an elegant structure of iron and masonry formed in open galleries.

The only water wheel approaching the one above described in magnitude, in the United States, of which we are at present aware, is that which supplies power to the Burden Iron Works, in Troy, N. Y. This is an overshot wheel, 50 feet in diameter and 22 feet in breadth.

THE GREAT LAXEY WATER WHEEL.

A Suggestion for Electroplaters.

We would throw out a suggestion, says the *Building News*, which has occurred to us in connection with electro gilding, namely, we cannot see why a pattern or ornament (similar in character to the old style called damascening) could not be either printed or penciled upon the articles to be plated, with a varnish or medium which would prevent the deposit of the electro silver or gold upon the parts which it covers, and which would be easily removed after the article has been electro gilt. If this could be done a wide field would be opened up for its application, as, for instance, supposing an article was first plated with silver, and then a damascene pattern was put on the silver in the manner above described, and then the parts left uncovered were plated with gold, we should have a work of art of a very high class, at a comparatively low cost, the pattern being gold upon silver, or *vice versâ*. As to the practicability of the operation, we have no manner of doubt whatever, and, therefore, commend the hint to those whom it may concern.

Envelope Making.

At the recent International Exhibition in London, a series of machines were exhibited by Messrs. Dickenson, manufacturing envelopes from the roll of paper to the finished article, gummed and counted into packets. In this series the web, as the roll of paper is called, is drawn along by suitable rollers and cut into sheets, one of the chief features of the machine being the method of varying the rate of advance of the web, or, in other words, the size of the sheets. On the roll shaft and that of the knife are deeply flanged pulleys, the rings of which are in segments; the radial arms carrying these segments are operated on by wedges attached to a collar which can be slid along the shaft, so that, when the wedges are brought into play, and to just the extent to which they are advanced or withdrawn, the pulley is increased or decreased in diameter. The circumferential proportions of these pulleys are preserved by an ingenious piece of mechanism, so that the driving belt in connection with them is always at the same tension. When the sheets are cut to size they are passed through milling rolls, where they are glazed, and are then piled to about an inch in thickness under a shaping press consisting of a series of punches, which cut the heaps into the shape of an opened envelope. The operations of gumming and folding are accomplished by ingenious mechanism which could not be explained without elaborate drawings. Several machines were exhibited for effecting these operations, one of which lifts each envelope from the heap by a pneumatic plunger, and hands it over to the gumming mechanism. The lip of the envelope is sometimes embossed by the cutters at the same operation as the cutting, but special embossing is performed by a separate machine, as are also the black borders and the folding. As may be supposed, these machines, from their complicated construction, are expensive, but they are models of mechanical ingenuity. Bookfolding and newspaper folding machines were also exhibited, but these do not afford so remarkable a saving of labor and time as to insure their general adoption.

To the New York and New Haven and Hartford Railroad Company is accredited the following brilliant plan for keeping switchmen awake: It is proposed to have the lever of the switch in a sentry box, so arranged that when the switch is open the door is shut and locked, and can only be opened by closing the switch. If a train comes along while the switch is open, it is sure to smash the sentry box first, and the switchman can only save his life by attending to his business. He is not likely to sleep much when trains are due on his track.

TURNING THE TABLES.—An Irish gentleman, of a mechanical turn, took off his gas meter to repair it himself, and put it on again upside down, so that at the end of the quarter it was proved that the gas company owed him £3 7s. 6d.!

PITTSBURGH has eleven blast furnaces in operation. At present prices of iron the proprietors of these furnaces must be a cheerful class of persons.

Continuous Expansion Engines.

At a recent meeting of the London Association of Foremen Engineers, Mr. Nicholson referred to the continuous expansion engine, made by Mr. John Stewart, Blackwall Iron Works, which, he stated, is the only engine on the compound principle now in the market as a competitor to the Woolf machine. The steam is worked in a different channel from any other engine. It is cut off at about half stroke on the small piston. At the time the small piston passes the cellular ports in the sides of the small cylinder, the two pistons begin to share the steam between them. At the same time they begin to expand the steam, when the small piston has finished its up or down stroke. The large piston continues to expand the steam until nearly at the end of its stroke, which causes it to be, as its name indicates, really a continuous expansion engine. The steam is a less time exposed to the atmosphere than in the ordinary compound engine; it gives out a steady motion, and each cylinder can be worked separately at pleasure, which is a great consideration in case of a break down.

This engine is applicable to all purposes, and more particularly where a steady motion is required, such as flour or cotton mills. It is nearly as economical when working non-condensing—commonly called high pressure—as the ordinary condensing engine, and is well adapted for American rivers. The steam could always be worked to within one pound of the atmosphere, and no more noise would be heard than from a condensing engine.

The difference between the continuous expansion engine and the ordinary compound engine is that, in the latter the steam has to expand in the first cylinder until nearly the end of the stroke: then the steam passes to the second cylinder. If cut off at half stroke, the steam would then be half of the boiler pressure, before it entered into the apertures prepared to receive the steam previous to acting on the second piston. In the continuous expansion engine (the steam going through a different channel, and as soon as the piston passes the cellular ports in the side of the first cylinder, the two pistons sharing the steam between them), it is therefore absolutely necessary to proportion the engine with minimum ports and not to throttle, in order to get the maximum power. That is the reason why the hollow valve or traveling steam chest is introduced between the two cylinders, to receive the steam from the first and pass it to the second. The steam does not enter the chest; it passes through the hollow valve, which is nothing more than the continuing of the steam ports from the one cylinder to the other. Both pistons are running in the same direction, and the pressure of the steam on the large piston is just in proportion to the space that is filled; the smaller the spaces, the greater the pressure, that is, minimum spaces and maximum power. In the compound or, rather, Woolf system of working, the greater the pressure on the large piston, the greater the resistance on the small piston. Not so in the continuous expansion engine. Instead of a resistance, there is a great assistance by a vacuum being formed in the first cylinder as well as the second. Very long stroked engines, working from 12 to 14 strokes per minute, would not give such good results by being connected to the condenser; but engines running from 60 to 100 strokes do not allow time enough for the cooling to take place in the cylinder; therefore the continuous expansion engine will give out considerably more power with the same area than any other compound engine yet discovered.

A CORRESPONDENT, J. W., of Ill., in writing on the criminal negligence of large corporations, states that the superintendent of a railroad in his State has been heard to say, when applied to for employment: "Wait a while; there will be a vacancy soon. We kill or cripple a man every day."

THE PROGRESS OF CHEMISTRY IN 1872.

The year that has just closed has not introduced to us any startling discovery, or produced an invention which is likely to work a revolution in any art; but it has added its fair share to the general stock of knowledge, and its contributions may be said to compare favorably with those of times past. It may be well to review some of the most conspicuous chemical events of the old year, in order to make a fair beginning on the new. The continuous and economical manufacture of chlorine gas, directly from hydrochloric acid without the intervention of manganese dioxide, as proposed by Deacon, has been improved and perfected during the year, and may be set down as one of the most important contributions to chemical technology of recent times. A heated mixture of atmospheric air and hydrochloric acid gas is made to pass through tubes filled with fragments of brick saturated with a solution of sulphate of copper, or is driven through a reverberatory furnace, the floor of which is covered with bricks filled with a copper salt, and at a temperature of 370° to 400° C. The hydrochloric acid is thus decomposed and chlorine gas is liberated. If the heat be increased to 425° C. considerable chloride of copper is volatilized and there is a considerable loss of the reducing material. The importance of an invention of this character can readily be appreciated by all who are familiar with the enormous consumption of chlorine in England and this country. Hydrochloric acid may be said to be an incidental product in England, and it has therefore long been employed in the production of chlorine by the manganese process. To enable the manufacturer of bleaching powders to dispense with manganese and substitute a continuous copper method constitutes the chief merit of Deacon's invention.

The artificial production of alizarine from coal tar, which merely dawned upon us a year or two since, has, during the past year, been brought up to the standard of a commercial success. The reasoning by which the inventors of artificial alizarine arrived at their results is one of the best illustrations of the value of applying real scientific training to the solution of technical problems. Two chemical manufacturers in Germany, Messrs. Graebe and Liebermann, in their study of a class of bodies called *quinones*, came to the conclusion that alizarine was one of them, and to prove this, they passed the vapor of natural alizarine obtained from madder over heated zinc dust, and obtained a product which proved to be in every way identical with anthracene. Having made anthracene from alizarine, the next step was to reverse the process and produce alizarine from anthracene; this they were finally enabled to do in a circuitous manner, but sufficiently economically for commercial purposes. Artificial alizarine is now largely made and employed as a substitute for the natural Turkey red of the madder root. Attention has consequently been called to anthracene, which, occurring in small quantities among the products of coal tar distillation, has not been hitherto much studied or appreciated. The demand for it as a source of color has invited the study and invention of chemists, and during the past year, Messrs. Fenner and Versmann have discovered more economical methods of preparing it from pitch as well as tar, and there is every indication that they may be able to separate it commercially from the native asphaltum of Trinidad. Thus anthracene, which few persons have ever seen or heard of, bids fair to become an article of large manufacture for use in the production of colors. There are so many articles of value which are now made from coal tar that it is safe to predict that, if it were not incidentally produced in the manufacture of illuminating gas, we should soon have works started to give us the tar required in numerous industries. It is not many years since the tar of the New York gas houses was allowed to run away into the North river. It would certainly be curious to see works created to manufacture it, while the gas was allowed to escape into the air. Such a reversing of the ancient order of things is not impossible, however improbable it may seem. At the present time, there are fifty-six distinct products resulting from the distillation of coal. Only a few of these are of direct practical value, a majority of them being less known than was anthracene a year ago. Every year witnesses the picking up and utilizing of one or more of these compounds; and if chemists did not continually add to the number, we might hope before many years have passed to get through the entire list.

