SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

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

Vol. XLIV.—No. 11. [NEW SERIES.] NEW YORK, MARCH 12, 1881. $3.20 per Annum. [POSTAGE PREPAID.

GARBAGE DESTRUCTOR AND CARBONIZER.

The matter of disposing of garbage and various kinds of refuse, in our large cities, is becoming a serious one, and is beginning to receive the attention its importance demands. Some experiments have been tried in this direction in the city of New York, in Chicago, and elsewhere in this country, but with indifferent success.

In England, however, the case is different, a number of furnaces for this purpose being in successful operation, consuming all refuse without nuisance. The furnaces were designed by Mr. Fryer, of Nottingham, and are thus described in an address delivered by Mr. Alfred W. Morant to the Association of Municipal and Sanitary Engineers, and published in the *Engineering*:

The destructor consists of six compartments or cells, formed of brickwork lined with firebricks, and tied with iron rods; it occupies a space of 22 feet by 24 feet, and 12 feet in height, and is so arranged that there is an inclined road leading to a platform over the top of it, on to which the refuse is carted; and there is also another incline from the level of the firing floor to the adjoining road, by means of which the mortar, charcoal, old iron, and other matters which resist the action of the fire, are carted away.

Each of the six cells is capable of destroying 7 tons of refuse in 24 hours, and consists of a sloping furnace with hearth and fire grate covered in by a reverberatory arch of firebrick, with one opening for the admission of the refuse, another for the gases to escape into the flue, and a furnace frame and doors for the withdrawal of the clinkers. The brick arch above concentrating the radiant heat upon it. The opening for the entry of refuse is divided from the opening for exit of gases by a wall, a bridge preventing the refuse, which is heaped up immediately below, from finding its way into the flue also. At intervals of about two hours the clinkers are withdrawn through the furnace doors, and a further charge of refuse shoveled in at the top. The result of the process is that everything is consumed, or converted either into clinkers or a fine ash. Every two cells are also provided with an opening for the introduction of infected mattresses, diseased meat, etc., on to the fire, where everything is readily consumed without causing a smell.

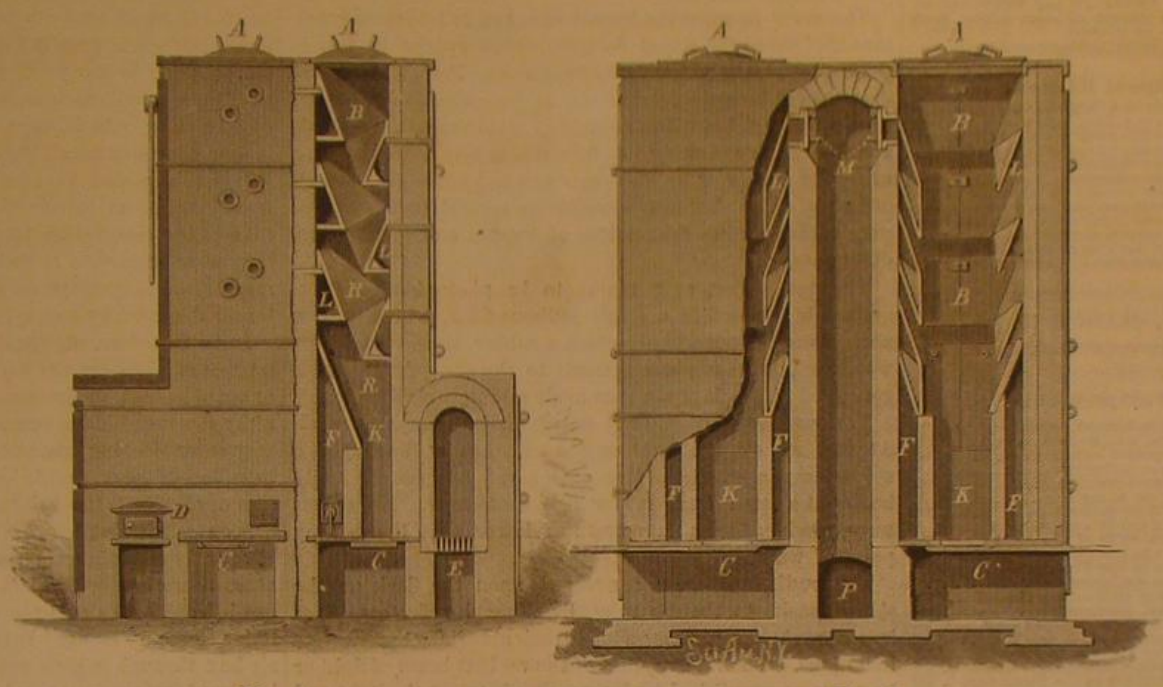


Fig. 1. Fig. 2.

CARBONIZER FURNACE.

FIGS. 1 AND 2.—A, feeding hole, with covers; B, cast iron plates; C, discharge door; D, fire door; E, fire grate; F, F, F, flues; K, hot chamber; L, flue behind cast iron plates; M, damper; P, flue to chimney.

The gases from the furnaces on the way to the chimney shaft pass through a multitubular boiler, 6 feet in diameter, 10 feet in length, and make steam to drive a horizontal engine with 12 inches cylinder and 2 feet stroke, which works the two mortar mills with pans 8 feet in diameter. In these the clinkers made in the destructor are mixed with lime, and ground into an exceedingly strong mortar, which is readily sold at 5s. per load. No fuel of any kind is required, the ashes mixed with the refuse being amply sufficient. The old tins and iron which have passed through the furnace are sold for old metal. During the year 1879 the following quanti-

[*Continued on page* 165.]

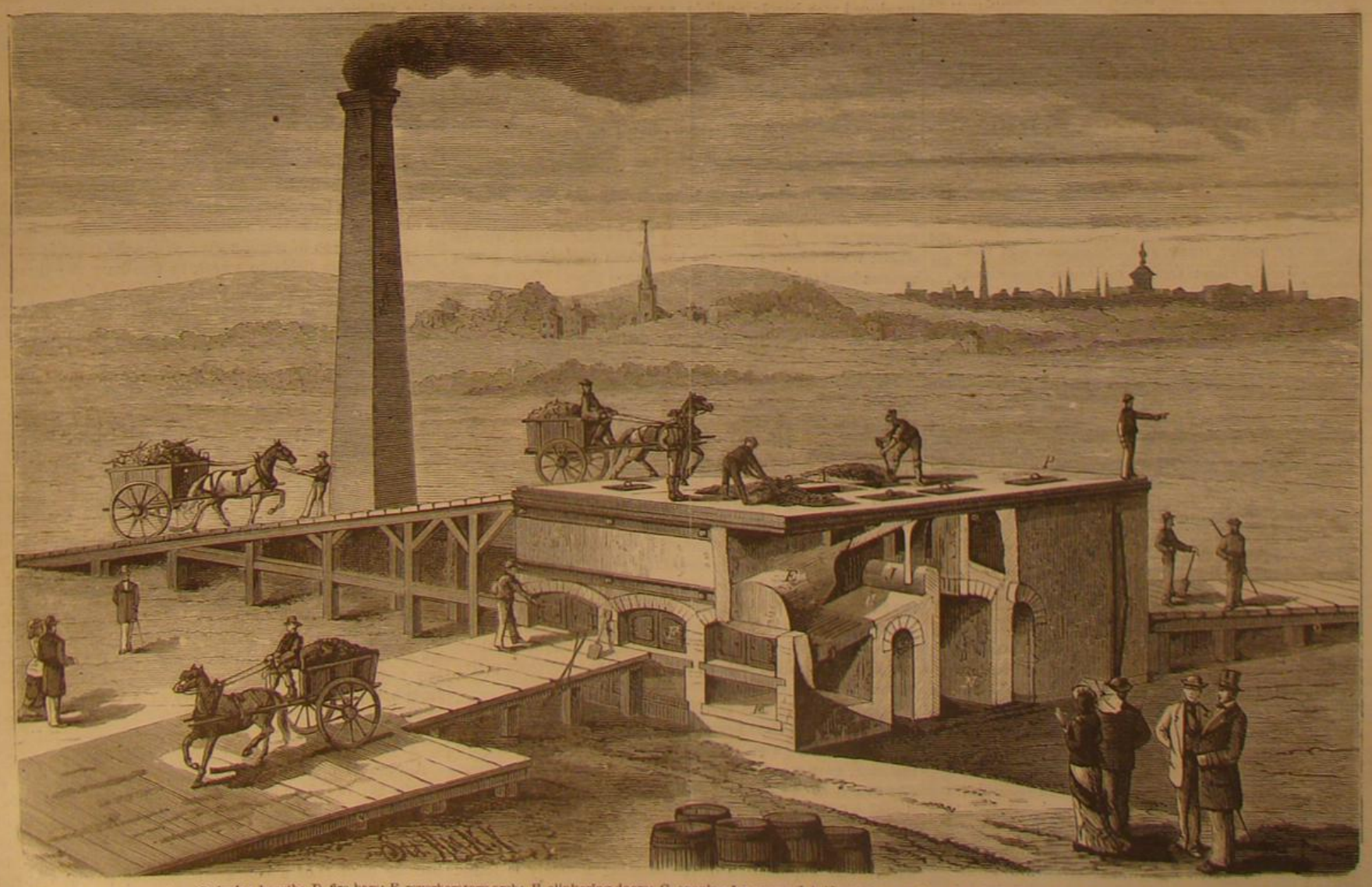


FIG. 3.—A, refuse feed opening; C, drying hearth; D, fire bars; E, reverberatory arch; F, clinkering doors; G, opening for gases; J, bridge to keep refuse out of the flue; M, ash pits; N, flue to chimney; P, mattress opening.

Fig. 3. FURNACES FOR TREATING GARBAGE AND OTHER REFUSE MATTERS.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

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

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address
MUNN & CO., 37 Park Row, New York.

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information: (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MARCH 12, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 271.

For the Week ending March 12, 1881.

Price 10 cents. For sale by all newsdealers.

THE SOUNDS OF VAPORS AND GASES.—THE PHOTOPHONE AS AN INSTRUMENT OF PHYSICAL INVESTIGATION.

Mr. Graham Bell's recent discovery, that musical sounds are produced when an intermittent beam of light falls upon a solid, at once suggested to Prof. Tyndall the idea of testing by the same means the relative capacity of gases and vapors to absorb radiant energy.

The theory is that the sounds observed by Mr. Bell are caused by rapid changes of temperature in the body impinged upon by the light, such variations of temperature producing changes of shape and volume, giving rise to sound waves.

From the superior mobility of gases and vapors, Prof. Tyndall reasoned that the absorption of radiant energy by them would in like manner produce sounds, and louder sounds than are possible with solids. He reasoned further, that the loudness of the sounds would furnish an unmistakable measure of the relative capacity of gases to absorb radiant heat or light; and, if so, the photophonic method of investigating such substances would be likely to afford a satisfactory solution to certain experimental problems hitherto involving such delicate and difficult tests that competent observers have not been able to agree upon the interpretation of the results indicated.

The event justified the hypothesis; and in two recent communications to the Royal Society, which appear in full in the SCIENTIFIC AMERICAN SUPPLEMENT, Prof. Tyndall has described at length several series of investigations, opening up a novel and beautiful method of experimental research, and not only confirming in a remarkable way the correctness of results arrived at by him years ago by less simple methods of investigation, but also clearing up several points of dispute with regard to the relation of vapors and gases to radiant energy.

The gas, vapor, or perfume to be photophonically examined is inclosed in a small bulbous flask, with a narrow neck, from the outside of which a rubber tube with a boxwood or ivory ear piece extends to the ear. Any sounds generated in the flask are thus made minutely audible.

Various sources of radiant energy have been employed. At first an electric light was used, then a lime light, a spirit lamp, a candle, a live coal, a red hot poker, finally bodies at a lower temperature than a red heat. No effects were produced with temperatures lower than the boiling point of water.

The radiations were converged upon the flask on the side opposite to the ear tube, by silvered reflectors, glass lenses proving unsuitable owing to their absorbing the effective radiations. The interruption of the radiant beam of light or heat was accomplished by interposing between the light and the flask a disk of sheet zinc carrying radial slits or teeth with interspaces. When revolved in the beam the disk interrupted the radiations at any rate that might be desired, converting any sound produced into a musical tone.

At first vapors known to be highly absorbent of radiant energy were tested—sulphuric ether, formic ether, acetic ether, etc.—a loud musical tone being obtained. When the flask was filled with the vapor of chloroform, or bisulphide of carbon, and placed in the intermittent beam, the sound produced was barely audible, as was anticipated from the known feebleness of the absorptive power of these vapors. With other vapors, whose behavior toward radiant energy had been previously established, the musical tone produced corresponded in loudness to the ability of the vapor to absorb radiant heat.

The investigation was then carried to gases and vapors whose absorptive power is in dispute. Dry air emitted a note that could be heard only with close attention. Dry oxygen and dry hydrogen behaved like dry air. Carbonic acid gas gave a louder note than was obtained with any elementary gas. A still louder note was produced with nitrous oxide, while under favorable conditions olefiant gas gave a note as loud as that of an ordinary organ pipe. Water vapor, whose deportment toward radiant energy as determined by Prof. Tyndall's earlier experiments had been strenuously disputed, testified in his behalf with a voice distinctly audible.

The next step was to determine beyond question what portion of the intermittent beam—the luminous or the dark rays—produced the sounds. Among the many test experiments was this: a liquid layer of formic ether, sulphuric ether, or acetic ether, one-eighth of an inch thick, was placed in the path of the interrupted beam. The musical sound was stilled. As these liquids are transparent to light it was inferred that the sound-producing rays which they intercepted must have been those of obscure heat. The correctness of this inference was strongly sustained by the result of another test in which the light was cut off and the invisible rays allowed practically free transmission. This was accomplished by interposing a thick layer of bisulphide of carbon rendered opaque by dissolved iodine, under which conditions there was hardly any diminution of the sounds of the more active vapors.

Equally curious and significant were the results obtained when the intermittent beam was converged upon bulbs containing colored gases. The brown vapor of bromine, for instance, gave a somewhat forcible sound, though its capacity to absorb radiant heat is low. Indeed the tones continued when the heat radiations had been entirely cut off, and were stilled when the luminous rays were shut off leaving the obscure radiations an uninterrupted passage to the flask. The explanation of the seeming anomaly is found in the capacity of the brown vapor to arrest the rays of light and convert its motion into that of heat.

With a very rude photophonic arrangement Prof. Tyndall has been able to hear the sounds of the more active vapors at a distance of one hundred feet from the source of the interrupted rays. He is confident that the vapors of all compound liquids will be found sonorous in the intermittent beam, and thinks it probable that even the vapors of elementary bodies, including the elementary gases, when more strictly examined, will be found capable of producing sounds.

It may be that, in connection with the electric sonometer, the photophonic method of investigation will ultimately give us also a new, simple, and efficient method of chemical analysis, as far reaching in its results as spectrum analysis has proved. At any rate it is a valuable addition to the outfit of the physical investigator.

MIDWINTER MALARIA.

From some cause or combination of causes the present winter has been remarkable for a widely extended and marked increase in diphtheria and scarlet fever, which have invaded homes in which the highest attainable skill has been exercised and the most approved appliances have been employed to render them as healthy as possible. In some cases the immediate causes of these disorders are undiscoverable, but in the light of sanitary science the class of agents which either initiate or greatly increase the virulence of these complaints is no longer problematical. Decaying organic matters, more particularly animal excretions, give rise to a subtle blood poison, which, though it yet evades chemical analysis, is now conceded on all hands to be a positive deadly fact. When this poison invades a dwelling, no matter whether from exterior or interior sources, in sufficient quantity, the lives of the inmates are jeopardized as positively as though they were compelled to breathe a mephitic gas. The effect may not be so prompt or fatal, but the danger is a fact no longer disputed by any intelligent physician.

It is, therefore, not sufficient to guard against interior sources of diseases; the peril may be in a neighbor's house or outbuildings, in the emanations of a compost heap or a filthy street or hidden cesspool, which if they find an avenue may enter sleeping apartments, find a *nidus* in clothing, carpets, and drapery, and bring in their train the swift destruction of all that is most cherished.

A case in point has occurred in a neighboring village. Five cases of diphtheria appeared in a household where the utmost care had been taken with the plumbing. The obvious inference was that the causes of the complaint were exterior to the dwelling. It was found that the mouth of the air-box through which exterior air entered to supply the heating furnaces was on a level with the top of a cemented pit on the adjoining premises, in which accumulations of kitchen refuse, animal and vegetable, and barn manure were promiscuously stored and allowed to rot for fertilizing purposes. The foul air from this pit was drawn into the house through this one avenue, and the poisoning of its unfortunate inhabitants, four of whom died in quick succession, was the result. It seems that disease may pervade a house with deadly result where the cause is least suspected; it therefore devolves upon every housekeeper, whether resident of the city, village, or on a farm, to be constantly watchful, not only of his own, but also of his neighbor's premises, that none of the obvious causes of disease be permitted.

RICE CULTURE IN THE SOUTHWEST.

Before the war our rice crop came chiefly from the Carolinas. During the past ten years the rice industry has been extended to Louisiana, where over 50,000 acres are now devoted to it, and the annual crop of the country has been doubled. In the meantime great improvements have been made in the methods of thrashing and cleaning the grain by the introduction of machinery. When the grain is cut it is stacked in the fields to sweat, to facilitate the thrashing, after which the rice is sent to special mills for hulling and polishing. There are seven mills of this sort which have been built in New Orleans during the past decade. Each mill employs from twenty to forty hands, and all are busy. The rough rice is received in large bins, from which it is taken by elevators to the upper floor, where it is winnowed and sifted to remove sticks and rubbish. To remove the beard the rice is passed through a revolving "hoodlum," from which it is carried to the "stones," which crack off the hulls. Then the dark-colored grains are polished for market. The polisher consists of sheepskin, tanned, stretched over sheep wool on revolving cylinders, the space between the sheepskins and wire gauze being just sufficient to allow the rice grains to find their way by degrees to the bottom. The grains are highly polished by the friction against the skins, which rubs off the bran and leaves the grain clean and white. The bran amounts to eight barrels for every hundred barrels of clean rice. It is sometimes used to adulterate spices. The waste in hulling averages about 5 or 6 per cent, but sometimes reaches 20 per cent. The hullers receive from half a cent to three-quarters of a cent per pound for hulling.

Dangers of Aniline Reds.

A number of the aniline colors, especially the red pigments, are, in the course of their manufacture, oxidized by the use of arsenical acid, and some of the arsenic is retained in the finished coloring matter. When such colors are used for dyeing, for wall papers, for artificial flowers, etc., they become carriers of a dangerous poison, whereby sickness and suffering are extensively occasioned. The only real safety is in the use of good cochineal for red colors.

COMPRESSED LIGNITE AS FUEL.

An important, if not a vital, question in Texas, especially with respect to the industrial development of the State, is how to utilize the extensive beds of lignite which abound there. Indeed, in the lack of true coal, the State can hardly accomplish much in the manufacturing line without first solving this problem.

We are informed that Mr E. T. Dumble, of Houston, has devised a process of coking the lignite, which works well on a small scale and is likely to prove valuable in larger operations, particularly in smelting iron, there being an abundance of iron ore in the neighborhood of the lignite deposits. For other than smelting purposes, however, it is desirable to retain in the fuel the volatile fuel elements which are wasted in coking, and which amount to about two-fifths of the total weight of the lignite.

A sample of this fossil fuel, from a seam ten feet thick, in Robertson County, Texas, may be taken as a representative specimen. Analyzed by Prof. E. T. Cox, of the Indiana Geological Survey, it showed—fixed carbon, 45 per cent; gas, 39½ per cent; water, 11 per cent; white ash, 4½ per cent. It furnished nearly 50 per cent of lusterless coke, closely resembling wood charcoal. As taken from the bed the lignite is dull brown in color, and is apt to shrink, crack, and fall to pieces on exposure to the air, a property unfitting it for transportation.

Judging from the success achieved in New England in compressing peat, and in Pennsylvania in compacting coal dust by pressure, Mr. N. A. Taylor, of Palestine, Texas, is confident that by similar mechanical treatment the soft and watery lignite might be converted into a fuel that would rival cannel coal. The solidity and high specific gravity of true coal being due to the pressure to which it has been subjected by overlying rocks, mechanical pressure, he argues, would do the same for lignite. Such pressure would expel the water, and by compacting the fuel would make it more durable in combustion and add greatly to its heating power. "Nature does it: why can't we?"

It is purely a question of economy of power. If the lignite can be squeezed into true coal, or something like it, for less than it will cost to bring coal from the coal fields of the north, the advantage to Texas will be obvious and great. As the lignite beds are easily accessible, and can probably be made to furnish the power required for converting the lignite into a more useful fuel, there would seem to be no theoretical obstacle to the accomplishment of the end at which Mr. Taylor aims. At any rate it is a good opening for invention, and one that Texan inventors will probably follow to profitable solution as soon as they discover its importance. And the value of a successful process of compacting lignite so as to fit it for transportation and the ordinary uses of soft coal would not be confined to Texas. There are in many parts of the West, and in other countries, extensive beds of lignite, the utility of which would be vastly increased by the invention called for by Mr. Taylor.

SMOKELESS FUEL FROM COAL.

Mr. W. D. Scott-Moncrieff, in a paper read before the Society of Arts, has recently brought to the attention of that body an important project for not only hereafter preventing, but also for rendering commercially available the dense stratum of smoke that has so long hung like a pall over the city of London, obscuring the light and rendering the atmosphere dangerous to the whole community. He proposes to substitute for the bituminous coal now in universal use for domestic and industrial purposes, a modified form of this coal from which the gas has been partially extracted. Experiments made by him as long as ten years ago showed that a semi-coke, resulting from a short distillation of coal, furnishes a fuel that is practically smokeless; and he has since discovered that, by treating this coke with water when hot, renders it still more smokeless and makes it the most perfect fuel imaginable, as it has all the cheerfulness and heat-giving properties of the unprepared coal with none of the disadvantages arising from its use. To produce this fuel in quantities suitable for public use he proposes to take advantage of the existing plant of the gas companies, finding that they are amply sufficient for the purpose. Instead of taking 10,000 cubic feet of gas per ton from the coal, he would take 3,333 cubic feet, or any other convenient proportion, and pass three times the quantity through the retorts. In this manner the gas would be coming away from the retorts all day long, just as formerly, with a slight loss of time to be allowed for the additional frequency of the charging. The supply at the end of the twenty-four hours would be in excess of that which is obtained from the long extraction, and in this way less and not more plant would be necessary to give the same quantity in a given time, while the gas itself would be of better quality. The author claims, from his investigations and experiments, that the results of the application of his scheme would prove startling. The gas companies would have double the quantity of by-products, in the shape of tar and ammoniacal products, that they have at present; the community would have 24-candle instead of 16-candle gas; the fuel resulting from the process would be of a nature to ignite readily, make a cheerful fire that gives out 20 per cent more heat than common coal; and London would become a smokeless city. The only extra expense to the companies would be that of the additional workmen employed in charging the retorts and interest upon the additional capital required for transit appliances; but, as an offset, the companies would receive an increased quantity of valuable by-products and a supply of fuel that would be in universal demand; and the profits from the sale of this at prices much below that of coal would be such that the companies would be actually getting their coal for nothing.

