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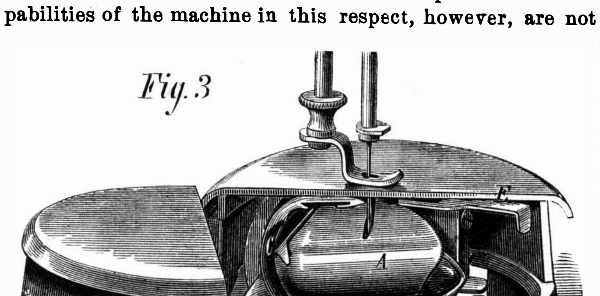
THE LITTLE MONITOR SEWING MACHINE.

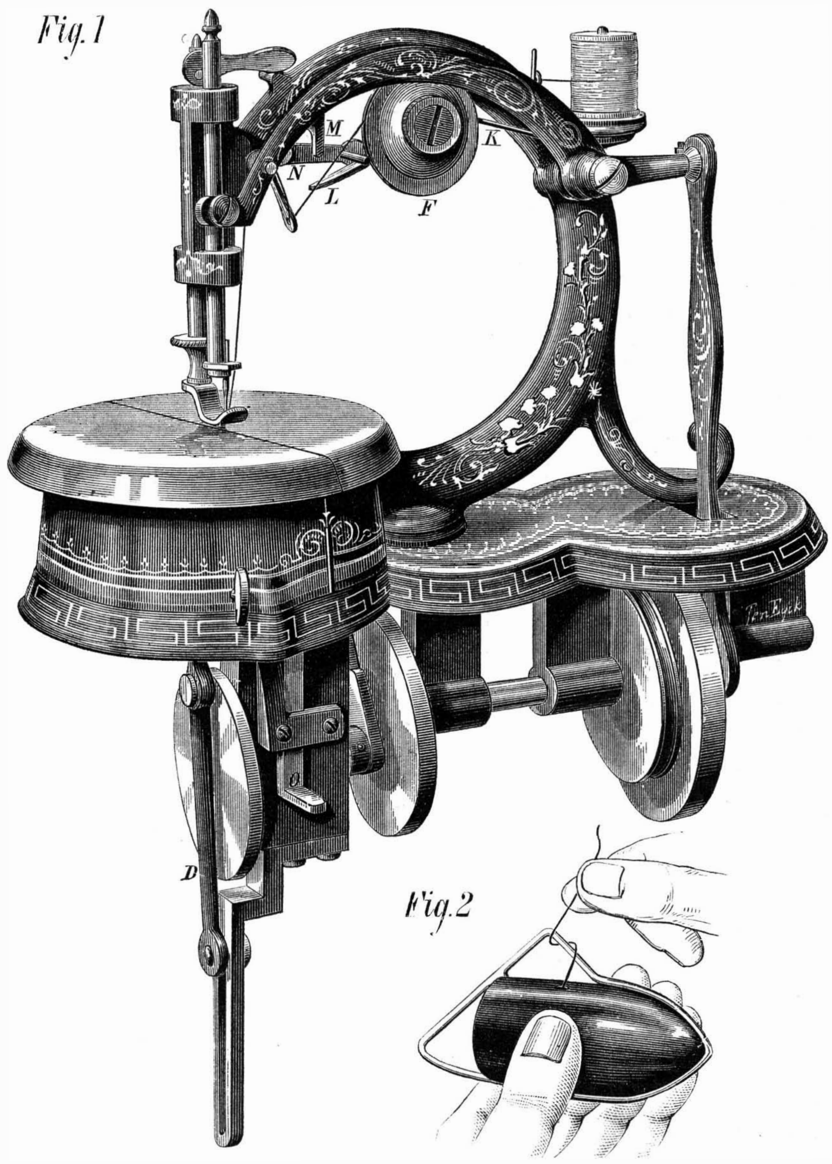
We have examined with much interest sundry novel improvements, which have recently been added to the sewing machine the distinctive title of which forms the above caption. These improvements are claimed by the inventor, in connection with the other advantages already possessed, to impart capabilities to the implement of considerable value in their variety and utility, and at the same time to insure for it that popular appreciation which is always accorded to simplicity of parts and facility of operation. We took occasion, some years ago, to describe in detail this machine as then constructed; and as certain important portions are unaltered, a repetition of the description is deemed unnecessary. For the proper comprehension of the improvements, however, the principal features may be briefly considered as we progress.

The machine is one in which two threads are used to form principally a lock stitch. This is effected wholly without shuttle mechanism; and the thread, in lieu of being wound upon bobbins, is used directly from the ordinary spools. One spool is located above, as shown in Fig. 1, the other is somewhat curiously placed directly below, the needle, and is previously inclosed in a hard rubber case, shown in Fig. 2, which is exactly the shape of a conical rifle shot. The end of the thread is carried through an opening in this case, and is then wound once or twice about the wire guard. The case is then inserted between two curved metal pieces, A, Fig. 3, and is retained in place by the pivoted stop, B. The end of the thread is carried back between the parts of the case holder and there left. It requires no further care, for the turn or two made around the wire guard of the case gives it the requisite tension. The general construction of the parts last described is new, and is an improvement on that of the similar portions in the older machine.

As regards the manner of forming the stitch, instead of the usual shuttle mechanism there is a rotating hook, represented at C, Fig. 3. Its shank is shown at D, Fig. 1. It is pivoted to a disk which imparts to it its rotary throw. The upper thread, after being carried through the fabric by the needle, is retracted so as to produce a slack loop. Into this the advancing hook catches, pulling it (the loop of course opening out) over the point and the smooth surface of the spool case, until it finally slips off said surface and likewise off the hook. The loop then lies loosely on top of the spool case and incloses the lower thread. The hook, continuing its rotation, takes a second loop from the needle, and carries it along as it did the first. As it opens out the second loop, it pulls taut the slack of the first one, and thus the stitch is completed. The capabilities of the machine in this respect, however, are not



confined to the lock stitch alone, although that form, owing to its strength and security, is usually the most popular. A very neat embroidering stitch with two threads can be produced, or the lower spool may be abolished altogether and the instrument transformed into a single thread chain stitch machine, and this without any adjustment whatever beyond pushing in the little catch, shown at E in Fig. 3. It will easily be understood that, without the lower thread to lock the stitch, the rotating hook would keep on making loop after loop of the upper thread, which would slip off over the spool case and never be caught. Now, with the catch, E, pushed in (the lower thread still absent), the loop catches at once on that obstacle, giving the needle time to come down and pass through loop No. 1, and for the hook to engage loop No. 2, so that the second loop is pulled through the first one and so on, forming the chain. With the lower thread in action, precisely the same operation continues, only the lower thread becomes caught over a portion of the chain made by the upper thread, and literally forms a spiral about it, so that on one side of the cloth is a row of simple, straight stitches, and on the other a chain stitch and a spiral thread mingled, the latter not passing through the fabric



DU LANEY'S "LITTLE MONITOR" SEWING MACHINE.

The most ingenious portion of the machine, and at the same time the newest, is the device for giving tension to the upper thread, and this is entirely different from any other piece of mechanism, devoted to like purpose, which has come under our notice. Its disposition and its construction will be seen in Figs. 1, 4, and 5. It consists of a metal disk, F, having a sharply grooved periphery, G, and secured by a screw to a lug on the stationary arm of the machine, as represented in section, Fig. 5. This screw serves as an axis, about which the disk revolves. The screw head is countersunk, and beneath it are several flexible washers. The threaded portion enters the lug, as stated, and therefore it is obvious that, by turning said screw inward, the disk may be crowded against the lug, and its rotation, through the friction engendered, rendered less free. This, however, is adjusted by the manufacturers, and the limit of the inward motion of the screw is defined by the small set screw, H, Fig. 5, inserted in the lug from the opposite side.

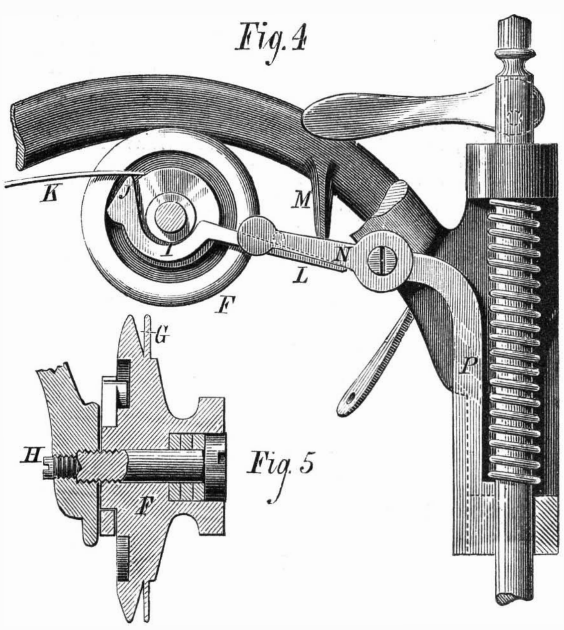
The principle on which the attachment is constructed is that (the thread from the spool being wound once around it), when every stitch begins, it shall turn so as to release exactly enough thread to make that stitch. This is carried out as follows: In a channel in the disk, and between it and the lug, is placed a clutch, I, Fig 4, which embraces the axial screw and has a wedge-shaped extremity, J, which bears against the inner periphery of said channel, being thus held by the spring, K. The other end, L, is elongated and is so placed as to be struck and carried down by the projection, M, on the moving arm of the machine. The consequence is that, at each descent of the needle, the arm, L, being forced down, its opposite end, J, is wedged against the disk, and turns the same forward a distance proportionate to the travel of the arm, L. It is obvious that, by governing this travel, we govern likewise the rotation of the disk, and hence the amount of thread unwound in the direction of the needle. This is easily done by the simple pivoted bar, N, which has an arm at right angles at its extremity, as shown in Fig. 1, which extends directly over the clutch arm, L. By raising or lowering said extremity of N, the clutch arm is pushed more or less down, and consequently the projection, M, strikes it earlier or later, and accordingly pushes it a greater or less distance.

The tension regulator must, of course, be used in connection with the stitch governing devices. To alter the length of the stitches, it is simply necessary to raise the catch, O, Fig. 1, which governs a stop limiting the motion of the feed bar, which is actuated by eccentric devices on the rear of the disk on the left. When a short stitch is used, the tension regulator is set to allow but little thread to escape from the tension disk, and *vice versâ*.

In Fig. 4 it will be seen that the bar, P, to which the bar, N, is pivoted, is curved and extends downward, terminating just below the coiled presser spring. This is a very neat device for yielding, automatically, the extra thread required in sewing thick cloth. In that case, the upward motion of the feed teeth acts on the fabric and lifts both it and the foot; as the latter rises, the bar, P, ascends with it, and consequently the bar, N, also lifts, and is followed by the clutch arm. The ensuing descent of the last causes, as before explained, a partial revolution of the tension disk, and thus a small amount of thread is given off, in addition to that caused to unwind through the movement of the main arm. This arrangement is sufficient to give the extra thread without requiring any adjustment of the tension or change of stitch, and of course adapts itself to varying thicknesses.

Lack of space compels us to summarize briefly the other advantages. These are: An ingenious arrangement whereby the chafing of the thread against the needle is prevented; ball and socket joints which render the pitman and treadle adjustable; a self-setting needle which cannot be inserted wrongly; and the noiseless operation of the mechanism.

We are informed that the demand for the machine is now very large, and has made it necessary for the manufacturers considerably to increase their facilities for construction. This has been done in the purchase of the Union Iron Works, at Rhinebeck, N. Y., with all the machinery therein, so that at the present time 300 machines can be made weekly. A large machine for manufacturing uses, on the same principle as the one that we have described, is now being manufactured. The various devices have been



patented in this country and abroad by Mr. G. L. Du Laney. For further information address the manufacturers, Messrs. G. L. Du Laney & Co., 744 Broadway, New York city.

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Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, New York	264	Horse power, etc., in storms	263
Acetic acid, determining	264	Horses, clipping	258
Aluminum, coating with (2)	266	Hose carriage*	262
Amazon stone	264	Hydrogen, lifting power of (20)	266
Answers to correspondents	267	Induction coil (9)	266
Asbestos, the industrial uses of*	258	Ink, sympathetic (34)	267
Asparagus, culture of	262	Ironclad fleet, the British	263
Battery carbons, renewing (49)	267	Lenses, mounting (51)	267
Battery details (6)	266	Lightning and flag poles (1)	266
Battery for decomposing water (15)	266	Lightning rods	259
Battery for magnetic engine (10)	266	Magnets for engines (18)	266
Battery, sesquioxide of iron (5)	266	Magnet, the axis of a (42)	267
Boilers, small (54)	267	Milk and the lactometer	264
Boilers, steam domes on	263	Oil, coal, odors of	264
Boilers, various forms of (40)	267	Paris green dangers (28)	267
Bone black, estimating value of	260	Patent office appropriation, the	256
Business and personal	267	Patents, American and foreign	264
Capsuling medicaments*	259	Patents, official list of	267
Cement for sponge and metal (19)	266	Phosphorus lamp (26)	266
Cement to harden quickly (59)	267	Planets, the years of the	260
Centennial, free passes at the	257	Poisonous dyes (22)	266
Centennial, horticulture at the*	264	Porous cups for batteries (13)	266
Centennial, Rodman gun at the	257	Postal stamps, Newfoundland	264
Cisterns, concave floors to (32)	267	Potassa industry, the	260
Coffee, sham	263	Power for circular saws (31)	267
Copper solutions (56)	267	Practical mechanism—No. 1	261
Cube in a ball, the largest (58)	267	Printing in gold, etc., (55)	267
Cutting metals with iron disks (41)	267	Propellers, blades of (52)	267
Dental engine, electro-magnetic*	259	Road rollers, etc	257
Dyeing wood (23)	266	Ropes, tension of driving (53)	267
Eggshells, utilizing (21)	266	Sewing machine, improved*	255
Electric clock (16)	266	Silvering glass, process of	262
Electric lamp lighting (48)	267	Spectroscope, practical uses of*	257
Electric light (7)	266	Speed of machinery, etc. (39)	267
Electric resistance (17)	266	Spring motors (45)	267
Electric shocks (11)	266	Steel for magnets (50)	267
Electric shocks from coils (14)	266	Telegraph, domestic (8)	266
Enameling machine, cloth*	259	Telegraph lines, street (4)	266
Engine, speeding an (43)	267	Timber, cutting (35)	267
Exhaust pipes, vacuum in (47)	267	Trademarks, ancient	263
Filters, river side (36)	267	Waste water (37)	267
Fire fiend, checking the	261	Water, method of obtaining	262
Fire fish, the red*	263	Waterproof boot grease (24)	266
Galvanized iron (25)	266	Water tanks, iron (33)	267
Gas machines (29)	267	Wire, straightening (57)	267
Glass, use of by the Chinese	263	Woman's work for science, a	256
Gold mining in the Black Hills	262	Wood, preserving*	259
Grain cleaner, improved*	262	Wrinkles and Recipes	263
Gurnard, the filamentous*	263		

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 17.

For the Week ending April 22, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876, with 8 engravings.—The Australian Geological Exhibit, 1 figure.—Arrival of Foreign Exhibits, 1 engraving.—The Spanish Building, 1 engraving.—The Ohio Building, 1 engraving.—The Michigan Building, 1 engraving.—Exhibition Notes.—The English Buildings.—The Centennial Opening.—Australian Copper Mining Machinery, 3 figures.

II.—MECHANICS AND ENGINEERING. With 10 figures.—Cornish Pumping Engine, Hull, with two pages of engravings.—Clothing for Boilers.—Smoldering Fires in Mines.—Flexure of Beams.

III. TECHNOLOGY. With 10 figures.—Mordants —Preparation of Photo Paper.—Purple Tint for Linen.—Watering Silk.—Removing Varnish from Negatives.—Oils in Lubricating Machines.—Manufacture of Alum.—Manufacture of Blotting Paper.—Black Ink.—Manufacture of Sulphuric Acid, 3 engravings.—Petroleum Trade of the United States.—Remarkable Photographs, the Largest in the World.—Photo-Portrait and Frame at Once.—Vegetable Silks.—How to Cast Medals, Vases, and other Ornamental Objects, 6 figures.—How to Make Easily Fusible Alloys.—Turf Flower Pots and Vases, 4 figures.

IV. ELECTRICITY, LIGHT, ETC. With 6 figures.—The Gramme Magneto-Electric Machine, 2 engravings, showing Construction.—The Earth's Magnetism —Mechanical Action of Radiation, by PROFESSOR L. C. COOLEY.—New Ebullioscope, 4 figures.—Increasing the Induction Spark.

V. CHEMISTRY, METALLURGY, ETC.—Manganese in Cast Iron.—Titanium.—Recent Metallurgical Processes.—Coal Dust and Explosive Fire Damp.—Iodine and Bromine in Fresh Water Plants.—Aniline Black.—Spectroscopic Method for Gases.—Spectrum of Nitrogen.—Transformation of Cane Sugar.—Chemical Changes by Light.—Action of Ammonia upon Rosaline.

VI. NATURAL HISTORY, ETC.—Geyser in New Zealand.—The Sub-Wealden Exploration.—Pigmy Graveyard.—Anthracite Coal from Spring Water.—Light and Lunacy.—Discoveries in Egypt.—Limits of Perception in Regard to Musical Tones.—The Mamertine Prison, Rome.—South Park, Colorado.

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THE reader's attention is called to the advertisement of Mr. Fredolin Smith's patent bent wagon hound, on the back page of this paper. This is claimed to be a useful and excellent invention, calculated to be of much economical value to carriage and wagon builders. It relates to a construction of hounds whereby they may be better and stronger when bent than before, and whereby they may be formed without spoiling so many in bending as is unavoidable when they are bent in the ordinary manner. J. H. Cole, of Tiffin, Ohio, is the sole agent of this patent.

A WOMAN'S WORK FOR SCIENCE.

"Great men and great causes have always some helper of whom the outside world knows but little. Sometimes these helpers have been men, sometimes they have been women, who have given themselves to help and to strengthen those called upon to be leaders and workers, inspiring them with courage, keeping faith in their own idea alive, in days of darkness 'when all the world seems adverse to desert.' Of this noble company," says her biographer, in a volume of recently published memoirs, "Caroline Lucretia Herschel was one:" and the record of a life which lacked but two years of a century in length offers a bright example of what a woman's work may be, when an intense personal sympathy and affection enlists her powers. It was to the advantage of Science that those powers were directed to its furtherance: for had Sir William Herschel, unstrengthened in his purpose by her, remained the humble music teacher, he would have passed to posterity as the composer of a few mediocre symphonies, and not as the discoverer of Uranus; she herself, at the close of a vocalist's career, would have sunk into oblivion, and Sir John Herschel, the son of the one and nephew of the other, doubtless would have followed his father's lowly path. It is only necessary to remember the inestimable value of the labors of these three persons in the cause of the grandest of the natural sciences, to realize how great would have been the loss to mankind had the three lives passed away unmarked and unknown.

The life of Miss Herschel was for nearly half a century so closely linked with that of her brother that, in reading her own story of her discoveries, it is difficult to believe that she speaks of her own original labor, so modestly and withal so persistently does she hold herself forward as "merely the tool" which Sir William shaped to his own use "for minding the heavens." It was in 1772, at the age of 22 years, that she left Hanover, her native country, and joined her brother in England, where she found him a hardworking teacher of music, with but a few hours at his disposal to devote to the study of astronomy, a work in which his whole soul was fast becoming absorbed. Insufficient mechanical means aroused his inventive genius, and he had begun to contrive a telescope of eighteen or twenty feet in length. "I was much hindered in my musical practice," says Miss Herschel, "by my help being continually wanted, and I had to amuse myself with making the pasteboard for the glasses which were to arrive." This "pasteboard" was the first crude model of the great instruments subsequently made by her brother, whose then early attempts soon led him to seek larger mirrors, though none were to be had. By good fortune, he obtained the tools of a Quaker resident at Bath, who had made efforts in a similar direction, and forthwith, "to my sorrow," says the sister, dropping the astronomer for the housekeeper, "I saw almost every room turned into a workshop."

In those days the grinding of specula was done by hand, there being no accurate machinery for the purpose. The tool on which they were shaped having been turned to the required form and covered with emery and water, they were ground on it to the necessary figure and afterwards polished with putty or oxide of tin. To grind even a six inch speculum was no small labor; and some idea of the work that William Herschel undertook may be gleaned from the fact that once, in order to finish a seven foot mirror, he would not remove his hand from it for sixteen hours together, while Caroline says, "by way of keeping him alive, I was constantly obliged to feed him by putting the victuals in bits in his mouth."

At this time the name of William Herschel was fast becoming famous, mainly through his repute as the inventor of instruments of unheard-of power. Now (1781) came the discovery of Uranus, and a few months later the election of the discoverer into the Royal Society. King George III, whose army in America just then was meeting reverses, commanded the presence of the astronomer at court, and solaced his royal disappointment over the probable loss of his colonies by frequently gazing at the new planet, which had been christened Georgium Sidus, after him. Herschel, however, did not fancy following the king about with telescopes; "company is not always pleasing," he naively writes, "and I would much rather be polishing a speculum": but despite this distaste, he chose to be Astronomer Royal at $1,000 a year, rather than go back to music teaching for a livelihood. "Never bought monarch honor so cheap," caustically said Sir William Watson, when the meager stipend was granted.

"I found," says Miss Herschel, "that I was to be trained for an assistant astronomer, and by way of encouragement a telescope adapted for sweeping was given me. I was to sweep for comets, and to write down and describe all remarkable appearances I saw." Her brother, near her, meanwhile devoted himself to his magnificent observations on the new planet, the nebulæ, and the double stars; and to Caroline's labors with her instrument, which consisted mainly in searching for nebulæ to be marked in her catalogue, were added the duties of assisting him "either to run to the clocks, to write down a memorandum, to fetch and carry instruments, or measure the ground with poles, etc.": certainly enough tasks without the further implication of the *et cetera*. Often she remained patiently beside Sir William, jotting down his rough notes, when the weather was so cold that the ink froze in the bottle; and then before dawn she would take the manuscript to her cottage, and by morning have ready a fair copy of the night's work. Occasionally her brother did not need her services; and at such times she prosecuted the observations that resulted in the discovery of the comets of 1786, of 1788, of 1791, of 1793, and of 1795 (the last now known as Encke's) and rediscovered three previously found comets. In 1783-4-5, she produced a new catalogue of a thousand stars; in the five years following she added a thousand more stars to the list; and she discovered the places of five hundred others between 1788 and 1802. Meanwhile she studied mathematics, her brother aiding her only by asking difficult questions at the breakfast table, the answers to which she carefully preserved. She was thus enabled to help him in his numerical calculations, while she unceasingly ministered to his wants during the construction of the famous 40 foot telescope. She tells us in her letters some pleasant anecdotes of that great instrument: how when it was completed a large company, headed by Sir William, entered its huge tube and sang "God save the King." Later King George himself walked through it, followed by the Archbishop of Canterbury. The prelate was portly, and the road was not an easy one for him, so the king graciously extended his hand to assist him, saying "Come, my lord bishop, I will show you the way to heaven."