There is another product of Nature which has received great attention during the past year, and that is cellulose. The chemical properties of cellulose have long been understood, and its use in many arts dates back to remote antiquity; but nevertheless it has been subjected to close scrutiny in late years, and its applications have been proportionately extended. We have paper, gun cotton and clothing made from cellulose; and during the past year, we find it taking the place of parchment and membrane for many purposes; and, as a good solvent has been found for it, it is made into strong bands to be employed as substitutes for leather, and is applied to the manufacture of roofing, gas pipes, water conductors, safety fuses, hats and boots; and the best photographic collodion is now made from precipitated cellulose. These are only the beginning of the purposes to which it is safe to predict that cellulose will some day be applied.

The chemistry of fermentation has been the subject of considerable controversy during the year, and Pasteur, the champion of the germ theory, has invented a new process for brewing beer, which is attracting much notice in this country and Europe. We gave a full description of it a short time since. According to Pasteur's process, the fermentation is accomplished with the exclusion of the air, and thus the deterioration due to the absorption of oxygen is avoided. It remains to be seen whether the French "revenge beer" will eventually drive the German lager from the market.

In the economical use of furnace slags, there has been much improvement during the year. The unsightly accumulations about blast furnaces bid fair to disappear; and by degrees, we shall see the slags worked up very much as the waste tar has been, after many years of study. The slags are useful for glass, for cements, for fluxes, for artificial stone, for alum, for fillings, and for the production of chemical salts. Many German furnaces now sell them for a moderate sum, which will doubtless be increased as new uses are discovered. The progress in this direction during the past year is one of the most satisfactory we have to record.

The interest attached to nickel plating has in no way flagged; but, on the contrary, the processes have been greatly improved and the application of the art has been extended in all directions. One of the most important improvements has been that of nickel plating for facing type. The hardness of nickel makes it very desirable for this purpose.

In the direction of tanning, we have recorded a few inventions; and the attention of chemists to the best methods for obtaining concentrated extracts of tannic acid is meeting with encouragement.

The general topic of disinfectants and antiseptics has been discussed and experimented upon, but not much valuable information has been added to our previous store of knowledge. The distinction between a disinfectant and an antiseptic is now better understood, and as the paths of investigation are cleared of rubbish, we may anticipate important discoveries in this line in the future.

The cheap production of hydrogen was announced by Du Motay, and the oxyhydrogen illumination of the same inventor still struggles on without finding acceptance among gas men. The ozone generators which are in the market do not offer this modified oxygen cheap enough to admit of its use as a bleaching agent. But ozone is still claiming a large share of attention. Houzeau quite recently invented an ozonizer, described in these columns last summer, similar to the one exhibited at the last fair of the American Institute. Now comes M. Boillot with a new and improved form of ozonizer constructed as follows: A tube 13 inches long and ½ an inch in diameter is covered externally, for 11 inches, with powdered coke attached with gelatin. Another tube 11 inches long and ¼ inch in diameter was similarly covered with carbon and placed within it, and both enclosed in an outer tube of glass. A current of oxygen was passed between the cylinders, one tube was connected with one pole of an induction machine and the other with the other pole, and a silent discharge kept up for several hours. A large quantity of ozone was thus obtained. P. Thénard publishes a method of measuring the ozone produced by determining the amount of arsenious acid that it is able to convert into arsenic acid. This test might, perhaps, be used in comparing the results produced by various forms of ozone generators. The peroxide of hydrogen, which is also a powerful oxidizer and is likely to be of great use if any easy and cheap method of preparation can be discovered, does not convert arsenious into arsenic acid, and hence there is a readily noticed distinction between them.

H. Struve has noticed that, when freshly precipitated carbonate of barium is exposed to a low red heat, a small quantity of peroxide of barium is formed, which, on being treated with water and carbonic acid, forms peroxide of hydrogen.

In the manufacture of aniline dyes, we are glad to notice that, although it is still impossible to produce aniline red on a large scale without arsenic, this disadvantage is partially overcome by preparing some of the colors directly, which can be accomplished without arsenic, instead of making them from the aniline red which seems necessarily to contain arsenic. W. F. Gintle has found cheap aniline dyes adulterated with sugar, which he detects with a lens, the color and shape of the crystal being sufficient to distinguish them.

Under the general head of sugars, we find Casamajor recommending the use of subacetate of lead in place of bone black for obtaining colorless solutions to be used for polarimetric analysis. The manufacture of starch sugar, free from gum, for the preparation of spirit coloring, is accomplished in the usual manner, boiling with sulphuric acid; but the boiling is continued 5 to 8 hours after the liquid has ceased to show starch reactions with iodine, or till a portion of the liquid remains clear when mixed with one sixth volume of 96 per cent alcohol. For beer and liquors not stronger than 30 to 50 per cent, commercial starch sugar will answer. It is first heated until it begins to burn, and one fiftieth its weight of carbonate of ammonia stirred in.

Bone black ignited in a current of hydrogen possesses equal decolorizing power with the ordinary charcoal, so that this power cannot be due to condensed oxygen in the pores.

Another new anæsthetic has been discovered, to which Romensky gives the name of trichlor-hydrin, $C_3H_5Cl_3$. It occupies an intermediate place between chloroform and chloral, as it can be either inhaled or given by the stomach. Its action when inhaled is slower than that of chloroform, and given in the stomach, it produces gastro-intestinal irritation.

Carefully conducted experiments with *phénol* (carbolic acid) continue to sustain its well merited rank of queen of the disinfectants. Its physiological actions were found to be similar to those of strychnin.

The crude ammonia salts resulting from the purification of coal gas are frequently found to contain sulphocyanates which render them unfit for manure. In some cases, the amount of sulphocyanate of ammonia present was sufficient to destroy the crops where it was applied.

M. Gorceix has directed his attention to the gases given off by Vesuvius and other volcanoes. Analyses show that the composition varies daily, most of it being carbonic acid mixed with a little sulphuretted hydrogen.

The phosphorus in iron ores, which is highly injurious, may not only be removed so as to render the iron fit to smelt for pig iron, but can itself be utilized, according to Jacobi, by treating the ore with a solution of sulphurous acid. The insoluble basic phosphates are converted into soluble acid phosphates, which are precipitated by lime, and used for fertilizing or other purposes.

The experiments of Weiske-Proskau and Wildt have contradicted the former supposition that considerable quantities of earthy phosphates mixed with the food were deposited in the bones.

Transparent stereoscopic pictures can now be made on well sized albuminized paper, sensitized as usual, but laid for exposure with the side not made sensitive and not albuminized on the negative. Print rather strongly and tone as usual, the tone being judged of by the transparency.

Several new methods for concentrating sulphuric acid have been proposed. Carlier recommends passing steam of three atmospheres pressure through leaden worms lying at the bottom of wooden tubes lined with lead inside, and filled with acid of sp. gr. 1·5 which, as soon as its gravity has risen to 1·7, is transferred into another wooden tank of the same kind.

We have thus given a few of the topics of interest that have attracted more than usual notice during the year, and the reader will see that our statement made at the outset, that, while no startling discovery has been made, the progress in past discoveries has been important and useful, is justified.

A GIGANTIC FIRE ENGINE.

The city of New York, occupying as it does the narrow tongue of land washed on one side by the Hudson and on the other by the East river, may be said to stand in the very midst of water; but, strange to say, this most abundant supply is rarely made use of for the extinguishment of fires. We fill our fire engines with water brought in pipes from a lake distant some forty miles from the city—a source which is always liable to be cut off or diminished at the moment of greatest necessity.

The idea of employing stationary engines located near the rivers, for the purpose of sending strong streams of salt water through the city, for use in the event of fire, has been frequently suggested by prominent engineers, but has never been carried out. We are pleased to notice, however, that an experimental beginning is about to be made, the success of which may have an important influence in the improvement of our fire department.

Messrs. A. S. Cameron & Co., the well known steam pump builders, in East 23d street, this city, have lately obtained permission from the municipal authorities to lay a six inch water pipe from their factory to the river, for the purpose of drawing salt water, for use in case of fire. They are placing a large Special steam pump in their works, fitted with discharge pipes, and have so arranged them as to command not only their own building, but also those adjacent, including the Corporation yard. The pump is intended exclusively for fire purposes, and will be of the capacity of about three first class city fire engines. This great pump will be supplied with water from the river as stated.

The work is being done entirely at the expense of Messrs. Cameron, and it will furnish an example of the availability and advantage of salt water for protection against fire in this city. The extensive business of Messrs. Cameron requires them to have a pressure of steam, and watchmen on hand at all times, so that the great pump can be put in operation at a moment's notice.

Steam versus Fire.

The following facts, clipped from the *Boston Advertiser*, are from the report made to an insurance company over twenty years ago, on the application of steam to the extinguishment of fires. Steam possesses decided advantages over water, as it is not so liable to injure goods or furniture, while it can penetrate to places which a stream could not be made to reach.

The experiments were made in a large mill, through which suitable pipes and connections had been laid, communicating with the different rooms. A box of waste cotton was ignited in the second story, making a fierce blaze. Steam was turned on, filling first the upper stories and finally reaching and completely extinguishing the blaze. After trying this experiment with dry cotton several times, lamps were lighted and placed in various positions on the stairs and floor, with the wicks very high, producing strong flames. It was remarked that each lamp, as the steam reached it, was immediately put out.