THE SILK INDUSTRY OF THE UNITED STATES.

The preliminary report of Mr. Wm. C. Wyckoff, Special Census Agent on Silk Manufacture, shows that this industry gives employment to something over 34,400 hands, and that the finished goods turned out are worth about $34,400,000, or a thousand dollars net to each worker.

The product of the census year ending June 30, 1880, is divided as follows:

Sewing silk	$776,120
Machine twist	6,000,265
Floss silk	219,250
Dress goods	4,115,305
Satins	1,101,875
Tie silks and scarfs	606,675
Millinery silks	891,955
Other broad goods	627,595
Handkerchiefs	3,862,550
Ribbons	5,955,005
Laces	437,000
Braids and bindings	999,685
Fringes and dress trimmings	4,950,275
Cords, tassels, passementeries, and millinery trimmings	1,866,575
Upholstery and military trimmings	1,302,355
Coach laces and carriage trimmings	37,510
Undertakers', hatters', and fur trimmings	59,805
Mixed goods and silk values therein	510,763

Reports were received from 383 factories, with 8,467 looms, representing an investment of $18,899,500. Connecticut has 28 factories; Massachusetts, 22; Pennsylvania, 49; New Jersey, 108; and New York, 150. The Connecticut factories give employment to 3,766 hands; those of Massachusetts to 2,068; Pennsylvania, 3,360; New Jersey, 13,932; New York, 10,484. The chief centers of the silk industry are Hartford County, Conn., with 549 looms; Hudson County, N. J., with 1,060 looms; Passaic County, N. J., with 3,238 looms; New York city, 1,820 looms; Philadelphia, Pa., 769. Nearly half the silk operatives are women. The wages paid during the census year footed up $9,107,853, of which Paterson, N. J., had $3,335,045, and New York city, $2,196,660. The gross value of materials and supplies was $22,371,300, and the gross value of manufactured product was $40,975,285, which includes the returns from those who do not make finished goods—throwsters, makers of fringe silks, spoolers, winders, dyers, etc.

SUPPRESSION OF ONE CLASS OF INTERFERENCES.

An important modification of the practice of the Patent Office in the matter of trade mark interferences has been ordered by the Secretary of the Interior.

Since the decision of the Supreme Court affirming the unconstitutionality of the United States statutes relating to trade marks, the Office has continued to register the applications of such persons only as, with knowledge of the decision, voluntarily paid the fee previously required. The Office has also continued the practice of deciding between conflicting or interfering applications for certificates of registration.

This practice is now discontinued, the Secretary of the Interior having decided, in the case of Braun & Co. vs. Blackwell, that it is not within the province of the Commissioner to decide questions of priority of right between applicants or those who have already received certificates of registration. All interferences pending in trade mark cases have accordingly been dissolved. Hereafter, on receipt of an application for the registration of a trade mark, notice will be given the applicant of the decision of the Supreme Court, as heretofore, and if the applicant still desires registration, and the matter is proper therefor, the application will be considered without reference to any pending application or to any registered trade mark.

Thus the function of the Patent Office in relation to trade marks becomes purely one of registration and certification. The question as to the applicant's legal claim to the mark so registered is left for decision where it properly belongs, that is, with the courts, to which appeal must ultimately be made in case of dispute.

It may be seriously questioned whether the function of the Office with respect to patent rights should not be similarly limited. With its present force and the vast multitude of applications to be considered it is physically and morally impossible for the Office to give more than a few minutes, on the average, to the determination of the questions of originality, novelty, and the rest. For this reason not only are improper applications granted—the existing practice of the Office only being considered—but worse, really proper and deserving applications are denied. And yet, after all, the property right of the patentee must be passed upon by the courts before it has more than a presumptive value.

To the popular mind the possession of letters patent bearing the broad seal of the United States, is a guarantee that the owner's right to the invention claimed has been officially examined and decision rendered in his favor; and on this presumption not a little money has been paid for patents which could not stand legal investigation. The knowledge that the Patent Office simply registered and certified claims to property rights, leaving them, as in the case of trade marks, to be adjudicated by the courts, would in no wise lessen the legal value of letters patent, while it would greatly simplify and expedite the work of the Office, and at the same time put an end to a vast amount of expensive and vexatious litigation, which, even when successful, merely establishes a claim.

For when an inventor has been subjected to a costly trial to prove his freedom from interference, and has obtained the patent applied for, he has gained nothing which the Patent Office could not justly have given him at the outset, namely, a certificate that he claims the invention described. The decision of the Commissioner that there is no interference is worth nothing in the courts if the claim is contested there. The entire case must be retried on its merits.

The simple and efficient working of the law with respect to copyright should relieve any apprehension that may exist as to a possible injury to patent rights in case the suggested change in the practice of the Patent Office should be made.

The value of copyright property is very great; yet the litigation with respect to copyrights is relatively small, though the government entertains registers and certifies claims to copyright, as it hereafter will trade-mark claims, without pretending to determine their legitimacy. That is the business of the courts. And the courts would probably have fewer patent cases to try if it were generally understood that the decision of the Patent Office in granting letters patent gives only a presumptive title to the invention claimed, and that the proper function of the office is clerical rather than judicial.

Failure of Another Railway Viaduct.

Following the destruction of the Tay bridge now comes intelligence of the destruction, on Feb. 6, by ice, of a section of the Solway Viaduct, the most important part of the Solway Junction Railway, and until this week, a connecting link between England and Scotland. In former years the thaw has been accompanied by high winds, breaking up the ice and saving the Viaduct; but this season no wind has arisen, and the packs have been carried down in unbroken masses, hurling themselves against the piers, carrying everything before them. The accident has been unattended by any loss of life, owing to the vigilance of the railway authorities, who had watchmen stationed, who gave timely warning.

The structure is very similar to the Tay bridge in construction and size. The viaduct is about a mile and a quarter in length, and about 40 ft. in height; the spans are in groups of seventeen of 30 ft., each group being connected by a span of 5 ft.

Some idea of the force of the floating ice may be formed from the narrative of the fishermen, that for some days the channel was covered with fields of ice acres in extent from 6 ft. to 12 ft. in thickness. The crashing of the ice as it swept along, borne by the current at the rate of twelve knots an hour, was heard two or three miles off, they said, and even half a mile away from the viaduct the noise was audible, although the wind was blowing in the opposite direction.

A New Electrical Society.

A new organization styled the New York Electrical Society has lately been organized in this city, having for its object the advancement of the knowledge and uses of electricity.

The following officers were elected for the ensuing year: President, F. W. Jones; vice-presidents, George B. Scott, Professor Vander Weyde, Gerritt Smith, W. J. Dealey, George A. Hamilton, and G. G. Ward; secretary, John W. Moreland; treasurer, M. Brick. The membership is already quite large and comprises many of the foremost electricians residing in this vicinity.

A Meteoric Stone.

A meteoric stone fell at Wiener Neustadt, a few days ago, near the telegraph office, and penetrated deeply into the gravel-covered road. The phenomenon was witnessed by several persons, who all declare that the meteor showed a brilliant light. Upon inspection a triangular hole was discovered of five centimeters width; the ground was frozen at the time. The meteoric stone was excavated in the presence of Dr. Schober, director of the Wiener Neustadt High School. It weighs 375 grammes, is triangular in shape, its exterior is crystalline, with curious blackish, grayish, and yellow reddish patches. Here and there metallic parts give a brilliant luster. Its specific weight is very high, its hardness about 9. An analysis is now being made.

Fifteen Hundred Miles a Minute.

The cable message to Australia respecting the Hanlan-Trickett match was an extraordinary achievement in telegraphy—in fact, it has never been excelled. The total extent of lines—namely, 12,000 miles—was traveled in one hour and twenty minutes. The greater portion of this time was occupied in transmitting the message through India. From Singapore to Sydney, 5,070 miles, the message occupied only thirty-five seconds in transmission. This message was repeated fourteen times, from station to station, between London and Sydney.—*Sydney Mail.*

The American Institute of Mining Engineers.

The annual meeting of the American Institute of Mining Engineers was held in Philadelphia the third week in February. The attendance was unusually large, and many important papers were read and discussed. The following officers were elected:

President: William Metcalf, Pittsburg, Pa. Vice-Presidents: J. P. Kimball, Bethlehem, Pa.; W. H. Pettee, Ann Arbor, Mich.; C. O. Thompson, Worcester, Mass. Managers: J. S. Alexander, Philadelphia; H. S. Munroe, New York; J. C. F. Randolph, New York. Treasurer: Theodore D. Rand, Philadelphia. Secretary: Thomas M. Drown, Easton, Pa.

It is probable that the next meeting of the Institute will be held at Staunton, Va., in June next.

NEW INVENTIONS.

Mr. George T. Manley, of Canton, N. Y., has patented a vessel for containing viscous substances, simply constructed and so arranged that any desired quantity can be drawn off conveniently without opening the lid of the can, and which also prevents the formation of a skin or crust on the top of the substance, and excludes dirt therefrom. The can has a delivery aperture at its lower part which is closed by a slide or gate. A follower or piston is placed in the upper part of the can, and a rod passing therefrom through the lid is provided with a knob. The slide being opened, pressure on the knob causes the viscous substance to flow out. The can is well adapted to holding printer's ink and analogous substances or mixtures.

Mr. Charles de Vauréal, of Paris, France, has patented a process for extracting gold and silver from their ores, more especially ores containing sulphur, arsenic, and antimony, by which the extraction can be performed at low cost, and the difficulties heretofore pertaining to the reduction of this class of ores are claimed to be so far overcome that the quantities of gold and silver extracted are equal to, or even greater than, those obtained by fire assay. The arsenic is first eliminated by treating the ore at a dull red heat with hydrogen. The ore is next roasted to oxidize the copper, which is removed by sulphuric acid. Lastly, the antimony is removed in the form of a chloride by the action of hydrochloric acid.

Mr. William W. Mallory, of Holland Patent, N. Y., has patented a hand force pump for sprinkling plants, washing windows and carriages, and other uses, and so constructed that it carries the overflow back to the reservoir. It is a very simple, ingenious, and convenient device.

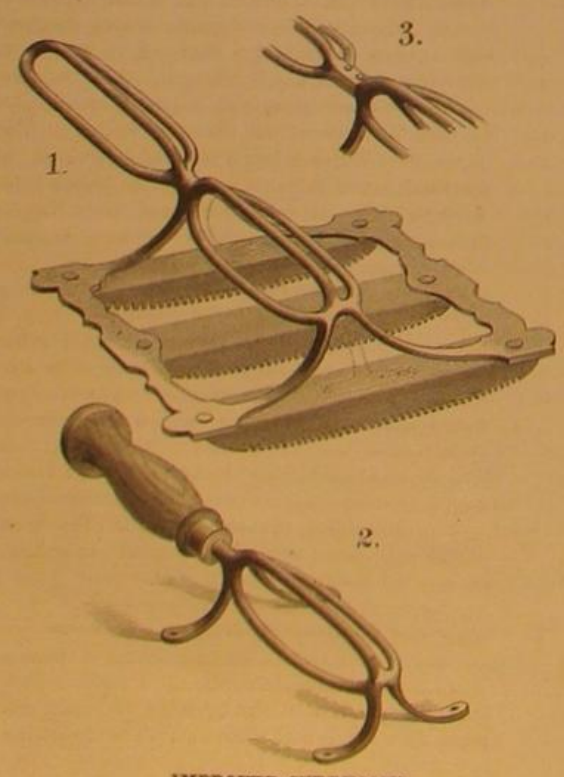
Mr. Dwight Burdge, of Battle Creek, Mich., has patented a folding writing desk which is simple in construction and can be folded very compactly. The invention consists in the novel construction and combination of parts whereby a hinged case or paper and envelope receptacle is held in an upright position on a folding table top when the latter is adjusted horizontally on the two pairs of crossed and pivoted legs, to one pair of which the table-top is itself hinged so that it may fold between the legs when the desk is closed.

Messrs. Rafael Martinez and John Petry, of New York city, have patented an extension bath tub, which is simply constructed, occupies little space, and can be easily extended. It is contained in a box provided with an extensible part which can be drawn out to lengthen the tub when required, and pushed back when the tub is not in use. It is also provided with a pump which can be used for transferring the water to a bucket in emptying the tub.

IMPROVEMENT IN CURRYCOMBS.

The improvement shown in the engraving relates mainly to the handle, which is made wholly or in part of malleable iron, and is formed so as to afford two places for the hand, one immediately over the back of the brush, and the other projecting over the side of the brush.

The handle, although of a single casting, has the appearance of being made of wires curved so as to form a light yet very strong handle. The handle shown in Fig. 1 is made of a single piece, that shown in Fig. 2 is made partly of wood, and Fig. 3 shows the iron handle made in two parts, fastened together with rivets.



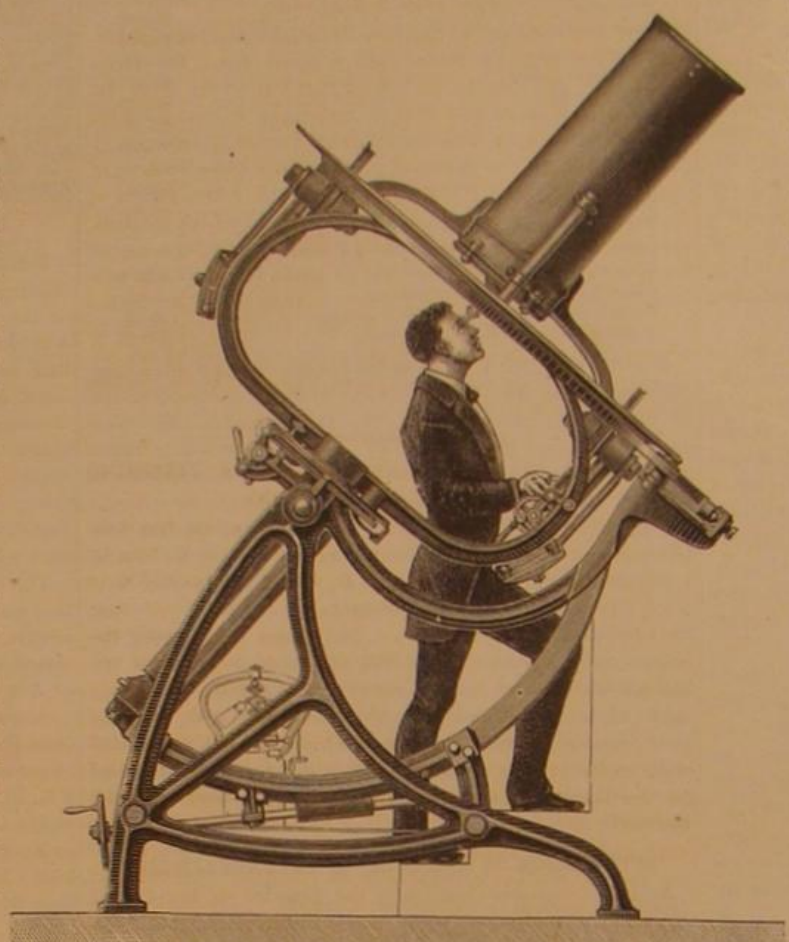
IMPROVED CURRYCOMB.

This device is the invention of Mr. W. P. Kellogg, of Troy, N. Y.

NEW TELESCOPE OF SHORT FOCUS.

We represent herewith a new telescope devised by M. Leon Jobert, the able director of the Popular Observatory at the Trocadero, Paris.

This instrument is like the Cassegrainian telescope in form, and is of short focus, its parabolic reflector being only half the focal length of those of Foucault. It is of variable latitude, or, in other words, may serve for all points of the globe. In order that the observer may, without changing his position, be able to sweep the whole heavens above the horizon, the ocular is located at the intersection of the polar axis with the axis of declination. The sides of the tube are furnished with two supports, which are jointed around the horary axis, and pass through two other large supports that form a part of the last-named axis, and that are connected with each other by a turned circle moving over two large rollers. This circle is made very solid by a wide open-work backing, and both the latter and the circle are open in such a way as to allow the body of the telescope to pass when the instrument is directed toward stars which are at the celestial equator or near the southern horizon. The body of the telescope is balanced by two weights whose supports are fastened to the axis of declination. The polar axis passes through a journal box, whose two extremities are held in the upper ends of the two large cast iron sides forming the main frame. The cast iron cross-stays which connect the two sides of the frame are provided with a couple of projections which carry an arc, against which the large arc may slide with slight friction. The latter is firmly united at one of its extremities with an arm which descends from the journal box and supports the bed plate, on which rests the lower end of the polar axis; and its other extremity is connected with another arm which likewise starts from the journal box and forms, by branching laterally, the bearings which carry the two rollers on which the turned circle revolves through the action of the clock which causes the diurnal motion. The clock is regulated by a regulator which is plainly visible in the annexed figure.



M. JOBERT'S NEW TELESCOPE OF SHORT FOCUS.

By means of a hand wheel the instrument may be fixed at the latitude of the locality where it happens to be placed, in such a way that the prolonged polar axis is parallel with the axis of the earth and points to the celestial pole. The instrument is furnished with a polar circle and a circle of declination with verniers that are moved by endless screws. In the figure the observer is represented with his hand on the hand wheel, which actuates at the operator's will, either rapidly or very slowly, the axis of declination. The clockwork movement is transmitted by bevel wheels and an axle, to a wheel which revolves loosely on the axis of latitude formed by the bearings of the large arc; and from this point motion is transmitted to the axis of the endless screw, and from thence to the endless screw which actuates the polar axis. With this instrument the observer can sweep every point in the heavens without changing his position, the only change he makes in the latter being that of moving with the instrument, which makes one complete revolution every twenty-four hours.—*La Nature.*

By adding phosphorescent material to printer's ink, it is said that books and papers can be made legible in the dark. A luminous newspaper is proposed at Turin.

A Project for the Year 2000.

Lake Mackenzie is one of those "possibilities of North America" recently suggested. The lake would result from a proposed closing of the northerly outlet of the valley of the Mackenzie River, at the line 68° north, and storing up the water of 1,260,000 square miles. And to this could be added the water of other large areas. It would be a lake of about 2,000 miles in length by about 200 of average width. Its surface would have an altitude of about 650 feet above sea level. It would cover with one continuous surface the labyrinth of streams and lakes which now occupy the Mackenzie Valley. It would be a never failing feeder for the Mississippi. It would connect with Hudson Bay and with the "great lakes," and also with the interior of Alaska by connecting with the Yukon and its affluents. By concurrent results and other "possibilities" it would become, during some months of each year, a navigable water, adding not less than 12,000 miles of communication to the Mississippi. It would complete the interior lines of river courses by connecting them. Cutting the "divide" which now exists between the Mississippi and Mackenzie would do this. This work is small when measured by its results, and it becomes easy of accomplishment under the methods proposed. The connecting of the Upper Mississippi with the proposed Lake Mackenzie would be easily made if that lake had a surface at the proposed altitude of 650 feet above the sea. The outflow from such a lake, having a length of more than 2,000 miles from south to north, and draining a very wide range of altitudes and latitudes, would be a timely and enduring one. This lake would make possible and easy the straightening of the Lower Mississippi. It would also contribute to the proposed ship channel from Cairo, Ill., to the Gulf of St. Lawrence, by the almost straight line which cuts the Wabash Valley, the Lakes Erie and Ontario, and the Lower St. Lawrence. This commercial channel, receiving all the waters converging at Cairo, would complete the demand for a constantly open ship channel from the St. Lawrence to the sea by way of the Strait of Belle Isle. That demand can be complied with, and the shortest and best line of communication can be thus opened between the interior and the seaboard.—*St. Louis Republican.*

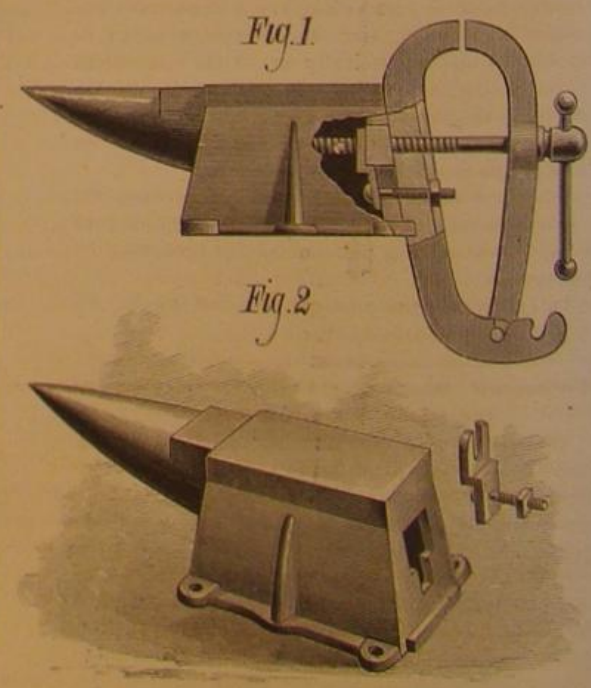
Opium in San Francisco.

There are said to be 400 places in San Francisco where opium is sold, and many of them are said to average $75 a day. If such is the fact the sale of this fatal drug in the United States must be enormous, and with the influx of Chinese to this country, it would seem that before long some national legislation will be necessary to control the sale of this delusive drug.

COMBINED ANVIL AND VISE.

A handy tool for the use of blacksmiths and other mechanics, as well as for farmers and others who occasionally require conveniences for working in iron, is shown in the annexed engraving. It consists of a combined anvil and vise, the former forming a very solid foundation for the latter.

Fig. 1 shows the combined tool complete, and Figs. 2 and 3 represent the anvil and the clamp which retains the vise. The anvil is recessed to receive the nut of the vise and the clamp which retains it. The nut is allowed to remain in the anvil when the vise is removed.



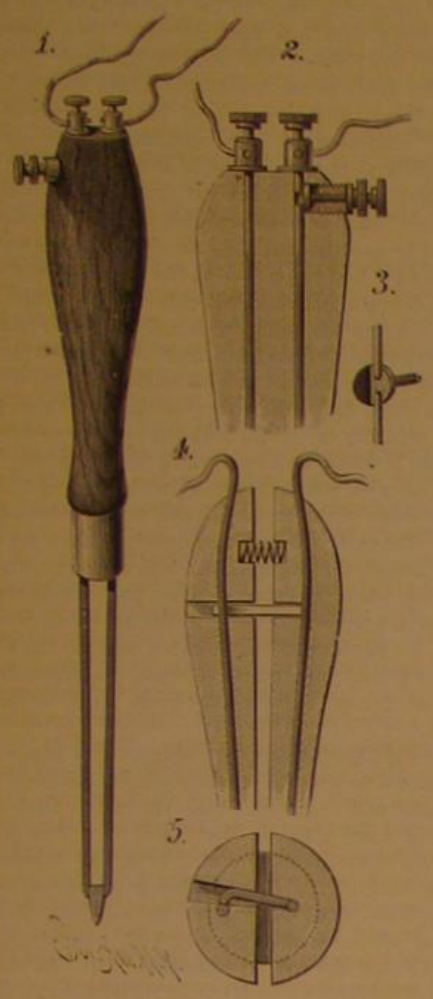
COMBINED ANVIL AND VISE.