In 1822, Sir William Herschel died, and the faithful sister returned to Hanover, almost brokenhearted with grief. She did not, however, relinquish her beloved labors, but at the age of over seventy years began the laborious reduction of the places of 2,500 nebulæ, presenting in one view the results of all Sir William's observations of those bodies up to the year 1800. It was an instance of touching fidelity, this labor in her old age, for the dead brother for whom she had so earnestly worked during his life. The task was completed in 1828, and won for her wide renown. The twenty years yet remaining to her were passed in Hanover, where from her quiet seclusion she watched the growing fame of her illustrious nephew, aiding him by her mature advice, and welcoming, with an enthusiasm equal to his own, the results of his great efforts. In January, 1848, that long and useful life peacefully and tranquilly closed.

THE PATENT OFFICE APPROPRIATION.

No better evidence of the progress of invention is needed than the fact that the receipts of the Patent Office for the month of March were the largest ever known. They exceeded eighty thousand dollars, which is in excess of the same month of last year by ten thousand dollars; and Congress will act very unwisely if it reduces the appropriation for this department. Such a step would necessarily decrease its working force, which is now hardly sufficient to permit prompt action and careful research on the part of the examining officers. The salaries of the examiners are at present so small that it is impossible to retain for a great length of time those best qualified for the work; and the prosperity of the Patent Office department and the interests of inventors depend largely upon the efficiency of the Commissioner and the examiners, the latter of whom decide upon the patentability of all inventions submitted to the Office.

Commissioner Duell has proved himself one of the best executive officers that has presided over the Patent Office since Judge Mason was Commissioner; and the liberal construction of the laws, inaugurated by the last named gentleman, allowing inventors to receive patents for improvements without regard to the degree of invention, is the wise policy of the present Commissioner. This liberal interpretation meets the approbation of inventors, and at the same time largely increases the revenue of the department.

Since the above was in type a correspondent of one of our daily papers—the *Graphic*—writes from Washington that, "since it has become generally known that our reform House of Representatives has proposed cutting down the appropriation for the support of the Patent Office, every mail has brought to Commissioner Duell letters, from inventors, manufacturers, and business men in all parts of the country, protesting against such retrenchment. It should be constantly remembered that the overburdened taxpayer, about whose sad condition such jeremiads have been chanted in Congress and on the stump, does not pay anything to support the Patent Office. That institution is self-supporting, and, as I showed in a former letter, has over $750,000 to its credit in the Treasury. It is carrying retrenchment a little too far to deny the inventors of the country speedy and intelligent action at the hands of the government while taking their money for it. In some of the communications sent to the Patent Office, the writers say that, if Congress cuts down the salaries in the way proposed by Randall's committee they will favor the starting of a subscription to pay the examiners proper salaries, so that the Office may not lose their services."

The latter named proposition is, of course, not feasible, and those who have written letters offering to subscribe for such an object cannot but know that no employee of the Patent Office would be allowed to receive any contributions from inventors or others doing business with the department; but that such a thought has entered the heads of a considerable number of persons indicates the objection, felt by persons interested in the prosperity of the Patent Office, against Congress reducing its appropriation. We are not among those, however, who think that there is no room for further economy or improvement at the Patent Office. We hope that Congress will carefully look into the institution, and faithfully do whatever may be necessary to increase its usefulness and efficiency.

STREET TELEGRAPH LINES.

In this misgoverned city of New York, the constant extension of the telegraph has resulted in the lining of all our principal streets with unsightly wooden poles, and the cry is "still they come." The sidewalks are obstructed by them, while the lives and limbs of citizens are more or less endangered by the poles and wires. In winter, especially, the ice-covered wires frequently break, animals are maimed, drivers of vehicles sometimes thrown, pedestrians tripped, etc. In London the wires are, to a large extent, carried underground The portions above ground occasion more or less trouble We have before us the details of three serious accidents

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that lately took place in that city from breakage of overhead wires during a storm. In one of these cases, the driver of a cab was caught by a sagging wire and fatally injured, his head being nearly severed.

In the Court of Common Pleas, Philadelphia, Judge Thayer presiding, application was recently made to restrain the Western Union Telegraph Company from erecting telegraph poles on 10th street, on the ground that by so doing the company were obstructing a public highway. It appeared in evidence that the company was authorized by charter to place its wires either above or under ground.

It was alleged against the company that the city would be greatly disfigured by the erection of these poles, and it was argued that, in view of the public injury and inconvenience arising from the great extension of the telegraphic system, the great increase in the number of lines, and the consequent increase in the size of the poles and number of wires, telegraph companies should be compelled to lay their wires under the streets instead of over them. Judge Thayer considered that it was impossible to doubt the practicability of successfully working lines laid down in that manner, in view of the fact, which was in evidence, that for the last twenty-five years important wires have been carried underground through the city of London. The extent of the underground wires in London, according to Mr. Fleetwood, is at the present time 3,500 miles. Underground wires are also extensively used in Paris, Berlin, Dresden, and other European cities. In view of such facts, all arguments against the practicability of this method founded upon mere theories and opinions amount to nothing.

Doubtless the time is not far distant when the necessities of public convenience and the great increase of telegraph systems in this country, will, through the instrumentality of legislative enactment, compel all companies to lay their wires underground in the large and populous cities of the country.

"Upon the whole case," said the court, "we are of opinion that the defendants, the Western Union Telegraph Company, have shown no sufficient title to warrant them in erecting their poles and wires on 10th street, between Market and Walnut, and the proposed erections are contrary to law, in violation of the city ordinance, and injurious to the public." The injunction was then continued until further notice.

So much for Philadelphia. We fear it will be some time before any such wholesome lesson is taught to the street-obstructing corporations of this city. Not only are telegraph poles everywhere allowed, but the builders of iron railway bridges are to be permitted to occupy and cover our principal streets. In the name of "Rapid Transit," no less than thirty-five miles of these structures, upon which locomotives are to rattle and roar, have been sanctioned by our local commissioners, and are now in process of erection along some of our finest and busiest streets.

It would seem to be in keeping with common sense that all structures like telegraph lines or steam railways, which can be effectually operated either underground or between the blocks, should be kept out of the public streets. But the citizens of New York, instead of following the enlightened progress of other cities in such matters, are at present actually moving backward.

FREE PASSES AT THE CENTENNIAL.

The Centennial Commission appears to be somewhat perplexed over the question of distributing free passes for the the Exposition. Every politician in office, every newspaper man, in fact everybody who can conjure up even the shadow of a reason for the privilege, deems himself entitled to enter the Centennial grounds free, and the consequence is that the Commission is unable to fix any limit as to where this deadheading shall terminate. It seems to us that there is one, and but one solution, to the problem, and that is to issue no free passes at all. No respectable journal desires any such favor, and in fact the prevailing tone of all the press now-a-days is strongly averse to receiving any obligation of the kind on any account. The thousand and one reasons commonly urged for granting privileges to politicians and others should be scrupulously set aside, and in doing so the Commission will act not only for its own, but for the public's, best interests. It must be evident that, in order that the Exposition shall pay back the money invested in it, a very large daily attendance will be requisite, even at fifty cents per head admission. Every free pass given, therefore, is simply a diminution of receipts, and when the number of passes swells, as it easily may, into thousands, the loss will be one to make itself felt. This deficit will have to be made up, and there is only one source available, and that is the pockets of the general public; so that, reduced to its simplest terms, the pass system involves the payment by the people for the admission of a privileged class. Of this class the individuals are ten times better able to pay for themselves than half the masses who will flock to Philadelphia.

The only people who should have free entrance are the employees of the Commission, the exhibitors and their servants, and the judges. The only exception we would have made to the fixed tariff would be in favor of working men. When the latter come to Philadelphia, their means will be limited, and it would be a sensible act for the Commission (of course after proper proof that the applicants are *bona fide* working men) to sell them tickets at a reduced price, good for several admissions. These tickets might be made of conspicuous color and form, wholly different from any others; and each one should be distinctively numbered and provided with other checks to render it non-transferable. These might be forwarded to the principal industrial establishments in the country, to be disposed of by employers to their men, and their possession might also entitle their holder to especial privileges in the reduction of railway fares. We believe that it is to the interest of the whole country to have the Exposition made as cheap to working men as it possibly can be; and if any deficit occurs on that account, let it be charged upon the public. The public can much better afford to bear it than to pay for official courtesies which confer no benefit except upon the immediate recipients.

THE PRACTICAL USES OF THE SPECTROSCOPE.

When light, in its way from a luminous body to one's eyes, passes through more or less transparent media, it is more or less absorbed; and the spectroscope, which decomposes the light into the different kinds of colored and other rays of which it consists, is the apparatus which reveals what portion of the light is thus absorbed by the media through which it passes. This is the simple cause of the dark lines in the solar spectrum; they are generated by the atmosphere which surrounds the sun, which atmosphere absorbs certain kinds of rays and so forms the absorption bands, which we call the Frauenhofer lines, after the distinguished scientist who first observed them. Even our own atmosphere gives some such lines; they are situated between the solar absorption bands, and they have been closely investigated. They increase, both in intensity and number, as the sun approaches the horizon; while they decrease and finally almost vanish as we ascend with our spectroscope to the summits of high mountains. The absorption bands (caused by transparent or translucent, colored or colorless, solid or liquid, substances) are of much practical importance, for every substance either absorbs different parts of the light or does it in a different manner; so that the absorption lines produced form characteristic properties of many bodies, by which they may always be recognized. To make these observations, it is best to use a white light giving a continuous spectrum, such as is produced by a gas flame, a petroleum lamp, a white hot platinum wire, a hydro-oxygen lime light, or an electric light passing between carbon points. As the solar spectrum has its own absorption bands, it is not to be preferred; however, it need not be totally rejected for this purpose, as the bands are very narrow and well defined, and their positions are well known, while the absorption bands of the solid and liquid transparent substances referred to are wide or broad, with somewhat undefined edges; and therefore they are generally easily distinguished from the solar absorption lines.

The substance to be examined is simply placed before the slit of the spectroscope, and the light passed through it. If this substance is, for instance, smoked glass (that is, a piece of glass colored gray or black by exposition to a smoky flame), it will be seen that the light of the spectrum is dimmed over its whole extent, and this quite equally. The smoked glass, therefore, absorbs all kinds of rays, all colors, in the same way, and is an example of a continuous or general absorption. Quite different, however, is it when we use colored glass. A red glass, for instance, even when so intensely red as to appear almost as black as the smoked glass, will not absorb the red ray; but it will all the others. Cobalt blue glass admits the passage of the blue rays, and absorbs the green entirely, and the red only partially. Such kinds of glass, therefore, show an elective absorption, and this property of colored glass is made use of for signals on lighthouses, ships, steamers, railroads, etc., to give any desired color to a white light. If it were possible to make a colored glass which could transmit only the reddish or the bluish green rays contained in the solar protuberances, it would be possible to see, every time the sun shines, these protuberances directly, without the help of the spectroscope.

Most of the colored pigments have already been investigated with the spectroscope. It would occupy a very large space to recapitulate all the results obtained; and we will only give the general results in regard to the manner of observation and the definite laws which have been ascertained.

Melde has made experiments for determining these laws as far as possible; and he divides the variously colored substances into a number of groups, and gives a general account of the behavior of each class. To the first class belong such substances in solution, or such solid bodies, which, during a gradually increasing concentration, or a gradual increase of thickness of the transparent layers, continue the absorption from the red end of the spectrum toward the violet end; so that at last only a violet luminous band remains. This class does not contain many substances; but one of them is the ammonio-sulphate of copper.

The second class has the opposite property. The absorption progresses by increasing concentration from the violet end of the spectrum toward the red end, so that at last only a red band remains. This class contains a large number of bodies: and among them are many very intensely colored pigments, such as chromate of potassa, picric acid, iron chloride, saffron, etc, To this class belong also several translucent substances, which have in common the property that, when examined in thin layers, they admit the whole spectrum; but if increased in thickness, they absorb the light, first at the violet end of the spectrum, and continue to do so toward the red, until at last all is absorbed. One of the most common substances of this kind is water mixed with soap or with milk, so as to deprive it, more or less, of its transparency.

These two classes thus contain the substances which exhibit a one-sided absorption. A third class contains those bodies in which the absorption commences in the middle of the spectrum and extends toward both ends, and which may therefore be called two-sided absorbents. There are not many substances of this class. One of them is Prussian blue dissolved in water with help of oxalic acid. In spectrum analysis, the bodies belonging to this class may be distinguished, one from the other, by the fact that the most intense portion of the middle band appears in different parts of the spectrum.

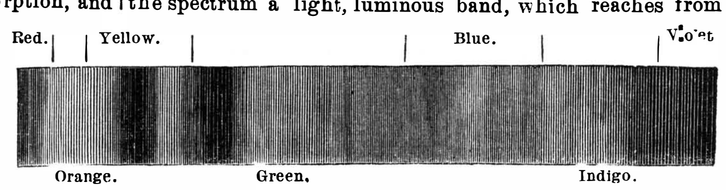
A fourth class contains substances which show luminous bands in two different places, separated by a middle dark band, with other dark bands at the extremities, which increase or diminish in width with the degree of concentration of the solution or thickness of the layer. A great many bodies belong to this class; among them are solutions of aniline blue, fuchsin, ammoniacal solutions of kino and Brazil wood, solution of salicylic acid colored with chloride of iron, etc.; and among solid bodies, cobalt blue glass. Each of these bodies is easily distinguished by the different character of the absorption, especially by the fact that the dark bands always occur at definite places in the spectrum, although the bands differ in position for each substance.

To the fifth class belong those bodies which, on increasing the dilution of the liquid, show three different luminous bands, and which, on further dilution, leave two dark absorption bands between them. This class is very numerous, and to it belong the solution of cæsium in ammonia, watery dilution of blood, and the alcoholic tinctures of alkanet root and of sandalwood; but the various positions of the two dark bands peculiar to each make it easy to distinguish one from the other.

A sixth class contains substances producing three dark absorption bands. To this belong the ammoniacal solution of alkanet root and the alcoholic solution of chlorophyll, the green coloring matter of plant leaves. This classification may be continued for substances forming merely absorption bands.

In order to make practical and useful applications of the above, Melde made experiments to find out how far the various absorption bands pertaining to different substances were subject to fixed laws, which would explain their origin. He found that, in general, the absorption bands are not independent of each other, and that the absorption, exercised by a mixture, is not simply the sum of the absorptions of the simple substance, as is the case with the spectroscopic lines of the glowing gases. He found that, in colored mixtures, first, an absorption band is often observed between the two nearest bands of the simple fluids; a simple shifting of the bands, however, never takes place. He found, further, that the temperature of the substance had in most cases no influence on the position of the bands, even if the solution were heated nearly to its boiling point. In some cases, however, the absorption proceeded from the violet to the red end of the spectrum. Finally, he found that a greater concentration of the coloring material is perfectly equivalent to a greater thickness of the layers.

Armed with this preparatory knowledge, the determination of the nature of various colored solutions, such as ascertaining the presence of blood in a copious dilution with water, became an easy matter. Stokes, Hoppe, and Valentin made many observations, which led to infallible and therefore highly valuable results. Valentin found that the thicker layers of the light or dark red blood produce in the spectrum a light, luminous band, which reaches from



THE BLOOD LINES IN THE SPECTRUM.

the red to the dark line, D, in the yellow. Very thin layers of fresh blood, or thicker layers of blood diluted with water, give two characteristic bands in the green, both between the lines D and E, at a place where no other substance, as yet experimented upon, caused them to appear. These lines can be faintly seen, even when the blood has been diluted with 7,000 times its volume of water, when it is perfectly colorless to the naked eye by transmitted light, and by reflected light shows, at most, a faint yellowish tinge. The very same apparent color, given with a few drops of any yellow solution, such as saffron, gamboge, yellow wood, aniline, etc., does not produce these lines, which are characteristic of blood exclusively, and are, therefore, called the blood bands.

Valentin's skill in this respect was severely tried by giving him for investigation twenty numbered packages, containing small amounts of dirt of different origin. He emptied each separately in water, filtered the solutions, submitted them to spectroscopic analysis, and pointed out four packages containing blood. The first contained scrapings of a block which had served in the dissecting room of a medical college, but had lain for three years unused in a corner; the next contained scrapings from a block still in use for a similar purpose; the third contained rust from an old iron hook on which meat had been suspended in a butcher's shop; and the fourth contained a piece of cloth from a coat. In every case he could recognize the two absorption lines of the blood so clearly to leave no shadow of a doubt of its presence.

IT is a curious fact that England, so interwoven with a network of railways, should supply an American exhibition with road locomotives and road rollers, the United States having at least 20 miles of road to one in England.

THE 51-tun Rodman gun has arrived at the Centennial

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THE INDUSTRIAL USES OF ASBESTOS.

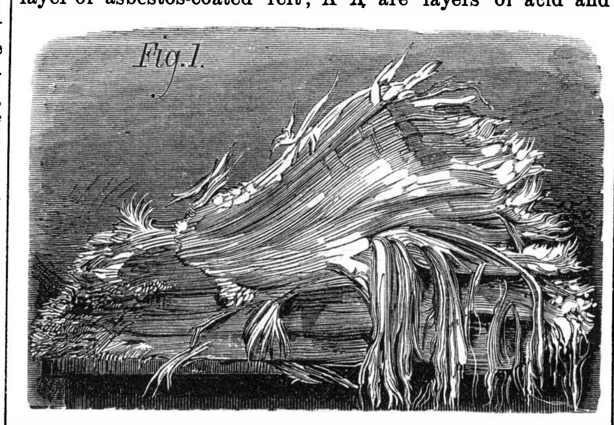
Asbestos is a mineral fiber, composed of silicate of magnesia, silicate of lime and protoxide of iron, and manganese. Mineralogically the name is given to the fibrous varieties of tremolite, actinolite, and other varieties of hornblende, excepting such as contain alumina, and also to the corresponding mineral pyroxene. It exists in vast quantities in the United States, in various parts of Great Britain, Hungary, Italy, Corsica, and the Tyrol. To various kinds of asbestos have been applied the names "mountain leather," "mountain cork," "amianthus," and "chrysotile;" and certain other minerals having characteristics resembling those of asbestos are described as asbestoid, asbestiform, and as lamellar-fibrous. Without entering into any description of these species (for we have to deal only with asbestos proper, in considering its industrial applications), we may at once note the chief characteristics upon which the value of the mineral depends. And these are, first, its indestructibility by fire and its insolubility (except for a few varieties) in acids; secondly, its peculiar fibrous quality.

The material is obtained from the mines in forms ranging from bundles of soft silky fibers to hard blocks. The blocks may be broken up and separated into fibers, which, like those naturally obtained in that state, are extremely flexible, admit of great extension in the direction of their length without cracking, are greasy to the touch, and very strong. The fiber obtained in New York and Vermont varies in length from two to forty inches, and resembles unbleached flax when found near the surface; but when taken at a greater depth, it is pure white. Upon the length, flexibility, and strength of the fiber, the value of the asbestos depends. The engraving, Fig. 1, is drawn from an exceptionally fine piece, and exhibits the fibrous structure very perfectly. The fragment is 43½ inches long, 7½ inches thick, and 21 inches wide, and weighs 114 lbs.

It is a curious circumstance that, although the valuable qualities of asbestos have been known since time immemorial, it is only during very recent years that the mineral has been extensively used. Its employment among the ancients was confined to the manufacture of an incombustible cloth in which the bodies of the dead were cremated, and of napkins which were cleansed by throwing them in the fire. We find record of its employment as lampwick and for fireproof gloves and clothes for metal workers and firemen. Not very long ago, we learnt of its entering into a peculiar quality of wall paper made in Rome, Italy. With these few exceptions—and in no case has any of them risen to the level of even a minor industry—asbestos has occupied the position of a mineralogical curiosity, a product reasonably certain some day to find its place in human economy, but nevertheless one which inventors seemed systematically to overlook.

It is to Mr. H. W. Johns, of New York city, that the credit of first using asbestos for industrial purposes on a large scale is due. Some years ago, that gentleman invented a cement in which one of the ingredients was asbestos. Asbestos, however, despite its abundance, was then exceedingly difficult to obtain. It could be purchased only in small quantity at a high price, and certainly offered no very promising prospects of an adequate supply, should a large demand for the cement be realized. Nothing daunted by this scarcity, the inventor advertised his cement widely, through the SCIENTIFIC AMERICAN and other journals; and the result of his advertisements (as with considerable shrewdness he had anticipated) was not merely an augmented sale of his invention but an avalanche of letters from all quarters of the globe, in which the writers mentioned deposits of asbestos in their vicinity, and offered supplies. Thus, ere very long, Mr. Johns became possessed of abundant facilities for obtaining any quantity of the mineral, and was free to proceed with the experimenting which led to the other and more important utilizations which we are about to describe.

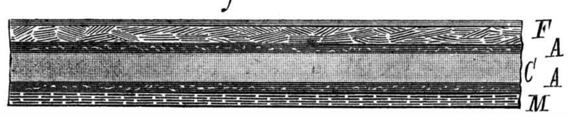
In a little volume which has been compiled from Patent Office records, we find over three hundred patents for roofing compositions, and probably this number is much below the total of this class of inventions. In all these compounds, there is a general sameness, due perhaps to the presence of gas tar and various conglomerations of gravel, resin, paper, felt, cement, and chemicals in the large majority. From all these, the asbestos roofing differs: not merely through its containing asbestos, but through its composition independent of that material. From Fig. 2, which is a section of the asbestos roofing, its construction will be understood. F is a layer of asbestos-coated felt; A A are layers of acid and



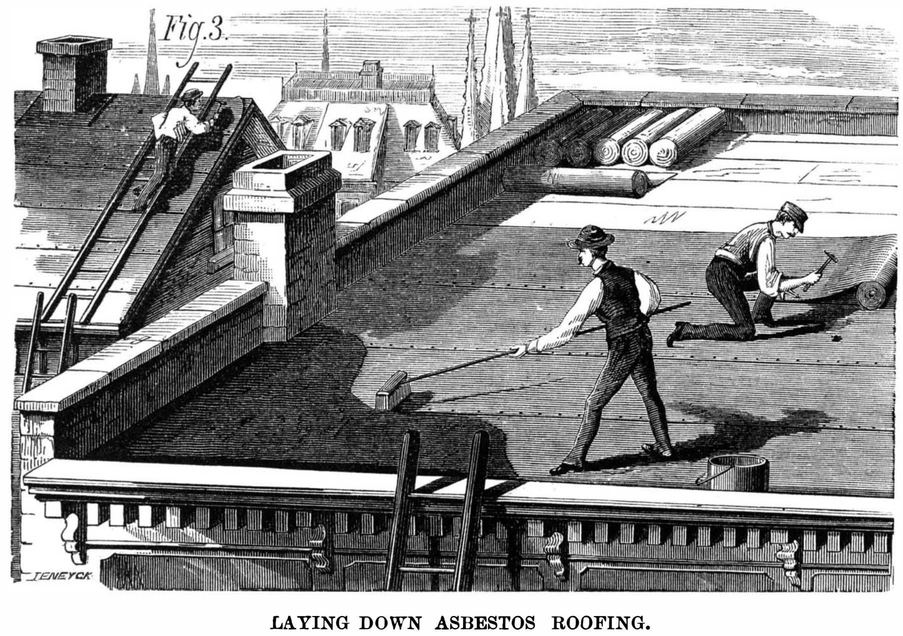
A FINE PIECE OF ASBESTOS.

waterproof composition into which asbestos enters. C is a canvas, and M a manilla lining. These materials are compressed to a sheet resembling leather, about one tenth inch in thickness, and produced in continuous rolls about 40 inches wide, each roll containing 200 square feet. The weight is 50 lbs. per 100 square feet, or about one tenth that of gravel roofing. The manner of applying the rolls to the roof is shown in Fig. 3, the operation consisting in merely tacking the fabric to the boards. This is done with equal facility on either flat or steep roofs. The last process is to go over the laid roofing with a prepared coating of suitable color. This is made of asbestos in a flocculent state, mingled with silica paint body and other ingredients. It is applied with a brush, and forms an elastic waterproof felting. For large and important city edifices, an asbestos concrete may be applied by means of a trowel and in lieu of the above coating. The advantages claimed for the roofing are that it forms a water and airtight smooth surface, which is a good non-conductor of heat, and is practically a resistant of fire: also that it is adapted to all climates, and is unexcelled in durability and cheapness by tin, slate, or shingles, of the qualities ordinarily used.