Steam, it was shown, can be let into any and every part of the mill in much less time than water could be under the best arranged water mills. In case of fire, the steam is attached to or upon every surface in all positions, and will follow fire into every recess, hole, or crack. It will, in fact, precede the flames, and, covering everything in its course with water, prevent their spread.

THE new scheme for a network of tramways, proposed by an American company for the city of Berlin and its environs, has been sanctioned by the Minister of Public Works, by a concession. It comprises an encircling line round the ancient *enceinte* of the town, with various suburban routes branching out therefrom, to the number of nine. But, singularly enough, not one of these lines is prolonged into the center of the city; and it is considered that, short of their extension to a common center in the heart of the city, the full benefit of the system can hardly be realized.

SCIENTIFIC AND PRACTICAL INFORMATION.

UTILIZATION OF FATTY MATTER FROM THE WASHING WATERS OF CLOTH FACTORIES.

For spinning every 100 lbs. of washed wool, 12 or 14 lbs. of oil (mostly olive oil) are required; and extensive cloth manufactories use for fulling 50 or 75 tuns of soap, each, yearly. There are, annually, 25,000 tuns of washed wool spun in Austria, and almost 3,500 tuns of oil are consumed; the oil is valued at two millions and a half florins. This quantity which, until lately, has been entirely wasted, is again separated by fulling with soap. A writer describes a process in operation in Brünn, near Vienna, for saving this waste. It has been in operation for four years, and consists of the following manipulations: The soap water is collected in a reservoir from which it is pumped into a wooden tub. Sulphuric acid of 66° B., diluted with three times its volume of water, is then added under constant stirring, until the soap is perfectly decomposed. The fatty acids rise to the surface and, when cool, are collected, put into bags, and are subjected to high pressure in order to separate the water as much as possible. After a few hours the bags are emptied, and the mass, which in the meanwhile has become consistent, is formed into cakes, to be molten at a temperature of from 350° to 400° Fah. and pressed again. The thus-gained product is mostly used for the manufacture of soap, and it is estimated that the value of the material thus reclaimed amounts in Austria alone to 350,000 florins.

CHEMISTRY IN THE WORKSHOP.

H. W. Behse has just published a book, entitled "*Die Chemie in der Werkstatt*" (Chemistry in the Workshop) which we should like to see translated. A review says: "Chemistry, more than any other science, is called upon to shed light upon the darkness yet prevailing in many technical manipulations, in order that the manufacturer, guided by theoretical knowledge, may not only operate with more certainty, but may also obviate failures with more reliance. The author has solved this problem in the most meritorious manner."

REFINING GOLD BY CHLORINE GAS.

The application of chlorine to the refining of gold, as some of our readers may be aware, consists in passing a current of chlorine through the molten metal covered with borax. In a few minutes the silver present is converted into chloride, which floats on the surface, while the chlorides of lead, copper, antimony, and arsenic escape. The fineness of the gold produced in this way varies from 991 to 997 in 1,000 parts; the few remaining thousandth parts of the product are silver, a quantity which is less than that resulting from any of the previously known processes. E. Dumas informs us that in the Mint in London as much as 750,000 kilogrammes of gold have been refined and toughened by the process, one kilogramme being 2·2046 lbs. avoirdupois. The apparatus is in use for only three days per month, and the cost of the chlorine gas is only from four to five francs for refining 5,000 kilogrammes of the gold. In order to refine 40 kilogrammes, a current of the gas for five minutes' time is sufficient. The silver is found in the borax covering the gold.

NEW PROCESS FOR EXTRACTING GOLD AND SILVER FROM COPPER PYRITES.

This method, invented by F. Claudet, is based upon the insolubility of the iodides of gold and silver. After the pyrites have been desulphurized by the addition of salt, they are placed in a barrel with a false bottom and lixiviated with acidulated water. The wash water consists of sulphate of soda, chloride of copper, and some chloride of silver. From this liquor the copper may be precipitated in a metallic state by means of sheet iron or iron scraps; but if the noble metals are to be separated, the waters from the three first extractions are collected, and the requisite quantity of iodide of potassium in solution is added to them. After having been left undisturbed for twenty-four hours, the clear liquor is drawn off, the vessel is then filled again, and iodide of potassium is added (in short, the operation is repeated) until a sufficiently large quantity of precipitate has collected. This contains sulphate of lead and copper salts, besides the iodides of gold and silver. The salts of copper are washed out, whereupon the residue is mixed with zinc, in a finely divided form, which combines with the iodine. Hence the result is a mixture of gold, silver, lead, and some oxide of zinc, from which it is easy to separate the noble metals. Claudet produced in 1871, by this process, from 16,300 tuns of desulphurized pyrites, 333·242 kilogrammes silver, and 8·172 kilogrammes gold, at a net profit of $16,160.

DYEING SHODDY WOOL BROWN.

The advantage of the process here described consists in that the operation can be carried out in one vat. One hundred lbs. wool are left for half an hour in a boiling bath containing 30 lbs. yellow wood, 3 lbs. alum, 2 lbs. crystals of tartar, and 1 lb. sulphate of copper. After that time, one pound chromate of potash and three quarters of a pound of a solution of rosain in hydrochloric acid are added to the bath, which is now kept gently boiling. By the addition of turmeric, various shades may be obtained. Logwood will darken them, 6 lbs. of logwood and 10 lbs. of turmeric being recommended for 100 lbs. wool. The term rosain applies to a waste product obtained in the manufacture of aniline red.

DYEING SHODDY BLUE.

In this method, half woolen threads are destroyed by muriatic acid; the acid is then neutralized by chalk, and the fabric is well washed and dyed. One hundred pounds require one pound of chromate of potash, one pound sulphate of copper, five pounds alum, one pound crystals of tartar, and one pound oil of vitriol, which are dissolved in the vat, the goods being left in the boiling liquor for half an hour. The goods are then boiled in a fresh bath containing 25 lbs. logwood, to which half a pound of "shoddy" carmine and a quarter of a pound of rosain are added, the liquor being left boiling for another half hour. The so-called shoddy carmine is prepared by dissolving in hot water twelve pounds alum, nine pounds indigo carmine, and three pounds of soluble aniline blue, and stirring until cool. This carmine is very suitable for dyeing ordinary wool.

DETERMINATION OF IRON IN BLAST FURNACE SLAGS.

This method is recommended as being free from the objections belonging to the generally known systems of analysis. The finely pulverized slag is mixed in a platinum crucible with three or four times its quantity of fluoride of ammonium. The crucible is first heated in the water bath under gradual addition of sulphuric acid; and when the boiling has ceased, it is heated in the sand bath until the acid commences to evaporate. Upon cooling, water is added; the insoluble residue is put on a filter and washed out, until the washing water ceases to indicate iron. It is now heated in a balloon with some zinc, so that the peroxide may be reduced to protoxide; and when this is the case, the iron is determined by volumetric analysis in the generally known manner.

RECENT PATENT DECISIONS

Locking Nuts.

APPEAL OF PETER CAMPBELL.

LEGGETT, *Commissioner:*

Applicant fully sets forth his alleged invention in his claim, which is—

A nut lock composed of a portion of the metal of the nut, projecting into a recess in one of the threads of the bolt, said recess being formed and the metal forced into it at one operation.

It is obvious, upon mere inspection of this claim, that it does not cover a patentable invention. Applicant cannot make such a nut lock as he describes so as to be ready for use or sale in the market. His invention, then, is not a device or article that he can offer to the public as complete for their use. It is only a process that he presents, which every man must apply himself to secure the result contemplated. In other words—every man must make his own fastening, upon the plan proposed, every time he wishes to employ it. The process merely is all there is in the case, and that, as shown by the reference cited—patent of A. D. Smith, No. 78,899—is old. There is nothing new or patentable in this application in view of the reference, and the decision of the Board is, therefore, affirmed.

Ladies' Hoopskirts.

APPLICATION OF SAMUEL PEBERDY FOR EXTENSION OF PATENT NO. 22,197, GRANTED NOVEMBER 30, 1858. DECIDED NOVEMBER 27, 1872.

Extension refused where only five per cent of the net profits to arise from the extended term were to go to the inventor, and ninety-five per cent to assignees.

United States Circuit Court---Southern District of New York.

Machines for Pegging Shoes.

GALLAHUE *et al.* vs. BUTTERFIELD.

Before WOODRUFF, Circuit Judge.

A suit in equity, brought by Alpheus C. Gallahue and Eli Bennet against William Butterfield, for the infringement of certain letters patent on shoe pegging machines, granted the complainant, Gallahue, on the following dates, respectively, namely, August 16, 1853, and reissued July 6, 1869; March 29, 1859, and reissued June 22, 1869; and August 26, 1862.

Patent sustained. Decree for plaintiffs granted.

Keller & Blake, for complainants.

G. L. Roberts, for defendant.

United States Circuit Court--District of Massachusetts.

SMITH vs. NICHOLS.

WM. SMITH'S PATENT FOR IMPROVEMENT IN CORDED ELASTIC FABRICS—INVENTION DISTINGUISHED FROM MERE SKILL IN CONSTRUCTION.

A suit in equity under the patent involved in the various cases, Smith vs. Elliott, same vs. Warren *et al.*, etc., tried heretofore, the claim of the patent in the present case, however, being modified by a disclaimer filed in May, 1872.

The case was heard by Mr. Justice Clifford, of the Supreme Court, and his honor Judge Lowell.