The vise is of improved construction, which permits of quickly adjusting the movable jaw so that the two jaws are parallel. This is accomplished by means of notches opening outwardly and upwardly in the forked lower end of the fixed jaw, the movable jaw having a pivot adapted to the notches.

This invention was recently patented by Mr. A. L. Adams, of Cedar Rapids, Iowa.

SOLDERING BY ELECTRICITY.

The engraving shows a soldering iron heated by the electric current, and capable of melting all kinds of solders, such as gold and silver solder, which have heretofore required a blowpipe to melt them. It may also be used for the more fusible solders employed in making tin ware. Now that the electric current is distributed so generally and is used



ELECTRIC SOLDERING IRON.

for all manner of purposes it seems quite practicable to employ it for soldering.

Figs. 1, 2, and 3 show one form of electric soldering iron, Fig. 1 being a perspective view, Fig 2 a section showing the switch for controlling the current, and Fig. 3 a detail view of the switch button. Figs. 4 and 5 are views of a modified form of the device. In Figs. 1 and 2 the electric conductors extend through and project beyond the handle, and embrace a piece of platinum or other material offering sufficient resistance to the passage of the electric current to become heated more or less according to the strength of the current. One of the conductors is separated near the upper end of the handle, and bridged by a button made partly of electrical conducting material and partly of insulating material, so that by turning the button the circuit may be completed or broken as circumstances may require. The device shown in Figs. 4 and 5 is on the same general principle, the only difference being that the handle is split lengthwise and the two portions are pressed apart by a spring. When apart to their fullest extent a hook attached to one of the conductors touches the other conductor and short circuits the current in the handle. When the two halves of the handle are pressed together the current passes through the refractory point.

When the point is heated to incandescence the tool may be used for melting either silver or gold solder. For melting soft solder the heat may be less intense.

This invention was recently patented by Mr. C. E. Ball, of Philadelphia, Pa.

Marketable Weight of Fish—Amendment of the Game Laws Suggested.

At a recent meeting of the Long Island Sportsmen's Association, held in this city, certain amendments of the New York State game laws, pertaining to the capture and sale of fishes, were suggested.

In the close season, if a box of trout should be sent to a dealer and he should open it on his stand in the presence of a citizen he might be heavily fined, although he had not sent for the trout, and did not know what the box contained.

Mr. Eugene Blackford said that he had a lot of trout once sent to him on which he might have been fined $40,000. He thought the laws should be amended in such manner that only the guilty should be punished.

The marketable weight of fishes was also thought a proper subject for legislation. The following weights and sizes for different fishes were agreed upon: Bluefish, not under three-quarters of a pound; weakfish, not less than half a pound; sea bass, half a pound; porgies, half a pound; black bass, half a pound; yellow perch, one-third pound; white perch, one-quarter pound; mullet, one-quarter pound; butter fish, one-quarter pound; flounders, half a pound; sunfish, one-quarter pound; Spanish mackerel, one pound; brook trout, not less than four ounces. It was decided that dressed eels should not be less than twelve inches long, while eels not dressed might be sold fifteen inches long.

A motion was carried that between the sundown of Friday and sundown of Saturday, shad fishing in the Hudson river should be suspended and nets hauled up on the shad poles. This was to let the shad run up the river and spawn.

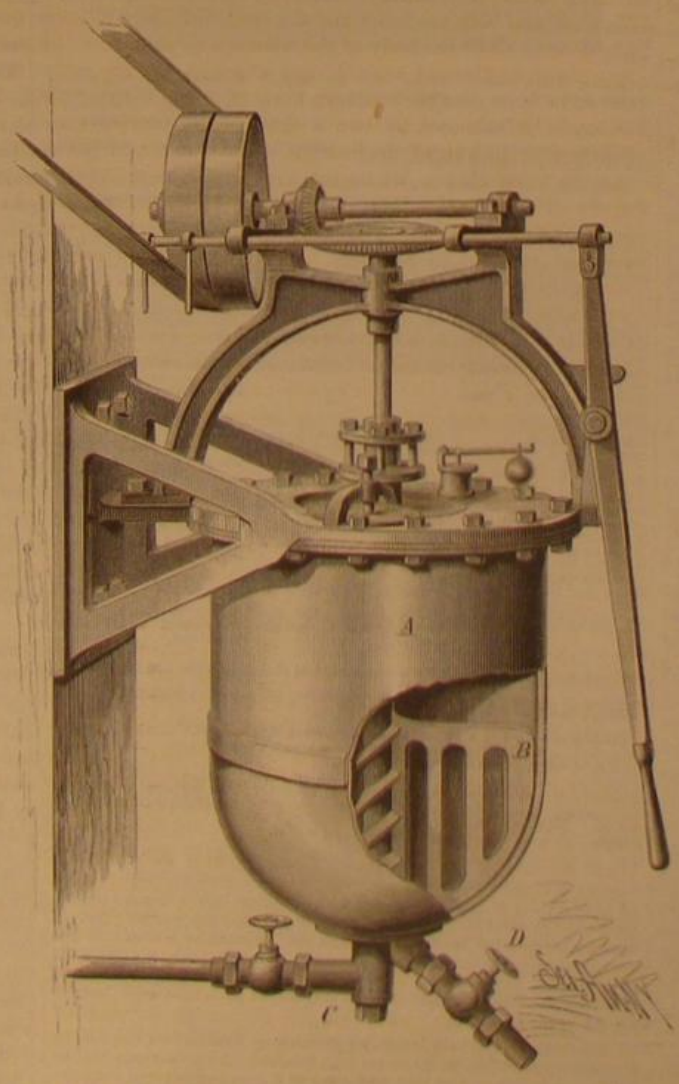
The Lick Telescope.

At a late meeting of the San Francisco Academy of Sciences, Professor Davidson read a letter from Dr. Hugo Schroeder, of Ober Ursel, near Frankfort-on-the-Main, intimating that he would like to undertake to make for the Lick Observatory a fifty-inch refractor upon a new principle, with single in place of double lens objectives. Dr. Schroeder has been very successful in the manufacture of lenses; but his proposal failed to interest the Lick trustees, for sufficient reason that a contract had already been signed with the Clarks, of Cambridge, to make for the Lick telescope an achromatic object glass having thirty-six inches clear aperture. The cost is to be $50,000. The glass is to be finished within two years after the rough disks are obtained, and it is expected that these disks will be had before November 1, 1883.

APPARATUS FOR PREPARING STARCH FOR FINISHING LINEN AND COTTON GOODS.

Starch used for finishing linen and cotton goods has usually been prepared in open boilers with a double bottom by the action of direct or indirect heat, and alum was added to give the starch the desired quality.

Mr. F. A. Hempel, of Plauen, in Saxony, has greatly improved on this method by boiling the starch in a closed vessel under a pressure of five atmospheres, while continually agitating it. The apparatus, which is shown in the annexed cut, consists of a copper kettle, A, the lid of which is covered with copper on the underside. A vertical shaft is journaled in the lid, and is rotated by a horizontal shaft through beveled gear wheels. Wings, B, are attached to the vertical shaft and agitate the contents of the kettle. The lower end of the vertical shaft is bored axially, and diagonal channels lead from the central longitudinal channel. Through these channels steam, at a pressure of five or more atmospheres, can be admitted into the kettle, the pressure being regulated by the valve. The starch is passed into the kettle through the opening in the lid, and can be drawn from the kettle through the pipe, D. Steam is admitted through the pipe, C, and the kettle is provided with a pressure gauge safety valve. The operation requires three-quarters of an hour, and the starch is as clear as water. The starch thus obtained is of excellent quality and does not require alum.

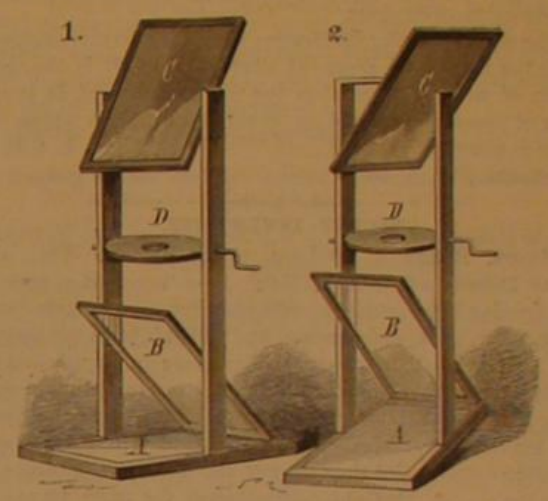


APPARATUS FOR PREPARING STARCH FOR FINISHING LINEN AND COTTON GOODS.

A SIMPLE EXPERIMENT WITH POLARIZED LIGHT.

Scientific toys sometimes awaken a love for further investigation, and experiments in optics often prove more fascinating than was expected. Few of our young readers, we presume, are aware that by the exercise of a little ingenuity and patience they may construct for themselves, without the expenditure of a cent, and from materials to be found in every old garret or store room, a very pretty scientific toy that will afford profit and pleasure for many an idle hour. Many who have seen or read of the Noremberg apparatus have no idea of how easy it is to make one of tolerable excellence. Two pieces of good window glass, a small piece of looking-glass, some strips of wood, and a jack-knife are the principal articles required in its construction.

The principle employed in this form of apparatus is simply the fact that when a ray of light is reflected from a piece of unsilvered glass, making an angle of 35½° with the glass (or 54½° with a perpendicular to the glass), it becomes polarized. Such a ray of polarized light will not bear reflection from a second plate of glass turned at right angles to the first, if it strikes it too at an angle of 54½°. But if a thin plate of mica or other biaxial mineral is placed in the path of this ray it will not only be rendered visible, but be beautifully colored, the color depending upon the thickness of the mica and its position.



POLARIZING APPARATUS

It is evident, then, that we need, first of all, some means of measuring and constructing an angle of 35½° and 54½°. If a circular protractor or scale of chords be not at hand, the following will give sufficiently accurate results:

Take a large sheet of paper or cardboard having a right angle at one corner, and measure off 10 inches in one direction and 14 inches in the other. Join the point thus formed by a straight line, and you will have a right angled triangle, one angle of which is 54½° (that opposite the longer side) and the other angle is 35½°. An ordinary business card is cut so as to have the same sized angles and used in constructing the apparatus. Procure a piece of thin wood 3 inches square for a base, two strips of wood ½ by ¾ inch, and 9 and 10 inches long, respectively, for uprights. From a broken mirror cut a piece 2¼ inches square. A piece of quartz or very sharp steel will answer instead of a diamond to scratch the glass if care is used in breaking it. Also two pieces of clear window glass, each 2¼ by 4 inches. One of these is covered on one side with dull black paper, over which is laid a piece of cardboard, and the whole bound together with a strip of black paper. A circle is also cut from cardboard, and a hole cut in it as large as a nickel five cent piece. A groove is cut in each of the uprights about two inches from the lower end in a slanting direction, so as to have an angle of 35½° with the upright, and 54½° with the base. At a height of about 8 inches are two similar grooves, at the same angle, but in the opposite direction to the lower ones instead of parallel to them. This groove is made wide enough to receive the glass backed with cardboard. Two uprights are now attached to the base, by tacks or otherwise, at such a distance apart as to allow the strips of clear glass to slide tightly in the grooves, while the mirror, placed flat upon the base, is received in notches at the foot of the uprights. The blackened glass is slipped into the upper pair of grooves face downward, the transparent one is slid into the lower grooves, and at a point midway between them the circle of black cardboard is held in position by short pins passed through the uprights on either side. Place the apparatus thus arranged before a window so that the upper edge of the upper glass is about on the level of the eye, or a little below it. On looking into this upper glass a bright circle will be seen reflected in it. Take some pieces of clear mica, and place them one, two, or three at a time, in various positions on the pasteboard disk, which can also be turned at various angles. In certain positions the circle, as viewed in the upper plate of glass,

will acquire beautiful colors which change with every movement of the mica. Other biaxial minerals in thin sections do the same.

By a slight modification of the apparatus it can be made to prove the other peculiar property of polarized light. (See figure 2). Remove the upper plate of glass, and attach to its reverse the oblique surface of a large cork cut at an angle of 35½°. The cork may be tacked or glued to a thin piece of wood by its large end, and this strip of wood fastened to the top of the longer upright, after the manner of a gibbet. This will suspend the strip of glass at the same angle as before, but at right angles to the lower one, and the observer, in order to see the disk, must stand with his side to the window and look just over the top of the shorter upright. Instead of seeing a bright spot as before, the center will be comparatively dark. But on replacing the mica on the revolving stage, rich colors again appear. Beautiful effects can be obtained by combining and overlapping strips of mica of different thicknesses.

A thin section of a crystal of quartz cut perpendicular to the axis also produces a very pretty series of colors, depending upon the thickness and the angle of the plain glass plates.

Instead of wooden uprights the plates of glass may be mounted on wire apparatus, as described by Hopkins in the SCIENTIFIC AMERICAN of December 4, 1880, page 354, making use of the principles illustrated in Figs. 16 and 20, with necessary modifications.

The accompanying illustration shows the second position. A is the horizontal piece of silvered glass, B is the clear piece of window glass, C is the blackened glass, D is the disk of black pasteboard or revolving stage on which the mica is placed.

E. J. H.

Atlanta, Feb. 5, 1881.

RECENT INVENTIONS.

Messrs. Robert F. Dobson, of Darlington, Wis., and Isaac Dobson, of Lincoln, Neb., have invented a process for tanning hides which is claimed to involve comparatively little labor, time, and expense, and which injures the fiber of the leather less than processes heretofore employed, and by which the leather produced is made stronger and more durable than that heretofore produced. They place the hides for ten days, or thereabout, in a bath of strong brine and tanning extract, and then subject the hides to the fumes of sulphur in an air-tight compartment for from twelve to twenty-four hours or more.

A steam-supplying apparatus, patented by Milton W. Hazelton, of New York city, combines with a heating tank appliances for supplying steam either for power or heating purposes. A central heater is employed to heat a mass of water to a prescribed temperature higher than the boiling point. This hot water is carried through pipes to local steam generators, in which the pressure upon the heated water being reduced steam is generated. The water in these generators, cooled by the generation of steam therefrom, is led back to the central heating tank for reheating.

Mr. David S. Thomas, of North Platte, Neb., has patented a windmill which supplies an improved device for controlling or adjusting the sails or vanes. A clutch wheel or spider and a spirally grooved loose sleeve, to which is attached a small vane, are fixed on the axle of the wheel. The sleeve engages with a stud, and, when turned in one direction, draws the wind wheel into clutch with the spider, whereby the vanes are set to the wind. The vane on the loose sleeve also acts to adjust or throw the vanes flat in a high wind.

Mr. John T. Stoll, of Sacramento, Cal., has patented a horse collar pad for collars of the kind which open at the top, and which supplies an upper pad of such form and material as will securely keep the collar in its proper shape, prevent the strap which holds the hames together from pressing through the top of the collar, and which is supplied with a hook or holding iron, that prevents the hame strap from slipping forward, and keeps the hames in their place on the collar.

Mr. John W. McKee, of Moselle, Mo., has patented a drag-sawing machine which may not only be used for sawing down trees, but which may also be advantageously used for cutting the trees into logs when felled. It may conveniently be moved from place to place.

Mr. Tom Owen Memery, of Key West, Fla., has patented a sewing machine shuttle provided with a hinged spindle for receiving the spool and a friction nut and screw, which also sustains the moving end of the spindle when in position for use, thus permitting the ready application and removal of the spool.

Mr. Elihu Quimby, of Hanover, N. H., has patented an automatic time register and alarm, which acts to cause an alarm at any desired place in case of failure of the watchman to perform his duty, obtains a permanent record indicating the time of any dereliction, permits the watchman to operate the distant signal at any time independently of the ordinary working of the apparatus, permits a person at such distant point to distinguish regular from unusual signals, and which cannot be tampered with. A novel combination of electrical devices and clockwork effect the results stated.

Mr. Frank W. Mix, of Terryville, Conn., has patented an indicator lock which prevents the opening of the lock and the subsequent restoration of the indicator dials to their former positions by turning the key back. A peculiar construction and arrangement of an obscuring disk closes the openings in the face plate to prevent the entrance of dirt, rain, etc.

Mr. Edwin L. Barber, of Henrietta, Texas, has patented a water cooler wherein the vessel holding the water is surrounded with felt attached to the inner side of a casing for the vessel. The casing has apertures formed therein for the escape of vapor arising from the felt which is wetted in use, and troughs are provided to convey away the drip.

An extension straw stacker has been patented by Mr. William Holmes, of Ashland, Ohio, which is so constructed that it may be extended or contracted without affecting the tension of the endless belt carrier or of the adjusting chains.

Elementary Physics.

BY L. J. OSBUN.

A teacup with a little water; a small sponge; a sheet of blotting paper six inches square, folded twice, so that all the corners shall come together; pin three of the corners together, press the others away, thus forming a little pocket or filter; a mixture of pulverized chalk, or ashes and water; a bowl of water; two blocks of wood; two pieces of sole leather; if possible, a magnifying glass; a narrow bottle or test tube; some alcohol or naphtha or kerosene; some cotton; a glass tube one fourth inch inside diameter, one foot long, closed at one end; a test tube; a shingle or strip of pasteboard; a knitting needle; a brick; a short candle; a bottle or test tube filled with colored liquid; a piece of pipe stem or glass tube; a lamp; a dry bottle fitted with cork, and glass tube or tobacco pipe.

EXPERIMENT.	OBSERVATION.	INFERENCE.
Into a teacup containing two tablespoonfuls of water thrust a dry sponge, and then lift the sponge from the cup.	No water left in the cup.	The water in the cup entered spaces in the sponge.
Squeeze the sponge.	Water drops out.	
Into a little bag of unsized paper pour a mixture of powdered chalk and water.	The water passes through, and the chalk remains upon the paper.	Between the fibers of the paper there are spaces large enough to allow the molecules of water to pass through, but too small for the particles of chalk.
Into a bowl of water put a little block of unpainted pine wood, and a little piece of sole leather, set aside for a day, then take the wood and leather from the water, and compare their weight with equal-sized pieces of dry wood and leather, by lightly tossing them in the hand.	The wet pieces are much heavier than the dry.	Water has entered spaces in the wood and leather.
Look carefully at the sponge, paper, wood, and leather, if possible, with a microscope.	Little spaces between the fibers of the different bodies.	In many bodies there are little spaces, visible to the naked eye or by the aid of a microscope, called pores.
Into a bottle, or test-tube, *full* of alcohol, naphtha, or kerosene, attempt to thrust some cotton from a roll of batting.	A great quantity of cotton may be put into the bottle while the liquid does not overflow.	Between the molecules of the liquid are spaces for the molecules of cotton to enter, and between the molecules of cotton there are spaces for the liquid to enter.
Half fill a long, narrow glass tube with water; upon this pour alcohol until it is full. Close the tube with the thumb, invert it, and shake so as to mix the liquids.	The tube is no longer full, while none of the liquid has escaped.	The molecules of water must have entered into little spaces between the molecules of alcohol, and *vice versa*.
Heat to boiling in a test tube half a teaspoonful of strong ammonia.	A penetrating odor of ammonia about the mouth of the tube.	The tube must be full of ammonia gas.
Quickly invert the tube full of ammonia gas over some water. Shake the tube, but keep its mouth under water.	Water rises and fills tube.	There must be spaces between the molecules of the ammonia gas.
Examine the cotton, liquid, and gas.	There are no spaces visible.	Between the molecules of solids, liquids, and gases there are invisible spaces or pores.

Definition.—Pores that are visible are called *sensible pores*, and pores that are invisible are called *physical pores*.

Notes.—Matter is made up of molecules, and these in turn are made up of atoms. Between the atoms and between molecules there are spaces.

Lean a shingle against a knitting needle for a brace, and heat the needle.	The shingle falls because of the expansion of the needle.	The molecules of iron have been separated. In hot iron the spaces between the molecules are larger than in cold iron.
*Carefully heat a bottle or test tube with colored water, and fitted with a cork through which passes a narrow glass tube, or a pipe stem.	The water rises in the tube, and overflows.	The molecules of water have been separated. In warm water the spaces between molecules are larger than in cold water.
Cool the bottle.	The liquid lowers in the tube.	When water is cooled the molecules come together.
†Carefully heat a bottle or test tube, filled with air, and fitted with a narrow, bent glass tube, or a tobacco pipe, holding the end of the tube or pipe stem under water in a tumbler.	Bubbles of air escape from the tube and rise through the water.	The molecules of air have been separated. In warm air the spaces between the molecules are larger than in cold air.
Cool the bottle.	Water rises through the tube and enters the bottle.	When air is cooled the molecules come near together.

When solids, liquids, and gases are heated the molecules are separated.

Note.—A change of temperature in matter is attended with a change of position in its molecules.

Examples.—In the parts of a stove when a fire is built. In the mercury of a thermometer. In the earth and air when the sun rises. In the walls of a cold room when a person enters it.

Regard all the objects of matter about us, solids, liquids, and gases.	They are constantly changing in temperature, from warm to cold, or cold to warm.	The molecules must be constantly in motion.

—*Journal of Education.*

* Heat a piece of glass tubing, and when the glass is soft, remove it from the flame and quickly draw the hands apart. A tapering, narrow tube will thus be formed, the large end of which may be fitted to a cork that has been pierced and neatly filed with a slender, round file. The bottle should be so full of water that when the cork is pushed in, the liquid, which is colored with violet ink, shall rise half way up the glass tube, or entirely to the top of the pipe stem.

† The narrow glass tube is bent by warming, so that its free end may be conveniently held under the water in a tumbler. A tobacco pipe may be fitted to a bottle or test tube by means of a common tapered cork, the large end of which shall tightly fit the pipe bowl, while the small end fits the neck of the bottle. The cork, of course, must have a hole punched through it.

Making Iron Columns Secure.

So many accidents have occurred at fires to life and property by the sudden giving away of iron columns used for supports to the various floors of buildings, that such columns are looked upon with distrust by firemen, and their use discouraged. When they become heated by fire they warp and twist, and if water is thrown upon them they are apt to break entirely, thus letting the upper floors fall. It was in consequence of the giving away of the iron columns at the Broadway fire, some time ago, that the floors from cellar to roof fell in, and two firemen who were on the roof were hurled to a terrible death in the seething furnace within the building. All large cities are full of buildings whose several floors are supported on iron columns, and, in case of fire, they are quite as likely to collapse as did the one we refer to. Our building laws, which are yet crude and imperfect, permit their use, and, as they are cheaper than most anything that could be used instead, they are still favorites with builders. The very best thing to take the place of iron columns would be columns of brick, but objection is made to them that they take up too much room and are not ornamental.