Fig. 2.

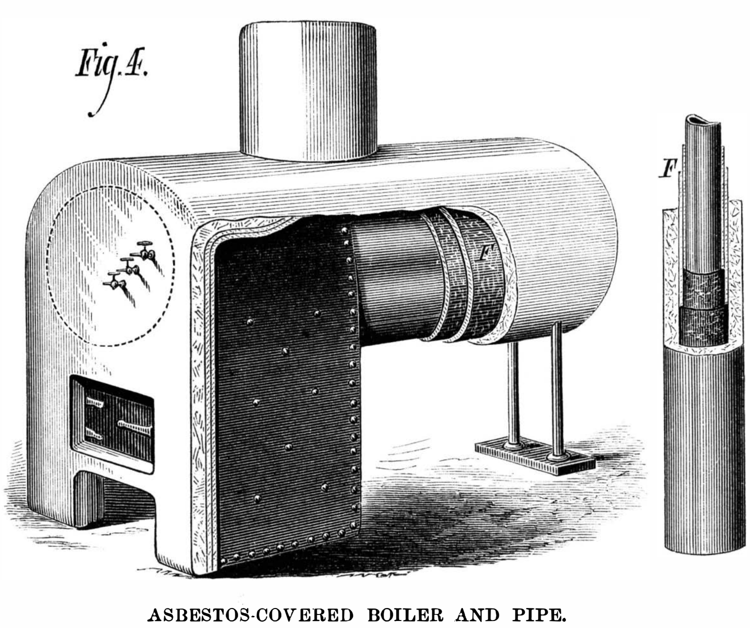


ASBESTOS ROOFING—SECTION.



LAYING DOWN ASBESTOS ROOFING.

The second application of asbestos to which attention may be directed is as a covering for steam boilers and pipes. For this purpose it is prepared in various ways. A cement felting, composed of asbestos and a cementing compound, may be used like mortar and applied directly to the pipes, forming an excellent fireproof non-conductor of heat. It is improved, however, as a covering by the addition of an asbestos lining felt, which is a strong sheathing, to one side of which is attached a layer of flocked asbestos. This is applied, say in two turns, directly around the pipe, and the cement laid on outside. Each layer of asbestos thus forms a sort of air chamber, which adds greatly to the insulating capabilities of the cover. At the same time the felt admits of the expansion of the pipe and also serves to protect hair felts, when the same are placed over it, from charring and other injurious effects of heat. An asbestos-lined hair felt is likewise manufactured, which is especially suitable for covering marine and locomotive boilers. The mode of applying the insulating material will readily be understood from Fig. 4, which shows both a boiler and a portion of a steam pipe, covered, F being the felting. We are informed that the materials are very easily and cheaply applied, that the pipes so covered are smaller and neater than is usually the case, and that there is no danger of the envelope cracking through the expansion of the pipes. These feltings were subjected to severe tests, at the New York navy yard in 1874, which they successfully withstood, showing the highest degree of efficiency as non-conductors of heat.



ASBESTOS-COVERED BOILER AND PIPE.

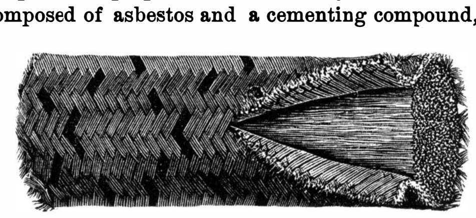


Fig. 5.—ASBESTOS PACKING.

Asbestos steam packing offers in itself utilizations as important in some respects as any other here mentioned. Ordinary packing in engines is obliged to contend with an elevated temperature, moisture, and friction, all agents tending towards its destruction. From the testimony of those who have used asbestos prepared as below described, it appears wholly indifferent at all times to temperature and moisture, while its self-lubricating qualities protect it greatly against wear due to friction. The mode in which the packing is made is shown in Fig. 5. The long flexible fibers of the asbestos are securely covered by a thin braid, forming ropes from three eighths to two inches in diameter, which are put up in coils of 50 lbs. each. It is especially suited for use in cases where the effect of high pressure steam is to be met. We are informed that it has been employed without removal on an ocean steamer which sailed over 90,000 miles, and in another case on a locomotive which ran over 50,000 miles, in both instances showing but slight effects of wear, and necessitating no stoppages.

As a paint body, some varieties of asbestos, through its capability of being reduced into almost impalpable powder, has been found excellently adapted. It is exceedingly tenacious, and so renders the pigments not liable to chalk, crack, or scale, while it possesses superior covering qualities. Less coloring matter is required in the manufacture of these paints than in any other, and they are prepared and sold by Mr. Johns ready for immediate application by the brush. The ingredients are simply the best linseed oil and colors, with the asbestos body; and the paints are not offered as strictly fireproof, although it is believed that they will resist fire after drying, much better than ordinary paint. They are made in all shades, and are especially well suited for outside work, such as railroad cars and bridges, walls, fences, etc.

Lack of space prevents our describing, in detail similar to the above, the many other productions into which asbestos enters. Of the more important of these we may mention asbestos cements (fire, acid, and water proof) for linings and fillings for iron columns, floors, and for slate and other roofs, for cementing steam and other joints, fire clay retorts, etc., A fireproof coating is also made for wooden structures and shingle roofs, and for surfaces, not exposed to the weather, which are liable to ignition. This is applied with a brush, and may be subsequently coated with asbestos paint. Asbestos board is made from pure asbestos in flexible sheets of various sizes and thicknesses, forming a valuable covering for locomotive boilers, and for flat packing, gaskets, etc., and as a protection for all surfaces exposed to fire. Asbestos paper is used for lining cloth, fire screens, etc , and for filtering acids. Asbestos thread may be woven into fabrics, and an asbestos lubricator is manufactured, designed for heavy machinery, wagon axles, etc.

All these varied applications are the result of continued experimenting and investigation on the part of the inventor, a labor which has lasted since 1867, and which is still in progress. That they are of a high degree of value and utility may perhaps best be judged by the rapid increase which has been felt in the demand for asbestos products, and by the excellent results which actual employment has demonstrated them capable of yielding. Any further information will be cheerfully given by the patentee and manufacturer, Mr. H. W. Johns, 87 Maiden lane, New York city.

CLIPPING HORSES.—M. Veterinary Surgeon Félizet recommends that, instead of clipping working horses in autumn, a good shining coat, free from skin dust, can be secured by giving the horses, from the middle of September, either alone or mixed with their evening feed of oats, one tenth of a quart of bruised hemp seed, and the same quantity of buckwheat in its natural state.

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IMPROVED LEATHER AND CLOTH ENAMELING MACHINE.

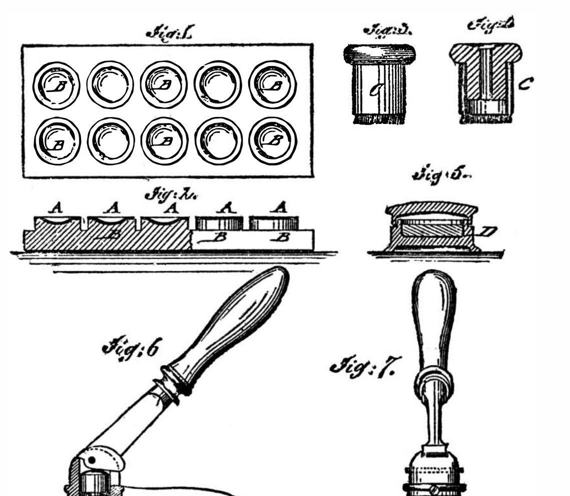
The annexed engravings represent a machine for enameling cloth and leather, which is capable of a great variety of useful applications, such as spreading waterproofing and and other compounds on textile fabrics. The inventor gives the following description of the machine, as illustrated in the engraving. Fig. 1 is a view of one side; Fig. 2 is a central vertical longitudinal section; and Fig. 6 is a top view of a portion of the machine.

The cloth or other material to be enameled or to be covered with waterproof or other substance is wound around the beam or roll, *c*, and is then made to pass, by the power communicated to the machinery, under the bar, *d*, and over the top of the bar, *d'*, the corrugated, toothed, or grooved surface of the bars, *d d' d''*, serving to smooth and evenly spread to its full width the cloth or other material, which is then fed along over the rod or bearing, *r*, and below the hopper, *k*, from which the enameling, waterproofing, or other substance or compound is deposited upon the cloth or other material, and regulated in its delivery through an opening or throat in the bottom of the hopper, *k*, by the action of the sliding gate, *h*, which is raised or lowered by the operation of the lever arm, *l*. The cloth or other material is then carried along between the smooth rollers, *t t'*, which are kept moistened by the dripping of water or other liquid contained in sponges or other suitable substance held in the trough, *v*. The cloth or other material is then brought over the cushion, H, and under the blade, F, which is raised or lowered by the action of the lever arm, E, so as to accommodate itself to the thickness of the cloth, etc., which is then fed over the upper surface of the corrugated, toothed, or grooved bar, *d''*, and thence between the cushion, H', and blade, F', and is then carried between the smooth rollers, *x x'*, whence it is delivered and placed upon drying racks. The blades, F F', serve to spread, distribute, and incorporate the enameling or other mixture evenly upon the entire surface of the cloth, etc., upon which it is firmly and evenly pressed by the action of the rollers, *t t'* and *x x'*. The bars, *d d' d''*, may, if desired, be arranged with heating chambers, and may have either the upper or under surfaces formed with corrugations, teeth, or grooves, and the cloth, etc., be made to pass over or under them, as may be required. Either one or more troughs, or one or more sets of rollers and blades, may be used. The invention may be operated by hand, steam, or any other suitable motive power.

Patented September 3, 1872, to Luther L. Allen, Hallowell, Me.

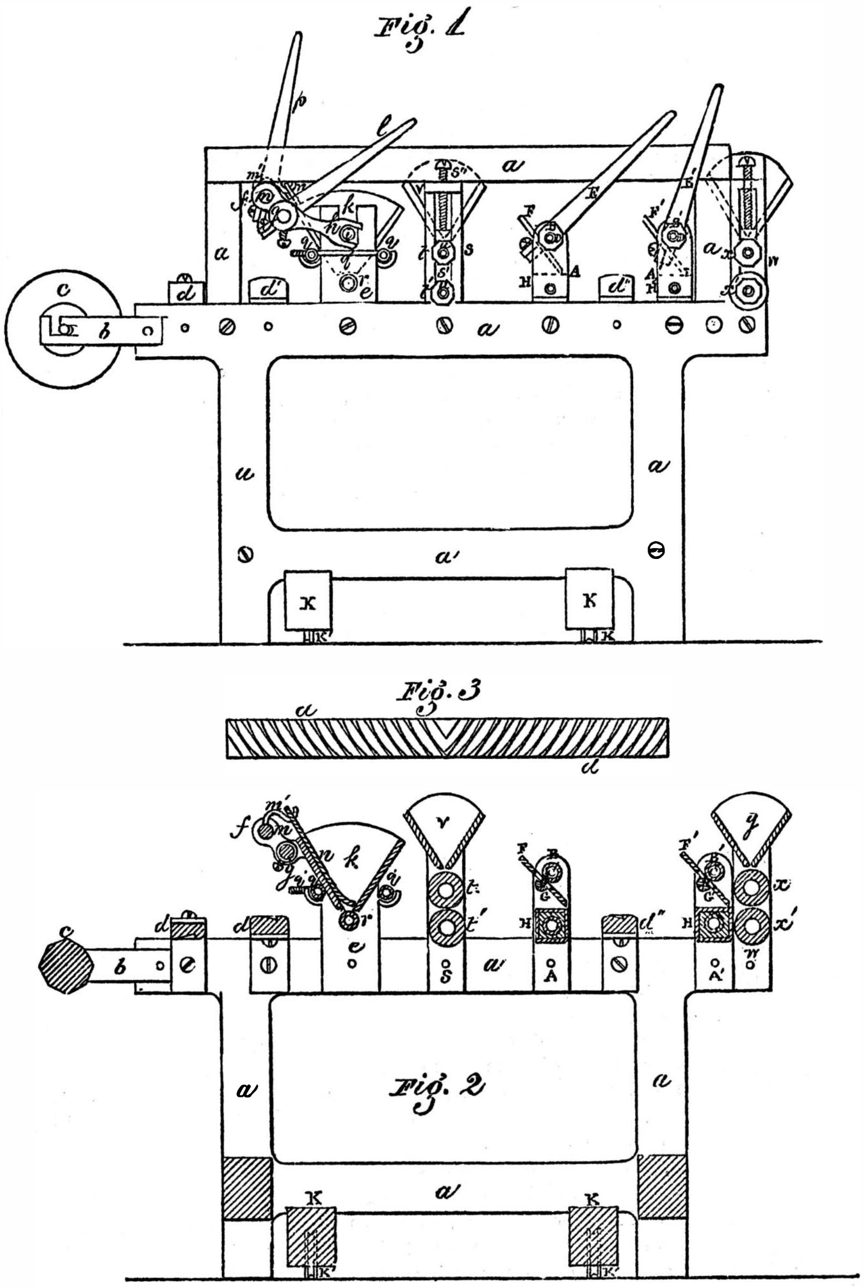
IMPROVED PROCESS OF CAPSULING MEDICAMENTS.

M. S. A. A. Limousin, of Paris, France, has patented, through the Scientific American Patent Agency (February 8, 1876), an improved mode of capsuling medicaments, by which druggists may furnish them in a neat and readily made up form to the public, to be taken in an easy and convenient manner. Disk-shaped wafers, A, of different sizes, according to the quantity to be enclosed by the same, are made with concave



central parts, which may be at the same time embossed with the name, address, etc., of the druggist, and the name and quantity of the medicament contained therein. A number of concave stamped wafers are first placed on a series of concaved disks, B, of the same size and shape, so as to fit exactly thereto, the disks forming the support for the wafers, which are then filled by a graduated measure with the exact quantity of the medicament. The outer edges of a corresponding number of wafers are then moistened by the device, C, which consists of a double metallic tube with interior filling of suitable fabric that retains and distributes the water, taking it up by dipping it in a dish, D, with spongy material saturated with water. The main object of the dish and moistener is to supply only so much of the moisture as will be sufficient to produce the adhesion of the edges of the wafers when placed one on the other. The second series of wafers, when moistened at the edges, are then placed on those supplied with the medicaments and transferred with them to the lever press, E, to be firmly closed at the edges. The press, E, has concaved metal disks, corresponding in size and shape to the wafers, so that only the edges are compressed, while the central part of the wafers is not interfered with. The jointed wafers form a lens-shaped central space in which the powders are contained and held securely enclosed by the wafers.

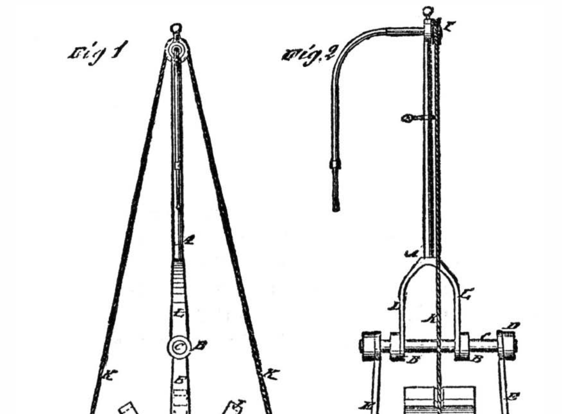
Any medicament taken in the form of a powder may be made up in this manner, and kept on hand for any length of time without deterioration.



ALLEN'S CLOTH-ENAMELING MACHINE.

IMPROVED ELECTRO-MAGNETIC DENTAL ENGINE.

Mr. Elihu Pettit, of Philadelphia, has patented a simple contrivance for coupling a magnetic engine to a dental engine, for use instead of the foot power for driving it.



The armature wheel of the magnetic engine is employed in the place of the driving wheel of the foot power for running the band, and the standard of the dental engine is mounted on the shaft of the armature for its support. Fig. 1 is a side, and Fig. 2 a front, elevation.

A is the crotched standard of the dental engine, which is cut in two just below the bearings, B, for the shaft of the driving pulley. The latter is worked by the foot treadle, and fits on a shaft, C, which is mounted in bearings, D, of standards, E, secured to the projecting ends of the armature shaft, F, with extensions, G, to the base, connecting with a spring, H. This serves to keep the standard upright, but at the same time allows it to vibrate for swinging the top forward and backward, as may sometimes be required in the manipulation of the tools. The shaft pulley, I, is thus brought directly over the armature wheel, J, so that it may serve for the band wheel, for which V notches are made in the armature for a round band, K, and flat bottomed notches for a flat band.

In making new machines for connection with a magnetic machine, the crotch, L, of the standard will be extended so as to serve for the standards, E, and fit the bearings, D, on the armature shaft, thus dispensing with the shaft, C, which is only necessary in the connection of dental engines made for foot power.

Patented through the Scientific American Patent Agency, February 22, 1876.

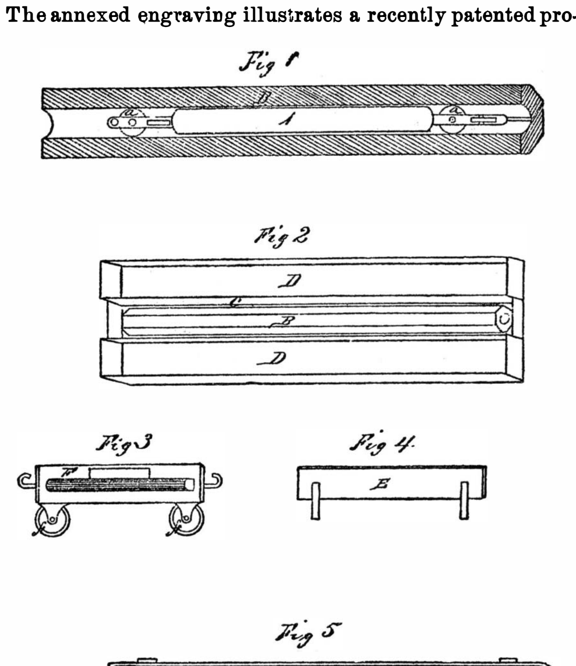
Lightning Rods.

The committee appointed by the Prefect of the Seine to superintend the construction of lightning conductors in Paris has been changed into a permanent one. A sum of $40,000 has been appropriated by the municipal council for reconstructing all the lightning conductors in Paris, or at least all those which may be found defective or inefficient. This sum is a first instalment, as the whole of the work, it is supposed, will cost $250,000, although the committee do not recommend the use of copper conductors.

Until the appointment of the committee, lightning conductors were constructed by ordinary blacksmiths, under the superintendence of architects who knew nothing of physics. A competitive adjudication took place recently, between a number of competent electricians, for the construction of all the lightning conductors on the Paris municipal monuments. The successful competitor is M. Grenet, the well known electrician. A list of instructions with seventy carefully drawn provisions has been published. The continuity must be tested yearly, and the contractor will be paid by instalments; so that his claim will be cleared up only when the efficiency of his work shall have been tested during a certain number of years. The platinum cone has been abolished and replaced by a copper cone. The quality of the iron, as well as of the copper and solder, is to be tested by chemical analysis. The insulation of rods has been abolished as being useless. The committee has diminished the diameter of protection area, which was supposed to be twice the hight, and has reduced it to 1·45. The consequence is that rods are to be multiplied.—*Nature.*

NEW PROCESS OF PRESERVING WOOD.

The annexed engraving illustrates a recently patented pro-



cess of saturating wood with any liquid which will fill the pores of the wood and solidify on cooling. The method consists of heating the wood till all moisture is evaporated and the pores opened, and then plunging the wood while hot into a suitable liquid. Fig. 1 shows a bored section of a pump log, B, cut in half longitudinally; and A is the heating apparatus, having a coal fire within it. It will be seen that the cylinder, A, is kept from immediate contact with the bore of B by the rollers, *a*, which are slightly larger than the cylinder, A. The heating cylinder can thus be

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moved along the bore of the log so as to thoroughly dry the latter in every part without charring, the heat being intensified by a draft of air passing through the cylinder longitudinally. In Fig. 2 is shown a double fire box, D D, with an internal trough, C, by which the outside of the pump log can be dried in a similar manner. In Fig. 3 is shown a manner of applying the invention to roofs of buildings, decks and sides of ships, etc., the firebox, F, being placed in a case mounted on wheels, *ff*, to be drawn from place to place. Figs. 4 and 5 show the trough, F, made of boiler iron, to contain the saturating substance, a fire being built under the trough to keep the substance liquid.

Patented August 1, 1865, reissued August 20, 1872, to George Palmer, of Littlestown, Pa.

Correspondence.

The Years of the Several Planets.