Upon the whole we feel constrained to agree with the opinion of the learned circuit judge of the second circuit, that the old webbing was a fabric of like kind with the complainant's, and that the improvement, important though it is, must be held to be due to the skill and sagacity with which the mode of operation, by which that webbing was made, has been adapted and applied by the plaintiff, by the use of better materials and a more careful weaving, but not by the exercise of the invention requisite to enable him to claim the product as a fabric before unknown.

Bill of complaint dismissed.

T. A. Jenckes, for complainant.

B. Dean and *B. R. Curtis*, for defendant.

The Hop Preserving Patent Case.

To the Editor of the Scientific American:

In your issue of 7th December, I find *in extenso* the decision of the Acting Commissioner in the matter of the interference between the application of Benjamin Bates and the patent of Seeger & Boyd.

Decisions of the Commissioner have not unfrequently contained extra judicial opinions derogatory to the validity of existing patents. Whatever of evil there may be in this practice is vastly augmented by the greatly increased publicity now given by the publication of these decisions in the *Patent Office Gazette*, the SCIENTIFIC AMERICAN, and other journals. Extra judicial opinions are objectionable at any time, and in this case the strength of expression amounts to a grievance. On behalf of my clients, and all other honest patentees, I enter my protest.

The patent, being already granted, is beyond the jurisdiction of the Commissioner. He can say nothing to impair its validity; but his words may encourage infringement and incite litigation. A patent receives validity only through the signature of the Commissioner; its issue is his act; and for him to assert that a patent is illegal and fraudulent is to stultify his own record. A patent granted is property. To stigmatize as fraudulent that in which a citizen has a vested interest, proclaims to the country that the right in that property may be set at nought with impunity; but the Commissioner has no power to protect such persons as may, ignorantly relying upon official expressions of the Commissioner's opinions, infringe that patent.

In the present instance, the Commissioner characterizes as fraudulent, and unworthy to be called invention, a matter which had twice been passed upon by the Examiner, and had passed the Examiner of Interferences and the Board of Examiners in Chief, without any challenge of this sort. In matters of issue, on appeal to the Commissioner, the law makes his judgment of superior force; but in matters of pure and gratuitous opinion, destitute of legal force, such expressions, when officially made, are, to say the least, not in good taste.

Misconception of Seeger and Boyd's patent has led the Commissioner into this error of judgment; but it is none the less objectionable on that account. A patent is not invalid because no special skill is required to work it, or because a child can exercise it, or because there is no evidence of inventive genius. Simplicity is generally regarded as a merit rather than a demerit. A patent is not granted for inventive genius, as many have found out,—or for special skill, or for what requires bodily strength; but for some new or improved art or thing wherefrom the public may derive benefit.

That the thing claimed by Seeger & Boyd is both new and valuable as an acquisition to trade, is not questioned by the Commissioner; he should have, therefore, confined his decision to the question of priority, which was the only issue before him.

R. D. O. SMITH.

Washington, D. C., Dec. 3, 1872.

NEW BOOKS AND PUBLICATIONS.

GEMS OF GOLDSMITH. With Notes, Illustrations, and a Sketch of the Author's Life. New York: Samuel R. Wells, 389 Broadway.

An admirably printed edition of "The Traveller," "The Deserted Village," and "The Hermit," with excellent engravings. It will make a most acceptable present for the season, and deserves commendation as a beautiful production of three masterpieces of one of the purest and most elegant of English writers. We should like to see a complete edition of the works of the talented but erratic Goldsmith, published in a style similar to this little book.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From October 22 to December 5, 1872, inclusive.

COUPLING CARS.—J. C. Morton, Boston, Mass.
CUTTING GLASS, ETC.—C. W. Lewis, New York city.
CUTTING HARD SUBSTANCES.—B. C. Tilghman, Philadelphia, Pa.
GORING FOR BOOTS, ETC.—C. Winslow, Boston, Mass.
GRAIN SEPARATOR.—A. Hunter, E. H. Osborn, Quincy, Ill.
GRINDING MACHINERY, ETC.—A. Assman, Linden, N. J.
LEVER AND SCREW PRESS.—G. B. Boomer, Syracuse, N. Y.
MAKING BARROWS.—W. Barr, Jersey city, N. J.
MAKING BRICKS.—I. Gregg, Philadelphia, Pa.
MAKING GAS, ETC.—T. A. Howland, C. G. McKnight, Providence, R. I.
MAKING IRON TUBES, ETC.—E. Wheeler, Philadelphia, Pa.
MAKING STEEL.—T. Brooks, Minerva, Ohio.
MALLEABLE CAST IRON, ETC.—J. M. Roberts, Burlington, N. J.
MOTOR FOR SEWING MACHINES, ETC.—G. W. Manson, New York city.
PISTON PACKING.—J. C. Furness, Boston, Mass.
PRINTING MACHINE.—E. L. Ford (of Brooklyn, N. Y.), London, England.
PRINTING, PRESSING, ETC., MACHINE.—E. L. Ford, New York city.
PRINTING TELEGRAPH.—E. Gray, E. M. Barton, Chicago, Ill.
PUMPING ENGINE.—E. Cope, J. R. Maxwell, Cincinnati, Ohio.
RAIL JOINT.—J. McL. Staughton, Riverton, Ky.
RAISING SUNKEN VESSELS.—H. F. Knapp, New York city.
ROCK DRILL.—A. C. Rand, J. B. Waring, New York city.
SEWING MACHINE, ETC.—J. L. & D. H. Coles, New York city.
SEWING MACHINE.—R. Whitehill, New York city.
SHEET METAL CANS.—G. H. Chinnock, Brooklyn, N. Y.
SHOE PEGS.—J. H. Oliver, M.D., Baltimore, Md.
SHUTTLE SPOOL.—T. H. Dodge, Worcester, Mass.
SPINDLE BOLSTER.—C. F. Wilson, J. E. Folk, Brooklyn, N. Y.
SPINNING MACHINERY.—E. Freeman, Norton, Mass.
STEAM PUMP.—W. C. Selden, Brooklyn, N. Y.
STENCH TRAP, ETC.—N. Thompson, Brooklyn, N. Y.
TELEGRAPH.—S. F. Van Choate (of Boston, Mass.), London, England.
UTILIZING HYDROCARBONS, ETC.—P. F. Goodrich, San Francisco, Cal.
VENTILATOR.—S. C. Maine, Boston, Mass.
WATERING LOCOMOTIVES.—W. E. Prall, Washington, D.C.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

WASHING MACHINE.—George Washington Mollineaux, Marble Hill, Mo.—The invention consists of a pair of horizontally reciprocating washing or rubbing boards, suspended adjustably from slides upon the cover, with their rubbing surfaces on the under side, to work on the top of the clothes, which rest on a stationary ribbed board, and the sides of the tub are provided with vertical ribs for acting upon the clothes. The rubbing boards are suspended from a vertically adjustable cross head, mounted on rods rising up from the slides, and held down upon the clothes with the required pressure by friction pawls on the cross head, held on the rods by springs. The slides are worked by a lever pivoted to the top of the tub between them, so as to work them simultaneously in opposite directions. The top of the tub is hinged at one end, and held fast at the other end by a yoke, which is readily disengaged to allow the top to be lifted. The slides and rubbers swing out of the tub when the cover is raised, to facilitate the adjustment of the clothes.

WASHING MACHINE.—Ira B. Stillman, Almond, N. Y.—This invention relates to that class of washing machines in which the washing is performed by passing the clothes between a set of rollers held to their work by spring power; and it consists in the construction of the pressure spring, whereby a greater range of elasticity is effected than has been gained by springs heretofore used, and in the manner of adjusting the said spring to the different degrees of pressure required. It also consists in a device whereby the machine may be readily and securely attached to and conveniently detached from the tub or other vessel in connection with which it may be desired to be used.

BLOTTING, RULING AND CUTTING IMPLEMENT.—Hugh S. Ball, Spartanburg, S. C.—This invention has for its object to furnish an improved ruler, blotter and paper cutter combined, which shall be so constructed that it may be used with as much facility as a ruler, blotter, and paper cutter as if it were constructed especially for each of said uses. It consists in a plate of light sheet metal, of suitable length and breadth, the sides of which are bent downward so as to hold in a semi-cylindrical form a sheet of india rubber which is covered with blotting paper. A narrow strip of metal soldered to the sides of the device serves as a paper cutter. When the blotting paper becomes soiled it may be easily replaced.

WASH BOILER.—Wellington H. Lines, Cannonsville, N. Y.—This boiler is designed to cleanse the clothes by means of boiling water elevated by means of steam pressure and discharged upon the top of the clothes. The operation is as follows: Water or suds sufficient in quantity to fill a lower compartment is introduced into the boiler, which passes down through a valve tube. The clothes are then put in. When heat is applied to the bottom of the boiler and steam generated, the ball valve will be forced up and will close the top of the tube, and the water will rise in the outside tubes and be discharged on top of the clothes. This water will pass down through the clothes, and will accumulate on the bottom till it will in a few seconds overcome, by its weight, the pressure of steam on the valve. The latter will consequently fall, and the water will return to the lower compartment. When the steam accumulates the valve will be again forced up and close the top of the tube, and thus intermitting action will be repeated every few seconds. No water is allowed to pass upward except through the outside tubes. This action is kept up as long as may be required to thoroughly cleanse the clothes.