Many experiments have been tried with a view to making iron columns fireproof, or at least sufficiently so to be able to stand a small fire in their neighborhood without bending, and thus bringing the entire building to the ground in ruins, long before it would be destroyed by the fire alone. Casing the columns with wood, asbestos, brickwork, etc., has been tried, and some of the methods have been described in the *Journal*. Recently two more suggestions have been made. One is to inclose the columns in rings of terra cotta, put on over the top when the column is set up. These would act as a shield to keep off the heat till the fire could be subdued. The plan is simple and inexpensive, and has the added advantage of giving opportunity to make the columns highly ornamental, as terra cotta readily lends itself to decorative treatment.

The second plan is to fill the columns with water. To do this the plates or castings, usually placed between the columns where they stand one over the other, have holes or openings of some kind, so that there is a free communication from column to column, from the bottom to the top of the building. Where columns are already erected, short pipes are used to connect them at each floor. The uppermost column is also provided with a small escape-pipe, passing through the roof to the open air. At the base of each tier of columns a pipe is connected with the street mains, so that all the columns may be filled with water, either permantly or on emergency. When thus filled with water and provided with an escape for the expansion of the water or steam, the columns would stand unharmed until every floor was burned out. Were the girders also hollow and filled with water in the same manner, both girders and columns would undoubtedly stand intact, even after all the floors and the roof had fallen in, and they could be used again in rebuilding. The system has the merit of cheapness and ease of application, and is patented in this country. We have little confidence, however, in iron columns under the conditions incident to a great fire, and the sooner their use is prohibited by law the better it will be for the public.—*Fireman's Journal.*

Salicylic Acid in Foot-and-Mouth Disease of Cattle.

The Duke of Brunswick has of late successfully combated the ravages of this much dreaded enemy on his estate at Stampen, near Oels, in Prussian Silesia, by treatment with salicylic acid, the well-known antiseptic. Instead of several weeks being required to effect a cure with the remedies hitherto employed, truly surprising results have been brought about within a few days by this new treatment. A solution of the acid is prepared by pouring some hot water on about three tablespoonfuls of salicylic acid in an earthen vessel, and adding lukewarm water to make up a gallon. The mouth and feet of the diseased animal should be carefully washed three times a day with this liquid, and the tops of the hoofs well powdered with the dry acid after each ablution. The effect will, moreover, be greatly increased by salicylating the drinking water of the beasts by the addition of two tablespoonfuls of the acid dissolved in hot water. During the above treatment great attention must be paid to the perfect cleanliness of the stables or sheds. The dung must be saturated with salicylic acid solution to prevent further infection, for it is chiefly in the dung that the germs of the disease are to be found.

Changes in the Relative Elevation of Land and Sea.

The impression that the northeastern coast of the American continent is slowly rising, and Professor Shaler's estimate of the rate of emergence in progress as being over a foot, and perhaps as much as three feet in a century, has been recently denied (*American Journal of Science and Arts*) by Mr. Henry Mitchel, who states, in the Coast Survey Report for 1877, that the salt marshes are still, as they were in the time of the early explorers, at ordinary high water level, and that the rocks upon our coast, long notorious as dangerous to navigation, have not risen since they were first discovered. In his statements ancient maps and documents are cited, and the conditions of the various rocks are considered in detail. He claims that no tilt in either direction has taken place in the Gulf of Maine. But eastward of longitude 64° 13', and especially in Newfoundland, great changes present themselves in the comparison of charts, the depths appearing to be at some points less and at other points greater now than formerly.

FRYER'S DESTRUCTOR AND CARBONIZER.

[*Continued from first page.*]

ties of materials were consumed in the destructor: 14,000 tons of rubbish, 59 beds, 131 mattresses, 264 carcasses of pigs which had suffered from swine fever, 1 cow, 8 sheep, 2 lambs, 28 quarters of bad meat, 13 cwt. of bad meat.

The total quantity of rubbish consumed in 2½ years in the Burmantofts destructor was 30,041 tons.

For each depot the following men are required: One foreman, who also acts as engine-driver; four furnacemen, one laborer, who also attends to two mortar mills; and the same for night duty.

The carbonizer is used to convert the refuse obtained from the sweepings of the paved streets and the markets, and other vegetable refuse, into a carbon very useful as a manure and deodorizer, and which finds a sale at the rate of 30s. per ton.

The carbonizer consists of a group of brickwork cells and furnaces, each cell having its own distinct furnace alongside of it. It is 26 feet long, 12 feet wide, and 15 feet 6 inches high, tied together with iron rods and angle-irons.

The refuse to be carbonized is fed into the apparatus at the top, the loose cover of the cell being removed for that purpose and immediately replaced; within the brickwork cells are hung, by means of cast iron plates fixed in its walls, a series of cast iron plates or eaves, touching the walls along their top edges, but standing free from the walls some inches along their lower edges. These plates are arranged to overlap one another, and form a continuous sloping ledge or eave, winding round and round the cell in a kind of spiral. Near the bottom of the cell the spiral eave finishes with a fire-block eave, the lower edge of which rests on a wall dividing the contents of the cell on one side from the hot gases of the fire which are admitted to it on the other side.

The refuse is fed into the cell until it forms a solid mass within the well of the spiral eave, being withdrawn at the bottom as it gets sufficiently charred, but it is not mobile enough in its nature to rise up again either underneath or behind the eaves, so that a space is there left forming a continuous flue in connection with the chamber behind the fire-block at the bottom of the cell, and up this flue pass the hot gases from the fire, heating the contents of the cell. At the top of the cell these gases pass through the damper frame into the vertical flue, and so into the main flue and thence to the chimney. The process undergone by the refuse is as follows: After being thrown in at the top of the cell it sinks gradually as it becomes closer packed, and as the finished charcoal is withdrawn at the bottom it sinks, and continually comes in contact with hotter and still hotter plates, until at the bottom of the cell it enters a chamber of nearly redhot firebrick.

No air is admitted during the process, except a slight amount which reaches it from the flue behind the eaves, so that instead of being consumed it is charred. The cell terminates about 2 feet from the ground in a strong cast iron plate, in which is an opening closed on the underside by a sliding door; this is opened at certain intervals (about three hours) by letting out a charge of charcoal into a small truck which is run in below the plate ready to receive it. The furnace with firegrate and door is of ordinary construction, and within it a thick, dull fire is kept up. Sight or peep boxes are provided to enable the flues nearest the fire to be cleansed, and similar peep boxes higher up allow a view on to the backs of certain of the cast iron plates for the purpose of seeing that they do not become overheated.

Though the cast iron plates are bolted to the walls, or through the walls to one another, they are removable if need be without pulling down any of the brickwork.

The charcoal, which comes out of the carbonizer redhot, is cooled in a char cooler, by passing through a revolving cylinder, over which cold water is continuously streaming, and is sifted as it issues from the outer end. This cooler is also driven by the steam engine which works the mortar pans.

Each cell deals with about 50 cwt. of refuse in every twenty-four hours, and the fuel required for the furnaces is sifted from the contents of the dry ashpits, it not being necessary to purchase any.

The cost of an establishment with one six-celled destructor, a carbonizer with eight cells, boiler, steam engine, two mortar pans, cooler, chimney shaft, and buildings, is about £4,500.

No nuisance of any kind is experienced in the vicinity of the depots, and this system of dealing with the refuse of towns appears to be gaining ground; the apparatus has been adopted in Kralingen, near Rotterdam, Leeds, Heckmondwike, Blackburn, Bradford, Warrington, and Derby, and is, I hear, about to be adopted in Bolton, Dewsbury, and Rotherham.

Prize from the Belgian King.

In December, 1874, the King of the Belgians offered a yearly prize of 25,000 francs "for the encouragement of intellectual effort." The prize for the year 1881, which is open to the competition of citizens of all nations, will be awarded to the best work on the means of improving ports established on low and sandy coasts, like those of Belgium." The conditions of the competition and award are as follows: 1. Foreigners desiring to compete will be required to send their works, either printed or in manuscript, to the Minister of the Interior at Brussels before March 31, 1881. 2. A manuscript work obtaining the prize must be published in the course of the year following that in which the prize shall have been awarded. 3. The award will be made by a jury appointed by His Majesty the King of the Belgians. The jury will be composed of seven members, three of whom are to be Belgians, and four foreigners of different nationalities. General Eaton, Commissioner of Education, in a circular calling the attention of American scientists, engineers, and educators to the subject, says: "Competitors in the United States are advised that they should forward their articles through the Department of State."

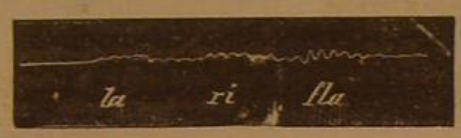
RECORDING TELEPHONIC RECEIVER.

Doctor Boudet has published a very interesting volume upon the application of the telephone and microphone to physiological and clinical uses. The book is made up entirely of details of the researches and experiments which he has made in his laboratory.

We extract some passages relative to the electrical recording of speech.

The automatic recording of telephonic messages is the first step towards the solution of a problem which has been declared insoluble. In order to arrive at a result which so many scientists have considered paradoxical, Dr. Boudet modified the telephone receiver in the following manner: Removing the diaphragm of the Bell telephone, he screwed

to the wood one end of a steel spring, the other end being opposite the pole of the magnet. To the free end he soldered a small piece of soft iron weighing a tenth of a gramme. Attached to this piece and in the prolongation of the axis of the spring he fixed a light bamboo arm ten centimeters long and terminated by a needle of whalebone. In fact the diaphragm is replaced by a movable armature resembling the interrupter of an induction coil. By means of this instrument, the tracings shown in the annexed engravings were obtained These tracings were made upon smoked



paper, and transferred to glass to be studied with a microscope.

As will be seen in the examples given, there are some remarkable points of difference between the several tracings as well as some points of resemblance, which make it probable that tracings of *this* character may be deciphered. These tracings, though far from being perfect, seem to contain the germs of success.

Dr. Boudet has made practical use of some of these experiments. He expects to enable deaf mutes to hear singing by means of a microphone, in cases where the auditory nerve is not entirely lacking, but where some defect in organization renders speech impossible.

The musical sounds are inscribed upon a smoked cylinder, which permits of the comparison of the visual record with the audible sounds which have been heard. It remains to be seen whether the reversal of this process will reproduce the voice as in the phonograph.

Cultivation of and Trade in Peanuts.

The trade in peanuts, already large, is annually increasing. Because the unreflecting public sees it mostly as conducted by petty retailers on stands at street corners, it is generally inferred that the peanuts are at best an unimportant article of commerce, but this, as is usually the case with conclusions derived from superficial observations, is erroneous. The trade extends in a similar way to not only all our large cities, but also to inferior towns and villages.

The *Confectioner's Journal* has compiled some statistics of the trade which are worthy of attention. By those who have entertained false impressions regarding the value of this crop it will scarcely be credited that it amounted last year to 2,220,000 bushels, which, at prices realized to first hands, reaches an aggregate of $2,150,000. The crop is principally raised in Virginia, which last year produced 60 per cent of the entire consumption. The crop is generally harvested in October, beginning a little earlier in Virginia. Tennessee produces about 35 per cent of the crop annually sold, and North Carolina about 5 per cent. Peanuts are elsewhere raised for home consumption, the amount so produced being difficult to estimate. "The nuts marketed in New York and hereabouts come chiefly from Virginia, while those from other Southern States find a market in the West. When peanuts are scarce and high, the African nut is imported, but with the present supply and low prices, foreign nuts have no place in the market. Peanuts are sold by dry measure by jobbers, but retailers sell by wine measure, making forty quarts to the bushel.

RECENT DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

FLETCHER, APPELLANT, *vs.* BLAKE.

Mr. Justice Harlan delivered the opinion of the court.

This is an appeal from a decree in the Circuit Court of the United States for the Southern District of New York, dismissing a bill in equity based upon an alleged infringement of letters patent issued to the plaintiff in error on the 8th of June, 1869, for an improvement in stamps used for revenue and other puposes.

Held:—An invention consisting of a postage or revenue stamp having a portion of its surface composed of thin fragile paper or other suitable material loosely attached, and on which a portion of the design or other matter is printed, is not infringed by a stamp composed of one continuous piece of paper, of uniform thickness, upon the face of which is certain printed or engraved matter, with blank spaces, in which are inserted, at the appropriate time, certain figures and names required by law to appear upon revenue stamps, which blank spaces are prevented from adhering to the barrel by the interposition of a red slip of blank paper attached to the back and outside edges of the stamp.

Decree of Circuit Court sustained.

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

BUCHAN *et al. vs.* MCKESSON *et al.* SAME *vs.* HENRY *et al.*—PATENT CARBOLIC ACID SOAP.

Blatchford, J.:

1. The first claim of reissued patent No. 5,007, to Isabella Eames and Charles A. Seely, July 30, 1872, being a claim for "a soap made by incorporating carbolic acid, or its equivalent, with ordinary soap, substantially as specified," *Held* to be anticipated by the English patent of Alexander McDougall, No. 2,510, of October 15, 1860, for "improvement in materials or composition for destroying vermin on sheep and other animals, and for protecting them therefrom."

2. If McDougall, by using with a fat and an alkali a crude carbolic acid or creosote which did not contain carbolic acid or cresylic acid as pure or as concentrated as it was afterward made, produced a true soap developing the properties of the acids referred to, there was no invention in subsequently using the purer article. The advance was only one of degree.

3. Although soaps made with the finer carbolic acid existing at the date of plaintiffs' patent may be applicable to purposes to which soaps made with the less pure carbolic acid could not be applied, that shows only a difference in degree and not invention.

4. The effect of an earlier invention upon the claim of a patent not avoided by a specific disclaimer in the specification when it appears that such disclaimer is based upon an unsound view of the invention to which it relates.

Malleable Castings.

Considerable pretense of mystery is assumed by manufacturers of malleable castings both in this and the old country, and doubtless there are some trade secrets of value to those in the trade relative to mixtures of different irons, etc., but the process is in itself simple, and a little experience should enable any foundryman to attain a creditable success in it. Nearly every founder has his own mixtures and methods, but they are all based upon the processes of Samuel Lucas, of Dronfield, which date back to 1811. The general features of the process, as carried out by the Birmingham (England) iron founders, is given in the *Ironmonger*, as follows:

"For the purpose of the casting pig of a fine quality is needed, and great care is used in the preparation of the moulds, so that there may be no flaw or imperfection in the casting. The latter, after cooling, is, of course, hard and brittle, and it is to remove this brittleness and give it the character of malleable iron that the special process is required. The casting is now placed in hermetically sealed pots or boxes surrounded by powdered ore, and subjected for several days to intense heat, which, by cementation, gradually softens it and renders it malleable to the core, when it may be bent or wound into any shape. The annealing process takes ordinarily about ten days. Thus a pot made up on Tuesday is got up to a white heat about Friday, and this heat is maintained for some twenty-four hours or more, according to the size or thickness of the article annealed. The fire is then allowed to die down, and when the mass is cool the castings are found to be thoroughly annealed and malleable. Scarcely a trade in Birmingham fails to use malleable castings for some purpose or another.

"The introduction of Bessemer steel has somewhat operated against the trade, but there is still a great field for malleable iron founders in catering for the requirements of the Birmingham gun, harness, and engineering trades."

The journal quoted thinks it much to be regretted there is not a more free interchange of ideas and experience among English iron founders, as in this only is there hope that the English trade can keep pace with German and French progress in the art.

Courage, Ingenuity, and Perils of Firemen.

The perils to which firemen are frequently subjected and the courage with which they are faced are scarcely inferior to the dangers met with and courage evinced by brave soldiers on the field of battle. If statistics were carefully compiled, we think the loss of life and personal injuries sustained by the trained corps that by day and night guards this city from conflagration would more nearly approach the proportion usually killed and wounded in active military campaigns than we could easily believe. They are a noble, though a small army, which yearly gains respect from our citizens; and they often perform heroic deeds that merit a higher reward than the praise bestowed by the chronicler who records the story.

A rare instance of the exercise of great ingenuity under circumstances of great personal danger occurred in a recent fire in this city, an account of which we transcribe from a leading daily:

A portly man was imprisoned by fire and smoke in the fifth story, and there were no ordinary means of reaching him. The adjoining house was smaller, its roof reaching about half way between the fourth and fifth story windows of the burning structure. A fireman reached this roof with a small ladder. He then slid down the ladder until he could get into the fourth-story window, but he found it impossible to ascend to the fifth floor. Then he put the short ladder on the window sill and held it flat against the building, so that it would reach to the story above, and on this support the man whose life was endangered descended. The men were now together, but not out of danger. The ladder was next put with one leg on the sill, but aslant, so that it would reach over to the roof of the adjoining house. Held in this position by the fireman at one end and volunteer assistants at the other, it formed a very dangerous but, as it proved, successful means of escape for the citizen whose life was endangered. The fireman was now left alone, but escaped by the same path, trusting entirely to the grip of the men at the top of the ladder. All this was done at the height of thirty or forty feet from the stone sidewalk, in the midst of excitement attending a great fire. The man who does such work with the necessary quickness of invention and cool bravery deserves something better than the mere wages necessary for his existence, with the chances that, if injured or disabled in the service, he will be discharged as useless.

SLATE PENCIL MACHINE.

It is easier for the schoolboy, with his innate inquisitiveness, to ask how slate pencils are made than it is for the boy of larger growth to answer; however, the machinery employed in making slate pencils is very simple, and the process will be readily understood by studying the annexed engraving.

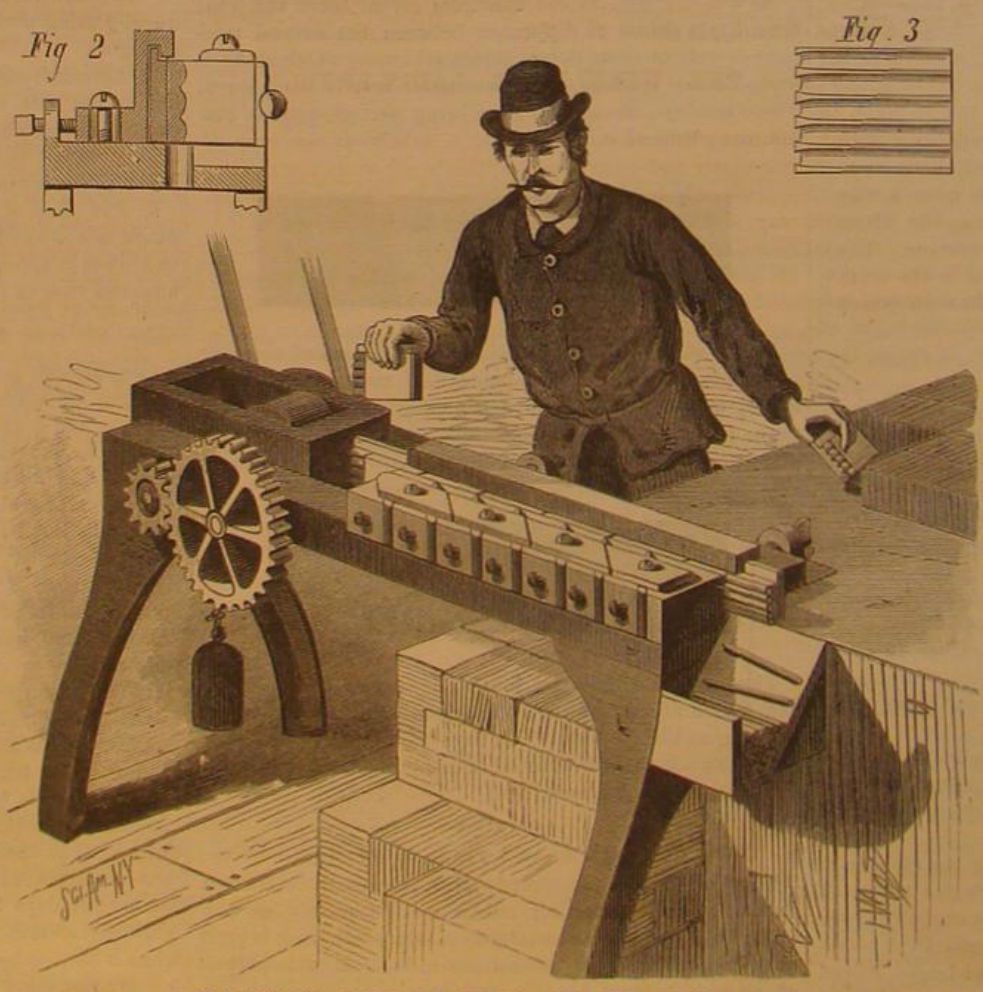
The bed of the machine has a series of diagonal slots, in which multiple knives, shown in Fig. 3, are clamped by set screws. These knives differ in form and in the size of their curved cutting edges, and the smaller knives succeed the larger ones in acting on the slate blanks.

Opposite the cutting edges of the knives there is a groove adapted to slides capable of carrying blanks, from which the pencils are made. At the receiving end of the machine a frame arranged to slide lengthwise of the main frame is pushed forward by a cam and drawn backward by a weight.

The slate blanks from which the pencils are made are brought to a uniform thickness and length, and are placed on the slides, and put in the machine, one at a time, as the sliding frame falls back.

When the cam pushes the frame forward the slate blank is pushed through the first set of knives. When the next blank is pushed forward in the machine the first one is pressed beyond the second set of knives, and so on. When the blanks emerge from the machine after the first cutting the pencils are half formed.

The blanks are reversed and again put through the machine, when they are separated, and the finished pencils are delivered in a receiver at the end of the machine. This machine is the invention of Mr. J. C. Richards, of Brooklyn, N. Y.



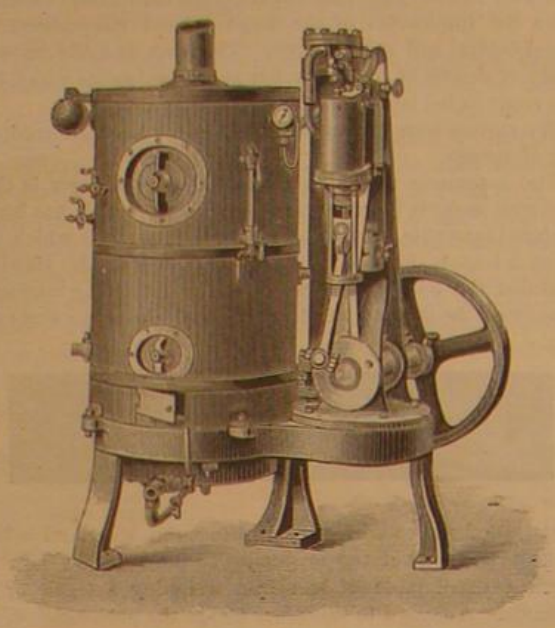
MACHINE FOR MAKING SLATE PENCILS.

Remarkable Locomotive Explosion.