To the Editor of the Scientific American:

It is the rule, among astronomers and authors on astronomy, to call the sidereal revolution of any planet (the earth excepted) its year, and, so far as practical and instrumental astronomy is concerned, the name will pass; but where truth and proper understanding of the fact is required, it will not do. The reason is obvious. It is not true that the sidereal revolution of any planet in the solar system is the exact year of that planet, whichever one it may be. The sidereal revolution of any and of every planet is more than its year, and that inversely as the number of their respective revolutions round the sun. Thus, Mercury revolves round the sun 107,080 times during the period of precession (25,800 years), and by virtue of the gyration of his poles (which, I claim, is in the same direction as is the gyration of the earth's poles, and that the motion of the one keeps exact pace, so to speak, with the other), he finishes his year at a point, in his orbit or in the heavens, twelve seconds and one tenth of a second (12·1″) short of the point at which he finished his previous year. Venus makes 41,876 revolutions round the sun in the same space of time, and hence, by virtue of the like gyratory revolution (for planets all gyrate in the same direction, that is, retrogressively and in the same space of time), she completes her year at a point in the heavens thirty seconds and three fourths of a second (30·75″) short of the point where she finished her previous year. The earth revolves round the sun, during the same period, 25,800 times; hence she completes her year at a point 50·25″ from her sidereal place, or from the point where she completed her previous year. Mars makes 13,731 revolutions; and hence completes his year at a point 1·34″ short of where he completed his previous year. Jupiter makes 2,175 revolutions; and he of course finishes his year at a point 9′ 55·5″ short of where he completed his previous year. Saturn revolves round the sun 876 times in 25,800 years; and of course he completes his year at a point in the heavens 24′ 39″ short of the point at which he closed his previous year. Uranus moves round the sun 307 times in the above period; hence he completes his year at a point distant 1° 1′ 21·5″ from the point where he finished his previous year. And Neptune revolves round the sun about 156 times; hence he completes his year at a point 2° 18′ 28″ distant from the point in the heavens where he closed his previous year.

Claiming that, by virtue of solar retrogressive motion, the poles of every planet gyrate as do those of the earth, and that the planets complete their respective revolutions in the same time. I maintain that the year of each planet, as given above, is approximately correct.

I therefore call upon astronomers, especially those having the use of powerful telescopes, to note these facts, and watch the polar movements of the several planets. If the several planets do not gyrate as I say, and if their several poles do not complete revolutions in the time I say (25,800 years about), then my theory of solar retrogressive motion is untrue. But if they do, and I risk my honor on the assertion, then my theory is true, and the sun moves in the plane proper of the ecliptic.

Gloucester, N. J. JOHN HEPBURN.

[For the Scientific American.]

ESTIMATING THE VALUE OF BONE BLACK.

BY F. L. BARTLETT, STATE ASSAYER, PORTLAND, ME.

The direct value of bone black for refining purposes consists in the capacity of the black for absorbing lime and removing the coloring matter common to raw sugar. The value can hardly be estimated by chemical analysis, which also has the disadvantage of requiring considerable time and no little expense. My method of determining the value of bone black, although not wholly new, has the advantages of quickness and accuracy.

All raw sugars contain more or less lime and coloring matter, which must be removed by the bone black. Following out this idea, I prepare my solutions as follows: No. 1. Take best granulated sugar 195 grains; molasses (45 per cent) 3·5 cubic inches; lime 772 grains; boil all together in 1⅝ pints water for about 30 minutes, filter, and add sufficient water to make 2⅜ pints. This will be a solution of saccharate of lime containing the coloring matter from the molasses. Solution No. 2 is made by adding 0·915 cubic inch sulphuric acid to 1⅝ pints of water. This will be found to very nearly neutralize the lime solution, bulk for bulk; if it does not, water or acid must be added to No. 2 until 3·05 cubic inches of it will just neutralize 3·05 cubic inches No. 1. To use these solutions, 154 grains of the bone black to be tested is weighed out, and powdered fine enough to pass through a 60 sieve; 1·52 cubic inches of solution No. 1 is poured into an evaporating dish and the black added, well stirred, and thrown on to a filter, and washed with water to make 3·05 cubic inches of the filtrate. This is then slightly colored with a solution of litmus, and enough of the acid solution No. 1 is poured in from a burette to neutralize the lime remaining in the filtrate. The amount of the acid solution required will indicate at once what the value of the given sample is, compared with pure bone black.

I find that pure bone black treated in this way will require about 0·305 cubic inch of the acid solution to neutralize the remaining lime; while an old valueless black requires about 0·6 or 0·7 cubic inch, a fair commercial article will require from 0·4 to 0·5 cubic inch, of the acid solution. Of course the acid only indicates the declining power of the black; the color of the filtrate from the treated black will show its power for decolorizing. Good black will make a very nearly colorless filtrate when treated as above. By comparison one may soon learn to select from any number of samples the one best calculated for refining purposes. It is perhaps necessary to state that the black should always be dried before operating with this test. I usually dry at 300° Fah. My results, so far, with this process have been extremely satisfactory.

The Potassa Industry.

Not more than twenty years ago all the potassa in commerce was made from the ashes of trees and plants which contain potassium. The steppes of Casan, Bukowina, the Moravian forests, and the primeval forests of Canada were the chief sources of this compound, so indispensable in many of the arts. The costliness of the raw material, the extermination of the forests drawn upon for its production, and the remoteness of the places of production combined to make potassa an expensive article, an article which in the course of time it became necessary to be sparing of, and to avoid using as far as possible.

The time when even hard soda soap was made with potassa, and the potassa soap then decomposed with common salt, salted out, has long since passed away. In the manufacture of hard soap, the potassa was long since replaced by soda, which, since the introduction of the Leblanc process, has been getting cheaper year by year. Soda has been introduced into the glass manufacture, and is even used for washing by the housewife.

There are a few industries in which potassa, or carbonate of potassium, cannot be dispensed with. This is the case in the manufacture of lubricating soap, of prussiate of potassa, and of crystal glass. The more the forests were thinned out, the more necessary it became to seek for other sources of production; and hence in the last twenty years various new manufactories have been started, which may be classed under three heads, and, strangely enough, belong to the three different kingdoms—animal, vegetable, and mineral. The three chief sources were: 1. Beet root molasses. 2. Suint of wool. 3. Sulphate of potassium, or, in general, from the potassic *abraum* salts of the Stassfurt mines.

The manufacture of the potassa from charred beet root molasses, called in Europe savin or *Schlempekohle*, is the oldest of these three. It had its origin in the north of France, in districts where the cultivation of the beet and the manufacture of beet sugar are extraordinary developed. Robert de Massy, of Rocourt, was the first who took up this branch of industry. The method of manufacture has gradually attained great perfection, and is described in full by F. Kuhlmann in the report on the chemical portion of the London Exposition of 1862.*

Potassa from beet molasses is made, as stated, in Northern France, also in Belgium, Moravia, and the provinces of Hanover, Saxony, Pomerania, Brandenburg, and on the Rhine. The total production at present in all these countries is about 12,000 tuns of potassa of 80 to 84 per cent. It is almost exactly proportional to the development of the beet sugar industry in the separate States, and is divided about as follows: 64 per cent in Northern France, 24 per cent in Germany, 4 per cent in Belgium, and 8 per cent in Austria.

The manufacture of potassa from the suint of wool is of more recent date. Maumené and Rogelet, of Rheims, exhibited the first sample of this interesting product at the world's fair in London, 1862. Its manufacture was described by A. W. Hofmann in the reports by juries.

The manufacture of potassa from sulphate of potassium, by Leblanc's process, could attain greater development, because it was not limited for crude material. This industry is also of recent date. Kuhlmann, in his report on the London Exposition of 1862, stated that the sulphate of potassium, obtained as a by-product in refining that made from beet molasses, was partially worked over into potassa. In Germany, this branch of manufacture was introduced on a large scale, in 1861, by Vorster and Grüneberg, at Kalk, near Cologne. Here, too, it was instigated by the sulphate of potassium, obtained from beet molasses, and which contained so much of cyanogen compounds that it was scarcely saleable in market.

The discovery of the Stassfurt salt mines, of course, turned attention in that direction. The methods employed for treating Stassfurt brines have recently been given in our columns, so that we here give but a brief outline of the process employed by this firm:

1. A double sulphate of potassium and magnesium is obtained by the action of a hot solution of sulphate of magnesium, kieserite, on the chloride of potassium: $3K\,Cl + 2Mg\,SO_4 = Mg\,SO_4, K_2\,SO_4 + K\,Cl, Mg\,Cl_2$.

2. Decomposition of the first double salt by allowing its hot solution to act upon chloride of potassium, or by macerating the undissolved double salt in a cold solution of chloride of potassium: $K_2\,SO_4, Mg\,SO_4 + 3K\,Cl = 2K_2\,SO_4 + K\,Cl, Mg\,Cl_2$.

3. Decomposition of the artificial carnallite ($K\,Cl, Mg\,Cl_2$) by refining, or by maceration with cold water.

Starting with three molecules of chloride of potassium and one molecule of sulphate of magnesium, they obtain as end product one molecule sulphate of potassium, one molecule chloride of magnesium, and one molecule chloride of potassium.

The sulphate of potassium obtained in this way was very pure, and, when put through the Leblanc process, yielded a pure potassa, free from soda. In places where sulphuric acid is cheap, and there is a market for hydrochloric acid at a fair price, it is preferable to convert the chloride of potassium directly into sulphate by the use of sulphuric acid. For this latter process, the chloride of potassium from the refinery of the savin of beet molasses, containing 10 to 12 per cent of sulphate, is well adapted. The sulphate of potassium obtained from kelp in the manufacture of iodine should be mentioned among the sources of crude material for making potassa.

In converting sulphate of potassium into carbonate, the same precautions must be taken as in the manufacture of soda ash. If the charcoal used in the reduction contains much nitrogen, like the English Sunderland coal, prussiate of potassa is formed in such quantities during the fusion that, in the latter case, its manufacture pays.

On evaporating the carbonized lyes to 50° Baumé, the ferrocyanide crystallizes out along with the undecomposed sulphate, and can be separated from the latter by extracting with hot water. A second recrystallization produces a beautiful commercial product, which contains about one per cent of the potassa made. Andrae and Grüneberg, and the chemical manufactory of Pommerensdorf, make prussiate of potassa in this way as a by-product.

Potassa made from sulphate of potassium is very pure; it contains, as an average, 92 to 93 per cent of carbonate of potassium, and, as impurities, 2 to 3 per cent soda, 2 per cent chloride of potassium, and 1 to 2 per cent sulphate. It is highly prized on account of its purity, as compared with Russian potassa, which only contains 68 to 70 per cent potassa. The following table shows the analysis of the best kinds of potassa in market:

SOURCE OF THE POTASSA.	Quality.	Carbonate potassium and hydrate calculated as carbonate.	Carbonate sodium.	Sulphate potassium.	Chloride potassium.	ANALYST.
American potassa	1	104·4	1·4	4 0	2·0	F. Mayer.
" "	2	71·2	8·2	16·1	3·6	"
" pearlash	..	71·3	2·3	14·3	3·6	Payen.
Tuscany potassa	..	74·1	3·0	13·4	0·9	"
Illyrian "	..	89·3	0·0	1·2	9·5	H. Gruneberg.
Russian "	..	69·6	3·0	14·1	2 0	Payen.
Siebenburger potassa	..	81·2	6·8	6 4	0·6	H. Gruneberg.
Hungarian house ash	..	44·6	18·1	30·0	7·3	"
Gallician potassa	..	46·9	3·6	29·9	11·1	"
Refined suint ash	..	72·5	4·1	5·9	6·3	"
French beet ash	1	90·3	2·5	2·8	3·4	"
" " "	2	80·1	12·6	2·5	3·4	Denimal.
German potassa	1	92·2	2·4	1·4	2·9	} H. Gruneberg.
" "	2	84·9	8·2	2·8	3·5	}

The small quantity of phosphate of potassium in beet root potassa is included in the carbonate.

According to tolerably reliable data, there are at present 7,250,000 kilogrammes (over 7,000 tuns) potassa of high grade manufactured in Germany by the Leblanc process. There is no doubt that this potassa, together with that made from the beet, will gradually supplant the Russian potassa. In Russia, the cost of production is increasing from year to year since the emancipation of the serfs, and the production has proportionately decreased. The quantity exported in the last 10 years was 5,171,758 pouds, or 84,717,315 kilogrammes (about 84,000 tuns), decreasing from 11,010,910 kilogrammes in 1864 to 5,540,035 kilogrammes in 1873, or nearly one half.

A still greater falling off is noticed in American ash. The quantity exported from New York in 10 years was 10,981,400 kilogrammes; that of 1865 was 2,610,725 kilogrammes, against 388,050 kilogrammes in 1873. These fallings off must be met, and this is doubtless done by the manufacture of artificial potassa in Germany, France, and England.

The present state of the potassa industry is given in the following table:

	Tuns0
1. Wood ashes: Russia, Canada, United States, Hungary, Gallicia	20,000
2. Beet ashes: France, Belgium. Germany, Austria	12,000
3. Potassa from sulphate: Germany, France, England	15,000
4. Potassa from suint: France, Belgium, Germany, Austria	1,000
Total	48,000

The relation of these figures, compared with those of twenty years ago, at which time wood ashes were exclusively employed, and Russian potassa ruled the market, show that the potassa industry is at present in the midst of a complete revolution. The quantity of potassa made from wood ashes forms scarcely half of the total production; it decreases from year to year, and the time is not distant when wood ashes will have entirely disappeared from the market. The latter is first displaced by the beet root potassa, which is a constant by-product in the beet sugar manufacture, and can be put into market at a very low price, and is produced in the refining of other valuable by-products, such as chloride of potassium, carbonate of soda, etc., which fully cover the cost of manufacture. The manufacture of potassa from the sulphate has now attained a still greater importance, as the Stassfurt salt deposits promise an inexhaustible supply of potassium compounds. The center of gravity for beet root potassa lies in Northern France; that for artificial potassa from sulphate of potassium naturally lies in Germany, which has every prospect of being the chief source of chloride of potassium and the chief country in the production of potassa.—*Dr. H. Grüneberg.*

* A. W. Hofmann: Report by Juries, 1862, p. 55; Wagner's *Jahresberichte*, 1,898 p. 276.

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PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—NUMBER I.

PATTERN MAKING.

Those savans who have read our old earth's unwritten history in and from its strata tell us that, in ages far remote, men made tools and contrivances of bronze, which, being an alloy, necessitated the fusion and casting of the metal. This casting involves the use of patterns, and pattern making may therefore lay claim to the highest antiquity. But the modern idea of the division of labor has exalted it to be a distinctive art: in the last generation, for instance, a good machinist (or rather engineer or millwright, for those terms were then applied to builders of machinery) was required to be alike expert in working upon both wood and metal. He constructed his framing of wood, and made the patterns for his cast metal work; he was to-day a lathe hand, tomorrow a vise hand, and sometimes a blacksmith, and the next day a pattern maker or perhaps a wheelwright.

As, however, the present age of iron dawned, it became apparent that working in wood and in metal must be separated, not only because the handiwork could be more cheaply produced by reason of the increased skill arising from continuous practice, but also because the amount of knowledge, required to make an artisan skillful in either the manufacture of wood or of iron, was too great to be thoroughly mastered in the working lifetime of an ordinary or even an unusually expert workman. Hence modern intelligence soon discovered that better as well as cheaper work could be obtained by a practical education in one particular branch of usefulness, and hence pattern making has taken its place as a specialty. The field of usefulness of cast iron has developed to a remarkable extent during the last twenty years, and the same remark applies to cast steel during the last ten years: both of these materials are steadily encroaching upon the domain of usefulness of wrought iron, stone, and bricks and mortar. So that the field of application for pattern making is stretching outward and onward to the discomfiture of its rivals From these considerations, we may readily perceive that a real proficiency in pattern making will exercise to the utmost the skill of the workman, on account of the unceasing variety of the patterns, in form and in the purposes for which they are designed; and the advantage of a retentive memory is evident when we consider that years may elapse ere the same pattern maker may be called upon to exercise his skill upon the same or a similar piece of work. In this art, there are to be considered many details that are seldom or never shown in drawings: such, for instance, as the amount necessary to allow on the pattern for finishing certain parts of a casting, and on what part such allowance is required; and the method which has been proved by experience to be the safest and most expeditious in molding from a certain kind of pattern. But above all these considerations lies the fact that drawings merely show the shape which the finished pattern is required to have, leaving it entirely to the judgment of the pattern maker to elect in what way the various pieces of wood (of which the pattern is constructed) shall have the grain lie, and how they shall be fastened or held together. There is, it is true, an unwritten practice which has obtained universal observance in particular branches of pattern making; but in the newer fields into which the art has advanced and is advancing, this unwritten practice is merely in the process of formation, which state of things must continue so long as casting is discovered to have new arenas of application. A goodly store of well remembered experience is therefore invaluable to the pattern maker; and this being so, the quicker it is obtained the better. Hence the learner should always keep a record of the work which falls under his observation, in which record the sizes and proportions of the work, the method of putting it together, the time taken in its production, and (if possible) whether the castings were satisfactory, noting the defects in the latter, if any, together with suggestions for the remedy of those defects. A pen and ink sketch of the pattern made in the margin will add to the usefulness of the record, besides accustoming the hand to making correct sketches and elucidating the explanation. The operative's intelligence will be much exercised in the shaping and building-up of patterns, depending as this does on the strength of the material of which the casting is to be made,the strength of the pattern itself, and the desirability of its molding well. Dr. Andrews has well said (in the *English Mechanic*): "The correct forms to be given to the materials employed in the construction of tools or machinery depend entirely upon natural principles. Natural form consists in giving to each part the exact proportion that will enable it to fulfill its assigned duty with the smallest expenditure of material, and in placing each portion of the materials under the most favorable conditions of position that the circumstances will admit of. Such natural form is not only the most economical, but, strange to say, it is always correct in every respect,and is invariably beautiful and lovely in its outlines."

I may now mention the qualifications necessary to enable an artisan to become a good pattern maker: First. As the idea of the size and contour of the article or work required will be conveyed to him by drawings, it is necessary that he should be conversant with the principles of mechanical and architectural drawing; and it may be of great advantage to him, though it is not absolutely necessary, to be able to make such drawings. It is too often the case that the apprentice pattern maker gains his knowledge of drawing from the drawings from which he operates, which, being simple in the first case and becoming complicated only after the lapse of two or three years, makes the acquisition of a knowledge of drawing possible without either study or application; but the result is that, so soon as he is called upon in a new field of action, upon a description of work different from that to which he has been accustomed, he becomes timid, gets confused, finds it necessary to ask many questions upon and concerning various parts of the drawings, and then does not obtain credit for the amount of ability to which his skill in handling his tools perhaps entitles him. Furthermore, a knowledge of drawing will enable him to learn his trade in a comparatively short space of time, and give him confidence in, and a retention of, that which he has already learned. Secondly. He should be perfectly familiar with the operations of the brass and iron founder, as it is by him that patterns will be used to produce the required forms. The pattern must be so made that a mold can be made from it, and that it may be made in the most expeditious manner. The pattern maker, it must be remembered, determines how the molder is to mold the pattern, so that the latter is controlled in his operations by the former. For the benefit of those who have been unable to devote sufficient time to the work of the foundery, it will be necessary, as we proceed, to explain the operations of molding different kinds of patterns, selecting those which will best serve as a key to the whole. Thirdly. The pattern maker must be acquainted with some, at least, of the properties of the metals of which the castings from his patterns are to be made: such, for instance, as how they behave in passing from the fluid to the solid state, the strains to which a casting is subject during this transition, to what extent those strains may be modified by alterations of proportion or shape in the pattern, the shrinkage of castings, and the alteration in form which takes place in the cooling of castings of various sizes and shapes. Fourthly. He should, if possible, add to the above qualifications a general knowledge of the manner of fitting up the different kinds of work for which patterns are used.

With regard to the first requirement, it is not my purpose to enter into the subject of mechanical drawing, which will be found in a series of articles, written by Professor Mac Cord, and now being published in the SCIENTIFIC AMERICAN SUPPLEMENT. With regard to the second, I shall, as already stated, refer to it hereafter. The third I shall consider after I have treated upon timber and tools, and the fourth can only be obtained by watchfulness on the part of the student as to what is being done in the workshop in which he is engaged. This latter may seem a trivial matter; but I have on several occasions, by watching where certain castings required to be most operated upon in the machine or vise, had a pattern altered, making it apparently of an incorrect form, with the result that the time necessary to fit the work was reduced by one half. This subject, however, will be treated upon in its proper place.

Checking the Fire Fiend.

The amount of worry and anxiety, and consequent discomfort of living and the shortening of the term of life, caused by the apprehension of danger from fire, is enough to make every one search diligently for safeguards. The danger of loss of property is of course very great, and even the moderate chance of loss of life should not be disregarded.

When the communists tried to burn Paris, they failed, not because the fires were put out by engines of any kind, but because the city was so built that it would not burn. What must be the fate of an American city under similar circumstances is easily foretold. We build fire traps, and protect them by insurance. But money, though a great soother at times, can never pay us for loss of peace of mind. It cannot even pay us for the loss of those articles of daily use to which we have become attached by long associations; the many pictures and books which seem to us like old friends, and, far dearer than these, the mother's old arm chair or the dead child's playthings. We cannot reconcile ourselves to the loss of these, and we all long at times for a home in which they can be made reasonably secure to us. We do not ask for absolute safety. The world can seldom give that. We ask to have our treacherous enemy checked and retarded, to give time, at least,to get our priceless treasures beyond his reach.

Much has been said and written on fireproof construction, and most of it ends with advice to employ cumbersome and expensive work of iron, brick, and tiles. But little has been told to show how a comparatively cheap house can be built so that it will never burn quickly, and so that the chances of saving it altogether can be increased a hundredfold.

Before showing how this can be done, it may be well to transcribe, for the benefit of those whose houses are already built, a few suggestions from the London *Builder* with reference to the prevention of fires.

"Keep matches in metal boxes, and out of the reach of children; wax matches are particularly dangerous, and should be kept out of the way of rats and mice. Be careful in making fires with shavings and other light kindlings. Do not deposit ashes in a wooden vessel, and be sure that burning cinders are extinguished before they are deposited. Never put firewood upon the stove to dry, and never put ashes or a light under a staircase. Fill fluid or spirit (or kerosene) lamps only by daylight, and never near a fire or light. Do not leave a candle burning on a bureau or chest. Always be cautious about extinguishing matches or other lighters before throwing them away. Never throw a cigar stump upon the floor, or into a spit box containing sawdust or trash, without being certain that it contains no fire. After blowing out a candle, never put it away until sure that the snuff has gone entirely out. A lighted candle ought not to be stuck up against a frame wall, or placed upon any portion of the woodwork in a stable, manufactory, shop, or any other place. Never enter a barn or stable at night with an uncovered light. Never take an open light to examine a gas meter. Do not put gas or other lights near curtains. Never take a light into a closet. Do not read in bed.

"The principal register of a furnace should always be fastened open. Stove pipes should be at least four inches from woodwork, and well guarded by tin or zinc; rags ought never to be stuffed into stovepipe holes: openings into chimney flues for stove pipes which are not used ought always to be securely protected by metallic coverings. Never close up a place of business in the evening without looking well to the extinguishment of lights and the proper security of the fires. When retiring to bed at night, always see that there is no danger from your fires, and be sure that your lights are safe."