WATER ENGINE.—James H. Connell, Elizabeth, N. J.—This invention consists of an arrangement of the piston rod for filling up the space in the cylinder to economize water. It also consists in an arrangement of the piston and piston rod packing to simplify the cost of construction and utilize the water pressure for packing. It also consists of a combination of a valve and pipe connection with the valve chest, whereby the flow of water may be directed through it while the crank is passing the dead centers, so that the shocks common to the ordinary engines by the sudden stoppage of the water column will be avoided; and it also consists of the combination of an air chamber with the valve chest of a water engine, also with an escape valve for neutralizing these shocks more completely than can be done with either alone.

ROTARY ENGINE.—Truckson S. La France, Elmira, N. Y.—The invention relates to the packing pieces which are affixed to the ends of cogs in rotary engines, and consists in a peculiar construction and application thereof. By making the piece wider at the bottom than at the top, the inventor obtains extra surface, against which the stream may act, thus insuring a positive movement. The piece being beveled is loose, movable, and cannot stick fast when the expansion takes place. While the cog wheel is running in hot steam the packing piece is pushed down into the groove, and when the wheel is contracted by cooling, the springs push the pieces out against the case. Thus it is tight under all circumstances. This cannot be accomplished with a straight packing piece.

REFRIGERATOR.—J. Hyde Fisher, Chicago, Ill.—This invention relates to a new and useful improvement in refrigerators, having particular reference to a refrigerator for which letters patent of the United States were granted the inventor, dated August 1, 1865, and reissued the 31st day of January, 1871, which present invention consists mainly in an air space beneath the ice chamber, in the double bottom, between the ice chamber and the refrigerating or provision chambers, the lower portion of the bottom being of wood and the upper portion being metal. The air space being separated from the ice by only the metallic portion of the double bottom, the air therein partakes of the temperature of the ice, and assists in keeping up the circulation.

CASE FOR WRITING MATERIALS.—George B. Chase, Austinburg, Ohio.—This invention relates to a new case or box for the reception of pen, ink, paper, etc., and consists in providing a groove under the bottom of the narrow box for the insertion, transversely, of the cover, so that the cover will, when the box is opened, aid in supporting the box in an upright position.

RAILROAD RAIL JOINT.—Thomas Slaughter, Lawrence, Mass.—This invention is designed to fasten the fish plates and rails of railway joints together and to serve as a substitute for bolts and nuts. Holes are cut through the plates, flared large at the openings. In these are inserted gibs and, within or between the gibs, wedges are driven so as to bend the gibs against the tapering wall of the hole. The tapering ends of the gibs are bent around the keys to prevent their working out.

CONNECTING ROD.—Samuel N. Wate, Jr. Danville, Pa., assignor to himself and P. J. Adams, of same place.—This invention has for its object to improve the construction of the connecting rod described in letters patent No. 128,831, granted to the inventor and P. J. Adams, July 9, 1872, so as to make it simpler in construction and neater in appearance. A long strap passes around one end and along the side edges of the body of the rod. A short strap passes around the other end of the rod, and its ends overlap the ends of the long strap. A bolt or bar passes through slots in the end parts of the long strap through holes in the end parts of the short strap, and rests in a slot or notch in the end edge of the main body of the rod, and is secured in place by nuts. Bolts, one or more of which may be used, pass through holes in the strap and through slots in the rod, so that the said rod and strap may be moved upon each other in opposite directions and still be secured by said bolts. A small block is interposed between the overlapped ends of the straps and the end of the rod, and against which the inner brass at that end of the rod rests. A set screw passes through a screw hole in the center of the bolt in line with the length of the rod, the middle part of the end of the rod being cut away to receive it and allow it to be operated. By movement of this set screw, in combination with other mechanism, the straps are drawn toward each other, drawing the outer brasses inward just as much as the inner brasses moved outward, thus taking up the wear while keeping the pins at exactly the same distance apart.

PAPER FOLDING MACHINE.—Alyah Washburn, Medina, Ohio.—This invention consists of a series of light folding frames hinged on the top of a table, and provided with operating gear actuated by a cam shaft, which said frames are arranged in such order and sizes relatively to each other that a printed sheet delivered on the table over all the folding frames by the depositors of a printing press will be folded in the order of folding it by hand, and thrown off the machine by another frame similar to the folding frames. The said machine is operated by the printing press from which it receives the sheets as they are printed.

PLATE AND SHEET GUIDE FOR ROLLING MILLS.—James Moore, Belleville, N. J.—The object of this invention is to attach to rolling mills a device whereby the curling of the plates or sheets when they emerge from between the rollers will be prevented. At present it frequently and almost invariably happens that the plates or sheets curl up as they emerge from between the rollers which makes it more difficult to subsequently handle them and often threatens the destruction of the entire machinery, or injury thereto. In order to counteract this tendency of the plates to curl, a pendent lever is applied to the machine, with a foot at its lower end that reaches to the plate and holds its end down, following the motion of the plate as the same passes out of the rolling mill.

COAL CHUTE.—Cornelius W. Williams, Port Jervis, N. Y.—The pocket of the chute, in this invention, is to be elevated sufficiently for spouting from it into a wagon. The lower portion of the spout is hinged so as to fold up out of the way, so that a wagon can be drawn close alongside without being obstructed. A cross bar is suspended in front of the lower end of the spout for the coal to strike against, and be thereby turned directly downward to prevent it from shooting over the side of the wagon. A series of grate bars is arranged at the bottom of the spout to screen the coal as it flows from the pocket to the wagon.

RAILROAD FROG.—James Brahn, Jersey city, N. J.—The invention consists, first, in slotted iron blocks with wood filling between point and wings or between the wings. This construction greatly facilitates the putting together of the frog, as the blocks can be driven in till they fit, and then holes to receive the bolts can be bored through the wooden blocks through the holes in the wings and point. The wooded blocks alone bear the strain, and thus allow the point and wings to be drawn together more firmly and held more securely. The wood, by its spring, takes up the wear, and serves as a cushion to prevent jar and noise from the wheels. The wooden parts of the blocks thus do the work, while the iron parts strengthen the wood, and protect and preserve it from decay and from losing its elasticity. Second, each fish plate is made in two parts, which can slide upon each other. The inner part has two round holes formed in the end that is bolted to the end of the frog, and two short slots in the ends that are to be bolted to the end of the rail. The outer part of each fish plate has one round hole formed in its outer end to receive the outer bolt, and three slots to receive the other bolts. This construction enables the fish plates to be readily adjusted and secured to the ends of the rails of any road, and so long as one of the bolts remains tight the rail cannot move. The tread of the wheels, especially the drive wheels of the engine, is made considerably wider than the head of the rails, and by use becomes hollowed along the flange, so that the outer edge of the wheel, when running upon or leaving the point of a frog, will strike the other rail of said point and chip it out and injure it. To remedy this a solid iron block is placed between the rails of the point at the place where the outer edge of the wheels strikes or leaves the rail of the point, so that the outer part of the tread will be held up level with the top of the rail when passing upon or leaving it.

BLACKBOARD.—Frank G. Johnson, New York city.—This invention relates to a new and useful improvement in blackboards for schools and for all the purposes for which the ordinary blackboard is used; and it consists in a series of slates or tablets and in a grooved frame or case, in which grooves the tablets slide. When five (more or less) tablets are combined in the case they require no more wall space than a single one. A problem may be demonstrated on the outside of the first tablet; and it may be turned over and the other side used: or it may be drawn out so as to expose another tablet and laid away, or drawn in either direction so as to expose the next tablet or a part of it, and still remain in the case: and so of all the tablets. The case is designed to hang upon the wall.

COFFEE POT.—Martin Hofman, San Francisco, Cal.—This invention has for its object to furnish an improved coffee pot, extracting the strength so thoroughly from the ground coffee that a much smaller quantity will be required than when an ordinary coffee pot is used. The upper part of the body of the coffee pot is made cylindrical in form, and the lower part is bulged or swelled. The bottom of the pot is concave so as to more thoroughly concentrate the heat. A funnel rests upon the bottom of the body and its tube enters the tube of another funnel which is placed at the lower edge of the cylindrical part of the body and connected with and supported from the first named funnel. The steeper is fitted into the mouth of the cylindrical part of the body, and its bottom is finely perforated or made of fine wire gauze. In the center of the perforated bottom of the cup or steeper is formed a hole, in which is secured a tube through which the tube of the upper funnel passes, and which is made a little larger than said funnel tube, so that steam may pass up between them. A perforated plate with a hole through its center is designed to be placed upon the coffee in the cup and hold it down evenly and smoothly, so that the water may act upon and leach the coffee evenly. In using the coffee pot, the ground coffee is placed in the cup and the plate placed upon it; then, as the water becomes heated, it is forced up through the tubes, flows upon the plate, and percolates through the coffee, wholly removing its strength in a very short time, the plate and cup catching any fine coffee that may pass through the bottom of the cup, so that the coffee will always pour out clear.

LEVER FOR LATCHES.—Charles C. Lewis, Gainesville, Ala.—This invention relates to an attachment to door knobs, whereby the latch mechanism is brought within reach of small children, who can thus open the doors. The invention consists in a knob lever constructed with jaws and held by a key, and in providing a knob lever with spring and cord, and arranging it horizontally in a stop box.