On the night of the 23d of January, 1881, a freight engine on the Philadelphia and Reading road was sent out from Palo Alto, Pa., to bring in a train of loaded coal cars from a siding. An hour later the engine was found a mile beyond the siding with all the crew—engineer, conductor, and two brakemen—dead and terribly mutilated. The boiler had exploded, tearing the engine to pieces and killing all the men. As the explosion occurred in a very lonely place and all the men were killed, no details are known.—*Railway Gazette.*

ENGINE WITH GAS-FIRED BOILER.

The annexed engraving, which we take from *Iron*, illustrates a useful vertical engine combined with a gas-fired boiler, which was lately exhibited at the Agricultural Hall, Islington, for the first time, by its designer and manufacturer, Mr. E. S. Hindley, of Burton, Dorset, England. The engine is self-contained, occupies a very small space, and works without vibration, all the parts being strong and well proportioned. It can be supplied separately from the boiler, and either thus or in the combination which we illustrate is



ENGINE WITH GAS-FIRED BOILER.

reported to do excellent work. The boiler contains a large number of brass tubes running the entire depth from top to bottom. The gas is burned in a chamber below mixed with air, the burner being so constructed that any one or more can be lighted so as to vary the consumption to the power required. No attention is required besides occasionally regulating the feed-water cock; steam is raised in about thirty-five minutes, the boiler is neatly lagged with mahogany, and there is a feed-water heater supplying not only the boiler with water at over 200°, but supplying a large quantity of hot water besides for other purposes, and which costs nothing to heat. This renders it valuable for many trades requiring hot water, and also in stables. It is so safe from risk of fire that some of them are at work in the midst of hay and straw—cutting chaff, etc.

MISCELLANEOUS INVENTIONS.

Mr. Philip A. Palmer, of Chicago, Ill., has patented an improved means for treating teeth, and for preserving work done upon a tooth while permitting access to the pulp cavity for treatment. It consists of a hollow screw, into the outer extremity of which a smaller screw is inserted, which can be removed to permit access to the pulp cavity and replaced. Teeth may be filled or recrowned by the use of this device in cases where, without it, filling or recrowning would be impracticable. The patent covers broadly the use of hollow pivots with central removable stoppers for dental purposes.

Mr. Charles J. Schumaker, of Alleghany City, Pa., has patented a novel puzzle-game board, which consists in a sheet or board having twenty-one numbers arranged in the form of an octagon, which numbers are connected with each other by a series of rectangular and radial lines. Each number is provided with a pin, and to solve the puzzle all the pins must be taken out by one pin, by means of jumping over the others upon vacant numbers, and when the last pin is taken the player's pin must jump into a number that has been previously designated.

Mr. John F. Hoffman, of Cincinnati, Ohio, has patented a new paint for application to tinned roofs and other structures exposed to the weather. The ingredients are light dead-oil of coal tar obtained by distillation and treated with quicklime, rosin, and asphaltum, melted and mixed by heat in certain proportions.

Mr. Henry Textor, of Brooklyn, N. Y., has patented an improved sewer trap which will prevent the flow of back-water, and which cannot become clogged by sediments or floating matter. A hemispherical or cup-shaped vessel is connected with the sewer and provided with a cup-shaped strainer containing a hollow metal float which is raised by back-water and pressed against the lid of the vessel. The latter is provided with a central aperture and is covered by a strainer held down on the vessel by a removable screw clamp. An opening provided with a screw plug serves for cleaning the trap.

Mr. Henry B. Sherwood, of Westport, Conn., has patented a tool handle for hand-weeders, currycombs, and various other tools, which is firm, strong, and durable. The wood handle is formed with a transverse borehole and two grooves leading therefrom to the end, upon which is placed a ferrule. The wire shank is passed through the hole and bent down into the grooves, in which the ferrule holds it securely when applied. The ends of the wire are then spread apart and may be secured to the tool by riveting.

Mr. Henry D. Starr, of Texana, Texas, has patented an improved bale-tie buckle, so constructed that the bale can be easily and quickly tied, and it will hold securely. The buckle is made of a plate having four transverse slots formed therein, thus forming five crossbars, and having the second bar rounded or thickened to adapt the buckle to be hinged to one end of the tie, and also having its fourth bar stamped into a loop form to receive the other end of the band.

Mr. Edward P. Haff, of Brooklyn, N. Y., has patented a razor strop so constructed as to present on one side a fixed oval strop, and on the other a flexible strop the tension of which may be regulated.

Mr. John A. Moore, of Woodville, Tenn., has patented a combined cotton scraper, chopper, and cultivator, so constructed that the cotton will be scraped, chopped to a stand, and dirted at one passage along the row, and which can be adjusted to work closer to or further from the plants and at any desired depth in the ground.

Mr. Frederick W. Jackson, of Watkins, N. Y., has patented a wall paper exhibitor by means of which any number of samples can be exhibited rapidly and advantageously. An endless carrier is formed of a close series of slats movable in guide grooves. The slats to which the samples are attached are provided with studs which are engaged by a median spur wheel for turning the series. The samples are displayed upon an inclined apron.

Mr. Edward Barnard, of Rome, N. Y., has patented a quarter boot for horses, which, being an improvement on an invention for which he obtained letters patent No. 237,157, dated Feb. 1, 1881, causes the quarter boot to fit the heel of the hoof more closely and to keep in place better, and at the same time gives the article a neater appearance.

Mr. John B. Shaffer, of Kearney, Neb., has patented a well bucket so constructed that when lowered into the water it will readily fill, which holds the water securely while being raised and when standing in the spout, which can be readily emptied in part or wholly, and which is simple in construction and easily repaired.

Messrs. Charles Tyrell and Edward Kearns, of Norwalk, Conn., have invented an improvement in hat-pressing machines, which provides for more accurate and convenient adjustment and regulation of the pressure in machines for pressing hat-bodies, and which much increases the range of adjustment. The construction is simple and well calculated to secure the ends sought.

Mr. James Hill, of Providence, R. I., has patented a japanning oven, in which a novel construction and a blowing apparatus connected therewith secures a uniform temperature of the air throughout the oven while baking the articles to be japanned.

THE WINKLE, OR LADLE-SHELL.

BY A. W. ROBERTS.

It is impossible to walk on the seashore without being struck by the many strange objects that are cast up and left by the waves only to be swept away again by the next high tide, which, in its turn, brings new and varied forms. A week may pass by without new objects appearing, but, during the next, strange and grotesque forms will be scattered profusely at one's feet. I once commissioned a fisherman friend to procure for me all curious objects that might be cast on his immediate shore. In course of time a parcel arrived, having a promising marine odor; which, on being opened, was found to contain some very interesting objects. Among them was one that, at first glance, might have been taken for a dead sponge, it being eight inches in length, of a light olive green color, and hollow at one end as many sponges are. But on closer examination it proved to be a skeletonized cabbage-stalk, on which was growing a dense and velvety growth of *Ectocarpus*. This I still preserve as a specimen of my earliest ocean acquaintances.

One of the most puzzling and at the same time the most common objects to be met with on our shores are strings of egg cases or capsules of the winkle (Fig. 1). These strings vary from 12 to 20 inches in length, and contain from forty to seventy-five capsules; the first few capsules on the string are always small and barren, the others contain from fifty to one hundred eggs. The young winkles remain in the capsule till all of a jelly-like substance with which each capsule is charged is exhausted, and upon which the young winkles feed. They are now strong enough to eat their way out at the apex of the capsule, where is situated an exit covered with a tough membrane. The young winkles, so soon as out, bury themselves in the sand, all but the extreme end of their siphons, through which they breathe.

When newly laid the egg cases are of a light creamy color. The tough leathery substance of which they are composed is so translucent that by holding it up to the light the eggs are plainly visible. These egg cases are deposited by the winkle when buried under the sand. Several deposits of eggs are made from March till late into the fall.*

It is astonishing that one winkle is capable of producing such an enormous quantity of capsules and eggs, the bodily mass of which seems to far exceed that of the body of the snail itself. Extending along the under surface of the body of the winkle is a long corrugated disk, which is very tough and rubber like. On this the winkle moves, and it is known as his foot. When withdrawing into his shell the foot is the last part of his body that is taken in. Attached to the back part of the foot (see illustration) is an oblong and strongly grained operculum, a horny valve or door that closely fits the aperture of the shell and completely closes it up when the animal is within. The winkle is provided with a large and powerful "tongue" or lingual ribbon, which bristles with thousands of silicious teeth; all these sharp denticles point backward, so that the tongue acts not only as a rasp, but takes a firm hold upon the food.

THE WINKLE, OR LADLE-SHELL.

By many fishermen the winkle is said to be an enemy to the oyster and other bivalves; this is not so, as the winkle frequents only sandy and muddy bottoms, where traveling is easy, and small crustaceans and marine worms, on which it feeds, are plentiful.

In making the illustration of the winkle I purposely placed one in a rocky-bottomed tank, which I knew would cause him to elevate his shell as high as possible to avoid breakage. On no account does the winkle like a rough, rocky bottom, or one composed of sharp shells like an oyster bed.

On the Eastern coast the winkle is known as the "ladle shell," from the fact that the fishermen, when calking their boats, use an empty winkle shell to run the tar into the seams in lieu of a ladle.

The flesh of the winkle is the toughest of all marine food that I have ever eaten, still there is a colony of colored people back of Keyport N. J., known as "Winkle Town," from the fact that its inhabitants live largely on winkles, whose shells line the road side in large heaps. In Europe the winkle is known as the pear-shell, from a supposed resemblance of outline to that of a pear.

The winkle (*Sycotypus canaliculatus*, of Gill, and *Pyrula c.*, of De Kay) is one of the largest shells on the eastern coast of North America, sometimes measuring seven inches in length. It extends as far *north* as Cape Cod, and south as far as Mexico. It is found fossil in the post-Pliocene of Virginia, North and South Carolina, Pliocene of South Carolina, and Miocene of Maryland.

* During the summer season large quantities of winkle eggs come ashore on Coney Island, between Norton's Point and Brighton Beach.

EGG CAPSULES OF THE WINKLE.

Unappreciated Insects.

The *English Mechanic* reports a lecture on "Unappreciated Insects," delivered before the Chester Society of Natural Science, by the Rev. J. G. Wood.

With regard to the title of "Unappreciated Insects," it was a very wide one, said the lecturer, because he did not believe any insect was really appreciated. Appreciation depended almost entirely upon knowledge. Take, for example, the case of the silk-worm. A savage who wears no clothes does not appreciate the silk-worm at all, but looks upon it rather as a noxious insect because it destroys the mulberry tree, the fruit of which he wants for himself. The child saw a bee and grasped it, and the bee stung the child. The latter did not then appreciate the bee in any degree. But when the child came to know something about it, he learnt that the bee furnished the honey he liked so much, and accordingly began to appreciate it. So it was with the whole of the insect world; and he might state what he believed to be an absolute fact, that there was no insect, however insignificant it might appear, or however noxious we might seem to think it, which was not directly or indirectly a benefactor to mankind. He should choose one or two of these insects, which not only we do not appreciate, but which we fear or dislike, or even with the existence of which we are probably utterly ignorant. He would just mention an example of the mode in which insects benefit mankind. Insects were put into this world clearly for the purpose of preserving it and making it fit for creatures higher than themselves, and this they did by eating. It was clearly not likely that clothes-moths were created for the purpose of destroying young ladies' jackets. What was it then they were created for? It must be remembered that the clothes-moth existed in countries where the ladies did not wear any clothes at all, and existed on the earth long before there were any young ladies at all. It must be created for something, and

keeping in view the object of insect life, he found a clew to one reason for the existence of the clothes-moth. The caterpillar of the clothes-moth, fed on wool, which is hair; and hair, by the ordinary agencies of nature, is imperishable. In the Egyptian Room of the British Museum might be seen a wig—a lady's wig—which is as brilliant and as fresh as when it came from the hands of its maker 3,000 years ago. Wool is hair, and hair is wool. The clothes-moth never touches cloth garments while they are in use, and never while the wool was on the back of the sheep that furnished the cloth. Every sheep sheds its wool once a year, scratching it against trees. If the wool were not removed from the trees it would kill the trees, for they would not be able to breathe. The clothes-moth and its insect allies set to work when the wool was done with, and enabled the trees to shoot and grow. It was a curious but a positive fact that if it were not for the clothes-moth and its allies there would not be a tree on the earth, and no human creature could exist on it. So the insect was intended to render the world better for beings higher than itself. His most excellent and respected friend, the cockroach, was not appreciated. People did not like it. He did not know why, for it could not sting or bite. Some people objected to it on the ground that it had a disagreeable smell. The insect was not aware of that fact. Then, probably, human beings had a disagreeable smell to animals. A deer could smell a person a mile off, and as the deer got away as quickly as it could, it evidently thought the person had a disagreeable smell. It was all a matter of taste. As to the cockroach it was often called a black beetle. It was not a beetle, and it was not black. Its color was a ruddy, chestnut brown, which was now becoming quite a fashionable color. They would notice there were two very distinct shapes of the cockroach. There were the male and the female, and there was no possibility of doubting which was which, for they followed the universal law that the male was twice as handsome as the female. It was a fiction of poetry to state the reverse. Cockroaches were always found where there was wasted food. They were never found where food was not wasted, and belonged more to civilized than to savage life. They were never found in the wigwam of the savage. He went on to observe that the cockroach was capable of being tamed. Its use was that of a scavenger. There was one particular use in which it was directly beneficial. Cockroaches were considered noxious insects, but there were others quite as noxious. They were quite as flat, but happily not so large. A person historically inclined might speak of them as "Norfolk Howards," while a musician might designate them as "B flats." The cockroach consumed these insects. The lecturer went on to treat of the earwig, the lace-wing fly, and the goat, all of which he described and illustrated by sketches. Speaking of the gnat, he said it consumed in its life, in an aquatic state, certain animal and vegetable matter which, if not so consumed, would, with the warmth of the sun, produce gases productive of ague and asthma. The grand object of insect life was to eat, and render the earth fit for higher creatures to inhabit.

A Kentucky Robin Roost.

According to the *Times*, of Glasgow, Kentucky, there has been near that place the past month a robins' roost that equals the pigeon roost of olden times.

"A cedar thicket of about sixty acres furnishes the birds a lodging place. About sundown every evening constant streams from every direction pour into the grove, and almost obscure the heavens in their flight. Night finds almost every bush in the thicket bending with its red-breasted load. For the past few weeks lovers of sport for miles around have visited the place, and every night the thicket is illuminated with the torches of men with clubs and sacks gathering the feathery harvest. Mr. Smith has killed over 2,000, and hundreds are carried away every night, but they don't seem to decrease; there are millions of them. Large quantities of them have been sold in town. They are very fat, and make, when well cooked, a dish good enough for anybody."

Seeing that the robin is one of our most efficient destroyers of insect pests – a young robin requiring daily a bulk of such food equal to its own weight – it is probable that every bird killed at the "roost" will cost the country a dollar, perhaps ten times as much. In any case one of these birds "in the bush" is worth a score or more "in the hand" or in the frying pan.

The Gold Gravels of California.

Mr. W. S. Keyes, mining engineer, reviews at great length, in the San Francisco *Bulletin*, the advance sheets of an important work on the "Auriferous Gravels of the Sierra Nevada," by Professor Whitney, formerly State Geologist of California:

The gravels of California are of economic importance, because of the gold which they contain, and because they are so situated that they can be washed with profit. They present phenomena almost identical with those of Australia, and have the advantage of the latter in being better supplied with water and dumping ground. Professor Whitney reviews cursorily the few localities of gold-bearing gravel of the coast ranges in the northwestern part of the State, and then proceeds to consider the gravel region proper. This extends from Mariposa to Plumas, and is very nearly coterminus with the limits of the gold-bearing slates. The hydraulic interest increases in importance as we go north from Tuolumne to Amador county, and reaches its culmination in El Dorado, Placer, Nevada, and Sierra counties. He shows that all the placers must have sprung from the degradation of pre-existing quartz veins, which were probably richer than those we now see. He devotes considerable space to a description of the various mechanical appliances used for saving the gold, and credits Ed. E. Matteson, of Stirling, Connecticut, with the invention of the hydraulic method. The physical conditions necessary for an economical washing of the gravels are particularly favorable along the western flank of the Sierra. Water with a sufficient head is plentiful, and there is a gradual and easy slope from the mountains for a distance of about 70 miles, with a grade of about 100 feet to the mile. This sloping plateau is cut by deep gorges or cañons through which flow the present rivers, and into them the vast accumulation of tailings is dumped. The great depth of erosion may be inferred from a single example, viz.: at Spanish Peak, where the Pliocene gravel beds occur 3,800 above American Valley. The gravels vary in thickness up to two or three hundred feet. Usually, but not always, the lowest portions are the richest. They are found in channels of varying width up to 4,000 feet. Upon the gravels in many localities we find a capping of basalt or volcanic ash. The thickness of this cap, other conditions being equal, determines the method of working, whether by "piping off" or by "drifting."

The fossils of the gravels are divided into three classes: Microscopic organisms, plants, and animal remains. Professor Whitney devotes considerable space to the specimens of human handiwork, mortars, pestles, etc., found in several localities, and relates in detail all the facts attainable touching the fossil human skull found in a deep shaft in the Calaveras gravel measures. He gives two lithographic views of the skull. The finding of this fossil—for fossil it undoubtedly is, because the phosphate of lime has been changed to carbonate—has aroused much controversy, but in view of the proofs adduced we are constrained to accept its genuineness. And in so doing we acknowledge the existence of mankind contemporarily with the depositions of the gravels. Professor Whitney is of the opinion that there was no river or system of rivers running parallel with the present crest of the range. He believes that the whole mass of the chain was originally much higher than it now is. He attributes the formation of the gravel beds to running streams which, during the tertiary age, carried far more water than the present rivers. He denies the possibility of their marine origin, or that they were due to glacial action.

Contemporaneously with and subsequently to their deposition great outpourings of lava and volcanic ashes took place, whereby large areas of the gold regions were covered up. Through these formations the present rivers have cut their way and have formed the deep gorges which we now see.

Discussing the complicated questions touching the economical working of the gravels Prof. Whitney gives an example where a yield of 2·6 cents per cubic yard barely covered expenses. He concludes, however, that under favorable circumstances, a yield of 4·75 cents per cubic yard may be considered the mean minimum necessary for profit. He shows that about 20 cubic feet of water is, on the average, required to move one cubic foot of gravel. He closes with the opinion that hydraulic mining will continue for very many years, unless the injury from the *débris* shall be too great to be endured. "And," he says, impressively, "there is no part of the world where scientific oversight and judicious legislative interference is more desirable for the future welfare of the community than in the Sierra Nevada of California."

The Mineral Belts of the Great West.

The *Tribune*, of Denver, Colorado, is anxious that a National Mining Exposition shall be organized at that place. In an article setting forth the advantages of such an exhibition, it says: "There have already been ascertained to be four well defined longitudinal belts of silver mines between the eastern base of the Rocky Mountains and the shores of the Pacific. First, the Colorado and New Mexico belt; second, the Utah and New Mexico belt; third, the Nevada and Arizona belt; and fourth, the California and Old Mexico belt. According to Professor Rossiter W. Raymond, this latter belt extends along the east base of the Sierra. There are many transverse sections all through the mountain regions, but these great belts of mineral are sufficiently well defined. The attention of the floating capital of the country is attracted to the districts traversed by these mineral deposits.

"Railroad lines are penetrating into and through the mountains. Colorado is already handsomely provided for, and the great Southwest will be gridironed at no distant day by lines already projected. With these transportation facilities Denver will become, if she is not already, the center of the great mining industry, and an exhibition of the ores of the royal metals alone, and appliances for mining them, would be warranted. But aside from these, there are coal fields in Gunnison county, New Mexico, and the Southwest, whose importance will not be long in attracting attention, and such minerals as antimony, gypsum, quicksilver, zinc, graphite, and even cinnabar, exist in our mountains. The mining of all these mineral substances is important, and their display would have a growing interest in this community. Even such coarse material as slate, limestone, and building stone of all kinds would command no small attention among practical men, while the various crystals and fossils and rare petrifactions would prove an attractive artistic feature to a general mineralogical exhibit."

Correspondence.

Hearing Noises in the Sun.

To the Editor of the Scientific American:

For a couple of months past there have appeared in all the papers accounts of certain efforts on the part of Professor Bell to reproduce, by means of the photophone, the noises which accompany the solar disturbances. But I have looked in vain for any statement of the error in the assumptions on which these experiments are founded.

If we have a beam of light of varying intensity falling on the selenium cell of the photophone, the instrument will give out sound; but it by no means follows that this sound is a reproduction of any previously existing sound.

Suppose the light of a lamp to be thrown on the cell, and a screen be made to pass rapidly back and forth across the path of the rays. The alternate light and darkness thus produced would certainly give a sound in the instrument, yet the lamp may burn and the screen may move absolutely without noise.

It is only when the variations in the light are originally produced by the action of the pulses in the sound medium that the sound given out will be a reproduction of a previous one.

Furthermore, the intensity and character of the sounds in the photophone depend upon the degree and rapidity of the variations in the light.

Now, in the case of the sun we have no assurance that the requisite conditions exist to enable us either to reproduce the solar noises, on a small scale, or to originally produce anything similar to them. We certainly cannot say that the variations in its light come from the rays having been modified by sound waves in the solar atmosphere; nor is there any reason to believe that they are at all naturally proportional to any accompanying sound; and until one or the other of these conditions is shown to be a fact, it seems to me that the results of Prof. Bell's experiments will continue to be, as hitherto, "not wholly satisfactory."

W. V. BROWN.

Cambridge, Mass., February 19, 1881.

Sun Storms.

It is pitiful to witness the condition of the sun. The great fire-ball is in intense commotion. His surface is seamed and scarred in every direction, with black spots that indicate the disturbing elements at work in his chaotic mass. Occasionally, for a day or two, the blemishes disappear, and the glorious king of day shows a face like a shield of glowing gold. But the aspect quickly changes; spots come rushing in all directions and assuming all forms. They appear singly and in pairs, and again in groups and rows. Immense groups break up into small ones, and small ones unite to form great chasms, into which half a dozen worlds might be dropped and there would still be room for more. Sometimes the spots are visible to the naked eye, and at that time a good opera glass or a spy glass will make them easily perceptible. Hundreds of observers all over the world watch the sun's face every clear day, and keep a record of the number of spots, their size, and the direction in which they move, for as the sun turns on his axis they turn with him, some of them remaining for months without much change, some taking on new forms and some disappearing entirely. Very little is known of this mysterious sun or the spots that are visible more than ninety millions of miles away.