To these good rules might be added: Never keep or leave oiled rags or oiled cotton waste in any place where their burning could do any harm. They are more dangerous than gunpowder. Always have an ax, one or more buckets of water, and a small hand pump available at all times to put out a fire in its beginning. Do not allow accumulation of combustible rubbish about, especially in out of-the-way corners. These directions may prove of use to those whose houses are already built. Those who have yet to build need to be shown how to use their material properly. The great danger in our present system of construction lies in the inflammable nature of our building materials, and in the opportunity given by the arrangement of partition walls and floors, unchecked, unseen, and out of reach. It is best, if possible, to build outer walls of brick, and with judicious treatment and at moderate expense they can be made to look attractive even in the country. By making a projection or offset inside at each floor, an effectual stop can be put to any passage of fire up the inside surfaces; or if hollow or vaulted walls are used, the plaster can be put directly on the brick without using any wood. But if the outside walls are of wood, the spread of fire can be greatly checked by filling them full, between the joints and against the outside boarding, with brick and mortar or concrete, or any such incombustible material; or if that expense is too great, they may be filled at each floor, and for a short distance above. Then, by treating the partitions in the same way, there will be an unobstructed channel or flue for flame only one story high, and stopped tight at top and bottom. The wood will hold well and burn very slowly, even when only partially protected in this way. In war times, soldiers used to build chimneys with a cob house construction, of small sticks plastered inside and out with clay; and these frail structures would endure the heat of roaring wood fires, simply because the flame could not reach to envelop the wood. Protect a piece of joist on two sides with plaster, and it will be very hard to make the exposed flat surface burn long, and the charred wood soon furnishes a sort of check to further combustion. And this is the correct principle to apply to the protection of wooden houses. Cover the wood as far as possible with mortar, and stop all circulation of air. Having pugged the walls and partitions thoroughly, and treated the stairway in a similar manner by filling in between the supporting stringers or carriages with coarse mortar, we must next make the opening around each chimney tight, where it passes through the floor, by a filling-in of mortar, or by turning trimmer arches against the surrounding timbers on the four sides.

The next vulnerable point is the floor. In France, it is often the custom to cross-lathe the ceilings with lathes considerably thicker than ours, and then to put a flat surface of rough boards a short distance below the under surface of these lathes (supporting it by a staging), and to pour in from above a mixture of plaster of Paris, which hardens into a solid mass between the floor timbers and above and below the lathing. When the whole is sufficiently set, the staging is removed and the ceiling smooth finished from below. Plaster of Paris is at present too expensive here for us to follow this method in ordinary cases, but we have a very good substitute in wire lathing. This is simply what is commonly known as coarse wire netting, which is nailed to the furring strips of a ceiling, and may have coarse mortar spread upon it from above and between the floor timbers. The mortar is to be well worked up with a trowel against the sides of the sticks, and then the under side of the wire may be plastered in the ordinary manner from below. This method unfortunately costs about double what ordinary lath and plaster do, besides occupying more time in construction. Another and less expensive safeguard, which it is well to use in connection with this, or which may be made a partial substitute for it, is to cover the rough boarding of the floor with about an inch in thickness of ordinary plasterer's mortar, smoothed over, between inch square battens nailed to every other floor timber, to furnish a solid ground on which to nail the upper floors. These battens are sometimes taken out after the plaster is hard, and their places filled by fresh plaster, the whole surface covered with sheathing paper, and the upper floors nailed over this. The roofs may also be treated with a coat of plaster or cement, in which the slates should be firmly bedded while it is wet.

All these precautions against fire are also useful to make the house warmer, to deaden sound, and to help to stop leaks. And they are all in one sense economical, they may save expense in insurance. It is a good maxim in war to do what your enemy least wishes you to do. The fire fiend craves light woodwork, loosely arranged and full of draft channels. Let him find everything pugged solid with mortar. Make him dig for every inch of wood he seeks to devour; check him, hold him, worry him, cramp him in close quarters. Then with a little presence of mind, a strong arm or two, and a few homely weapons, you can drive him to a corner and finally destroy him altogether.—*J. A. F., in the Boston Journal of Chemistry.*

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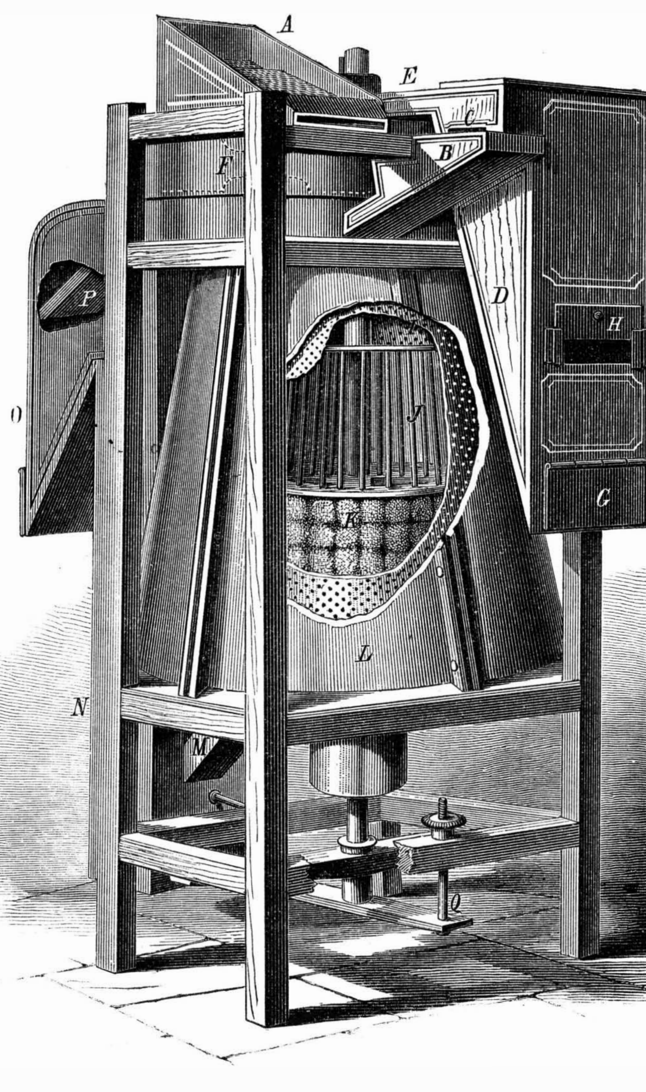
IMPROVED GRAIN CLEANER.

In the accompanying engraving is represented a new machine for removing smut and other impurities from grain. The material is subjected to an air blast while passing to the scouring device, and to another current afterward, while a third current jackets the scourer and effectually removes the dust, etc., which the rotating brushes and drum rods take from the grain. The scouring apparatus is tapered in order to render the passage and to grain slower, and so to keep it for a longer time under the cleansing process. The grain is discharged from the screen, A, into the leg or spout, C, and thence passes to the spout, B, which conducts it to the scourer. While in the upper portion of the spout, it is subjected to an upward current of air from fan, F (dotted lines) which escapes through the openings where the spout, C, discharges into B, and lifts the dust, smut, and light screenings. The dust passes through E to the fan, while the heavier screenings enter a vacuum chamber, D, and are removed through the aperture at G. At H is a valve which serves to regulate the admission of air to the chamber. The scourer has a perforated case, I, and an open upper head so that the grain can pass to the rods which form the drum, J. Below the latter is a series of revolving brushes, K. The object of tapering both brush and scourer, as shown, has already been stated. Outside of the perforated case is a close case, L, the space between the two acting as a dust space, and is traversed by air currents also generated by the fan, F. This draft removes the impurities loosened by the scourer and brushes. It enters through passages at the bottom, provided with suitable regulating devices, and escapes through openings above.

The grain then passes off through spout, M, into the suction conduit N, and finally into the stock hopper or bin, while the screenings pass up the conduit, N, into the vacuum chamber, O, and escape at a lower opening in the same. During the passage of the grain through N, it is once more subjected to a strong air blast in order to remove the heavier impurities, and the strength of the current is regulated by means of the valve, P.

The screen, A, is operated by an eccentric on the main shaft, and an adjustable yoke is provided to regulate its action. This arrangement is so contrived as to allow the shaft to be raised by the adjustable stop bearers, Q, for adjusting the brush as the latter wears away. The entire apparatus is run by a single belt, and is simply and easily adjusted.

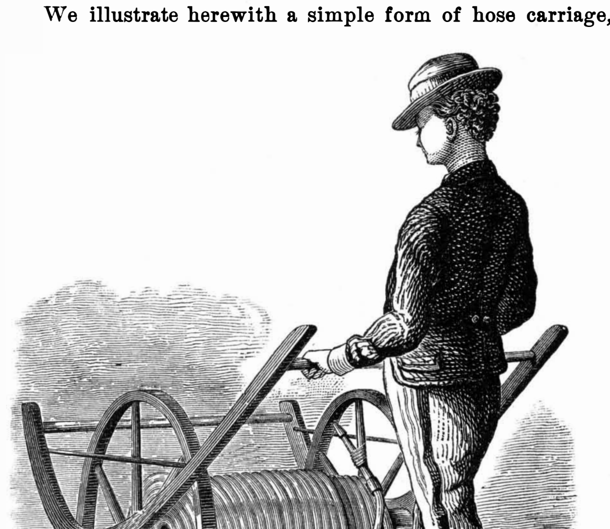
The invention combines a large number of useful improvements, and is doubtless an efficient and valuable machine. Patented February 29, 1876, through the Scientific American Patent Agency. For further particulars address the Johnson Grain Cleaner Company, Foreston, Ogle county, Ill.



JOHNSON'S GRAIN CLEANER.

MILLER'S IMPROVED HOSE CARRIAGE.

We illustrate herewith a simple form of hose carriage,



adapted to carrying hose from point to point for watering gardens, washing sidewalks or carriages, extinguishing fires, and many other purposes. The invention is so plainly shown in the engraving that little explanation is needed. It consists of a reel journaled in the curved frame, the rear bar of which serves as a handle. When disposed as represented, with a coil of 200 feet of hose, it can be moved by a child, and forms a very light, useful, and convenient carriage. On arriving at the spot where the hose is to be used, the whole apparatus is turned upside down, when the ends of the frame rest on the ground, and the wheels are lifted clear, so that their axle becomes a reel from which the hose is readily unwound. Several of our manufacturing establishments have one or two of these carriages on each floor of their buildings, ready for immediate use in case of fire. About a farm where gardens and lawns are to be watered and outbuildings protected from fire, this apparatus will be found of especial convenience.

Patented September 21, 1875. For further particulars address the manufacturer, Mr. Joseph A. Miller, Jr., Providence, R. I.

Improved Process for Silvering Glass.

Up to 1840 mirrors were silvered exclusively by means of an amalgam, a process most destructive to the workmen employed. An important step was effected by an English chemist, Drayton, who conceived the idea of coating mirrors with a thin layer of silver, obtained by reducing an ammoniacal solution of nitrate of silver by means of highly oxidisable essential oils. This process was subsequently modified by several chemists, but only became really practical when M. Petitjean substituted tartaric acid for the reducing agents formerly employed. The glass to be silvered is laid upon a horizontal cast iron table heated to 104° Fah. The surface is well cleaned, and solutions of silver and of tartaric acid, suitably diluted, are poured upon it. The liquid, in consequence of a well known effect of capillarity, does not flow over the edges, forming a layer a fraction of an inch in thickness. In twenty minutes the silver begins to be deposited on the glass, and in an hour and a quarter the process is complete. The liquid is poured off, the glass washed with distilled water, dried, and covered with a varnish to preserve the silver from friction. The advantages are evident. Mercury with its sanitary evils is suppressed; there is a gain in point of cost, as 60 to 75 grains of silver, costing about 20 cents, suffice for 10·75 square feet, which, under the old system, would require 1½ lbs. of tin and the same weight of murcury A few hours suffice to finish a glass on the new system, while the old process required twelve days as a minimum. On the other hand, the glasses thus silvered have a more yellowish tint; portions of the pellicle of silver sometimes become detached, especially if exposed to the direct action of the sun, and despite the protecting varnish the silver is sometimes blackened by sulphuretted hydrogen. M. Lenoir has happily succeeded in overcoming these defects by a process alike simple and free from objections on sanitary grounds. The glass, silvered as above, is washed, and then sprinkled with a dilute solution of the double cyanide of mercury and potassium. The silver displaces a part of the mercury and enters into solution, while the rest of the silver forms an amalgam whiter and much more adhesive to glass than pure silver. The transformation is instantaneous. The amount of mercury fixed does not exceed 5 to 6 per cent. The glass thus prepared is free from the yellowish tint of pure silver. It is also less attacked by sulphur vapors and the rays of the sun, in which last request it is superior to mirrors silvered by the old process.—*Bulletin de la Société d'Encouragement pour l'Industrie Nationale.*

Gold Mining in the Black Hills.

Colonel Dodge has published a small work on the Black Hills region, describing the physical features of the country, the soil, timber, climate, etc., and giving much information respecting the precious metals supposed to be deposited there. There is gold in the hills, no doubt, but how much is yet a question. The author thinks it is no place for poor men The mining is of such a nature that it requires capital to carry it on profitably.

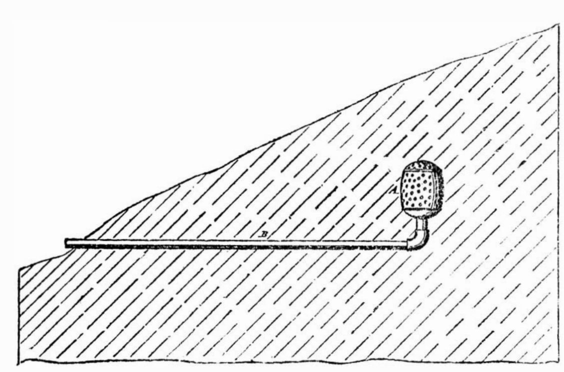
"It has passed into a proverb that 'placer' mining is the poor man's diggings, while 'quartz' mining is only for the rich. Placer mining in the Black Hills will not pay the poor man, unless he be a 'heathen Chinee.' He may make a little money by securing a claim, selling it out to a man or company who has capital to buy up many claims, then looking for and securing another claim with the same intention and result. This is a poor and precarious foundation on which to base a living. No man can make more than the barest wages by pan-working a single claim in the Black Hills. The placer mines, as well as the quartz mines, are here only for the rich man, and I would advise no poor man to go into the hills with the expectation of making money by mining for himself. Of course, he may be fortunate enough to strike rich diggings and do well; but as a general rule, he will make more money as day laborer for some wealthy man or company than he possibly can by working for himself on a single claim. The reports of the enormous wealth of the placer mines in the Black Hills are the most barefaced fabrications, got up by miners who wish to sell their claims. Money is to be made here by men who have sufficient capital to buy up many claims along a creek, sufficient to warrant the expense of dams, ditches, and all works necessary for hydraulic mining. If they have already the means of comfortable livelihood, poor men had better stay at home, unless prepared to work on wages. All this is said on the supposition that the Black Hills will, sooner or later, be opened to the miner. Under present circumstances, in addition to the disadvantages mentioned, he is liable at any moment to be arrested by the troops and sent from the hills a prisoner."

Culture of Asparagus.

W. H. Noble gives, in the *Gardener's Monthly,* an account of a garden lover who planted on good, level soil an asparagus bed of some 12 by 20 feet. When its growth became strong, he year by year covered it with some two or three inches of good rich mold. Up through this shot the stalks and crept the roots. The method was followed up every season, with the result of larger growth and product, till the bed became an oblong mound of some 2 or 3 feet in hight, and a perfect wonder in the quality and quantity of asparagus furnished for the table. That yearly blanket of soil was, my friend thinks, the only culture or enrichment given. The bed was never dug with fork or spade.

IMPROVED METHOD OF OBTAINING WATER.

A new plan of obtaining water, in rolling prairie lands where a porous soil rests upon a bed of clay or other formation which resists the downward passage of moisture, has been patented through the Scientific American Patent Agency (February 8, 1876), by Mr. Augustus Byram, of Atchison, Kansas.



The engraving herewith given shows a section of a side hill or prairie roll, with the device for collecting water in position.

A perforated case, A, of metal or other suitable material, is set in the ground at the depth of five feet, more or less, where the soil is moist, with a pipe, B, extending out to the surface of the ground in a horizontal direction, or with a slight downward inclination. With this arrangement the water in the soil will collect in the hollow case, and will flow out through a pipe, and may be received in a trough or other convenient receptacle. The water, the inventor claims, forms natural courses heading to the case, and will have a continuous flow. This will enable farmers in Kansas and in other States where the land is of a similar formation to obtain a supply for watering their stock, and for irrigating purposes, without the trouble and expense of digging deep wells and pumping up the water with windmills or other mechanism.

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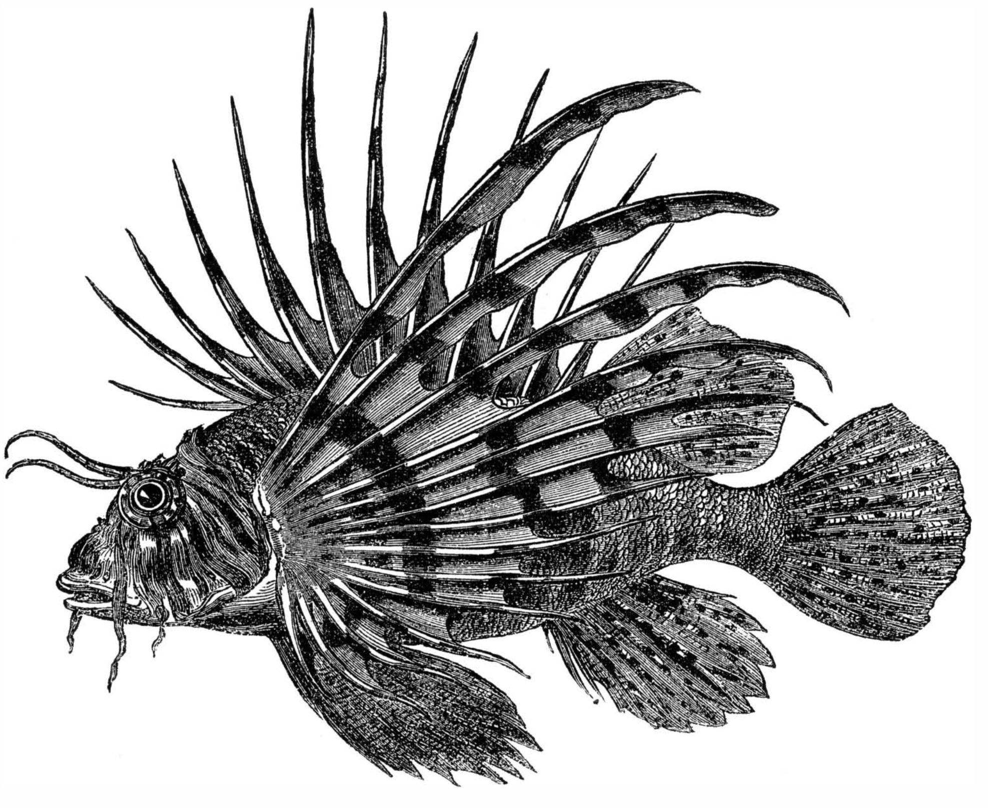
THE RED FIRE FISH.

The singularly weird-looking fish shown in our engraving* is a native of the Indian Ocean, and the race is represented in all parts of the tropical seas of the eastern hemisphere, on the coasts of Africa, India, Ceylon, New Guinea, and Australia. It is much prized as food by the natives of Ceylon, the flesh being firm, white, and nutritious. The color of the fish is a pinky brown, barred with darker brown, and the head is redder than the body. The pectoral and dorsal fins are very large, and crossed with black bars; the ventral fin is black, spotted with white; and the other fins and the tail are light brown, spotted with black. There are nine or ten species of this genus, and the usual size is seven or eight inches in length. The singular development of the dorsal and pectoral fins has given rise to an idea, in the minds of some naturalists, that they were used for the purpose of flying. This, however, is now known to be a mistake, as the rays of bone which carry the membrane which joins them are not sufficiently supported by the osseous system proper, and are therefore too weak for such use. Indeed the purpose of this abnormal form is unknown, and it adds one to the many thousands of curious problems which make comparative anatomy, especially of fishes, so fascinating a study.

The Cingalese have a belief that the thorny prickles of this fish inflict incurable wounds; but although this is an error, the fire fish is a formidable antagonist, and one which bathers and swimmers near his habitat will do well to keep clear of. The skeleton of this fish is one of the most remarkable known to Science its organization being very complex; and it will well repay investigation by those who can obtain a specimen.

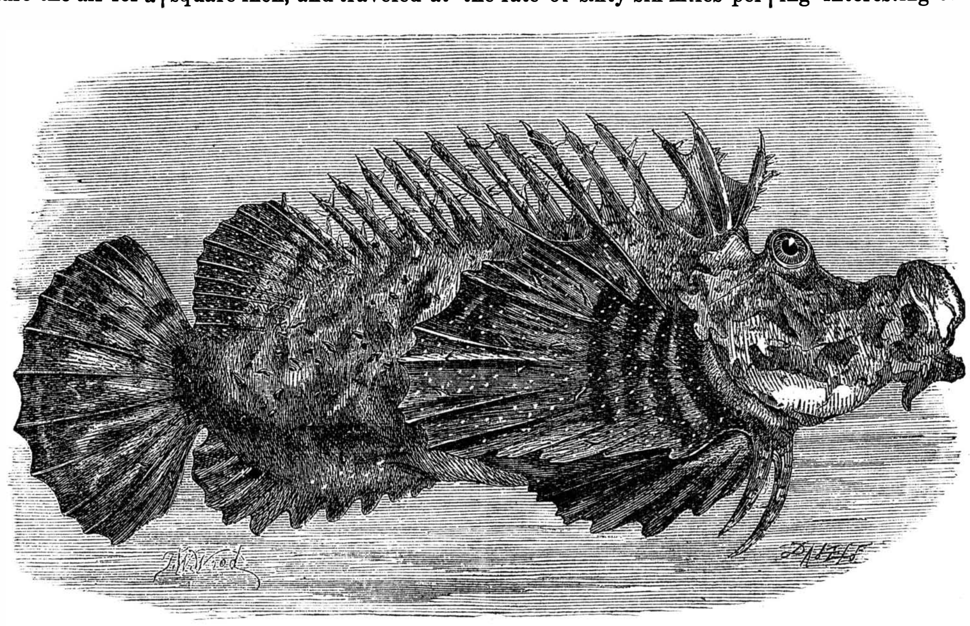


THE RED FIRE FISH.—(PTEROIS VOLITANS.)

THE FILAMENTOUS GURNARD.

The family of fishes known as *triglidæ* or gurnards are in many ways remarkable. Their colors are generally beautiful and often singularly brilliant; and their forms are various, some of them being almost repulsive. They are not strong swimmers, and therefore remain mostly in deep water; but some of them have large pectoral fins which enable them to leap from the water, and endure the air for a brief space. The mouth is mostly large, and the aspect is frequently repulsive.