TURBINE WATER WHEEL.—Thomas J. Alcott, Mount Holly, N. J.—This invention consists in the construction of an inside cylinder, with chutes and vertically adjustable guides, combined with an outside case. The object is to prevent the wear of the cylinder, to cause less friction, and make a perfect watertight joint. The inside adjustable cylinder has chutes or openings corresponding with the chutes or openings of the outer stationary case, the outer case being made of one solid casting with the lower half or curb smaller in circumference than the upper part. The upper part has twelve (more or less) openings, and between each opening and on the inside of the outer cylindrical case there are recesses for the purpose of passing off any sand or gritty substances that might collect between the cylinders, and causing less friction. On each side of each recess there are brass or Babbitt metal bearings to prevent the wear of the cylinder, making as perfect watertight joint. The inner cylinder is adjusted horizontally back and forward, so as to graduate the flow of the water passing through the openings of the outside cylindrical case, thus diminishing the size of the openings or closing them perfectly whenever required, and the inner cylinder is also adjusted vertically by the tightening or loosening of the nuts of the bolts or guides that pass through the top of the case and the cross arms of the top of the inner cylinder, the arms being below the cover of the case; and the center circular plate works backward and forward against and around the lower part of the dome of the top. For further particulars see advertisement on another page.

CRADLE, CRIB, AND STANDING STOOL COMBINED.—Calvin E. Nurse, Chesterfield Factory, N. H. assignor to William W. Hopkins, of same place.—This invention has for its object to furnish an improved combined cradle, crib, and standing stool, which shall be so constructed that it may be conveniently adjusted for use in either capacity, and which may be compactly folded for storage or transportation.

BEE HIVE.—William R. Clark, Piqua, Ohio.—The object of this invention is to provide convenient, safe, and efficient means for wintering honey bees. Through the cap, which is made to fit the top of the hive above the honey frame and is filled with straw, is formed a channel or passage way which is in communication with the alighting board in front. The filling is kept in place by two or more cross pieces, and is lined with woolen cloth or other material. The bottom or platform of the cap is composed of slats and clamps, and rests upon the top of the body of the hive, and is nearly covered inside with woolen cloth, which may be saturated with brine or other solution. The bees have free access to the passage way or channel, and from thence to the alighting board, and are thus allowed to feed in winter from one comb to another. The end clamps are grooved to the ends of the slats, where they are fastened in any suitable manner. The alighting board is attached to the clamp and may be removed therewith at any time. A ventilator and a shutter, one or both, may be closed down over the bee orifice of the alighting board, as may be desired. The filling absorbs the moisture, and, together with the lining, the natural heat of the bees is retained. The bees have free access from the honey frames of the hive to the channel in the cap, and from thence on to the alighting board. The honey frames are confined to the frame by a strap or metallic hook. The shutter may be elevated more or less, leaving the ventilator closing the entrance, thus enabling the ventilating air current to be controlled, while the escape of the bees is prevented. A small current is maintained through the entrance, and up through the filling and openings in the top, thus carrying off the moisture and relieving the brood chamber of foul air or odors.

LAMP CHANDELIER.—Randolph S. Mains, New York city.—The chandelier is so suspended that it may be raised or lowered, as may be required, and may be made and used either with or without a shade. With the common kerosene lamp in this chandelier, all the advantages of the expensive extension gas chandelier are secured with this additional advantage—the light may be readily removed and utilized away from the chandelier.

TREATING PETROLEUM.—Emil Schalk, New York city.—This invention consists of a continuous process of treating the distillate, by which much time and labor will be saved. Instead of having a tank and filling it with oil, and then adding the sulphuric acid, the oil and the acid, in the right proportion, are allowed to run in a continuous flow into a horizontal agitator, where it is agitated for a certain time, allowing the product to run out at the other end into a series of small tanks, filling one after the other and allowing the first to be emptied before the last is filled. From each tank the distillate is run into another horizontal agitator, where the washing is carried on in the same continuous way as when treated with acid, and in like manner it is again discharged into tanks, and from there into a third agitator to be treated with alkalies, and then washed again.

RAILROAD SWITCH LOCK.—James L. Anderson, Bucyrus, Ohio.—This invention relates to a new means for locking the switch levers on railroads, automatically and effectively. The invention consists in providing the switch lever with an up and down adjustable transverse bolt, which will drop into notches of the arcs between which the lever can be moved. The invention also consists in combining with the aforementioned key a projecting ear on the lever, a vertical drop bolt for locking into it, and an ordinary key for raising the drop bolt and liberating the lever when desired.

DUMPING WAGON.—Charles G. Taft, Triangle, N. Y.—The object of this invention is to furnish a wagon for transporting and unloading stone and similar material. The sides of the body are rigidly attached to the bolster and to the rear axle, so that they are immovable. The end boards are rigidly attached to the bottom. An iron rod, secured at the ends, passes through the two end boards, and rests upon the inside of the bottom in the middle of the wagon. The bottom and ends being thus supported by this rod, are allowed to turn thereon in either direction. On each side of the wagon box, and working in a slot in the side board, is a cam lever, so arranged that the cams come just above the bottom when the levers are turned up to the side boards. When one of the cams is turned out, the bottom will turn and dump the load; but when both cams are turned in, the bottom is secured in a horizontal position, and may be loaded with stone or other material, and in this condition the load may be moved or transported, and then dumped on either side, as may be desired.

ORE JIGGER.—Johann Friedrich Utsch, Iserlohn, Germany.—The object of this invention is to produce an automatic discharge for jig machines whereby the several grades of ores will be discharged according to their specific gravity without reference to size. The invention consists in the application to the jig sieve of two, three, or more discharge pipes, whose upper ends project at various distances above the sieves, so that during operation the heavier parts of the ore will be discharged through the pipe projecting least, while the lighter grades, forming higher strata on the sieve, will be discharged through the pipes projecting higher.

AUTOMATIC CAR BRAKE.—John E. Worthman, Mobile, Ala.—The invention has in view to connect all the brakes of a train with a mechanism on the tender, or on the truck of any car. It consists in the mode of tripping the spring rack, which locks the brakes, so that the latter will be at once allowed to assume a position out of contact with the wheels. It also consists in a novel mode of automatically ungearing a drum winding pinion from an endless screw which rotates it, so that the brake lever will be locked at a given point and the brakes operated with a given pressure. It also consists in a novel mode of regulating the time when the ungearing of said pinion from said endless screw shall take place, so that greater or less force may be applied. It also consists in the general method of operating all the brakes of a train of cars simultaneously and with a uniform force in going down an incline, the acquired momentum produces an immense strain upon the costly engine and racks, and greatly lessens its durability, because the brakes are applied at different times by the several brakemen. This is avoided entirely by using simultaneous brakes.

PLOW.—Henry C. Godfrey, Elizabeth City, N. C.—The invention relates to that class of plows which are employed in the cultivation of cotton, especially in its early growth. The invention consists in a scraper formed of two parts, one of which serves to run an inch (or a fraction thereof) beneath the surface of the soil and thus to cut up the weeds, while the other serves as a cutter, but mainly as a guard, to prevent the loose soil from falling over on the plants. Secondly, The invention consists in the arrangement of a small turn plow on the side, to the rear of the front, and above the bottom of the landside of a larger plow, so as to follow the scraper and throw clean soil to the stems of the young cotton plants. Thirdly, The invention consists, finally, in the mode of attaching the small plow to the landside of the larger one.

BLOW-OFF FOR STEAM BOILERS.—Buckingham C. Nye, Pomeroy, Ohio.—The invention relates to that part of a boiler which is immediately above the fire, which is accustomed to become covered with scale and sediment, and which is thereby rendered liable to rapid oxidation, to diminution in strength, and to the production of explosions. The invention consists in two horizontal tubes having each a continuous slot on the bottom, and emptying into a central vertical discharge tube which is open at the bottom, to produce an upwardly perpendicular current directly therethrough.

WAGON BRAKE.—George W. Jackman, Bath, N. H.—The invention consists in forming an automatic brake of a bar pivoted near to the end of a tongue and jointed to a brace hinged to the axle, whereby the holding back of the animals applies the brake. It also consists in a peculiar mode of curving the bar, and jointing it to the brace so as to give relief to strain upon the necks of the animals.

VERTICAL BOILER.—Philip Estes, Leavenworth, Kansas.—The invention relates to a vertical boiler, more especially designed for heating hot houses or other buildings with hot water. It consists, first, in constructing the boiler and furnace in three easily detachable sections, whereby the commonest mechanic can take it apart, clean, and again put it together. It consists, secondly, in providing the crown sheet with cups and circulating tubes that hang down in the fire chamber, to facilitate the heating operation.

MACHINE FOR CUTTING FABRIC INTO PIECES FOR BAGS.—William J. Cussen, Richmond, Va.—The invention consists in a spring clamp swiveled to the side of a table, holding together the fractional parts of a previously cut piece while others are being unfolded, and turning to one side when its function has been performed,

DOFFER STRIPPER.—A. M. Comstock, Holden, Mass.—The stripper is provided with teeth beveled on one side, and is arranged so as to support the stock or roving between the card cylinder and condensing rolls, and deliver it to the latter in a peculiarly effective manner. It is especially adapted for use when short stock is being worked up.

CULTIVATOR.—William D. Smith, Homerville, Ga.—This invention has for its object to furnish an improved cultivator, so constructed as to stir up the soil to any desired depth without turning up the fertilizer to the surface and to avoid having its gases evaporated by the rays of the sun. The bar or beam to which the plows are attached is made in zigzag form, to form shoulders or offsets for the attachment of the plows. The rear part of the draft bar or beam is bent or curved upward, and has a hole formed in its upper end to receive the round that connects the handles and holds them in their proper relative positions. The ends of the zigzag bar or beam are supported by the brace rods, the rear ends of which are secured to the ends of the said bar or beam, and their forward ends are secured to the forward part of the draft bar or beam. The plows are made long and narrow, are curved or bent downward and forward, and are twisted so that their forward sides may be slightly inclined to allow the soil to slide off the said plows as they are drawn forward, thus enabling them to stir up the soil thoroughly and move it toward or from the plants as may be desired. The zigzag bar or beam may be made of any desired length, and may have any desired number of shoulders or offsets for the attachment of plows.