Once in about eleven years the sun takes on his present sun-spot phase, and we are approaching the maximum of disturbance. No one knows the cause. Some believe that it is planetary attraction, some that it is the fall of great masses of meteoric matter, and some that it is the result of internal commotion and the rush upward of gaseous explosions in comparison with which our fiercest volcanic eruptions are but the flicker of a flame. Besides the sun-spot agitation, the gaseous outbursts are marked and vivid. The tongues of flame or rosy protuberances are darting forth in all directions and bearing their testimony to the solar commotion. Mr. Trouvelot, of Cambridge, who makes daily observation of the sun's chromosphere, gives a graphic description of a remarkable solar protuberance that he witnessed on the 16th of November. When first seen it was large and complicated, extending upward from the sun about a hundred thousand miles. Three or four hours after it had developed into huge proportions, extending far out into space, and vanishing gradually to regions where it could not be perceived. As nearly as it could be measured, it reached a height of over a quarter of the sun's diameter, or about two hundred and thirty-five thousand miles. Such a protuberance hurled upward from the earth would almost reach the moon! Two hours after, the whole structure had collapsed, and was only about eighteen thousand miles high. Observations like this give an idea of the mighty forces at work in the solar orb, and make observers long for the time when a satisfactory solution may be found for this mysterious periodical solar disturbance, so intimately connected with the meteorological condition of the earth.—*Providence Journal.*

Tea Curing and Packing in Foochow.

The following quaintly-worded, yet very graphic description of the work done in a large Chinese tea packing house, is given by the Foochow *Herald*, at the close of a season's operations:

A large tea packing house presents a very different scene from that two months ago. Then, at the door one found lines of fifteen catty boxes and waiting to be soldered up. Now, none. Next, one found fat bags stacked up eight or ten feet, bursting with Pehling tea that escaped here and there through holes temporarily stopped with bamboo leaves; the bottom of the bags mostly stained from contact with wet flights of mountain stairs upon which the exhausted cooly had set them down on the passage.

Now, one finds but empty chests, hundreds in number, square, deep, and oblong, used for handling the tea in the factory. Ordinary tea chests would not stand the rough usage.

Farther on, one came to the dozen long double row of sifters facing each other, forty in a row, the mesh of some taking a pencil—that of others refusing a pencil point—sifting tea leaf rough and bold, that after a persuasive grasp or two in the hand broke, and consented, after a few shakes in the sieve, to be stripped of some of the sappy leaf edges and to appear below, the even and uniform leaf which tea the drinker insists he must have (plus the dust due to the persuading). The transformation in a rough leaf on passing the meshes of a coarse sieve, with a gentle crush from the sifter's hands, enhances a rough, bold tea much in value.

In place of the rows of men then seen, tilting and jerking their sieves in a monotony only broken by the Cantonese taskmaker's roll-call twice a day before the general meal of fish and rice, there is now to be seen only the bare floor of hardened earth, piles of empty benches stacked in a corner, and the sieves of the twelve different sizes used, each in its division in the three-story stands.

The dozen or score of fanning mills are still now. The trained hands are gone that turned the cranks with a uniform motion; sending the heavy tea, light tea, and flaky dust each down its respective spout separated, never again to meet, unless haphazard, mixed in a Whitechapel grocer's window.

The tea leaf separated in these fanning mills has been parted with at the smart loss of Tis. 8,000 on 3,500 piculs to the foreign buyer, and has been let go by the latter to the London dealer or auction room habitue. The mills now stand still. The tea growers in the hills who waited through June and July for their money have now been paid. The losses to the packers here, however, have been so smart that there is little third crop tea now being packed in Foochow, and the mills will rest until another May shall bring the physical courage bred of hot blood back to the pale and dispirited native teamen. There are stacked up in this huge go-down a few hundred packages of a native maker's brick tea wrapped in plaited bamboo strips, bound in half bamboo and triply rattanned. Aside here, the Chinese upper millstone is being turned upon the nether by a Chinese who is grinding the seeds left by the fanning mill.

In these sycee boxes sharp spades are falling upon the tea stems, chopping them fine enough to go into the stemmy dust mixture to which the seed dust gives the strength, while the chopped stems vouch for it being tea.

In the firing house, four Chinese rice kettles, two feet across the mouth, set obliquely across the edge, turn the tea back in a shower over the hand of the stirrer, a wood fire being kept up in the brickwork underneath. Fire holes, scores in number, follow in rows the walls of the firing house; in each an iron pan is placed, now filled and rounded with charcoal ready to be lit. Placed over each of these fires is a huge hour-glass-shaped basket-hood or muffler that shuts in all heat of each fire to but one outlet—that through the tea sieve that chokes the throat of each basket.

In these baskets is dried off the tea that comes in from the hills wet or flat from constant down-pours and from the first fermentation of the leaf. These fires are out and all is still.

Here too, on the floor above, the benches are empty where girls and women came—some too often—to throw out the stems from the leaf, getting half a cent for removing those from the two catties of tea given them in wound bamboo-woven trays.

The floor is now bare where we saw the Ningteh tea brought to a uniform shade, by shaking in bags with a few spoonfuls of lampblack; then balked upon the floor, only to be strewn white as a grave in spring with the pure muhil blossoms; then blossoms, in turn, buried under another avalanche of funeral tea, and this again with blossoms, life upon death; then both were rudely mingled together and put away in boxes for a night till the fragrance should have been robbed by the dead tea, and the faded flowers be thrown aside, spent and worthless.

Our round finishes at the shed where Chinese lads, out of long sheets of lead, are glibly making lead cases by moulding them, hatter-like, upon a box, and then running the soldering iron along the edges. Here Chinamen in their natal costume, beside this huge four-hogshead vat of hot water, are washing off the dust and sweat of the day. Here are piles of wood for the hot tea-coppers, crates of up-river hardwood charcoal for the firing pans and firing baskets. We must leave without the sight we then had of the mad dervish dance of two Chinese, who, given a dozen pounds of tea stems under their sandals in a tray, performed about the interior periphery a double shuffle, twist and grind of the enemy under the heel, that is cooler for the spectator, the thermometer in the nineties, than for the performers, from whose bodies the perspiration rolls into the tea stems below.

The box factory is elsewhere. We enter on our homeward way. It is another old disused tea hong occupied by foreigners in the days when money was made, tumbledown now and abandoned to Chinese. Inside, a few Chinese youth eating a dollar's worth of rice per month, are rapidly gluing and dovetailing together, by rough wholesale strokes, boxes by the score. Few nails are used, for these are hand-made and cannot be afforded. What a bungling "mending" the merchant will pay for when these frail cases reach the land of rough usage and coarse nails!

Here you see a bit of thin tea-wood, there a bit of paper gaudily daubed with cardinal colors, a stroke or two, side marries end, the gaudy paper cover hides all joints, and the catty boxes, gay with bird, butterfly, dragon, and phœnix, are *en route* to be stared at in a provincial grocer's window.

The only foreign devices we have noted in those busy establishments, where in the season 500 men and women are busy from daylight to dark, are a Fairbanks scales and a Canton-made fire engine. Two red tapers stuck in the earth at the door burn for good luck, and good luck we must wish the patient set who work here.

Nearly 2,000 piculs this season have passed the sieves, one might almost say, a leaf at a time. And so this year, of hundreds of packing houses, some in hamlets in the hills, some, as in Foochow, in cities ten to fifteen miles from the hills. Women have carried, each her picul, up and down the mountain pathways, twenty-five miles a day, not complaining of the bent backs, nor once rudely jostled or insulted by "foreign coolies" from outside districts who come starving their way toward the work offering, their only food a double handful of salt in their girdle to bite at before they drink along the road. Boatmen at river marts have fought pitched battles for the tea, upon the transport of which depended their livelihood.

Probably all the tea leaving Foochow has been lifted up and down as most as if it had been carried up one side of the great Pyramid and down the other a score of times. Plenty of men have been ready to fight for the privilege of carrying it; plenty of women, too, under their loads behind their new husbands.

IMPROVED COFFEE POT.

The annexed engraving shows an improved coffee pot, which is claimed to be a very superior article, and capable of making coffee of a uniformly good quality, where a good properly roasted and ground berry is used. The coffee, C, is placed in the wire cloth sack, S, suspended from the flange, R, at the top of the pot. A trap, T, covers the inner end of the spout and prevents the escape of vapor.

The construction and management of the pot are very simple, and it has the indorsement of a large number of persons who have used it.

Further information may be obtained by addressing the Ideal Coffee Pot Company, 622 Filbert street, Philadelphia, Pa.

The New Mill of the Willimantic Company.

The new thread mill of the Willimantic Linen Company is said to be the largest and finest structure in the world devoted to the manufacture of spool cotton, and also the most capacious cotton mill anywhere on a single floor.

The main building is 820 feet by 174, with two porches at the ends 30 x 40 feet each, and two wings 80 x 60 feet, three stories high. The first girders are supported by 707 columns, 12 inches in diameter, while 353 columns on the main floor support the roof. The walls are chiefly glass resting on brick piers. The roof is also largely of glass, the dark part being covered with felt overlaid with asphalt and gravel.

Internally the mill is divided into five sections, each complete in itself and driven by a separate Porter-Allen engine of 250 horse power, making 350 revolutions. The power is distributed by steel shafting running the entire length of the building, that of each section being coupled directly with its engine. No belting over 2½ inches wide is employed.

The boiler house is 80 feet square, and covers two batteries of eight boilers, each boiler of 80 horse power. The chimney is 16 feet at the base and 153 feet high.

The mill is lighted throughout by Brush electric lamps. The generators are in the center of the building on the basement floor. One supplies 18 lamps of 2,000 candle power, the other is a 40-light machine.

Ring-frame spinning is employed throughout, the yarn ranging from No. 50 up to No. 120. The entire process of thread-making is completed on the main floor, which is 820 feet by 175 feet.

The architectural design and finish of the mill are elaborate. In all the windows are ample boxes for window-gardening. In the three towers are large water tanks of 30,000 gallons capacity each, to supply the closets and for other uses. The four entrance porches are neatly fitted up and supplied with wardrobes, each operative being given a numbered compartment. The spacious main entrance leads to the inspecting room, 60 x 80 feet, tastefully finished, opening upon the main room. Here, says a reporter of the *Economist*, to whom we owe these particulars, "a view, grander than was ever seen in any mill, either in the Old World or in the New, is afforded. The wide sweep of perspective, broad and ample, the long rows of windows bordered with stained glass above, and fringed with the bloom of plants and flowers below, the solid floor shining as clean as if waxed for the occasion, the whirl of spinning frames, the long white rows of bobbins and spools, the numerous lines of contented but busy operatives in their clean attire, white and neat, as the color of the skein so deftly shaped into thread for spools, all tend to form a busy, changing, stirring scene not to be forgotten."

In one of the wings is the dining-room provided for the operatives. The room is light and cheerful, and fitted up with the appliances needed for serving hot lunches.

The mill is located on the north bank of the Willimantic River, and from its high elevation commands an extended view of the surrounding country. Some idea may be formed of the skill and energy displayed in its completion, when it is stated that the site it occupies was a pine forest up to the first of March, 1880. During the first week of that month the excavations for foundations were commenced, and during the second week the timber was cleared away. In the short space of ten months the most beautiful and complete thread works of the country, or of the world, were erected, and thousands of spindles set running in the manufacture of six-cord spool cotton.

Glass Eyes.

A reporter of the Chicago *Inter Ocean* has been investigating the trade in glass eyes. From the leading dealer in the West, a firm which has sold glass eyes for many years, he learned that there were as many as a thousand wearers of them in that city, and that from 600 to 800 eyes are sold there every year. The best eyes are made at Uri, in Germany, the manufacture centering at that place on account of the occurrence there of fine silicates and other minerals needed in the business. The German eyes withstand the corrosive action of tears and other secretions better than those made in France.

At Uri are made also vast quantities of eyes used by taxidermists in mounting birds, animals, and other natural history specimens, besides a superior quality of glass marbles, known to boys as agates.

The artificial eye is a delicate shell or case, very light and thin, and concave so as to fit over what is left of the eyeball. The shell is cut from a hollow ball or bubble of glass, the iris is blown in, and then the whole is delicately recoated.

The trade in Chicago has undergone a curious change. Twenty years ago there were sold very many more dark eyes than light, but from that period on the sale of dark eyes has been perceptibly dying out. Now nearly all are light eyes, say twenty light to one dark. In Boston the percentage is even larger, about thirty-five blue or light eyes to one brown; while on the other hand, in New Orleans fifty brown or dark eyes are sold to one light. Regarding the change of color in Chicago of course fashion has nothing to do with it. No one has yet decreed that party-colored optics shall be the rage. The change simply shows that the influx of population has been from the East principally and from northern Europe.

Surgical operations are performed much more skillfully than formerly. Time was when it was deemed necessary to take out the eye entirely. Then the artificial eye became a fixed, glassy, staring object. Now amputation of portions of the eye can be performed in very many instances, and the glass eye fitted on the stump, which moves quite naturally.

Sometimes those who have lost an eye will keep two or three artificial substitutes. They will use one for the daylight with a small pupil, and another for night time with a large pupil to offset the dilatation.

Flexible Shafting for Tower Clocks.

Philadelphia has recently adopted a time ball similar to that used in this city. The automatic apparatus for dropping the ball at noon was devised by the builder of the clock, Mr. G. W. Russel, the city time keeper. To a delicate hair trigger the armature of a magnet is attached, so that when the electric current is passed through the magnet the movement of the armature sets off the trigger and lets the ball drop.

The current is sent to the magnet in a very simple manner. In the clock are three wheels, one of which revolves but once in twenty-four hours, the other once in one hour, and the other once in a minute. In each of the three wheels is a notch, and, of course, these three notches can be in the same straight line but once in twenty-four hours. This occurs on the completion of the last second before noon, and then a lever attached to the escapement drops into the notches, completes the electric circuit, and sets off the hair trigger.

The time ball is placed above the clock tower of the Union Insurance Company's new building at Third and Walnut streets, and is visible from a long distance.

Owing to lack of space it was found inexpedient to put the machinery of the clock in the tower, so it was placed in a separate loft and connected with the dial by flexible shafting. This avoids obscuring the skeleton dial by the boxing that would have been necessary with the usual right angle connection. Mr. Russel claims that this is the first application of flexible shafting to tower clocks, and that the result has been satisfactory. The time is taken daily from Washington.

Business and Personal

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

NEW BOOKS AND PUBLICATIONS.

BOLETIN DE LA SOCIEDAD DE GEOGRAFICA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Mexico, 1880.

The latest installment, consisting of parts 4, 5, and 6, vol. v., of this excellent periodical, published by the Mexican Geographical and Statistical Society, has just reached us, and its contents well sustain the high character possessed by the preceding numbers. Among the principal papers worthy of note in this issue are: Report on the Results of an Exploration of the Metalliferous Regions of the Sierra Mohajada, by Santiago Ramirez; A Hydrographic Study, by Pio Bustamente y Rocha; The Ores of the Sierra Queretaro, by J. M. Reyes; and a General Resume of the Mortality in the City of Mexico during the year 1879, by M. Flores Heras. In addition to these and several other original papers, there are numerous translations from foreign scientific works of subjects coming within the scope of the society's investigations, and forming altogether a collection of considerable scientific interest.

INDIA RUBBER, AND "VULCANIZED RUBBER FABRICS ADAPTED TO MECHANICAL PURPOSES."

This is the title of a handsome book just issued by the New York Belting and Packing Company. It gives thorough details of the manufacture, as carried on at the works of the Company at Newtown, Conn., and is beautifully illustrated. It is only intended for distribution among their customers, but those who use rubber belting, hose, packing, springs, etc., will undoubtedly find here much that is peculiarly interesting, and that will enable them "to care more understandingly for the preservation and prolonged wear of rubber goods," as well as to "discriminate more closely in their purchases, and avoid such products as are of imperfect or unskillful manufacture, or made with injuriously adulterating compounds." The book also contains a full description of their manufacture of vulcanite emery wheels, and the improvements they have made in this direction, whereby their emery wheels are in demand for the best class of work abroad as well as at home.

THE "GAS ENGINEER'S" DIARY AND TEXT BOOK FOR 1881. Birmingham, England: John Wright & Co.

The second annual edition of this work, prepared for the subscribers of the *Gas Engineer*. In addition to matter of special value to the gas manufacturers of England, the volume contains a series of original articles on gas manufacture and apparatus, and several tables of use to gas engineers everywhere.

DIE MATERIELLEN VERHALTNISSE UND VORTHEILE FUR EINWANDERER IM STAATE KENTUCKY. Frankfort: Kentucky Geological Survey and Bureau of Immigration.

A pamphlet for free distribution among Germans, describing the resources of Kentucky and the opportunities the State offers for colonization; together with a number of photographs of scenery in sections available for immigrants seeking cheap lands.

U. S. COMMISSION OF FISH AND FISHERIES. PART VI. REPORT OF THE COMMISSIONER FOR 1878. Washington: Government Printing Office. 1880.

A fat volume, giving, in addition to the Commissioners' report of the year's operations of the Fish Commission and a statement of the importance of the work it has undertaken, nearly a thousand pages of matter relating to fish, fish culture, and kindred subjects. These reports are becoming a library in themselves, and one whose significance and value are very imperfectly apprehended by the public generally.

NAVIES OF THE WORLD. By Lieut. W. Very, U. S. N. New York: John Wiley & Sons. 8vo, pp. 451.

Lieutenant Very has undertaken to describe concisely the plans, armament, and armor of the naval vessels of twenty of the principal nations, and to give the latest developments in ordnance, torpedoes, and naval architecture. His point of view is that of the naval officer rather than that of the engineer or ship builder, though he does not neglect the architectural developments of the past decade or two. An interesting chapter is devoted to the principal naval engagements since 1800.

THE SILK GOODS OF AMERICA. By Wm. C. Wyckoff. New York: Published under the auspices of the Silk Association of America. $3.

The second edition of Mr. Wyckoff's account of recent improvements and advances of silk manufacture in the United States. The new part comprises the Eighth Annual Report of the Silk Association, summarizing the progress of the year 1879, which, as our readers already know, was extremely encouraging. The directory of manufacturers and dealers in silk covers 38 octavo pages, indicating a rapid extension of the silk industry.

FIVE LITTLE SOUTHERNERS. By Mary W. Porter. Boston: D. Lothrop & Co.

A children's story of child life on a sugar plantation, with a tragic conclusion in a hurricane on the Gulf.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) A. H. asks (1) for the process of coating or plating small polished steel articles with tin (or a composition similar to it), by dipping the articles into the melted metal and have a good smooth, bright surface when taken out. A. *a.* Boiling water, 12½ lb.; ammonia alum, 17¾ oz.; add protochloride of tin, 1 oz. Dip the articles in hot potash solution, then rinse in clean water, dip in dilute sulphuric acid, and suspend in the tin solution for a few minutes until bright. *b.* Bitartrate of potassa, 10½ oz.; water, 17 oz.; protochloride of tin three-fourths oz. Immerse in this the cleaned articles in contact with a piece of zinc until tinned. *c.* Pyrophosphate of soda, 11 oz.; water, 17½ oz.; protochloride of tin, 4½ oz. Dissolve. Connect the cleansed articles with a wire from the zinc pole of a battery and immerse in the solution, the vessel containing which should be lined with pure sheet tin connected by means of a wire with the copper or carbon plate of the battery. In Wegler's process the bath consists of stannic chloride, 1; water, 10. The articles are pickled in dilute sulphuric acid, scoured with fine sand or scratch-brushed, rinsed with clean water, loosely armed with zinc wire or ribbon, and immersed for ten or fifteen minutes at ordinary temperature. Rinsing and scratch-brushing follows, after which whiting is used for finishing. 2. Will the same process do as well to coat or plate polished brass articles, and give a bright, smooth surface? If not what different process will be necessary? A. Yes.

(2) E. J. C. asks: 1. Will a steam gauge fixed upon a boiler during the hydrostatic test show the pressure within the boiler the same as it will show the pressure of steam? A. Yes. 2. I have a model oscillating engine, 1 inch by 2 inch cylinder. The valve faces are 1¼ inch by 2¼ inches. How can I lubricate these faces while the engine is running? A. With a proper lubricator cup attached to the steam supply pipe or steam chest. 3. What should be the weight of a fly wheel for the above engine, running with 15 lb. of steam and driving the belt from a 2-inch wheel on the shaft? A. 12 or 14 lb.

(3) C. P. asks: 1. At what temperature will a bar of soft steel, say half-inch in diameter, sustain the greatest weight? A. We know of no experiment to determine this point, but if steel behaves in the same manner as wrought iron, its greatest tensile strength is between 325° and 400°. 2. Are car wheels more liable to break in very cold weather, because the wheels are affected by the cold, or because the road bed is frozen, and consequently is not elastic? A. Yes from both causes. 3. Will a steel spring break quicker at a temperature 40° below zero, than at 40° above zero? A. Yes, especially if there be any sudden movement or jar. 4. Will a railrod sustain more weight at 40° below zero than at 40° above zero. A. No. 5. At what degree of temperature will a chain stand the greatest strain? A. From 325° to 400° Fah. 6. Is the power of cohesion in wrought iron the strongest at a very low temperature? A. No. 7. Is the power of cohesion in gray iron the strongest at a very low temperature? A. No.

(4) J. E. F. asks if the lumber for a boat bottom below the water line should be green or dry. A. All lumber used in the construction of a boat should be dry or seasoned.

(5) D. J. L. asks: 1. Is it safe to blow off steam with 60 lb. pressure and two gauges of water while the engine is running? If it is safe to do this, how low should I allow the water to go? I have blown off steam at 60 lb. on Saturday, and on Sunday at noon it will have water to the bottom of the glass. How can I remedy it? A. It is safe, but when the steam is blown off the water should be above the usual height to allow for evaporation over Sunday, and have ample supply for raising steam on Monday morning. 2. The polished parts of my engine become rusty quite frequently from water dropping on it. What can I get to keep it bright without using emery? A. Use pumice stone and oil. 3. I have a glass tube on the water gauge which has iron rust burnt into it, what can I get to clean it? A. Try vinegar or dilute sulphuric acid.

(6) C. H. F. asks: 1. Do the compressed air motors of to-day generate their own pressure while in motion, or do they have to be charged before leaving a certain place and stop to get charged again when the first is exhausted? A. They are charged at the stations. 2. Is there in existence, to your knowledge, any device whereby a greater head can be put on at a water power without increasing the natural head? That is, a greater head with the same dam, amount of water, and same mill machinery. A. No. 3. What does the term "perpetual motion" mean, or apply to? Does it needs be some machine that will not wear out and run perpetually, or one that will run perpetually if replaced when worn out by friction? A. A machine that will run without extraneous aid until its parts are worn out. 4. What is the reward, and by whom offered, for perpetual motion? A. The laws of force are now so well understood that any one acquainted with the rudiments of the subject would never think of offering a prize for perpetual motion.

(7) G. G. writes: Suppose I order two 3-inch governors from the manufacturer, one to run 100 revolutions and the other 170 revolutions per minute, what will be the difference in the construction of the two governors? A. With many governors there would be no difference, as means are generally provided for adjustment to the speed required.

(8) G. H. W. asks: Will opening the windows of a stamp mill diminish the noise in the mill? A. We think not.