The filamentous gurnard* (*pelor filamentosum*) is an instance of the capriciousness of Nature, being one of the strangest and most eccentric forms to be found in the annals of ichthyology; the head appears to be crushed out of shape, and is hung with scraps of depending skin. The body is armed with formidable looking spines, which are not suggestive of any purpose but that of self-defence. This gurnard is found in large numbers on the shores of the Mauritius. Its color is a light grayish brown, mottled with a dark shade of the same hue, and it is minutely spotted with white dots. Its usual food consists of crustaceans and molluscs, but pieces of cuttle fish have been found in its stomach. Possibly, the dreaded octopus has here found an enemy dangerous to meddle with, and one whose voracious appetite and defiant digestion may make him terrible in attack.



THE FILAMENTOUS GURNARD —(PELOR FILAMENTOSUM.)

Sham Coffee.

We learn from a statement in the *Journal of the Chemical Society* that sham coffee is manufactured from tough dough, squeezed into little molds and baked until the color becomes dark enough to deceive the eye. Real coffee berries, when small and worthless, are improved in color by rolling them about with leaden bullets in a cask. The green berries, too, are treated by a coloring matter. In coffee sold ready ground, the difficulty of detecting adulterations is greatly increased; beans, beet root, carrots, and carrot-like roots are roasted and mixed in large quantities with the genuine article. In the south of Europe, especially in the provinces of Austria, figs are roasted in enormous quantities and sold as coffee.

The British Ironclad Fleet.

A discussion recently took place in the House of Lords, relative to the constitution of the ironclad fleet. Lord Dunsany moved for statistics as to the draft of water of the present sea-going ironclad vessels, especially with regard to their capability of passing through the Suez canal; and he called attention to the necessity of adequate dock accommodation for these large and heavy ships. He also stated that Italy is now having built some 100-tun guns, and armor plates of 22 inches thickness (as described in our last issue) are now being rolled for the same government. Attention was called to the Russian circular ironclad, already described and illustrated in these columns. On behalf of the government, it was stated that the recently built vessels, of all calibers, were especially constructed with a view to their passage through the Suez canal. Ample dock accommodation is already provided at Portsmouth, and additional docks are to be constructed at Devonport and in Ireland. It was suggested in the course of the discussion that, looking to the dangers of accidental collision of vessels fitted with rams, movable rams, to be used only in time of war, should be constructed.

*The engravings are selected from the Rev. J. G. Wood's "Illustrated Natural History."

Horse Power and Fuel Equivalent of Storms.

The *Bulletin of the American Iron and Steel Association* says: "One of the most severe wind storms prevailed throughout a large portion of our country the week before last, extending probably 500 miles. It is stated that it exerted a pressure of 30 lbs. per square foot, or $\frac{1}{5}$ lb. per square inch, and traveled at the rate of sixty six miles per hour. It is interesting to estimate the force of such a storm, and the resulting figures are truly startling. There are in a square mile 27,878,400 square feet, or 4,014,489,600 square inches. Assuming that the pressure of the storm was exerted for a half mile of vertical hight, we have for each mile in width of the track of the storm an area of 2,007,244,800 square inches, upon which the storm acted with a pressure of $\frac{1}{5}$ lb., and with a speed of 5,800 feet per minute. To find horse power we have the formula:

$$\frac{\text{Area in inches} \times \text{pressure in lbs.} \times \text{speed in feet per minute.}}{33{,}000}$$

And our calculation becomes:

$$\frac{2{,}007{,}244{,}800 \text{ square inches} \times \frac{1}{5} \text{ lb pressure} \times 5{,}800 \text{ feet.}}{33{,}000}$$

which gives, as a result, 70,557,700 horse power developed for each mile of breadth of the track of the storm. To produce the same horse power, with improved engines consuming but 2 lbs. of coal per hour per horse power, would require 63,000 gross tuns of coal. Assuming, as above, the track of the storm to be 500 miles wide, the hourly consumption of coal to generate an equal power would be at least 31,500,000 gross tuns, or one and a quarter times the annual product of the entire anthracite coal region.

OWING to the large demand for WRINKLES AND RECIPES, the publisher has been obliged to issue a third edition. See advertisement on another page.

Steam Domes on Boilers.

Mr. Thomas Hoge, of Waynesburgh, Pa., in commenting on our answer on this subject on page 171, current volume, states that, after many years' experience with boilers of all kinds, he is unable to find any practical appreciable advantage in the use of steam domes.

"Small-necked cast iron domes, so much used on portable boilers," he states, "are of no use so far as dryness of steam is concerned, even admitting that large-bottomed ones are; and domes are generally placed in about the worst place on the boiler to secure dry steam. Steam should always be taken from the back end of the boiler, or at the furthest possible place from where the most of the steam is generated.

"My experience and reading have led me to have less faith in the steam generating power of flues and to have more in that of the fire box or of the two or three rings of boiler immediately over the fire, in stationary boilers. The greatest amount of ebullition taking place from the fire box, there evidently will be the greatest amount of foam, spray, or water in other form, carried up with the steam, its upward current there being greatest; and the dome being gradually set right over this point, water goes directly into it with the current of steam; and if the neck or entrance to the dome is small (making in effect only a large swell in the steam pipe) the current of steam will there (in the neck) be so strong that no particle of water can ever descend through it while steam is being rapidly used, the only time when priming occurs. I believe that, usually, three fourths of the steam made in a boiler is made in the first third or half of the boiler. If, instead of drawing it off here, it were allowed to pass slowly back to the back end, and there enter the steam pipe, we should, in effect, convert nearly all the steam space along the top of the boiler into a steam dome"

The Use of Glass by the Chinese.

At the last session of the Commercial Geographic Commission, of France, held in Paris, M. Edward Rénard, a former delegate of the Department of Agriculture and Commerce for the extreme Eastern countries, made the following interesting communication: "The product of manufacture which I submit to the Commission is as little known among us as is the process employed in its manufacture, which requires great dexterity. The specimen I exhibit consists of a thin layer of colored glass, which appears to have been cast over a sheet of lead. Its production is a branch of industry which flourishes in many parts of the great and industrious city of Canton, and is practised in many places, even in the streets and in front of the houses, on a small scale.

"While in India and Burmah I was often surprised at the lustrous appearance of the domes on the Buddhist temples, which were covered with curved plates, colored violet, green, etc., or white and yellow, looking like bright silver and gold; and at a distance showing, with surprising brilliancy, a light having the appearance of an electric light, especially when seen from the sea. I was also often surprised to see the Chinese glassblowers, whose labor is ill paid, and who, notwithstanding this, show very remarkable results in their exercise of this curious industry, and who make these brilliant and multicolored plates while exposed to wind and weather.

"A few days ago, I sent specimens of this singular product to M. Robert, the able director of the Sèvres porcelain works, and also to the savant M. Clemendot, whose thirty years service in the direction of our principal glass manufactories has made him the most competent man now in this line. I am confident that, thanks to these men and their investigations, we will be able in a short time to see the effects of such reflected lights in the ornamentation of kiosks and domes of various buildings, in the manufacture of reflectors for headlights, coast lighthouses, street lamps, and several other useful and practical purposes."

Ancient Trademarks.

Examples of the practice of using trademarks, to show the workmanship of various manufactures, have been discovered at Herculaneum, such signs having been in vogue among bakers and others. In modern times similar tokens have been adopted in textile and various other fabrics. The trademark is a recognized part of the system of commerce, by which a guarantee is given to the purchaser, and a legitimate protection afforded to the manufacturer. It is upon the uniform good quality of manufactured commodities that any foreign trade depends for its continuance; and (as the *Textile Manufacturer*, a London journal, says) it is in such cases that the use of trademarks is most useful.

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The New York Academy of Sciences.

The chemical section of this society met on March 27, Professor A. R. Leeds in the chair.

Mr. C. Chamberlain exhibited several magnificent specimens of

AMAZON STONE,

from the collection of Professor A. E. Foote, of St. Louis, Mo., who is now in Philadelphia preparing to exhibit the minerals of the New World to our foreign guests at the Centennial. Amazon stone is a variety of orthoclase or potassa felspar, of a bright verdigris green color, and quite rare. These specimens were brought by Professor Foote from Pike's Peak, Col. The crystals were remarkably large and perfect, while the color was unusually brilliant. The same gentleman exhibited a crystal of beryl found by himself in 56th street in this city. Also a perfect crystal of datholite, $\frac{3}{4}$ inch long, from Bergen tunnel, and a specimen of petzite or telluride of silver, brought from Colorado by Professor Foote.

Dr. H. Endemann exhibited and described a new form of apparatus for the

QUANTITATIVE DETERMINATION OF ACETIC ACID

in crude acetate of lime. It consisted of four glass flasks connected by glass tubes, the first and last being provided with safety tubes. The first flask is filled with water; the substance to be analysed is placed in the second flask along with a sufficient quantity of phosphoric or sulphuric acid. The third and fourth flasks, which are at some distance from the second, and at a lower level, contain a known volume of a standard soda solution. A gentle heat is applied to No. 2, steam is generated in No 1 and passed into No. 2, and drives out all the acetic acid, which distils over into No. 3 and is absorbed by the soda. The distillation is complete in 15 minutes, and it is only necessary to triturate the soda solution with the standard acid to ascertain how much of it was neutralized by the acetic acid, and then from this to calculate the quantity of acetic acid.

Dr. Elwyn Waller, E. M., read a paper on

MILK AND THE LACTOMETER,

in which were embraced most of the facts contained in the editorial on "Milk and its Adulterations" in our issue of April 1. Dr. Waller has analysed a large number of samples of milk for the Board of Health, and in almost every case found that the only adulterant employed was water. The speaker detailed his experience, and gave figures to prove the unreliability of the method, once strongly advocated by a city chemist, which was to shake the milk with a given volume of caustic potash, add acetic acid, heat, allow to cool, and read off the amount of coagulum formed, from which the quality of the milk is calculated by means of tables prepared for the purpose.

An animated debate took place at the close of the paper, between Drs. Waller, Doremus, Falks and others, during which the hour for adjournment arrived, and further discussion was postponed till Monday evening, April 10, at which time Mr. Mott's paper, on a comparison of the milk of the African and Caucasian races, will also be discussed.

The Odors of Coal Oil.

The refinement of crude petroleum is extensively carried on in the vicinity of Hunter's Point, N. Y., a locality situated opposite the center of New York city, directly across the East river. The distance of the oil works is a little over a mile in a direct line from this metropolis. For a long time the inhabitants of the northerly portion of the city have complained of bad health, due, as they allege, to foul odors that swept across the river from these works. A bill is now before the legislature, intended to effect an abatement of the nuisance Professor Charles F. Chandler, President of the Board of Health, a well known chemist, is of opinion that, at a trifling expense, chemistry can furnish means for the removal of the odor, if persons complained of will only take the trouble of using them. That the men at work in these factories do not mind the smell does not prove that sensitive women, young children, feeble convalescents, and prostrate invalids do not suffer from it. In a civilized community, the principal, as it is the most beneficent, purpose of law is to protect and help those whose struggle for existence is hard. As for the objection that persons living near the factories do not complain of the smell, it is well known that such odors ascend perhaps one hundred feet from their source before is they begin to diffuse themselves; and that great condensation or compression of odors often lessens their power—a bag of musk, for example, is not nearly so fragrant as it is in the handkerchief that has lain beside it.

The cause of this nuisance, said Professor Chandler, is simple enough. Crude petroleum is a liquid of dark, greenish brown color, and of an offensive odor, and must be refined before it is suitable for household use. The process of refining is threefold: First, the lighter oils, which are dangerously inflammable, and the heavier oils, which are not inflammable enough, are distilled; secondly, the product remaining after distillation is agitated with sulphuric acid in order to remove a portion of its color, and all its disagreeable odor; thirdly, the oil thus refined is again agitated with an alkali, either caustic soda or ammonia, in order to neutralize all traces of the sulphuric acid. After the second of these processes there is left a dark, tarry sediment called sludge acid, of an exceedingly disagreeable odor, and it is of this odor that the people of a large part of the city are now complaining.

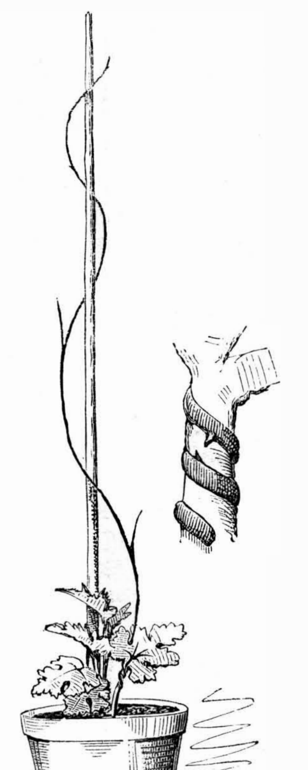
The effects of inhaling it, said Professor Chandler, are not different from those following the inhaling of any odor which produces or tends to produce nausea. The appetite is impaired, and the general tone of the system injured. It can rarely be proved that any particular odor causes any particular disease. But the body becomes degenerated, and the scale is turned against convalescence.

It is not quite certain whether the nuisance originates with the petroleum factory or with the fertilizer factory near it. The sludge acid which is made in the former is sold to the latter, where it is poured over spent bone black and other refuse animal matter in order to produce various sorts of artificial fertilizers. "In any case," said Professor Chandler, "either party can entirely prevent the disagreeable odor, were they so inclined."

[For the Scientific American.]

THE HORTICULTURAL HALL AT THE CENTENNIAL EXHIBITION.

The interior of Horticultural Hall greets the artistic eye very pleasantly, and promises to be, so far as architectural beauty is concerned, one of the most attractive parts of the Centennial Exhibition. The four forcing houses, two on the north and two on the south side, are already partially stocked with trees, shrubs, ferns, and plants, the smallest plant among which is most notable for its rarity. It is a parasite which has attached itself to the petiole on a *pyrethrum*. Our engraving represents the plant and parasite, the latter having two coils wound closely around the petiole or stem just below the leaf, sustaining itself by several small spurs with which it has pierced the petiole, and which are plainly visible from the semi-transparent nature of the stem. The parasite itself is of a reddish brown color, and might easily be taken for a piece of fine twine, were it not for its soft and sappy appearance. It has coiled itself about the stick in the pot, and is at present about a foot long, having no signs of leaves other than two short spurs or stipules which are cordlike and of the same color and diameter as the trunk. Mr. Thomas Mingey, the urbane head gardener of the hall, informs us that his lengthy and varied experience has never afforded him a similar curiosity upon such an order of plant.



The *pyrethrum* is one of the numerous orders of chrysanthemums, which also includes the ox-eye, daisy, fever few, and corn marigold. The *pyrethrum* is an annual plant, having flowers about 6 lines in diameter, with a white ray: others of the same class, however, vary from a golden yellow to the various shades of red. It is indigenous to Europe, Asia, and North Africa; it was introduced into England as a medicinal herb, and has become naturalized in some parts of that country. It runs from one to three feet high, with leaves pennately divided into broad-lobed segments.

The parasite is, we think, of the genus *cuscuta*, or, as it is called in England, "dodder," of which there are in that country five native species, which grow upon hops, flax, and nettles. They appropriate the sap of the plants on which they live, and frequently kill them. They belong to the second order of the fourth class.

Botany affords us no more interesting order of plants than the parasites. In tropical climates, they grow in great profusion, and attain large proportions; in cold climates, the classes are few and the sizes diminutive. Among the most remarkable is the genus *epidendron* (in the 20th class, *gynandria*, of Linnæus) one species of which, called *flos aeris*, or flower of the air, is found in abundance in the East Indies beyond the river Ganges, and it grows and even blossoms in the air, when hung up, without attaching itself to any solid body. The perfume of the flowers is so delightful that the inhabitants suspend it from the ceilings of their rooms, where it will vegetate for years.

Mirbel, the French botanist, says that in North America there are parasitical trees which grown on other trees; the long roots of the *clusia rosea* (rose colored balsam), a parasite of this kind, descend from the summit of the trees upon which they grow to the ground, and then sometimes become engrafted into each other, and are then covered with the same bark, so as to form an immense case in which the trunk of the stranger tree, supporting the *clusia* in the air, is enclosed.

Among the other plants and trees already in Horticultural Hall is a fine specimen of *monstera deliciosa*, bearing a fruit similar in flavor to the pineapple. Nearly all other trees of its class bear poisonous fruit. A large mango tree is bearing fruit, which is a somewhat rare occurrence in a hothouse. A South American mahogany tree is noticeable for having an unusually clean stem. There is a very fine specimen of the camphor tree in one of the forcing houses on the south side of the hall. Joseph Lovering, of Philadelphia, exhibits a collection of orange and lemon trees, so full of fine fruit that the boughs bend from its weight. The lemon trees have ripe and green fruit in profusion, and of a size rarely seen upon them. The trees bearing them have also new blooms, side by side with the fruit. The gardener says that he never saw such fine specimens, even at Hampton Court in England.

Two excellent specimens of the *cybotium*, from the Sandwich Islands, are noteworthy, both for their size and healthy appearance. The mat-like bark contains a profusion of pockets filled with the delicate golden colored and silky fiber for which this tree is famous. One of the hot-houses on the north side of the hall is pervaded with the delicious perfume exhaled by four specimens of the *malurina odorata*, whose small, yellow, buttercup-like flowers gracefully hang their heads as if at their orisons.

Among the trees and plants most notable on account of their size are a cocoa tree, a cinchona or Peruvian bark tree, a camphor tree, an *araucaria Braziliensis*, a Japanese *mespellus japonica* (bearing an edible fruit), and a Dicksonia or tree fern.

JOSHUA ROSE.

The government of Newfoundland has a characteristic emblem upon its postal stamps, a hungry-looking fish swimming in the sea, its mouth open, eyes expanded, anxiously searching for prey.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED ROWLOCK.

Francesco Roseti, New York city.—This consists in combining a ball with the oar shaft, so that a ball and socket joint can be employed in the rowlocks. It also consists of a contrivance of the socket to turn the oar around to the line of the gunwale of the boat and to lock it in that position; also, to lock the oar in the socket, so as to hold it while not in use.

IMPROVED SKATE SHARPENER.

William H. Fisher, Selin's Grove, Pa., assignor of one half his right to Charles K. Fisher, same place.—This is a device for sharpening skate runners, which may be readily carried in the pocket. A fine crosscut steel file is placed in the body of the implement, and secured rigidly in position. The file is made flat on one side for sharpening flat runners, and convex on the other for sharpening runners with a groove or gutter. A second crosscut file of coarser grain serves to remove the rough edge, while the finer grained file gives the fine edge or finish to the runner. There is a suitable guide flange and adjustable gage.

IMPROVED BOOT JACK.

George W. Phenix, New Brunswick, N J.—This boot jack is so constructed that it may readily be folded into a small compass, and conveniently carried in the pocket or in a traveling bag. It is formed of two hinged and one pivoted parts, constructed so, as when folded, as to give no additional thickness.

IMPROVED MACHINE FOR TRIMMING CIGARETTES.

Andrew Montes, New York city.—This invention consists of a spurred endless belt that feeds the cigarettes from a hopper to the revolving trimming knives at the sides of the belt, and then delivers them over an inclined end plane to a suitable receptacle.

IMPROVED SPRINKLING ATTACHMENT TO BAKING MACHINES

Alexander Rannie, Palmyra, N. Y.—This consists of a nozzle, arranged over the way on which the pans pass into the oven, for moistening the cakes with fine spray as they pass along, the said nozzle being constructed with very fine perforations in the lower end.

IMPROVED CONNECTING POSTS FOR ELECTRICAL APPARATUS.

Jerome Kidder, New York city.—This consists of a sliding collar and a spring on the post under or over the conductor to be used instead of the ordinary binding screw for binding the conductor. The spring presses the collar against the conductor. This binder has the advantage of being operated quicker than the screw, and it cannot be detached and lost, as there is a nut on the top of the post which prevents it from coming off.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—This stopper is easily opened and closed, and is retained when in open position in such manner that it does not interfere with the pouring out of the contents of the bottle. It is applied by an eye to an extension of the wire neck band, and closed by a yoke that slides in a curved slot of the stopper cap piece. The yoke is centrally indented or bent, to carry the stopper in position.

IMPROVED TOY PISTOL.

Samuel D. Goodale and Dexter C. Goodale, Du Quoin, Ill.—This invention consists of a toy gun with a slotted barrel, that guides a piece of card paper propelled by the action of a spring hammer. Said hammer is attached to a slot at the breech of the barrel, retained by a catch, and released by a trigger. A practical application of the device may be made for the purpose of throwing messages on board of passing steamships, also to the delivery of important dispatches on board of passing railroad trains.

IMPROVED LAMP-LIGHTING DEVICE.

Frank L. Camm, Brooklyn, N. Y.—This invention consists of a tube fitted in the burner, so as to direct the match up to the wick when inserted from the bottom of the burner. It is provided at the upper end with teeth, across which the tip of the match is forced, so as to be fired by them.

REMEDY FOR DISEASES OF THE THROAT AND LUNGS.

Ellen Rohrer, Monmouth, Oregon.—This remedy is composed of tinctures of consumption root and mountain balm, prepared with sirup. It is claimed to be efficacious in the maladies mentioned.

IMPROVED STILT.

F. Beaumont, Jr., Dallas, Texas.—This invention relates to a means by which a boy's stilt may be quickly, easily, and securely fastened at different elevations on the standard, and consists in connecting with the standard a stirrup and sliding sleeve, that together form a lever by which a rapid and convenient adjustment is made.

IMPROVED INSTRUMENT FOR FILLING TEETH.

Carl D. Ludwig, Houston, Texas.—After inserting a cement filling in a tooth, this inventor proposes to harden it by the use of instruments made of talc, which are heated over an alcohol flame, and are applied to the filling as soon as it is set. This process is repeated and the filling is rubbed gently until it shows a dull polish on the surface, which polish is brightened by using a polisher of agate or polished steel. The filling is said to be complete and as hard as marble when the patient leaves the operator.

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IMPROVED COAT HANGER.

Simon Scheuer, New York city.—This consists of a hanger of leather or similar material, provided with end mountings and wire bent eyes, to be attached to the coat or other article. These form a neater and a more durable device than the coat hangers generally in use, and may have the name of the tailor printed in gold letters thereon.

IMPROVED MACHINE FOR COATING PILLS.

William N. Clark, New York city.—This machine consists of a revolving cylinder with rows of radial needles so arranged in connection with a movable pill tray that the pills are picked up by the needles by the joint revolving motion of the cylinder and the forward motion of the tray. The pills are then dipped into the coating solution, and, after being dried, stripped from the needles by sliding clearer pieces.

IMPROVED GAS LIGHTER FOR STREET LAMPS.

James Chapman, St. John, New Brunswick, Canada.—This is a novel arrangement of a lantern on the end of a rod, so that when it is lowered over a gas burner the flame of the lamp may ignite the gas.

IMPROVED METHOD OF PACKING MATCHES.

Joseph Kayser, New York city.—This invention consists of a strip of paper that is crimped or corrugated by suitable machinery, and provided at the upper edge with any suitable friction covering. The matches are placed into the corrugations and secured tightly by a flat closing strip, glued over the intermediate face parts of the crimped strip.