BILLIARD TABLE.—William H. Griffith, New York city.—This invention relates to a new manner of bracing and sustaining the top of a billiard table. Such top is now usually made of slate or other mineral substance in three or more slabs, which are placed side by side upon the supporting frame, and is liable to sag in the middle, especially on tables having but four legs, and also to open the joints between the several slabs or pieces of slate. Either of these occurrences would virtually destroy the billiard table. The invention consists in the arrangement of metallic bars, which connect with the end slabs and press under a middle bridge of the billiard table, serving to draw the slabs firmly together, and also to hold the middle of the table up, and thus keep the top level. This invention is the conception of an extensive billiard table manufacturer, and is intended to greatly improve the strength of the table.

SASH HOLDER.—William Branch and Mark J. Liddell, Laingsburg, Mich.—The object of this invention is to furnish convenient and efficient means for holding window sashes in any desired position when raised, and for fastening them securely down when closed; and it consists in a weighted lever with a double cam attached thereto, one of which cams being arranged to hold the sash up and the other to hold it down.

BARBER'S CHAIR.—Francis J. Coates, Cincinnati, O.—This invention has for its object to furnish an improved barber's chair; and it consists in the arrangement of devices so that by operating a foot lever the seat may be reversed when it has become warm from use, or set at different angles when desired, and so that the pivoted back will adjust itself to the angle or position of the seat and the back of the sitter.

SHOEMAKER'S TOOL.—Joseph F. Ober, Mount Desert, Me.—This invention has for its object to furnish an improved combination tool, designed more especially for shoemaker's use. In using the tool the upper is grasped with the pinchers and drawn into place. The tool is then reversed while being raised, and with a blow, as if with a hammer, the awl is driven into place. A peg is then taken from the mouth and inserted in the hole and driven into place by a blow with the hammer, the tool being reversed in the hand while being raised to give the blow. In this way the shoe may be lasted without laying down the tool, except at the toe, when it is laid down to shave off the folds of the upper to make it lie smooth.

SUCKER ROD ELEVATOR.—Lewis K. Stitts and Solomon R. Dresser, Parker's Landing, Pa.—This invention relates to the pumping machinery of oil and salt wells; and consists in a device for elevating the sucker or pump rod. The elevator consists of a box or frame made in two parts, one part opens as a gate to allow the sucker rod to be slipped in or out. Pivots or journals are formed on or pass through the two parts of the box or frame. Bails are attached to the pivots and a stop plate is fixed on the outside of each of the two parts of the box or frame. In sending the elevator to the swivelman up in the derrick, both bails are put on to a hook of the sucker rod line, leaving the gate of the elevator open, so that the swivelman has nothing to do but to slip the elevator under the shoulders of the sucker rod and shut the elevator gate.

CAR COUPLING.—Erwin C. Hubbard, Green Bay, Wis.—This invention has for its object to furnish an improved car coupling, which will couple itself as the cars are run together. In the forward end of the bumper head is formed a mouth or recess to receive the coupling link. The coupling hook is a bar having a hook formed upon each end. The bar is placed in a slot in the upper side of the bumper head, the forward hook of said bar projecting downward into the mouth or throat of the bumper head, and its rear hooks projecting downward into a slot or recess in the middle part of the bumper head so as to sustain the draft strain by resting against the solid part of the bumper head between the said hooks. The hook bar is held down into its place by a spring laid in a groove formed to receive it in the upper side of the bumpers, which is kept from moving longitudinally, and which enters a recess in the said bumper head. The spring is held down in its place by the edge of the rear end of a shield, which is made hollow and open at its front end, and serves as a guard to prevent the hook from being pressed down or jammed, so that it cannot be raised by the entering link, and as a guide to prevent the bumper head from lifting.

LOCK FOR UMBRELLAS, ETC.—Sigourney Wales, New York city.—This invention relates to a new device for locking the wire springs which support the sliding tubes or sleeves, on which umbrella sticks are held in position, referring more particularly to the lower spring by which the umbrella is held closed. The invention consists in the combination, with the said wire spring, which is of ordinary construction, of a sliding slotted tube within the umbrella stick, and of a spring connected with said tube, and of a key for setting said tube so that the umbrella cannot be opened without said key.

SEWING MACHINE TABLE ATTACHMENT.—John C. Egley, Philadelphia, Penn.—This invention relates to the application of a hinged extension leaf containing two drawers to the table of a sewing machine, one of the drawers containing a pivoted self-balancing trough or vessel, which will always be right side up, whether the leaf attachment is swung up or down · while the other drawer has two slide covers, of which the one on top is or should be used in the corresponding position of the leaf.

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Knowles No. 2 pump, new, six horse Andrews engine, two large house heaters, with fixtures, for sale. Address Rahway Glue Manufacturing Co., Rahway, N. J. Agents Badoux's Rapid Evaporator.

Wanted—A Hydraulic Press with Cylinder 12 to 16 inches; platen, 30 to 40 inches. Address Box 224, Boston P. O.

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Standard and experimental machinery built for responsible parties at low rates. Every facility. S. C. Forsaith & Co., Manchester, N. H.

Notes & Queries

1.—Will some one give me a good and simple recipe for making tracing paper and cloth?—T. W. M.

2.—How can I make a varnish that will be transparent, and so hard that it will not scratch? It is to be used on paper and cardboard.—T. C. T.

3.—Can there be an ink manufactured of any particular color that will not be visible to the naked eye on a particular colored paper, and yet be discernible through some particular colored glass?—H. K. J.

4.—What chemicals are used in boiling water to kill moss and at the same time to dye it black? The moss grows here on the trees, and is used for filling mattresses.—G. G. L.

5.—Please give me a recipe for making "Alaska scenery," namely, white formations (in water), which, in size and form, have a resemblance to mountains, etc. I have seen them in druggists' windows in different parts of the city. Can the "Alaska scenery" be colored red, yellow, blue, and green?—G. W. H.

6.—The preparation and dressing of furs seem to be held a secret from the general public and an entire monopoly, from the Hudson Bay Company's trade to that of manufacturing the furs into garments. Can any one furnish particulars of the best and simplest methods of such preparation, and also any improved scientific methods adopted by those who so far monopolize the trade? What is the most elaborate work on fur dressing?—H. I. B.

7.—I can tin wrought and malleable cast iron by first placing the iron in a pickle of oil of vitriol, then I wash it off and dip it into muriatic acid, and then into molten tin. I always have good success with malleable cast and wrought iron, but cannot make the metal adhere to ordinary cast iron. Will you please inform me what different process I need to use for the latter?—C. H. B.

Answers to Correspondents

L. A. B.—See our editorial article, "Losses of Power in the Steam Engine." You are nearly right in your estimate of average leverage of cranks; the figure is 0·7854. There is no loss of power arising out of the employment of the crank.

S. L. P., of N. J., says there is a question between himself and friend in respect to two examples of masonry, one of which is built on straight lines and the other in form of an arch, the longitudinal space covered by the walls being exactly the same. One claims that the quantity of masonry in each example is the same, the other, that the arch contains the greater quantity. Answer: The arch, supposing it to be in the form of a half circle, contains fifty per cent more masonry than the straight wall.

A. P. M. says: Is the friction greater on journals three feet in diameter or journals one inch in diameter? The length and quality of the bearings, the weight upon the journals, and the number of revolutions are the same in both cases. For answer, see editorial remarks, on another page, entitled "Friction of Journals."

C. W. S. asks: At what speed or how many feet per minute a circular saw should run, for sawing zinc plates one half inch thick, and brass bolts or bars of three inches diameter? Answer: About 1,000 revolutions per minute for a six inch saw will do.

W. H. L. says: What is the difference of cost in running a car by horse and steam power? Answer: The estimated prime cost and running expenses for a first class two horse street car in this city, interest, wear and tear, driver, conductor, stabling and all the expenses included, is $8,150 per annum. The same estimate for the running of each dummy or steam street car is $7,178, showing an economy of almost $1,000 a year in favor of steam.

B. says: The SCIENTIFIC AMERICAN in an article headed "Scientific and Mechanical Possibilities" says on page 329, volume XXVII.: "Heat increases about one degree for every fifty feet that we penetrate the earth." A California paper of November 8 has the following: "The greatest blow ever given to the hot liquid theory of the interior of the earth was that demonstrated by the artesian well at St. Louis, which developed a temperature at the depth of 3,800 feet which was too cold to be determined by any instrument of science at the time in use for such a purpose." Will you please to explain whether the above article is erroneous? Answer: The statement which you quote from the California paper of Nov. 8, is absolutely false, and is either the result of some most remarkable misunderstanding, or is one of those unpardonable misstatements which are sometimes purposely introduced by dishonorable persons into newspapers, and which have done a vast amount of mischief by misleading the public. Experiments give varying results. Some indicate an increase of 1° Fahr. for each 50 feet of descent, while others show an increase of 1° Fahr. for each 100 feet. All concur, however, in exhibiting an increase of temperature as the earth's crust is penetrated. Estimates of the thickness of the earth's crust have been frequently made. It is not more than a few hundred miles, and may be less than one hundred. Below it, the temperature must be uniform, or nearly so, since there, all ordinary earthy matter and common metals are liquid. "It is not impossible, nor is it improbable, that there may be a central solid mass of alloyed metals whose melting point is too high to allow even a temperature higher than that of a blast furnace to fuse it."*

*Professor Thurston.