(9) F. T. D. L. writes: I want to get a light boiler for an engine the cylinder of which is 1½ inch bore by 3 inches deep, to run at 300 revolutions per minute, with a pressure of 50 lb., but of enough strength to stand 100 lb. It is for the purpose of running a small boat. Could it be heated by naphtha lamps? I would like to know what size the smallest and lightest boiler I could use would be. A. You should have a vertical tubular boiler with 1½ to 2 square feet heating surface. Such boilers are not on sale; they are only made to order.

(10) A. M. P. writes: In making a strength test of brick, will a column have greater pressure in an upright position than in a horizontal one, provided the whole weight is thrown on the brick? A. There will be no difference, if the weight of the column itself be taken into account.

(11) W. G. A. asks: Does water in a boiler get hotter than 212°, that is, if the boiler has 125 or 150 lb. of steam, does the water attain a greater heat than boiling point to generate steam to that pressure? A. Yes, the temperature rises with the pressure of the steam. It may be heated to very high temperatures, providing the containing vessel is strong enough to withstand the pressure.

(12) C. F. H. asks: 1. How can I make a gallon of silver plating solution? A. Dissolve 5¼ oz. pure nitrate of silver, and 8 oz. pure cyanide of potassium in 1 gallon of soft water. 2. How can I make a gallon of nickel plating solution? A. Dissolve three-quarter lb. of the double sulphate of nickel and ammonia in a gallon of soft water. 3. How many quart gravity cells will it require to plate medals of about an inch and a half to two inches in diameter? How large should the positive pole be in relation to the negative pole or the thing to be plated in the solutions? A. See nickel plating, page 153, vol. xliii., and page 81, vol. xliv., SCIENTIFIC AMERICAN.

(13) E. W. K. asks: What process if any will take fly specks from bronze? A. Lavender oil, 1 drachm; alcohol, 1 oz.; water, 1½ oz. Use a soft sponge, and proceed as quickly as possible, with little rubbing.

(14) J. B. S. asks for a formula for making permanent black dye for woolen goods, something that will not rub off. This latter trouble is what I am anxious to obviate. Several formulas that I have do not relieve this trouble. A. You will find practical formulæ and directions for black dye in Nos. 53, 54, 55, 74, 75, 76, and 109, SCIENTIFIC AMERICAN SUPPLEMENT. See Hints to Correspondents.

(15) G. W. C. asks: Which gives the most heat, the dry or green wood of same quality and quantity? A. Dry wood.

(16) O. B. S. inquires as to the best method of mending broken ivory. A. Moisten thoroughly a small quantity of very finely powdered quicklime (good) with white of egg to form a paste. Use at once, clamp the parts, and do not disturb for 24 hours. Do not use an excess of the cement.

(17) O. E. W. asks: 1. How can I make a galvanic battery with copper and zinc plates, each 2x2 inches, strong enough so that I can feel the current? What kind of acid shall I use? A. It would require several hundred such elements, joined copper of one to

zinc of next, and so on, and an interrupted current to produce the statical effects required. See "Galvanic Batteries," in SUPPLEMENTS, Nos. 157, 158 and 159. Also "How to Make Induction Coils," SUPPLEMENT, No. 160. 2. How can a cracked lamp be mended so the oil will not leak through? A. Clean the glass thoroughly with strong hot solution of sal soda, warm, and apply over the parts inside and out the following: Resin, 3 parts; caustic soda, 1; water, 5; boil together until completely saponified, then mix with half its weight of plaster of Paris. 3. What kind of wax is it that engravers use to coat the metals that are to be engraved upon by nitric acid? A. White wax, 2 oz.; black and Burgundy pitch, of each, ½ oz.; melt together; add by degrees powdered asphaltum, 2 oz., and boil until a drop taken out on a plate will, when cold, break by being bent double two or three times between the fingers. It must then be poured into warm water and made into small balls for use. 4. Is copper better for a boiler, 6 inches diameter and 12 inches long, than iron? A. Yes. 5. Is the pressure in the cylinder the same as in the boiler? A. No; it is always less, and how much less depends on the length and size of the steam pipes and the manner in which they are protected.

(18) I. K. E. asks: Can waterglass in small quantities be prepared for experiments without expensive apparatus? A. Fine quartz sand, 2 parts; carbonate of soda, 3½; reduce to fine powders, mix, and heat to a very bright red in a crucible capable of holding four times as much. As soon as the mixture is in a state of calm fusion pour out on an iron plate to cool. For use dissolve in hot water.

(19) H. G. E. asks: Cannot eggs, butter, etc., be kept for a considerable period by having them in a vacuum? Could a brick vault be cemented so as to be air tight, and capable of sustaining exterior atmospheric pressure? Would an air pump be the best way of exhausting the air? A. It is not practical; they would doubtless remain unchanged in a perfect vacuum, but that is unattainable by any ordinary means. Such a vault could be constructed; the pressure from without would be equal to about 15 lb. on each square inch.

(20) C. G. W. writes: I am led to believe that the cultivation of and gathering of such sumac as grows naturally in this sandy country would be a profitable industry. The stag horn sumac (*Rhus typhina*) grows here in abundance, other varieties to some extent. A. The best sumac of commerce is the leaves of the *Rhus coriaria*, cultivated in Sicily. It closely resembles the *R. typhina*, or stag's horn sumac, which has proved, when properly handled, to be nearly if not quite as valuable. See article on sumac, on page 199, vol. XXVI., SCIENTIFIC AMERICAN.

(21) C. D. A. writes: 1. I have heard good engineers say that the friction of a valve depended entirely upon the size of the ports, and if there were no ports in the seat, a valve might be held against it, and when the steam was admitted, if the support was removed the valve would drop down; is this true? A. It would drop down. 2. I always supposed that the size of the valve determined the amount of friction. A. The friction depends upon the size of the valve, deducting so much of the ports as may have steam within, and the pressure upon the unbalanced surface of the valve.

(22) S. B. G. asks: Does a large wheel have any advantage in power over a small one in overcoming the friction on the axle, the axle and load being the same, and running on a smooth level surface? A. Yes.

(23) H. C. M. writes: I notice in vol. xliv., No. 24, page 378, of SCIENTIFIC AMERICAN, article 8, a formula for making oxygen gas for inhalation. Can you tell me whether it is the same as is used by physicians in Philadelphia? A. Probably. 2. Can water be surcharged with it, and if so, how? A. By passing the gas through cold water under pressure the quantity of oxygen it normally contains may be slightly increased. On exposure to the atmosphere or heat the oxygen thus taken up will soon escape again. 3. If not, how can it be used other than in the manner given in the paper referred to? A. We know of no other way of using it. There is no liquid solvent for oxygen that will take up enough of the gas to be of practical service in the way you propose.

(24) W. H. asks: 1. Of what kind of silk are balloons made? A. Good common undyed silk will answer. 2. What kind of oil are they prepared with? A. Usually a mixture of boiled oil and wax, thinned with turpentine. 3. How are the seams made air tight? A. The seams are "felled," waxed, and varnished inside and out. 4. Will gas keep its lifting power for one week, or longer? A. Yes, if kept in a perfectly air-tight vessel. In an oiled silk balloon envelope as usually constructed, no.

(25) J. B. B. writes: 1. A claims that a hollow shaft equal in diameter to a solid one has more strength in driving machinery than the solid shaft. B claims that the solid shaft, equal in diameter to the hollow one, is the strongest. Which is right? A. If of the same diameter, the solid shaft is the strongest; if of the same weight, the hollow shaft is the strongest. 2. What steam pressure is considered in getting the nominal horse power of a steam engine? A. The average pressure in the cylinder. 3. Is it not advisable to give a slide valve as small a stroke as possible, provided you get sufficient port opening? A. Yes.

(26) D. B. M. writes: I have a copper boiler, 36 inches long, 12 inches in diameter, ⅛ in. thickness, no flues. What would be the highest pressure to run with safety? A. Without knowing more of its construction we could not say. 2. Would a two horse power engine, with the above boiler, afford sufficient power to run one of Edison's generators to supply one of his lamps? A. Your boiler will not supply a two horse power engine, it is not equal to one horse power except it be driven very hard. 3. What would such a generator lamp, etc., probably cost? A. They are not in the market. You should write the inventor in regard to them.

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

M. F. M.—No. 1. Tremolite—calcium-magnesium silicate. No. 2. Blue glass. No. 3. Calcium aluminum silicate. No. 4. The habitation of some insect—the material is chiefly lime carbonate. No. 5. Marcasite—FeS_2—with a coating of iron oxide. No. 6. Magnetite and hematite. No. 7 Argentiferous (silver bearing) galena. No. 8. Chiefly lead oxide. No. 9. Iron, alumina, and silica, with possibly a trace of silver.—E. S. B.—The gravel contains no precious metals—only mica and pyrites.

COMMUNICATIONS RECEIVED.

On a Mysterious Boiler Explosion. By W. A. D.
On Ripening Melons Underground. By I. T. B.
On the Wax Myrtles. By J. P. S.
How to Mount very Small Lenses. By C. J. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

February 8, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressor, J. F. Allen 237,359, 237,360
Air medicating apparatus, A. Bell 237,468
Amber, making articles from waste, A. R. Davis 237,497
Ammunition packing box, E. G. Parkhurst 237,406
Animal trap wheel, E. B. Ripley 237,601
Axles, machine for machining, F. D. Bliss 237,364
Barb holding device, T. W. Eaton 237,375
Basin attachment, wash, G. F. Schaffer 237,609
Bath tub, folding, G. Damen 237,494
Bed bottom, I. L. Landis 237,552
Belt lock or fastener, A. Loehner 237,399
Billiard cues, fastening tips upon, G. Zittel 237,656
Boot and shoe, O. E. Lewis 237,396
Boot and shoe, S. Newcomb 237,581
Boot and shoe heel, Stevens & Chisholm 237,636
Boot and shoe heel, M. Wise 237,651
Boot and shoe soles, frictional attachment for, G. W. Hewitt 237,529
Boot and shoe upper, H. G. Thompson 237,638
Bolt, C. Zube 237,657
Bolts and nuts, machine for threading, H. B. Burin 237,479
Brick machine, W. E. Talcot 237,636
Bridge, arch, S. Bissell 237,471
Brush bridle, H. D. Musselman 237,579
Brush, stencil, T. T. Lotherington 237,562
Buckle, W. D. Ewart 237,506
Buffing wheel, A. Leavett 237,395
Building, fireproof, J. Gilbert 237,382
Bull wheel for artesian wells, M. B. McManus (r) 9,559
Buoy, signal, F. Barr 237,361
Button, separable, G. Van der Burgh 237,644
Calendering machine, cloth, R. J. Walker 237,421
Can stopper, W. H. Rodden 237,446
Canal boat, A. Albertson 237,462
Car coupling, J. C. Mathews 237,568
Car coupling, W. V. Perry 237,588
Car coupling, E. Weidling 237,648
Car door, grain, T. Butterworth 237,482
Car heater and ventilator, G. Laube 237,555
Car wheel, J. J. Davis 237,370
Car wheel, P. H. Lindsey 237,398
Cars, atmospheric compressor for street, I. P. Wendell 237,424
Carpet lining, C. H. Bradley 237,474
Carriage, W. Ruby 237,411
Carriage spring, H. B. Osborn 237,443
Carriage top, shifting, J. H. Fairbanks 237,507
Cartridge crimping machine, H. S. Burns 237,480
Carving fork, Haddan & Smith 237,521
Casting car wheels, French & Robertson 237,511
Casting metals, mould for, C. Sneider 237,634
Casting mould boards, mould for, G. K. Smith 237,619
Cement and lime, manufacture of hydraulic, Dimelow & Peadro 237,500
Cement, bituminous, E. J. De Smedt 237,502
Centrifugal machine, G. A. Hagemann 237,523
Chain, detachable drive, J. L. Pope ..... 237,591 to 237,593
Chain, drive, J. C. Coonley 237,489, 237,490
Chain, drive, J. M. Dodge 237,499
Chair seat and back, G. Hunzinger 237,535
Chest lock, G. B. Cowles 237,492
Chuck, lathe, J. B. Secor 237,614
Churn, Bartlett & Burd 237,658
Churn, S. B. Rathbun 237,598
Cigar bundling machine, J. J. Kruse 237,391
Cigars, machine for coloring and flavoring, E. Hadra 237,522
Clevis, A. Sanford 237,447
Clock striking mechanism, A. E. Hotchkiss 237,532
Clothes drier, revolving, T. Pritchard 237,407
Clutch and brake, friction, D. H. Merritt 237,570
Collar pad, harness, J. L. Richards 237,445
Copy holder, E. P. Newman 237,582
Corset, S. A. Drewry 237,503
Corset, E. L. Smith 237,618
Cotton chopper, R. I. Draughon 237,502
Cotton gin, J. Du Bois 237,433
Coupling for earth augers and rock drills, J. H. Sutfin 237,629
Cradle, grain, M. Naumier 237,580
Crimping machine, S. A. Gould 237,515
Cultivator, J. G. Evans 237,376
Cutter head for wood-working machines, S. A. Woods 237,653
Doll, celluloid, Lefferts & Carpenter 237,559
Door fastening, L. C. Northrop 237,583
Draught equalizer, A. C. & J. T. Jacobson 237,538
Draw gauge, E. G. Latta 237,554
Earthenware vessel, R. B. Eason 237,505
Electric machine, dynamo, W. E. Sawyer 237,622
Electric push button, illuminated, E. J. Swan 237,455
Electric signal, H. R. Miller 237,575, 237,576
Elevator, J. M. Dodge ..... 237,[illegible]
Envelope and letter sheet, combined, J. F. Dodd 237,374
Evaporating pan, T. E. Scantlin 237,448
Evaporator, Whitney & Simpson 237,649
Fan, L. Sanders ..... 237,[illegible]
Fan, S. Scheuer 237,611
Fanning mill, H. Keller 237,458
Farm gate, A. Miller 237,572
Feeding and watering stock in cars, device for, A. D. Tingley 237,641
Feeding rack, W. T. Finch 237,525
Fence, D. S. Buck 237,367
Fence post, H. Laird 237,393
Fence stretcher, wire, Salisbury & Stevens 237,412
Fermenting vat, F. Fehr 237,509
Fermenting vat cooler, Kastner & Kunz 237,545
Fiber, machine for separating vegetable, E. A. Leigh 237,394
Fibrous stalks, machine for decorticating, A. Angell 237,463
Filter, J. Bergeman 237,469
Filter press, W. H. Harris 237,525
Firearm, breech-loading, W. H. Davenport 237,432
Fire escape ladder, O. Sherwood, Jr 237,616
Fire extinguishing sprinkler, automatic, A. M. Granger 237,517
Fish hook, E. Marion 237,566
Floors and ceilings, construction of, G. Howard 237,533
Forks, machine for cleaning and polishing, E. Hutchison 237,536
Fruit drying apparatus, C. H. Hill 237,530
Furniture, reversible center plate for, T. F. Darcy 237,495
Furniture spring, M. H. Learnard 237,557
Game board, C. E. Garrett 237,496
Gas generator, hydrocarbon, J. Flannery 237,993
Gas, process of and apparatus for manufacturing, J. J. Johnston 237,541
Gas scrubber, E. Jones 237,542
Glass articles, manufacture of, Dean & Peltier 237,371
Glass tile, mosaic, etc., L. C. Tiffany 237,416
Gleaner and binder, combined, H. N. Johnston 237,540
Globes, mounting and attachment for terrestrial, E. E. Fitz (r) 9,557
Governor, E. Wright 237,655
Grain drill gearing, J. King 237,390
Grain separator, W. Ackerman 237,460
Grain separator, A. S. Phelps, Jr 237,589
Grain separator, I. Sherck 237,453
Grinding mill, G. & A. Raymond 237,599
Grinding wheels, machinery for automatically delivering sand to, H. C. Luther 237,563
Gun, rocket, N. E. Rice 237,444
Hame fastener, L. E. Jones 237,905
Handles for cutlery from vulcanized fiber, manufacture of, J. B. H. Leonard 237,440
Harness, breeching lifter for, S. F. Smith 237,414
Harness fastening, J. S. Maddox 237,565
Harrow, T. Rogers (r) 9,561
Harvester, H. N. Johnston 237,539
Harvester guard finger, W. Scott 237,613
Hatter's iron, F. C. Taylor 237,637
Hay rake, horse, J. La Dow 237,553
Heel breasting machine, A. K. Washburn 237,646
Hides for tanning, preparing, J. S. Swan 237,630
Hinge, gate, N. B. Sebring 237,451
Hinge, spring, F. W. Brocksieper 237,476
Holsting and conveying machine, L. Messier 237,571
Hoop nailing machine, E. Cole 237,369
Horse bonnet, E. Boersch 237,473
Horse holding attachment for vehicles, R. E. Shannon 237,615
Hose nozzle, Johnson & Hoyer 237,386
Hot water apparatus, T. Fairbanks 237,508
Hubs, point band for, W. Neracher 237,441
Hydrant, J. Jonson 237,544
Hydrocarbons, device for burning liquid, L. E. & G. W. Dudley 237,504
Ice cutter, J. T. Martin 237,567
Ice making machinery, De La Vergne & Mixer 237,372
Indices, machine for cutting, W. E. Waters 237,647
Insect killer, E. S. Griffith 237,520
Kettle, preserving, J. I. Burr (r) 9,552
King bolts, manufacturing clip, Knowles & Hitchcock 237,550
Knitting machine, C. E. Kelley 237,546
Lamp, fountain, C. Stockmann 237,627
Lamp, street, E. Boesch (r) 9,556
Lamp switch, electric, W. Sawyer 237,608
Lathe, P. B. Conklin 237,487
Lathe tool support, E. Wright 237,654
Lead and crayon holder, C. W. Boman 237,365
Lead and crayon holder, J. Hoffman 237,284, 237,531
Leg and foot protector, W. Beattie 237,667
Life raft, H. Miller 237,574
Loom, L. J. Knowles 237,549
Loom, G. L. Pallatt 237,585
Lubricant, H. Hurty 237,437
Lubricator, H. Howe 237,534
Matches, apparatus for sulphurizing or paraffining friction, N. Butler 237,368
Mattress frame or bed bottom, F. A. Palmer 237,586
Meters, connection to, A. Mackey 237,564
Middlings purifiers, sieve for, J. A. Raney 237,597
Milk cooler, A. McCalium 237,403
Milk cooler, G. C. Shaler 237,452
Mitering machine, J. M. Rhodes 237,409
Mitten, Haight & Strossman 237,524
Moulding metals, flask for, C. Sneider 237,635
Mouldings, process of and apparatus for ornamenting, C. C. Stuart 237,628
Nailing machine, J. H. Foster 237,380
Net for horses, fly, J. F. Smith 237,622
Nut lock, E. J. Brooks 237,659
Oatmeal machine, G. H. Cormack (r) 9,558
Oil cup, S. G. Cabell 237,660
Oil cup for saws, F. Rousseau 237,604
Organ bellows, Fogelberg & Graves 237,378
Oven, baking, Aff & Jordans 237,461
Packing case, H. E. Clinton 237,486
Packing for steam and other joints, J. Kirkman 237,548
Packing, metallic piston, J. H. Brown 237,477
Pail, dinner, Ludlum & Peck 237,401
Pantaloons protector, B. C. Wilson 237,427
Paper box, Adams & Miller 237,358
Paper cartridge machine, G. P. Salisbury 237,605
Paper floor covering, D. H. Morrison 237,578
Paper weight and calendar, combined, G. A. Ogle 237,584
Pegging jack and bench, T. B. Ellis 237,434
Pen, fountain, W. W. Stewart 237,454
Photographic head rest, W. S. Laighton 237,392
Photographic negatives, producing impressions in line or stipple from, F. E. Ives 237,664
Pianofortes, stringing, A. K. Hebard 237,528
Piano lock, G. B. Cowles 237,491
Planter, corn, J. C. Van Dyke 237,430
Planters, fertilizer attachment for seed, H. Wright 237,428
Plow, Swenson, Lindquist, & Hedlund 237,631
Potato digger, L. V. Rouse 237,410
Preserving fruit juices, Schaumberg & Dillman 237,449
Press, C. L. Ingalls 237,537
Pressure regulating valve, R. H. Soule 237,624
Printing, apparatus for and method of chromatic, G. Schwarzwald 237,612
Printing machine, plate, H. Lee 237,558
Printing machine sheet delivery apparatus, W. Scott 237,413
Pulp, dry ground, H. B. Meech 237,569
Pump bucket and valve, S. A. Sauna 237,607
Pump piston, W. Burlingham 237,459
Punch, metal, S. H. Jenkins 237,439
Puzzle, geometrical, E. Anthony 237,464
Radiator, indirect, T. H. Brooks 237,429
Railway, elevated, M. E. Walton 237,422
Railway switches, operating, R. P. Garsed 237,381
Railway track drilling machine, A. Loehner 237,400
Railway tracks, apparatus for laying, N. Kimball 237,388
Railway train marker, C. W. White 237,459
Razor, J. Deasey 237,498
Reclining folding chair, F. Hunger 237,395
Rein holder, G. W. Miller 237,573
Safes and vaults, electrical envelope for, H. C. Roome 237,605
Safety pins, manufacture of, J. P. Courtney 237,661
Salt, manufacture of, N. B. Rice 237,600
Saw, circular, G. F. Simonds *et al* 237,617
Saw jointer, circular, A. S. Pierson 237,590
Saw mill log carriages, brake for, F. Tuxworth 237,457
Sawing and routing machine, S. M. Bragg 237,475
Scarf ring, F. A. Sundberg 237,415
Scoop, S. H. Kerfoot 237,387
Sewer and stench trap, C. Halstead 237,383
Sewing machine, G. F. Newell 237,442
Sewing machine feeding mechanism, G. F. Newell 237,666
Shed, cattle, M. Thorp 237,639
Sheet metal articles, dies for forming flat, A. Scherb 237,610
Shirt bosom, S. K. Devereux (r) 9,554
Shutter worker, J. C. Landes 237,551
Sifter, H. A. Trench 237,419
Soldering machine, can, W. A. Wicks 237,650
Stair rod fastener, M. L. Githens 237,514
Stamp, hand, H. P. Smith 237,620
Starching machine, R. Brenner 237,366
Station indicator, automatic railway, J. H. Whitelegge 237,425
Steam generator, D. Renshaw 237,408
Steam pipes, boilers, etc., covering for, W. M. Bitler 237,363
Steering apparatus, steam, J. W. Watson 237,423
Stench traps, mercury seal for, J. Bennor 237,362
Still, oil, M. Livingston 237,560
Stock clearance indicator, J. C. Uhler 237,643
Stone, wood, etc., wheel or tool for cutting, sawing, or grinding, H. Blackburn 237,472
Stove back, W. Schenck 237,450
Stove shelf, Hasselhoff & Mayne 237,526
Stoves, attachment for burning crude oil in, L. C. Snell 237,623
Straw cutter, W. Barrett 237,466
Straw cutter, S. Luther 237,402
Swing, R. S. B. Thornton 237,640
Syringe, vaginal, F. Wilhöft 237,436
Tablet, writing, G. L. Garrigues 237,513
Telegraph, chemical, C. A. Randall 237,595
Telephone, G. W. Foster 237,379
Telephone lines, switch board for, E. T. Frost 237,512
Telephone switch, H. R. Miller 237,577
Telephone, transmitting, E. A. Schoettel 237,633
Telephonic transmitter, C. A. Randall 237,596
Terret, head, H. A. Perkins 237,587
Thill coupling, A. French 237,510
Thrashing machine, peanut, J. P. K. Daughtrey 237,496
Ticket, admission, F. H. Cyrenius 237,493
Ticket reel and receptacle, C. S. Locke 237,561
Tobacco, apparatus for sweating and coloring, C. F. & B. A. Meyer 237,405
Toy, optical, G. E. King 237,389
Toy wheel, J. M. Jones 237,543
Truck, stove, H. G. O. Burrows 237,481
Turn table, A. J. Delavigne 237,373
Type distributing machine, D. Reynolds (r) 9,560
Umbrella and parasol, Bissland & Williams 237,470
Umbrella and sun shade, H. B. Gray 237,518
Umbrella and water cooler stand, J. F. Conway 237,488
Valve, steam, G. J. Roberts 237,602
Vaseline, refining, R. A. Chesebrough 237,484
Vehicle spring, E. Spaulding 237,625
Vehicle spring, J. Tilton 237,456
Wagon bolsters, adjustable standard for, J. Grier 237,519
Wall paper manufacturer's use, hanging up and carrying off machine for, J. Waldron 237,645
Washing machine, R. G. Baldwin 237,465
Washing machine, B. R. Trull 237,642
Washing machine, J. E. Watkins 237,458
Washing machine, B. Wright 237,653
Watch key, stem winding, E. C. Fitch 237,377
Water cooler, T. W. McKeever 237,404
Water elevator, windmill, J. M. Hasting 237,527
Weather strip, J. E. Gowen 237,516
Wells, method of and apparatus for sinking oil and other, L. Smith 237,621
Wheat scouring apparatus, A. Buhl 237,478
Windlass, E. & G. N. Waterbury (r) 9,555
Windmill, H. H., C. H., & C. Beckman 237,467
Window, colored glass, L. C. Tiffany 237,417, 237,418
Wire springs, machine for forming, G. W. Lewthwaite 237,397
Wood, producing designs upon, S. K. Devereux (r) 9,553
Wood working clamp, A. M. Colt 237,431
Wrench, C. L. & H. F. Praeger 237,594
Wringer and bench, I. R. Laux 237,556
Wringing machine, J. Kinleyside 237,547

DESIGNS.