IMPROVED PERPETUAL COUNTING HOUSE CALENDAR.

Frederick W. Luttgen, New York city.—This calendar consists of transferable monthly tablets, printed without the name of any month, and arranged in a case, having within it twelve or more compartments. There is a perforated plate with twelve or more openings for tablets, and having the name of a month formed upon the face of the plate, one adjoining each opening.

IMPROVED HEEL SUPPORTER FOR RUBBER SHOES.

Martin Bock, Conyngham, Pa.—This is a little wire supporter for holding up the heel of an india rubber shoe, to prevent it from slipping down at the heel of the boot. Said wire is contrived to stick into the heel of the boot by points, from which it extends up along the heel of the boot a little higher than the shoe, and has a stud near the top, projecting through a hole in the shoe and holding it up.

IMPROVED IRON-HEATING ATTACHMENT FOR STOVES.

Edwin G. Adams, Cohoes, N. Y.—This attachment for heating soldering and other irons is designed especially for oil-burning stoves, but may be used with advantage with stoves burning other fuel. A casing, made with a flaring lower part and a contracted upper part, is provided with a heating chamber made close except at its forward end, and with a smoke pipe to adapt it to be placed over the fire box of the stove. A cap is provided, made larger than the pipe, having its lower end connected with the pipe by a ring plate, and having its closed upper end perforated without the sides of the said pipe. By this construction, should a blast of air strike the cap, it will cushion itself upon the air in the ring chamber of the said cap, and will not blow into the pipe to impede the draft, but will rather increase the draft. The draft being admitted at the front of the stove, the flame will incline to the rearward, so that its greatest heat will be around the inner part of the chamber, where the point of the soldering iron is.

IMPROVED BALE TIE.

John M. Brandenburg, Fort Motte, S. C.—This invention consists in the bale tie provided with three slots, and with the lugs upon the ends of its side edges next the single slot. It is hardly possible to convey a clear idea of the mode of attachment, though the same is very simple and easily secured. The loop of the free end of the band is first passed into a cross slot of the tie, and then, after other adjustments, a novel brace, designed by the same inventor, tightens the whole.

IMPROVED FARE REGISTER.

Joseph G. Moody and Edwin E. Glaskin, New York city, and Theodore Miner, Brooklyn, assignors of one half their right to Eugene F. Daly, New York city.—This invention consists of one or more sliding and revolving face buttons and dials, according to the different classes of fares to be collected. Said revolving dials are thrown by suitable cog wheel mechanism and pawl detents into gear with cog wheels mounted loose on a central bearing, operated by a swinging lever and spring pawl, in such a manner that the turning of the dials and the clicking of a bell are produced at the same time, and the gear connection of the dial cog wheels then interrupted. The device is incapable of work when the required depression of the sliding button and the swinging of the lever is not jointly attended to. The revolutions of the dials are registered by a differential gear connected therewith.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED TUG BUCKLE.

William J. Darr and John W. Bowman, Leon, Iowa, assignors to themselves and Alonzo Robbins, same place.—This invention consists of a buckle made with tongues, in line with each other and with the length of the buckle, and in the bail made with lugs upon the rear parts of its side bars to rest against the side bars of the buckle frame. This construction is claimed to enable the tug to bear without splitting as many times the strain that would split it with a single tongue buckle as there are tongues used.

IMPROVED WAGON END GATES.

Samuel F. Adair and Evan K. Adair, Oasis, Iowa.—This consists of strap cleats for guiding the end gate, in connection with swinging cam hooks pivoted to the same, that enter staples of the cleats, and lock the gate securely thereby.

IMPROVED SASH BALANCE.

Wilson E. Facer, Toronto, Ontario, Canada.—This invention relates to certain improvements in that class of sash balances, in which the tension of a coiled band spring operates through a toothed wheel and a rack bar on the window sash to balance the same; and it consists in the peculiar construction and arrangement of devices for locking the wheel, and thus holding the window sash in any desired position against the uneven tension of the spring, or the attempts of burglars.

IMPROVED SHUTTER WORKER.

Abraham W. Seaver, 2d, Northborough, Mass.—This consists of blind hangings, which are so constructed as to enable the blind to be opened and closed to any desired extent, and locked in place when adjusted, without its being necessary to raise the sash.

IMPROVED FASTENER FOR THE MEETING RAILS FOR SASHES.

John J. Dinnan, New Haven, Conn.—This invention consists of a pivoted locking plate, that is thrown across the sashes by a swinging and spring-acted bar that bears, by a cam, on a recess of the locking plate. The latter has a shoulder and guard to embrace and retain the handle securely in closed position.

IMPROVED SPRING FASTENER FOR CARRIAGES.

Franklin Miller, Indianola, Ill.—This consists of a seat block and a cap plate of peculiar construction, for mounting and securing the springs of carriages on the axles. The new features are mainly bolt hole projections of both plates, which are extended beyond the faces, to prevent lateral movement of the springs.

IMPROVED WHIFFLETREE.

Peter P. Kunz, Florence, Iowa.—This is a new device for connecting the tugs with the ends of the whiffletree. One arm of a V-shaped rod passes through a lug, and is retracted by a special spring. The other arm passes through two lugs and the eye of the tug, said tug being between the lugs. The spring can be compressed enough to enable the arm to be drawn out far enough to allow the eye to be inserted and withdrawn.

IMPROVED COMBINED REIN HOLDER AND WHIP SOCKET.

John W. Weddel, Mount Carroll, Md.—In this device, the whip is held in a socket having one side movable, and acted on by a spring which causes it to clamp the reins. By this construction, a whip socket and rein holder are combined in one device.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SPIKE FOR THRASHING MACHINES.

Christopher Wilde, Canton, O.—This invention consists in spikes for thrashing machines, formed of wrought iron, faced with steel upon their forward edges and heads, in order to resist wear.

IMPROVED MIDDLINGS PURIFIER.

Albert Greenleaf, Kingston, Wis.—This is a new arrangement of passages, sieves, and fans for purifying middlings by the compound actions of gravity, suction, and blast currents of air and sieves.

IMPROVED PLOW.

Eugene R. Knight, Omaha, Neb.—This consists in the application of a colter, bent horizontally to the width of furrow, and turned up at the outer end to a mold board made of rods. This is claimed to afford a lighter draft.

IMPROVED GANG PLOW.

Enoch C. Eaton, Pinckneyville, Ill.—This is an improvement on a device patented to same inventor. By loosening a single screw a frame may be slid laterally upon the axle to move the plows toward or from the land, or may be slid forward or back to adjust the plows longitudinally.

NEW HOUSEHOLD ARTICLES.

IMPROVED BOOT JACK.

John Green, Greenville, Mich.—This boot jack is composed of a base piece and standard jointed together, so that they will fold together very compactly. When being used, the standard is placed and held vertically, and the base lies inclined, one end resting on the floor, the other being supported by the standard. The base is cut out to receive the boot, and also provided with a sliding toe piece or rest, which adapts it to various sizes of boots. The toe piece readily adjusts itself to the foot.

IMPROVED STEAM WASH BOILER.

James T. Brown, Saranac, Mich., assignor to himself and Marion Crane, same place.—The object of this is to improve the construction of the apparatus known as the Munger boiler. The water and steam pass up through pipes, are discharged upon the clothes, pass through the clothes, and pass back to the heater through another pipe, washing the clothes very quickly.

IMPROVED FOOT REST.

Edward B. Lovett, Amherst, Mass.—This is a pivoted foot rest, supported by standards, and having a newspaper pocket and slipper-holding loops attached to its opposite faces. The base frame has a boot jack formed in it.

IMPROVED APPARATUS FOR ADJUSTING MOSQUITO BARS.

Isaac A. Abbot, New Orleans, La.—This consists of a small pulley near each foot and corner of the tester, on the under side, through which run cords connecting with a traveling rod, running through other pulleys at the head of the bed, and terminating in a knot, which, being pulled down, will draw the traveling rod to the foot of the bed, and thus extend the mosquito netting, which is attached to the rod. Other cords terminate in a hanging knot for pulling the traveling rod up to the head of the bed, for gathering up the netting thereat when it is not required to be spread.

IMPROVED CLOTHES DRYER.

John J. Reed, Lyons, Iowa.—The arms in this device are adjusted for use by raising them into a horizontal position, drawing them forward, pasing the heads of screws through the enlarged outer ends of slots in a horizontal semicircular supporting head, and pushing them in to bring the bodies of said screws into the narrow parts of said slots. When not required for use, by reversing this operation the arms may be lowered into a vertical position against the wall and allowed to hang.

IMPROVED QUILTING FRAME.

John H. Sheets, Hartford, Minn.—This apparatus consists of parallel rollers for holding and adjusting the quilt, together with their holding ratchets, mounted on a couple of bars, one at each end of the rolls. Said bars are suspended by cords from a traveler on an overhead rail, so that the quilt can be shifted along a sewing machine, or by a hand sewer, readily for stitching.

READING AND WRITING DESK ATTACHMENT FOR CHAIRS.

Cevedra B. Sheldon, No. 7 State Street, New York city.—This well known inventor still finds a profitable business in working his patented inventions, of which he has a great number. His last invention is a handy and light desk attachment, to be fastened to a chair and used either for reading or writing. It consists in the peculiar form of clamping device for attachment to the chair, and in the combination therewith of a vertical standard passing through a socket in the clamping device, and carrying at its upper end a radial swinging arm or bracket which supports the desk. The desk is adjustable in inclination upon a segmental plate with binding screw, adjustable upon a slide either to or from the occupant, adjustable in horizontal planes upon the swinging arm, and adjustable vertically upon its standard. The device is readily portable, easily attached and removed, and, by reason of its varied adjustments, is applicable to beds, tables, and lounges as well as to chairs.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BALE BAND TIGHTENER.

John L. Sheppard, Charleston, S. C.—This invention relates to improved means or devices for applying bands or hoops to bales of cotton, hay, straw, etc., the same consisting mainly of a bent or angular lever, pivoted to the top portion of the baling press, and provided with a pivoted arm carrying tongs or clamps, for holding one end of the band and drawing it firmly around the bale into position for the other or free end (which is held meanwhile by any suitable fastening) to be attached to the buckle in the usual manner.

IMPROVED FINISHING CLOTH.

Charles E. Scrimgeour, Almonte, Canada, assignor to Rosamond Woolen Company, same place.—This invention has for its object to improve and facilitate the finishing of cloth in the process of steaming its face; and it consists in means for subjecting the face of the cloth to the action of vapor generated from water, to remove the gloss and creases resulting from the ordinary pressing process. The apparatus consists of the combination of a water tank having induction steam pipe and outlet vapor pipe connected with a perforated cylinder and boxing or other distributing device for applying the vapor.

IMPROVED CRACKER MACHINE.

Daniel M. Holmes, New York city, assignor to J. Cutler Fuller, Orange, N. J.—This is a very ingenious machine for molding in dough the fancy crackers, jumbles, and similar articles which hitherto have been produced entirely by hand. It includes eight entirely novel devices. The dough box is made with an extension and offset, to receive the cutters and enable them to operate at right angles with the plungers. Its discharge openings are at right angles with the line of motion of the plungers that force out the dough, and it is divided by partitions into two or more compartments, each provided with a discharge opening and with a plunger. The cutters work within the dough box, and are embedded in the dough when at work. They are made with beveled edges and cutter plates having openings with beveled edges. Two endless carriers, working in line with each other, and with a space or opening between them beneath the discharge opening of the dough box, convey the material for the cutters.

IMPROVED SAFETY VALVE APPARATUS.

Leonidas Moore, Louisville, Ky.—This is an improved safety valve arrangement for rag and straw boilers in paper mills, and for other purposes; and it consists of two valves arranged in such a manner that the pressure on the rag boiler is kept up at a uniform degree from the battery of boilers, and that the back pressure of the rag boiler assists in closing the main valve when the required pressure is established.

IMPROVED DREDGING BUCKET.

Theodor Smith, Jersey City, N. J.—In order to improve the construction of dredging buckets, so as to make them stronger, less liable to break or get out of order, and simpler in construction, this inventor makes the arms formed of the jaws, the bearings, and the slotted upper parts, which constitute a portion of the tripping arrangement of the bucket, in one solid piece.

IMPROVED CAR COUPLING.

Charles H. Briggs, Black Hawk, Col. Ter.—This consists of a combined link and hook-headed coupler, in combination with a catch in the drawbar behind the hole for a coupling pin, which may be used with cars only adapted for the ordinary link and pin connection. The catch is contrived to work vertically in opening and closing, so that it will fall and couple self-actingly, and can be uncoupled from the top of the car or from the side.

IMPROVED SANDING ROLLER.

George A. Crocker, Stockton, Me.—This inventor arranges a pair of rollers inside of the roller on which the sand paper is fastened, to hold the paper on tight and smooth by receiving the ends between them through a slit in the roll. The inner rollers are extended out through one end of the large roller, so as to be operated by hand and are geared together so as to be turned alike.

IMPROVED LEVER POWER.

Edward Fales, Edina, Mo.—This invention presents a novel construction of lever power which is especially adapted to the pulling up of stumps, but generally applicable also for other uses for which a lever power may be employed. It consists mainly in a long lever having a draft attachment at one end, and at the other two pivated clutch arms or grippers. Between these two grippers is a foot or bearing plate, upon which this end of the lever rests, and also an attachment for a chain, which is to pass around an immovable object which holds the lever. The two grippers are held together by a spring, and are adapted, as the lever is worked back and forth, to alternately seize a chain attached to the stump and gradually pull it to one side.

IMPROVED PLANE FOR MAKING EXCELSIOR.

Albion K. Hall, Box 1025, Jackson, Mich.—This is an improved power plane for making what is known as "excelsior," a thin shaving of wood, used for filling beds and for other upholstering purposes. The invention consists of a bit, with parallel rectangular grooves at the upper side, combined with a stock having correspoding grooves in its under side. The bit produces a two-fold cutting of the shavings, one set at the outer edges of the raised ribs, and the other at the bottom of the grooves, so that two distinct and separate shavings are formed for each groove of the plane. The inventor is desirous of disposing of State, county, and shop rights.

IMPROVED SHAFT COUPLING.

Herman Albrecht, Philadelphia, Pa.—This shaft coupling locks the shaft securely, and has the advantage of coupling shafts of different diameters with equal facility as shafts of the same diameter. A connecting sleeve has a central partition that divides the sleeve into two sections. To each section the end of a shaft is coupled, by means of eccentric wedges, a main key with top and bottom tongues, and a longitudinal key-binding bolt. The sleeve has circumferential flanges to protect the nuts of the bolt ends. As each shaft forms an independent coupling with the sleeve, shafts of different diameter may be coupled to the sections of the sleeve, the jaws and key merely varying in size.

IMPROVED OIL PRESS MAT.

Joseph L. Perkins and George O. Baker, Selma, Ala.—This consists of an oil press mat made of wood or metal plates, and covered with leather. The plates impart to the mat the main strength, and admit thereby of a higher degree of pressure than the hair mats while lasting longer and being more effective than the same.

IMPROVED BOBBIN WINDER FOR SEWING MACHINE.

Charles L. Noe, Bergen Point, N. J.—This consists in hinging the guide and spring held presser roll of a bobbin winder to facilitate the putting in and taking out of the bobbin.

IMPROVED FLOOD GATE.

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Notes & Queries

W. T. R. will find directions for purifying mercury on p. 131, vol, 30.—T. T. L. should consult a lapidary.—W. T. C. can waterproof his cloth by the process described on p. 347, vol. 31.—M. A. S. can utilize old rubber by the process detailed on p. 349, vol. 26.—W. J. will find directions for bronzing on pp. 11, 85, vol. 33.—E. J. K. should use marine glue. See p. 42, vol. 32.—McG. B. can cement pieces of marble together with plaster of Paris.—W. W. can dye his billiard balls red by the process given on p. 332, vol. 30.—W. T. B. will find an answer to his query as to church ventilation on p. 356, vol. 29.—R. M. C. will find on p. 74, vol. 31, particulars of the lifting power of hydrogen.—H. H. S. can mold rubber by the process given on p. 363, vol. 30.—L. R.'s trouble with the wind wheel is an optical delusion.—W. F. D. W. can anneal his lamp chimneys by the process given on p. 42, vol. 26.—J. G. G. will find a description of the compression engine on p. 66, vol. 34.—L. H. E. will find an answer to his query as to a cannon on a moving car on p. 273, vol. 32.—W. L. G. can unite glass with brass with the cement described on p. 117, vol. 32.—A. S. can paste paper labels on tin with the preparation described on p. 26, vol, 34.—C. D. T. can bleach straw hats by the process given on p. 11, vol. 32.—C. H. R. will find a full description of felting processes on p. 50, vol. 34.—D. J. I. will find a description of the tallest chimney in the world on p. 311, vol. 32.—W. C. R. will find directions for making furniture polish on p. 315, vol. 30.—C. L. B. will find directions for renovating gilt picture frames on p. 27, vol. 31.—F. W. K. will find directions for hardening tallow on p. 202, vol. 24.—H. B. L. can remove inkstains from marble by the process described on p. 58, vol. 30.—G. A. R. will find the table of weights of iron castings in proportion to those of wooden patterns in *Wrinkles and Recipes*.—J. W. C. should consult an oculist.—A. M. M. will find an article as to pressure on slide valves on p. 299, vol. 31.—E. N. C. will find a description of a small furnace for melting brass and iron on p. 235, vol. 32.—M. C. will find directions for making a battery for electrotyping on p. 26, vol. 32.—G. M., Jr., will find on p. 75, vol. 34, a recipe for *eau de Cologne*.—H. B. P., A. S., D. K. H., R. J. W., C. A. S., W. W., W. S., J. D. H., J. B B., J.G., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. W. A. says: I am about to put a flag pole on top of our store, and I am somewhat fearful of lightning striking the pole. How shall I arrange it? A. If you have a good lightning rod on the house, provide the pole with a good sized copper wire and connect the latter to the rod.

(2) H. W. G. asks: 1. Can I deposit alum inum or wrought iron by the electro process? A. It is difficult to do Several processes have been published, but they do not appear to be of any practical value. 2. Can I coat wrought iron with the aluminum by melting and dipping, as with zinc? A. We believe this has never yet been successfully accomplished.

(3) X. Y. Z.—You do not furnish sufficient data to have your question answered with any degree of accuracy. To what use is the flow to be put? How thick are the walls that are to support it? If for warehouse purposes, how high is the story to be for which this is to serve as a flow?

(4) J. W. asks: 1. How can I make one of the ink wheels used on printing telegraph instruments? A. Cut circles of beaver cloth, and place them together until the required thickness is obtained. Fasten with a small bolt and nut. 2. How is the ink put in the wheel? A. The wheels are thoroughly saturated with ink at first, and a little added daily while the wheel revolves.

(5) D. A. W. says: You recently described an electric pile in sesquioxide of iron, having one pole formed of a prism of charcoal, containing sesquioxide of iron in its pores. Is the prism composed of common charcoal, and how is the sesquioxide of iron placed in its pores? A. Charcoal or carbon will answer. Try soaking the carbon in an aqueous solution of the sesquioxide.

(6) C. M. B. asks: 1. In constructing a battery, how must I connect the wire to the disk of zinc? A. By solder. 2. How must I connect the insulated wire to the coil of copper wire, and also to the wire leading from the zinc of the next cell? A. The insulated wire may be connected to the wire coil by solder or by twisting the two ends together. It is usual and more convenient to employ binding screws for connecting one cell with another. 3. What is the most readily obtainable form of insulated wire that I can substitute for the gutta percha covered? A. Gutta percha or kerite is the best covering.

(7) E. B. K. says: I am desirous of constructing an electric light sufficient to illuminate a medium sized room. How many cells of Daniell's battery will it require? A. If a steady light is desired, it will be useless to operate without an electric lamp, and this, as usually made, is a costly apparatus. Forty or fifty large sized cells, of the form commonly called the tray battery, will give a good light.

(8) T. M. B. says: 1. I wish to build a small telegraph from one room to another. How can I soften ordinary round iron for the poles? A. It is not absolutely necessary to soften them, but you can do so by heating them red hot and allowing the fire to die out very slowly while they remain in it. 2. How shall I connect them, and what should they be wrapped with? A. Connect by means of a piece of soft iron, and wrap with copper wire covered with silk or cotton. 3. Please give me full directions for making a small sulphate of copper battery. A. See answer to E. M. C. on this page. 4. How many cells shall I need, and how shall I connect the battery with the poles? A. Four or five cells should be sufficient. Connect the zinc of one cell to the copper of the next in order; join the copper of the first cell to one end of the line and the zinc of the last to the other. Insert the coils of the magnets in the line circuit, so that the current shall traverse their whole length.

(9) G. A. T. says: I made a small induction coil for lighting a gas jet. Instead of putting my iron wires in a bundle in the center of the primary coil, I reversed them, putting the wires outside and surrounding the primary and next to the secondary coil. It works admirably. Has it ever been tried on large coils? A. We believe so; at any rate the idea is not new.

(10) E. M. C. says: 1. How can I make a battery for running a magnetic engine? A. A good form of sulphate of copper battery can be made thus: Fill a large jar about two thirds full with water in which about ¼ lb. zinc sulphate has been dissolved. Place a disk of copper, to which a gutta percha covered wire has been soldered, at the bottom of the jar; suspend a zinc casting or plate from the top, and drop a few crystals of copper sulphate on the copper disk. A wire from the zinc and one from the copper form the poles. The plates should expose considerable extent of surface if large wire is used for the machine. 2. What is the best form of such an engine? A. One of the easiest to construct consists of two electro-magnets, between which a piece of soft iron mounted on an upright is made to vibrate. The upright may be suspended or supported on an axis below. It also carries an attachment by means of which the current is shifted from one magnet to the other as it vibrates to and fro. The magnets are thus charged alternately, beginning with the most distant from the soft iron. Expensive machinery is not required for the construction of such an engine.

(11) F. L. H. says: I have a small electrical instrument known as a vibrating shocker. Will such an instrument give a current with Bunsen's cells, strong enough to decompose water? If so, how many cells will be required? A. Such an instrument, with a single cell, will probably decompose water, but we fear the quantity of the current is so small that the process would be a slow one.

(12) M. A. W. says: 1. In a plate electric machine, how large in diameter should the plate of glass be, and how thick? A. The plates are made of various sizes. One of 12 or 15 inches in diameter, and ⅛ or thereabouts in thickness, will be found easy to manage. 2. What would be best to make the cushions of? A. Make them of leather and stuff with horsehair. 3. Would iron wire $\frac{1}{16}$ inch in diameter do to connect the cushions to the ground? A. Yes. 4. Would an iron rod 1½ inches in diameter do to make the prime conductor of? A. Make the prime conductor of brass or tin tube, about 2½ or 3 inches in diameter, and have the ends rounded. 5. What diameter ought the arms to be, that connect the prime conductor and plate? A. About ¼ inch. 6. Of what metal should the points be? A. Any kind of metal will answer for the collecting points.