M. H. W., of N. Y., H. C. K., of Mass., and others, write us in reference to our reply to the question of R. and W. about the fly wheel. The subject seems to be one in which many of our readers are interested, and we will endeavor, in an early issue, to state the principles involved in such manner that all may understand the difference between a "standing" and a "running" balance and between the case which we specified and those presented by our correspondents. We will here simply remind them that we stated that "if the wheel is accurately balanced, and is perfectly symmetrical, it does not necessarily produce unsteadiness in the shaft." H. C. K. has experimented with molding machines, grindstones and planing machines and has been annoyed by unsteadiness of movement simply because, although, in good standing balance, there was a lack of symmetry. His method of securing a running balance is a method of securing symmetry. By symmetry is meant such an arrangement of heavy material that each particle is balanced by another, equally heavy and equally distant from the center of motion. In such a case only can we get a perfect standing and a perfect running balance at the same time. A standing balance, otherwise, will not be a running balance, nor is a running balance necessarily a standing balance.

P. R. S. says: I think of putting in a 10 horse power steam engine. I will have to dig 20 feet and get very hard water, or put in a cistern and use water from roof. Can you tell me how much water I would have to use per hour in my boiler to get 10 horse power, and how will it work to run the escape pipe down into the water in the cistern? Would it not condense it so that there would be but little loss? Answer: A moderately good boiler driving an ordinarily good 10 horse power engine would require about a hundred gallons of water per hour. A bad boiler and inefficient machine might use nearly double that quantity, while the best boilers and very best known portable engines may be expected to run regularly at 10 horse power on fifty gallons per hour. Your arrangement of exhaust would not be satisfactory. It would only heat the surface, and if carried down under water would subject you to serious loss by back pressure.

E. T. Q., of N. H., says: I observe in your paper for Dec. 21, 1872, a reply to R. and W., in which you affirm that a balance wheel perfectly symmetrical and accurately balanced, keyed firmly upon a shaft in any position, "does not necessarily produce unsteadiness in the shaft." I am unable to understand how your reply can be correct, unless you have some unusual meaning for the expression "unsteadiness in the shaft." Will you explain more fully, and will you also state whether a shaft carrying a perfectly symmetrical and accurately balanced wheel, keyed firmly at an angle of 45° to the shaft, will saw rapidly without jumping from its bearings if not held down? Answer: Already answered elsewhere. We were probably not sufficiently precise in our language. The shaft would leave its bearings if unconfined, and driven at sufficiently high speed. It would not necessarily give trouble in all cases.

E. B. M. says: I notice that some of your correspondents recommend tan bark to clear a boiler of scale. Will it be injurious to our boiler to use water strongly impregnated with old sour liquor from the vats of a tan yard, the liquor being conducted directly from the vats, after being exhausted of its strength in tanning skins, to the feed water of the boiler? Answer: Water strongly impregnated with old sour liquor from a tannery would, in time, corrode your boiler and might do serious injury. If you cannot elsewhere obtain pure water, try it cautiously. Vegetable acids attack iron as do mineral acids, although you may find the solution so weak as not to have any appreciable effect in a long time.

W. E. H. says: Given two boilers, each 3 feet diameter, cylindrical, one 6 feet and the other 12 feet in length, all other things equal, is there any difference in the pressure per square inch required to produce rupture? Or in other words, does the length have any thing to do with the bursting strain? Answer: The length of a steam boiler has no effect either to increase or diminish its resistance to bursting pressure.

One of your correspondents, Le R. F. G., of Mass., maintains, or strives to maintain, that the part of a moving locomotive wheel in contact with the rail does not, "for the time being," move forward. I am inclined to the opinion that, for the following reasons, no part of such wheel is devoid of a forward movement: 1st. If we closely watch a wheel while turning forward, it "seems" as though no part was stationary even for an instant. 2d. If the top part of a wheel has a forward movement dependent upon the progress of the wheel upon the rail, and independent of its motion upon the axle, it "seems" to me that every other part of the wheel must have a forward movement also, because no part of the wheel has a backward movement, and all parts are so connected with the top as that if one moves the other must. If a locomotive wheel, four feet in diameter, with No. 1 marked on its highest part, and No. 2 on the part in contact with the rail, revolves one quarter round, it will bring No. 1 two feet in advance of the axle; and as the axle has moved forward nearly three feet, or one quarter of the wheel's circumference on the rail, No. 1 will be near five feet in advance of the position it first occupied. And as the movement of the wheel one quarter round places No. 2 two feet behind the axle, which has moved near three feet forward, it places No. 2 near one foot in advance of the place it started from. And as the descending movement of No. 1 is equal to the ascending movement of No. 2, it results that No. 1 has moved more than three times faster than No. 2. If we take two wheels an inch in diameter, with a mark on the circumference of each, and hold one stationary in one hand while we take hold of an axle passing through the center of the other, we will find, on putting the marked places together and revolving the one on the axle around the other that the one revolving turns once, and only once, around on its axis.—S. S. G.

To J. E. S., query 1, page 378.—After more than twenty years experience in the use of rubber belts I find iron hooks to be the most convenient and most durable splice. Cut the two ends of the belt perfectly square, and punch the holes for the hooks on an exact line. For heavy belts use two rows of hooks. In this way each hook will have the same strain. Do not depend on your eye for punching the holes on a line, but first mark a line with a square and then punch the holes, not too large for the hook. Now about dissolving rubber in spirits of niter. There is no such thing as dissolved rubber in the true sense of the word. With essential oils it can be expanded, and it has the appearance of being dissolved, but such solution will not saturate. Shellac gum copal, pitch and rosin may be dissolved and mixed so that fibrous materials may be saturated with them, but rubber separates from its so called solvents, or rather the solvent evaporates and leaves the rubber in a thin film on the surface over which it is spread. Neither will fire melt it, for at melting heat rubber will decompose, making a tremendous smoke and leaving very little residuum. Rubber is a unique substance. About vulcanized rubber, there are many mistaken notions abroad. The process of vulcanization is simply submitting the rubber to heat (steam or hot air) in such a manner that the heat can be regulated and controlled as to time and degree. I have heard vulcanization compared with the burning of bricks, but there is no similarity in the processes, for the bricks are brought in contact with the fire. Rubber treated in that way would decompose.—A. E. V. E., of Mass.

By my query, page 340, Volume XXVII., I wished to find out if J. W., or any one else, knows any practicable way to shift a belt from a loose pulley at the driven end, provided, of course, that the belt is not in motion. There are plenty of mechanics who are ready to adopt any evident improvement when putting up machinery. I think some of them could be fooled several dollars worth with such advice as J. W.'s, page 292. J. E. S., page 378, intimates that it is not good practice to make the loose pulley much smaller than the tight one. His experience must differ very much from mine, though in my other article my language implied more than I meant when I said a difference of an inch is no hindrance to the shifting of the belt. The plan recommended by Mr. Coleman Sellers of making the hub of the loose pulley longer than the face is a good one, and in addition the face should be made very high in the middle, so that, if the hub wears so as to allow the pulley to tip to one side, the belt will keep as near as possible on the middle of it. When a loose pulley tips, so that the shifter has to be depended on to keep the belt from running off, the friction on the shifter wears the belt very fast. When the driven pulley is placed over the driver, a properly made tightener is in most cases preferable to a loose pulley. Some light machines, as a saw table, with the driving shaft directly below, can be set on guides and the tension of the belt made by moving the machine. This plan works exceedingly well. The tension of the belt can be, as it can also with the tightener, regulated to a nicety, which is very desirable as it saves unnecessary straining of the belt and saves much time in lacing it, and the belt is not wearing while the machine stands still.—W. G. B., of Mich.

To J. E. S. query 1, page 378.—For lacing rubber belts use calf skin, tanned as for boots. Cut lengthwise the skin, and take out the stretch with water instead of oil. My experience is that one such lacing will outlast two of the oil tanned, and will not spoil your belt.—H. D. I.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 10, 1872,

AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

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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:

23,152.—RULING MACHINE.—J. B. Blair. Feb. 19, 1873.
23,246.—MEAT MINCER.—A. W. Hale. Feb. 26, 1873.
23,209.—ENVELOPES.—S. E. Pettee. March 5, 1873.
23,316.—ENLARGING PHOTOGRAPHS.—D. Shive. Mar. 5, 1873.
23,320.—SKIMMER FOR BOILERS.—A. M. Sprague. Mar. 5, 1873.
26,361.—PEGGING MACHINE.—A. C. Gallahue. Mar. 12, 1873.
24,096.—SEWING MACHINE.—P. S. Carhart. May 7, 1873.

EXTENSIONS GRANTED.

22,379.—BORING MACHINE.—G. F. Rice.
22,381.—BRUSH.—R. Shaler.
22,340.—PEGGING JACK.—T. D. Bailey.

DESIGNS PATENTED.

6,282.—WATCH CASE.—J. C. Dueber, Cincinnati, Ohio.
6,283.—CRIB CHAIR.—J. C. Hall, Cincinnati, Ohio.
6,284.—COOKING STOVE.—L. W. Harwood, Troy, N. Y.
6,285.—MATCH STAND.—C. H. Leggett, Elizabeth, N. J.

TRADE MARKS REGISTERED.

1,080.—LINIMENT.—S. H. Kennedy & Co., Johnstown, N.Y.
1,081.—SEWING MACHINE.—Florence S. M. Co., Mass.

VALUE OF PATENTS

And How to Obtain Them.

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