Carpet, J. Neil 12,162
Hair ornament, A. Progel 12,163
Oil cloth, C. T. & V. E. Meyer ..... 12,150 to 12,161
Steam engine, C. M. Farrar 12,149

TRADE MARKS.

Bitters, A. Dryfoos 8,157
Cigars, A. Estlow 8,158
Medicinal preparation, Orthozoic Chemical Association 8159
Oily compounds for coating surfaces as a paint or lubricant, J. Dixon Crucible Company 8,161
Paper of all kinds, writing, Z. Crane, Jr., & Brother 8,156
Washing compounds, A. Zink 8,160

English Patents Issued to Americans.

From February 1 to February 8, 1881, inclusive.

Barrel hoops, machine for nailing, E. Cole, B'klyn, N. Y.
Buoy, signal, F. Barr, New York city.
Engine, hot air, A. S. Lyman, New York city.
Furnace for burning gas, A. L. Holley, Brooklyn, N. Y.
Hatter's irons, F. C. Taylor, New York city.
Ice, manufacture of, T. L. Rankin *et al.*, New York city.
Loom, F. O. Tucker, Hartford, Conn.
Moulding hollow articles, W. B. Carpenter, Newark, N. J.
Nailing machine, J. H. Foster, Chicago, Ill.
Necktie, Fisk, Clark & Flagg, New York city.
Pipe joint, W. Painter, Baltimore, Md.
Razor machinery, J. D. Frary, Bridgeport, Conn.
Separating solid from liquid matter, P. Cassamajor, Brooklyn, N. Y.
Steel, manufacture of, J. Conant, M.D., Prairie du Chien, Wis.
Steam boiler, D. Renshaw, Cohasset, Mass.
Transporting money, etc., J. C. White *et al.*, N. Y. city.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS FOR PRACTICAL MEN.

Valuable and Indispensable

Practical and Scientific Books.

LIST No. 4.

Rose. The Complete Practical Machinist. Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc. By Joshua Rose. Illustrated by 130 engravings. 12mo. Cloth, $2.50

Sixth Edition Just Ready.

Rose. The Slide Valve Practically Explained. By Joshua Rose. Illustrated by 35 engravings. 16mo, $1.00

Regnault. Elements of Chemistry. Illustrated by nearly 700 engravings. Comprising nearly 1,500 pages. 2 vols. 8vo. Cloth, $7.50

Riffault, Vergnaud, and Toussaint. A Practical Treatise on the Manufacture of Colors for Painting. Illustrated by 80 engravings. 8vo. Cloth, 659 pages, $7.50

Roseleur. Galvanoplastic Manipulations. A Practical Guide for the Gold and Silver Electro plater and the Galvanoplastic Operator. From the French of Alfred Roseleur. By A. A. Fesquet. Illustrated by over 127 engravings on wood. 8vo. 495 pages, $6.00

☞ *This Treatise is the fullest and by far the best on this subject ever published in the United States.*

Riddell. Lessons on Hand Railing for Learners. Illustrated by 32 plates. 4to, $5.00

Riddell. Mechanic's Geometry. Plainly teaching the Carpenter, Joiner, Metal Plate Worker, etc., the constructive principles of his calling. 50 large plates. 4to, $5.00

Riddell. The Artisan. Illustrated by 40 plates of Geometric Drawings, showing the most practical methods that may be applied to works and buildings and other constructions. 4to. Cloth, $5.00

Ropp. Commercial Calculator. Showing the value of wheat, corn, etc.; simple and compound interest; measurement of boards, scantlings, logs, cisterns, tanks, granaries, corn cribs, wagon beds, time table, wages table, etc. Cloth, $1.00; Morocco, $1.50

Safe Use of Steam. 12mo. Paper, $0.25

Sloan. Homestead Architecture. Containing 40 designs for Villas, Cottages, and Farm Houses. Essays on style, construction, landscape gardening, furniture, etc. 200 engravings. 8vo. Cloth, $3.50

Shaw. Civil Architecture. A complete theoretical and practical System of Building, containing the fundamental principles of the Art. Illustrated by 102 plates on copper. 4to. Cloth, $10.00

Sloan. American Houses. 26 colored engravings. 8vo. Cloth, $1.50

Slater. Manual of Colors and Dye Wares. Their properties, applications, impurities, etc. 12mo. Cloth, $3.75

Smith. A Manual of Political Economy. By E. Peshine Smith. 12mo. Cloth, $1.25

Smith. The Dyer's Instructor. The Art of Dyeing Silk, Cotton, Wool, Worsted, and Woolen Goods. Nearly 800 Receipts. 12mo. Cloth, $2.50

Do. Do. With Patterns, $10.50

Smith. The Practical Dyer's Guide. Containing 500 Dyed Patterns, to each of which a Receipt is given. 8vo (1880), $25.00

Smith. Parks and Pleasure Grounds. Practical notes on country residences, etc. 12mo. Cloth, $2.25

Syme. Outlines of an Industrial Science. 12mo. Cloth, $2.00

Shunk. A Practical Treatise on Railway Curves and Location. Pocketbook form. 12mo, $2.00

Smeaton. Builder's Pocket Companion. Illustrated. 12mo. Cloth, $1.50

Smyth. A Rudimentary Treatise on Coal and Coal Mining. Illustrated. 12mo. Cloth. $1.75

Snively. A Treatise on the Manufacture of Perfumes. 8vo. Cloth, $3.00

Snively. Elements of Systematic Qualitative Chemical Analysis. 16mo. Cloth, $2.00

Snively. Tables for Systematic Qualitative Chemical Analysis. 8vo. Cloth, $1.00

Starch. A Practical Treatise on the Manufacture of Starch, Dextrine, and Glucose. 50 engravings. 300 pages. 8vo. (In press), $3.50

☞ *Subscriptions will now be received, payable on Delivery in April.*

Stokes. The Cabinet-Maker and Upholsterer's Companion. Comprising the Art of Drawing, as applicable to Cabinet Work; Veneering, Inlaying, and Buhl-Work; the Art of Dyeing and Staining Wood, Ivory Bone, Tortoise-Shell, etc. Directions for Lackering, Japanning, and Varnishing; to make French Polish, Glues, Cements, and Compositions; with numerous Receipts, useful to workmen generally. By J. Stokes. Illustrated. A New Edition, with an Appendix upon French Polishing, Staining, Imitating, Varnishing, etc. 12mo. $1.25

Strength and other Properties of Metals for Cannon, with a Description of the Machines for testing Metals. Illustrated by 25 large plates. 4to, $10.00

Sullivan. Protection to Native Industry. By Sir Ed Sullivan. 8vo. Cloth, $1.50

Tables Showing the Weight of Round, Square, and Flat Bar Iron, Steel, etc., by measurement. Cloth, $0.63

Taylor. Statistics of Coal. Illustrated. 8vo. Cloth, $10.00

Templeton. Operative Workshop Companion. Illustrated. 12mo. $2.50

Templeton. The Practical Examinator on Steam and the Steam Engine. Arranged for the use of Students, Engineers, and others. 12mo. Cloth. $1.25

Thomas. The Modern Practice of Photography. 8vo. Cloth, $0.75

Thomson. Freight Charges Calculator. 12mo. Cloth, $1.25

Turning: Specimens of Fancy Turning Executed on the Hand or Foot Lathe. 30 photographs. 4to, $3.00

Turner's Companion. Illustrated. 12mo. Cloth, $1.50

Urbin. Practical Guide for Puddling Iron and Steel. 8vo, $1.00

Valle. Galvanized Iron Cornice Worker's Manual. Containing instructions for laying out the different miters, and making patterns for all kinds of plain and circular work. 22 plates. 4to. Cloth. $5.00

Ville. The School of Chemical Manures. 12mo. Cloth, $1.25

Ville.—On Artificial Manures. The Chemical Selection and Scientific Application to Agriculture. Translated and edited by Wm. Crookes. Illustrated. 8vo, $6.00

Vodges. The Architect's and Builder's Companion and Price Book. Illustrated. Cloth, $1.50; Pocketbook, $2.00

Watson. A Manual of the Hand Lathe. 78 engs. $1.50

Watson. The Modern Practice of American Machinists and Engineers. 85 engravings. 12mo. Cloth, $2.50

Williams. On Heat and Steam. Embracing new views of vaporization, condensation, and explosions. 8vo. Cloth, $3.50

Weatherly. The Art of Boiling Sugar. Crystallizing, Lozenge Making, etc. 12mo. Cloth, $2.00

Worssam. Mechanical Saws. 18 Plates. 8vo, $2.50

Wohler. Hand Book of Mineral Analysis. Illustrated. 12mo. Cloth, $3.00

Warn. The Sheet Metal Worker's Instructor. For Zinc, Sheet Iron, Copper, and Tin Plate Workers, and Boiler Makers. 32 plates and 37 wood engravings. 8vo. Cloth, $3.00

Ware. The Sugar Beet. Illustrated by 90 engravings. 8vo. Cloth. $4.00

Ware. The Coach Maker's Illustrated Hand Book. Containing complete instructions in all the different branches of Carriage building. Thoroughly illustrated. 8vo. Cloth, $3.00

Watson. The Theory and Practice of the Art of Weaving by Hand and Power. Illustrated by large engravings. 8vo. Cloth, $7.50

Weinhold. Introduction to Experimental Physics. Theoretical and Practical. Including directions for constructing Physical Apparatus for Making Experiments. Illustrated by 3 colored plates and 404 wood cuts. 846 pages. 8vo $7.50

First Principles of Political Economy. 12mo, $1.50

Wightwick. Hints to Young Architects. Illustrated 12mo. Cloth, $2.00

Wilson. A Treatise on Steam Boilers. Their strength, construction, and economical working. Illustrated. 8vo. Cloth, $2.50

☞ *The above or any of our Books sent by mail, free of postage, at the publication prices,* TO ANY ADDRESS IN THE WORLD.

Our Various Catalogues of Books, covering all branches of INDUSTRIAL SCIENCE AND ART, sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

RUBBER BACK SQUARE PACKING.

BEST IN THE WORLD.

For Packing the Piston Rods and Valve Stems of Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.

A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.

This Packing is made in lengths of about 20 feet, and of all sizes from ¼ to 2 inches square.

JOHN H. CHEEVER, Treas. NEW YORK BELTING & PACKING CO., 37 & 38 Park Row, New York.

SPECIALTIES.

WOODWORKING MACHINERY,

Of Superior Quality, for

CABINET AND PIANO MAN'F'RS.

SHAFTING, PULLEYS & HANGERS.

P. Pryibil, 461 to 467 W. 40th St., New York.

Will be mailed FREE to all applicants, and to customers without ordering it. It contains five colored plates, 600 engravings, about 200 pages, and full descriptions, prices and directions for planting 1000 varieties of Vegetable and Flower Seeds, Plants Roses, etc. Invaluable to all. Send for it. Address,

D. M. FERRY & CO., Detroit, Mich

WOOD PRESERVED

under the Thilmany Improved Zinc Patent, warranted to last almost indefinitely, at very small cost. It will not shrink or swell, avoids decaying, and preserves iron fastenings. Sea worms will not eat it. Toughened by the zinc fiber throughout, it wears equal to stone for pavements, bridges, railroad ties, wharfs, roadways, fence posts, stables, green houses, shingles, ship timber, etc. (retaining the qualities of wood otherwise). For pamphlet and full particulars, apply to J. LORILLARD, Pres. Manhattan Wood Preserving Co., 65 South St. N.Y.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to

JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.

☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

$5 to $20 per day at home. Samples worth $5 free. Address STINSON & Co., Portland, Me.

23 Sizes of Direct, 24 Sizes of Boilers, and the best Indirect Radiation.

Send for circulars.

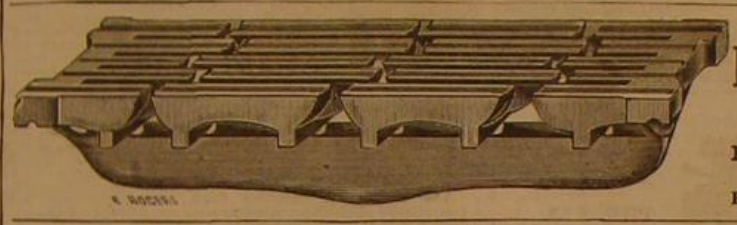
EUREKA STEAM HEATING CO.,
ROCHESTER, N. Y.

SURFACE FILE HOLDERS.

By their use a crooked file may be utilized as well as a straight one, and *both* are made to do better execution in filing broad surfaces than has hitherto been possible.

No. 4 holds files 12 to 14 in. long. Price 75c. each.
No. 5 " " 14 to 16 in. " Price $1.00 each.

For sale by the trade generally. Manufactured only by the NICHOLSON FILE CO., Providence, R. I.



W. C. WREN'S

Pat. Grate Bar,

Manufactured by

D. S. CRESWELL,
Eagle Iron Foundry,
816 RACE ST.,
PHILADELPHIA, PA.

The BELMONTYLE OIL

Prevents Rust, Tarnish, etc., on Firearms, Machinery, Tools, Cutlery, Safes, Saws, Skates, Stoves, Hardware, etc., without injury to the polish. In use over 10 years. Highest Testimonials. Samples 50 cents, three for $1.00, sent free of expressage. Send for circular.

BELMONTYLE OIL CO.,
SOLE MANUFACTURERS,
150 Front Street, New York.

MACHINISTS' TOOLS.

Iron Planing Machines

A SPECIALTY.

C. WHITCOMB & CO., Worcester, Mass.

VIOLIN OUTFITS.

Consisting of Violin, Box, Bow and Teacher, Sent to any part of the United States on 1 to 3 days trial before buying.

Violin Outfits

at $3.50, $7., $12. & $22. each. Send Stamp for **Beautifully Illustrated** 32 page Catalogue of Violins, Guitars, Banjos, Cornets, Flutes, Strings all kinds, Harmonicas, Organ Accordeons, Music Boxes, &c. **Lowest Prices.** Mail Orders a Specialty. C.W. Story, 26 Central St. Boston, Mass.

JOHN R. WHITLEY & CO.

European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E. C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

MACHINISTS' TOOLS.

LATHES, PLANERS, DRILLS,

Gear Cutters, Shaping Machines, AND ORE CRUSHERS.

GOULD & EBERHARDT,
NEWARK, N. J.

TELEPHONE Works 1 mile. Price $4. Pat'd. Circulars free. HOLCOMB & Co., Mallet Creek, Ohio.

JUST ISSUED. ROPER'S ENGINEER'S HANDY BOOK. Containing a full explanation of the steam engine indicator, and its use and advantages to engineers and steam users. 16mo. 675 pages. Fully illustrated. Price $3.50. E. CLAXTON & CO., Philadelphia, Pa.

ORGANS $30 to $1,000; 2 to 32 Stops. Pianos $125 up. Paper free. Address Daniel F. Beatty, Washington, N. J.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29. ST. NEW YORK CITY

FOUND

THE STEAM PUMPS MADE BY

VALLEY MACHINE CO.,

EASTHAMPTON, MASS.,

Are the best in the world for Boiler Feeding and other purposes.

"RELIABLE"

Engines a complete success. Prices still 40 per cent. below those of other makers. Unequaled for efficiency, simplicity, and durability. Prices from $250 for 10 H. P. to $400 for 30 H. P. All complete, with Governor, Pump, and Heater.

Address, for circular,
HEALD & MORRIS, formerly HEALD, SISCO & Co.,
Baldwinsville, N. Y.

The George Place Machinery Agency

Machinery of Every Description,
121 Chambers and 103 Reade Streets, New York.

FOUR SIDED MOULDER, WITH OUT-side bearing. We manufacture 5 sizes of these moulders.

Also Endless Bed Planers, Mortisers and Borers, Tenoning Machines, Sash Dovetailers, Blind Rabbeting Machines. Also a large variety of other wood working machines.

Address
LEVI HOUSTON, Montgomery, Pa.

---

50 New Styles, Perfumed Motto, Moss-Rose, Violet, Japanese Cards, name on, 10c. Card Mills, Northford, Ct.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

COE BRASS MFG. CO
BRASS AND COPPER IN SHEETS
WOLCOTTVILLE CONN.
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY.
WIRE AND BLANKS

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.

Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.

NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

$66 a week in your own town. Terms and $5 outfit free. Address H. HALLETT & Co., Portland, Me.

Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over other Steel Castings. Send for circular and price list.

CHESTER STEEL CASTINGS Co., 407 Library St., Phila, Pa.

SHEPARD'S CELEBRATED

$60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

ROCK BREAKERS AND ORE CRUSHERS.

We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers containing the invention described in Letters Patent, issued to Eli W. Blake, June 15th, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11th and July 20th, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under the superintendence of Mr. Marsden, who, for the past fifteen years, has been connected with the manufacture of Blake Crushers in this country and England.

FARREL FOUNDRY AND MACHINE CO., Manufrs., Ansonia, Conn.
COPELAND & BACON, General Agents, 85 Liberty St., N. Y.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

$72 A WEEK. $12 a day at home easily made. Costly outfit free. Address TRUE & Co., Augusta, Me.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.

IRON REVOLVERS, PERFECTLY BALANCED

IS SIMPLER, AND HAS

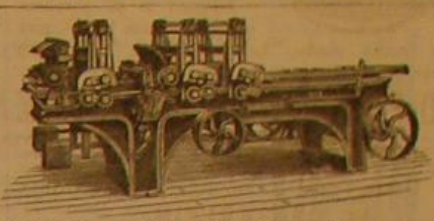
FEWER PARTS THAN ANY OTHER BLOWER.

P. H. & F. M. ROOTS, Manuf'rs,

CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street,
} NEW YORK.

☞ SEND FOR PRICED CATALOGUE.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Bail & Co., Worcester, Mass. Send for Catalogue.

HUB MACHINERY.—HUB TURNING, HUB MORTISing, and Hub Boring Machines. Send for price list and circulars. DAVID JENKINS, Sheboygan, Wis.

PORTER MANUFG. CO., Lim. New economizer. Only portable made with return flue. **Absolute safety from explosion** and from sparks. Send for cirs. to Porter Mfg. Co., Lim., Syracuse, N.Y. G. G. Young, Gen. Agt., 42 Courtlandt St., N.Y.

$55.66 Agents' profit per week. Will prove it or forfeit $500.00. Outfit and Samples worth $5.00 free. Address E. G. RIDEOUT & CO., 10 Barclay Street, New York.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.

WM. SELLERS & CO., Phila.

THE DINGEE & CONARD CO'S
BEAUTIFUL EVER BLOOMING
ROSES

The only establishment making a SPECIAL BUSINESS OF ROSES, 50 LARGE HOUSES for ROSES alone. We deliver Strong Pot Plants, suitable for immediate bloom, safely by mail, postpaid, at all post-offices. 5 splendid varieties, your choice, all labeled, for $1; 12 for $2; 19 for $3; 26 for $4; 35 for $5; 75 for $10; 100 for $13. We GIVE AWAY, in Premiums and Extras, more ROSES than most establishments grow. Our NEW GUIDE, *a complete Treatise on the Rose*, 70 pp. *elegantly illustrated*, describes 500 newest and choicest varieties—*free to all.*

THE DINGEE & CONARD CO.
Rose Growers, West Grove, Chester Co., Pa.

THE COTTON GIN, ILLUSTRATED, HAS been in use a number of years in the Cotton States, and has earned an enviable reputation which can be verified. The American Needle Gin and Condenser is essentially different in the ginning cylinder from the saw Gin in this particular: the teeth are formed of separate, curved, sharp-pointed steel needles, tempered, and firmly held in sections. They are better for the purpose intended than the teeth made on a disk of thin sheet steel: first, because there are no rough edges or acute angles on them to injure the delicate fiber while separating the cotton from the seed. Second, though having the same number of teeth to the inch there is more space between them, thereby increasing its capacity. This has been proved in numerous trials.

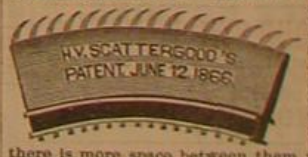


Fig. 1, the complete machine, gins, cleans, and passes the cotton through the condenser in a continuous sheet or bat, which may be handled from the gin to the press without loss. As a flue gin it is superior to the saw gin—gins faster and gives a greater yield of cotton.

The patterns, special tools, material, gins on hand and in process, the patents, and the good-will of the business of manufacturing these machines, are now offered for sale. For further information, address the inventor at Albany, N. Y. H. V. SCATTERGOOD.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought

STRUCTURAL IRON.

It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.