(13) E. W. asks: 1. Will a common unglazed earthen cup answer for a porous cup for Bunsen's battery? A. Yes, if not baked too hard. 2. How can I make a piece of wood a non-conductor? A. Soak it in melted paraffin.

(14) P. W. M. says: I read an article in your paper on taking life by electric shocks instead of hanging. I have experimented with a rat. I laid him on a table, and took a coil giving an 18 inch spark. I made connections with his mouth and tail, put on 6 large Grenet cells, and left the current on about 5 minutes, and apparently it did not affect him. I then made the connection through his two ears; this seemed to have killed him; but when I put him in the cage, in 5 minutes he opened his eyes and was as wild as ever. Please explain this. A. We are not in favor of practising cruelty to animals, not even to rats; and we do not wonder that your victim was wild. Had you placed him on a glass or ebonite plate,and arranged the connections so that the full force of the machine should be transmitted through him, we doubt if there would have been any occasion for repeating the experiment with that particular rat.

(15) J. S. asks: 1. What kind of a battery will produce the decomposition of water? A. Two or three ordinary Bunsen cells will answer. The same number of Daniell cells might do, but the action would be much less rapid. 2. How large a battery will cause 9 feet of No. 30 platinum wire to get red hot? A. It will probably require forty cells of Bunsen battery of very low internal resistance.

(16) E. says: 1. have an eight day clock which I am causing to make and break an electric current once every second. What is the proper metal or other substance to use in making the points of contact? How can I make and break the contact infallibly? I want to use the force of the current for lifting when I have the contact made. A. Nothing better than platinum is required for the contact points. If the spark arises from the extra current in the magnet coils, it can be cut off by using a condenser or resistance coil, one terminal of which is to be connected on each side of the break. If a resistance coil is used, it must be adjusted for the particular circuit in which it is to be placed. 2. Is the Hill gravity battery the best? A. Hill's is one of the best forms of the sulphate of copper battery. For light, however, or when strong currents are desired, the form known as the tray battery is better. 3. Is a horseshoe magnet the best form for lifting, and what size of wire will be the best? A. Yes. If the cups are connected in series, the resistance of the wire forming the coils should equal about 12 ohms. 4. How can I produce an electric light to illuminate a circle of 3 feet, to be kept going all night in the most simple and economical manner? A. Perhaps a carbonic acid vacuum tube, as arranged by Gassiot in connection with a small induction coil, would answer. It would certainly be the cheapest. See a description in the "Student's Text Book of Electricity," by Noad.

(17) W. C. A. says: How much wire and of what size will I require for a relay of about 120 ohms resistance? A. Nine ozs. of No. 28 pure copper wire will be about right.

(18) W. E. D. asks: 1. Would 6 pairs of magnets 3 inches long, 1½ diameter, with ½ inch iron for core, covered with No. 23 or 24 wire and placed at equal distances around a revolving wheel be of good proportion and have sufficient power to run a sewing machine if proper batteries were used? A. Ten or twelve bar magnets so placed would answer; we should, however, prefer larger wire, say No. 20, and use six cells, coupled three in series and two in parallel circuit. 2. How does the Eagles metallic battery compare with the Calland for strength and durability? A. The electromotive force is the same; as a general thing, however, the Eagles battery gives a stronger current on short circuit, in consequence of its lower resistance. 3. Does an ohm denote a unit of power or resistance? A. An ohm is the unit of electrical resistance. 4. In connecting batteries for quantity or tension, would quantity give more power or strength for lifting weights, etc., and tension greater power for overcoming resistance, as on a telegraph line? A. Yes.

(19) H. H. M. asks: How can I fasten pieces of sponge on to rubber, tin, or glass? A. Melt together in an iron pot equal parts of common pitch and gutta percha, and stir well. Use while hot

(20) W. M. says: 1. Suppose I have a 100 feet weight at the bottom of a stream 20 feet deep. What amount of hydrogen would it require to bring it to the surface? A. If the iron weighs 100 lbs. in the air, it will weigh only about 87 lbs. when immersed in the water. As iron weighs nearly 8 times as much as an equal volume of water, in order to balance 87 lbs. of the iron we shall have to displace about 696 lbs. of water. If we should measure our water we would find that it required about 28 cubic inches of water to weigh 1 lb., and consequently our 696 lbs. of water would measure 19,488 cubic inches, or about 11¼ cubic feet. An equal volume (19,488 cubic inches) of hydrogen will weigh 417 grains, or about the same as 1·65 cubic inches water. We must, therefore, add to the above quantity (19,488 cubic inches) sufficient measure of gas to displace about 2 cubic inches of water. 2. What amount of zinc and sulphuric acid would be required to generate the hydrogen in two minutes? A. Good zinc and strong hydrochloric acid would furnish hydrogen in large quantity and quite rapidly; but so much depends upon the apparatus employed, the purity of the materials used, and the temperature at which the operation takes place, that we can furnish you with no definite figures.

(21) H. P. B. asks: Can eggshells be utilized? A. We do not know that they have ever received any practical application in the arts. If obtainable in large quantities, they might be employed for fertilizing purposes.

(22) J. S. C. says: I send you a piece of a brown stocking which we purchased for a little girl 2½ years old. She soon complained of feeling badly, and was slightly sick at the stomach. Her mother took off the stockings, found her feet and legs discolored, and washed them off, and put on other stockings, when she felt better. I should not have thought so much about it, but I have heard of a case of decided poisoning from brown stockings, which had been colored with picric acid. A. The specimen seems to have been dyed with one of the aniline colors. If you will send us a larger piece of the material, we shall be happy to give the substance a chemical examination.

(23) B. C. Jr. says: I want a dye for coloring pine wood green, of a shade like that of trees and plants. A. To 3 pints of strong vinegar add 4 ozs. best verdigris, ground fine, ½ oz. sap green, and ½ oz. indigo. Boil the wood in this for several hours.

(24) R. L. L. asks: 1. How can I make a good waterproof boot grease? A. Take ½ lb. of shoemaker's dubbing, ½ pint linseed oil, ½ pint strong solution of india rubber. Dissolve the whole with a gentle heat (it is very inflammable), and apply with an ordinary blacking brush. One application will insure dry feet for several months. Of what substances and in what proportions is the camphor barometer made? A. See p. 230, vol. 33.

(25) W. T. asks: If an apparatus made from $\frac{1}{16}$ inch sheet iron be galvanized in every part after completion, will it have a tendency to corrode or rust if worked in either hot or cold water? A. Provided the water is pure, and the iron well galvanized, there should be no appreciable corrosion.

(26) J. D. J. asks: How can I make a phosphorus lamp that will work? A. If a strong solution of clear (not red) phosphorus be made in any of the essential oils, and a thin film of the solution be exposed to the air in a dark room, a strong phosphorescent glow will be observed. Advantage has been taken of this slow but luminous oxidation of phosphorus to construct numerous toys

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one of which is aptly termed the phantom lamp. It is commonly a strong solution of phosphorus in olive oil, half filling a small phial having a wide mouth for the admission of air when in use. A better plan is to have a piece of porous earthenware (biscuit) fastened to the lower portion of the stopper and dipping beneath the oil; and when it is desired to use the lamp, the stopper (cork) is reversed, when the whole surface will glow quite strongly with the characteristic phantom light.

(27) C. A. J.—Send us your address; we will be happy to accommodate you as to the Stevens Institute.

(28) B. H. S. asks: Would it be dangerous or unhealthy to sleep in a new bedstead painted with Paris green and varnished over? A. If the wood has been well varnished, we think not; but if the bed has not already been painted, we would advise you to employ some other variety of pigment, that does not contain arsenic.

(29) C. H. R.—We are not familiar with the particular gas machine you speak of. You should state concisely what the mode of operating the machine is, or send us illustrations or drawings of the same. Generally speaking, machines of this character, unless constructed and operated with the greatest care, are not safe.

(30) J. McD. asks: 1. What chemical change takes place in milk when it turns sour? A. When milk is allowed to stand for a short time it sours and curdles, that is, its casein changes from the dissolved to the solid state. This is brought about by a series of interesting changes, originating in the unceasing activity of atmospheric oxygen. Casein is insoluble in water, but in the milk it exists combined with soda, and this compound is soluble in water. When fresh milk is exposed to the air, its oxygen seizes upon a portion of its casein and causes it to ferment; this takes effect upon the milk sugar and converts it into lactic acid, which causes the sourness of the milk. 2. How can it be restored and made sweet again? A. When a sufficient quantity of lactic acid is formed, it seizes upon the soda, takes it away from the casein, and forms lactate of soda. The casein thus set free shrinks in bulk, and gathers into an insoluble curdy mass. This precipitated casein may be readily redissolved by the addition of a little soda; the milk, however, although it may still be palatable, will by no means recover its original flavor, owing to the partial decomposition of the milk sugar.

(31) R. E. D. asks: 1. Will a 6 horse engine do to run a circular saw or a good sized corn mill? A. An engine of the size you mention will run a circular saw from 48 to 50 inches in diameter, or your corn mill. 2. How large a sawmill will it run, and how much lumber will it cut per day? A. If your saw is run at the regular speed, say 9,000 feet per minute at the periphery, every ⅛ inch feed to every revolution will cut on an average 1,000 feet of lumber per day; ¼ inch feed will cut 2,000 feet: 6 inserted teeth in the saw will be plenty to saw this amount of good smooth lumber.—J. E. E., of Pa.

(32) W. A. W. asks: Why, if you make the bottom of a cistern concave, will it present a greater resistance to the action of the water than if it were flat? A. In some localities the water in the ground rises to within a few feet of the surface; and in such places, when a cistern is sunk to a good depth, the pressure from beneath on the bottom is considerable. The sides, being built in arched form, can withstand this outside pressure very well, but the bottom, when flat, has no power of resistance except what is given to it by its weight. When the cistern is filled with water the construction is firm enough, but when it becomes empty, as frequently happens, the upward pressure cracks the bottom, and a movement commences which eventually destroys the work. If, in a dry time, the water then lies lower in the ground, the cistern will leak and become useless. The answer referred to said "that, if the bottom were built concave, it would present a greater resistance to the action of the water beneath." We know of one instance, somewhat in point here, where it cost $1,000, spent in experiments, to protect the bottom of a vault from the upward pressure of water coming from a saturated under stratum.

(33) E. A. K. says: In villages it is possible to arrange, for water supply, a tank of boiler iron to receive the rain water from the roofs; but it is difficult to obviate rust, which discolors the water. To procure an easily working and durable faucet is also difficult. Can you help us to solve these difficulties? A. Cast iron tanks do not rust with the rapidity of wrought iron, and always keep tight. If you use what are called compression faucets, you would not be subject to the other annoyances complained of.

(34) S. F. S. asks: Can you give me a recipe for an ink that will be invisible when written, but which can be brought out by heating? A. Use a dilute solution of chloride of cobalt in water.

(35) W. C. asks: 1. When should timber be cut to give best results against rotting? Is it too late now (March) to cut timber here, where there are 2 feet of snow on the ground? A. Yes: it should be done before the sap begins to flow. 2. What is dry rot? In our mill the floors are constantly damp, our ceilings are (between the doors and ceiling) dripping wet from condensed steam that rises from the drying apparatus. One mill built six years ago is so rotten from foundation up that you can push your thumb into the timber. A. The rotting in your case is not dry rot, but decay of the wood from the constant absorption of water from the surface, and the consequent disintegration of the fibers. Dry rot manifests itself in cases where the material is closely encased in iron, brick, cement, etc., so as to be entirely excluded from the preservative influences of the atmosphere, and is most frequently found at the ends of timbers which have been let into a wall or encased in an iron shoe. A prominent instance of the latter occurred where the tie beams of the principal roof trusses of a church were discovered, from a slight settlement, to have been rotted off at the ends, where they were encased in a very large airtight iron shoe. The remedy in your case would seem to be to protect the wood from contact with the water, and at the same time to give it free access to currents of air; there should be sufficient change of air to carry off all the moisture without depositing it upon the surrounding surfaces of the room. 3. Would good sound and dry hemlock or chestnut, buried in hydraulic cement concrete, be proof against decay of any and every kind? A. No.

(36) J. A. asks: How can I build a filter on the side of a stream of water which is subject to sudden rises of from 2 to 8 feet, getting at such times very muddy? A. Several attempts have been made to filter large quantities of water from rivers without success; the filter beds were soon rendered useless by the great amount of filtered material deposited into them. The plan that has been adopted after the failure of the filter beds is that of a reservoir with a central dividing wall. One of the compartments thus formed is periodically filled, the water allowed to settle and then drawn off clear into the other, from which a constant distribution is made. The authorities at Poughkeepsie, N. Y., as also the Hudson River Hospital for the Insane, at the same place, have both passed through this experience.

(37) W. S. C. and others.—Wherever the waste water of a house can be conveyed away by a drain, it should be done, instead of letting it stand in a cesspool or suffering it to settle into the ground. Thirty-six feet of filtering material, as you mention, ought to purify the water as far as it can be satisfactorily done by mechanical and partially chemical means, but not wholly; a drain is better.

(38) J. C. asks: Does galvanizing cast iron tend to weaken the iron? A. We think not.

(39) F. P. asks: 1. Will a shaft or a spindle of a machine that is run at 2,000 revolutions per minute take more power than one run at 4,000 a minute. A. No. 2. Is not the balance wheel of an engine merely to govern the motion of the crank shaft? A. Yes. 3. Will a circular saw spring more from not having any set, or will it spring more from heating of the saw mandrel? A. From not having any set. 4. Is it a good plan to give a saw set enough, so that it does not bind on its sides? A. Yes 5. Is an engine which runs at 150, or one which runs at 200, revolutions a minute more economical? A. Quick piston speeds are the most economical.

(40) S. F. B. asks: What are the comparative lasting qualities of upright tubular boilers and those of locomotive or horizontal tubulars? A. So far as we know, there is not a great deal of difference, if the boilers are well built.

(41) A. W. S. says: I have seen several references to cutting copper and other soft metals by means of a disk of iron running at high speed. We have to cut up a great deal of 2½ inch No. 16 gage seamless copper tubing into short lengths; and using a fine saw, we have considerable trouble with its running. Can we cut it in the former way? A. Yes. Use a disk running about 25,000 feet per minute, of about 10 inches diameter, made of best charcoal iron.

(42) W. F. R. asks: What is meant by the axis of a magnet? A. The straight line joining the poles.

(43) A. J. says: 1. I have a 12 x 20 inches engine which will run two planers, rip saw, and scroll saw, with 20 lbs. steam; yet it takes hard firing under a boiler 42 inches x 18 feet, with two 13 inch flues. The engine runs at 125 revolutions per minute. Would it not be better to speed the engine down? A. Yes, if the engine would still be powerful enough for this duty. 2. How should the valve be set to use steam most economically? A. If a common slide valve, set it to cut off at three fourths of the stroke. 3. What would be the proper shape of the furnace? We have a good draft. A. We cannot say, unless we know the description of your boiler.

(44) L. B. C. & S.—There is probably something wrong in the arrangement of your pipes or valves, as the ram ought to do very well under the given circumstances. We think the wheel you speak of will give plenty of power. It would be better to have a valve in the delivery pipe.

(45) F. W. B. asks: What are the objections to the use of clockwork as a motor, to run a churn? A. The principal objection is the labor required to wind the spring. There are numerous light spring motors in the market, and by corresponding with their manufacturers you can doubtless obtain information about details. It has occurred to us that spring motors, suitable for household operations might be devised, to be wound up by a steam engine at some central locality, and distributed where desired.

(46) T. H. asks: How is the water got to the working barrel of a pump? Is it by suction, or atmospheric pressure? A. By atmospheric pressure. See article on "Suction," p. 352, vol. 31.

(47) W. D. M. asks: The grist mill in this place is driven by a 10 x 16 inches horizontal engine. The exhaust comes out on the under side of cylinder into a 3½ inch tin pipe which runs horizontally for about 8 feet, then turns up 2½ feet, and enters the heater. They are troubled by the tin pipe collapsing. This always has happened when starting the engine. What is the cause? A. The steam condenses in the pipe, so that a vacuum is formed. Attach a vacuum valve on the upper part of the pipe near the place where it collapses, or use an ordinary cock, which can be opened on starting the engine.

(48) W. A. says: I am making some experiments with a machine in which I wish to light kerosene in a place inaccessible with a match: is there not some cheap magnetic machine by which I can accomplish it? A. Yes. Two or three cells of Bunsen battery will heat a short length of No. 36 platinum wire red hot, if the resistance of the circuit is not too great.

(49) J. H. S. asks: What is the best method of renewing a carbon plate used in an electrotype battery? A. Soak the carbon in warm water. If it is to be used in the porous cup of a bichromate battery, you will find it slightly advantageous to place it for a short time in nitric acid.

What is the proper proportion of zinc to muriatic acid in making a soldering solution? A. Add zinc until the acid is nearly exhausted.

(50) J. L. asks: 1. Must steel be tempered before being magnetized? A. Yes. 2. At what heat does steel lose its magnetism? A. At a red heat.

(51) J. H. says: 1. What is meant by the brass rim of the lens, which the pieces of looking glass are fitted into, in your description of a homemade microscope of October 30, 1875? A. Magnifying glasses are usually mounted in a brass or hard rubber ring. We presume such is the rim referred to. 2. Where can I procure the lenses required? A. At any optician's. 3. Would the same sized stand do for a microscope to magnify 1,000 to 1,500 times? A. Yes.

(52) H. S. T. says: In regard to propellers, I used a two-bladed, one of the ordinary kind, for two seasons, and the vibration was very unpleasant; but for the last two summers I have used a modification of Dr. Collis Browne's (illustrated in the SCIENTIFIC AMERICAN some time ago); with that, the speed was increased about one third and all vibration ceased, and she glides along with all the smoothness of a sail boat. I make my propellers with cast iron hubs, into which I screw wrought iron arms and rivet on sheet iron blades, making very cheap and efficient wheels.

(53) R. W. R. says, in answer to W. H.'s query as to the tension of a cotton rope: Midway between the two buildings is a post holding 2 idler pulleys, elevated 20 feet, over which the rope runs. The sag of the rope, which is about 3 feet out of a straight line on each side of the idlers, keeps up the tension when the rope stretches.

(54) H. S. T. says, in answer to many correspondents: I will give you my experience with a small boiler. I constructed a boiler for a steam carriage; it is 15 inches in diameter and 30 inches high. The firebox is 14 inches in diameter and 12 inches high, with 207 copper tubes ⅛ inch in diameter and 10 inches long. Plates are only $\frac{1}{16}$ inch thick, of the best steel. Total weight, including all fixtures, is 200 lbs. It made steam for 2 cylinders of 3½ inches bore by 10 inches stroke, and ran the carriage (weighing 550 lbs., complete) on a smooth road a mile in 4 minutes, with one person and fuel and water. I have the boiler now in a boat, 21 feet long and 5 feet wide; it drives two cylinders of 2¾ inches bore and 5 inches stroke. Propeller is 22 inches in diameter. It makes plenty of steam, and, with good dry wood, I have the furnace door open much of the time to keep down the steam. I usually run at 60 lbs., and at that pressure it runs the boat about 7 miles per hour with about a bushel of wood.

(55) L. L. L. says, in answer to E. P.'s query as to printing in gold and bronze: To print clearly, use the finest quality of powder and size: use as little size as possible, and distribute it well; roll it thoroughly on the type, use only two sheets of smooth paper on the platen (for blanket), place five or six thicknesses of soft paper beneath the form, pull a light and quick impression, apply the powder carefully, and dust off thoroughly with a camel's hair pencil.

(56) C. R. L. says, in reply to T. C. M., who states that, in a sheet copper vessel, the sulphate of copper solution, after being allowed to stand for a few weeks, has deposited a hard, greenish coat, which prevents the working of the battery of which it forms a part, and asks how it can be removed: This is by no means unusual where the copper salt is very impure or contains a considerable excess of sulphuric, nitric, or acetic acids. When a piece of sheet copper is placed in a solution of sulphate of copper, already saturated with the salt, and containing a free acid in excess, a thick scum of copper salts soon forms on the surface of the copper, which, if allowed to remain or accumulate long enough, not only very materially weakens the current (in case the copper plate is a negative element in a battery) but offers a nearly perfect protection to the copper, so much so that the addition of strong nitric acid is without action, or nearly so, upon it.

(57) J. G. V. says, in reply to W. A. F., who asks for a plan for straightening wire: Fix three collars on a frame, two on the same level and the third one above and between the others This last one can be moved up and down by screws. The lower ones should turn freely on their centers, but have no other motion. Grooves of different sizes are cut on the rollers, and the wire is passed between the rollers in the groove nearest to the exact size of the wire.

(58) L. S. W. says, in reply to J. C. W., who asks how large a cube can be cut out of a ball 12 inches in diameter: The largest cube has for one of its sides the side of a square inscribed in one of the large circles of the ball. If x is this unknown side, $x=R\sqrt{2}=6\sqrt{2}$, that is, $x=8{\cdot}485281$ inches. The volume of this cube is 610·4026 cubic inches.

(59) J. H. asks: What cement is the best to harden quickly and resist the action of dampness the longest, without losing its firmness? A. Portland cement.

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

G. G.—It is iron pyrites.—W. H. S.—It is lignite containing iron pyrites.—A. J.—One is quartz, and the other is iron pyrites in limestone.—A. W. S.—No. 1. The shining particles are scales of mica. No. 2 is crystallized carbonate of lime. No. 3 is quartz. No. 4 is impure limestone. No. 5 is gneiss rock.—C. M. D.—It consists of carbonates of soda and lime.—I. R.—It is a variety of brown ocher. It is of no particular value.—J. L. I.—They all consist of clay and sand cemented together by a small amount of oxide of iron. They are not iron ores.

J. J. W. asks: How are glass marbles of different colors made?—J. I. asks: How can I preserve speckled or brook trout in cans, etc.?

COMMUNICATIONS RECEIVED.

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

On a Raft in a Stream. By R. K. B.
On a Scroll Saw. By C. A. S.
On Barbecues. By C. S.
On Incubation. By G. N. S.
On Man in Limestone. By M.
On Small Engines. By J. S.
On Sailing Faster than the Wind. By J. G.
On Italy. By C. E.

Also inquiries and answers from the following:

C. B. H.—A. B.—W. K.—J. H. M.—W. S. G., Jr.—P. C. N.—H. B.—E. E. E.—M. B. H.—E. W. N.—R. C.—B. P. K.—L. & W. W.—E. F. W.—J. E. W.—R. G.—H. J. G.—J. C. W.—B. F. M.—S. M. G.—L. B. S.—T. S. L. G.—F. McD.—E. M. L.—A.—W. H. M.—W. H. S., Jr.—J. N. H.—J. D. G.—C. F.—E. B. R.—R. S., Jr.—J. M.—C. C. R.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes elevators, worked by hydraulic power? Who sells waterproof matches? Who sells cracker-making machinery? Who makes chilled iron or cast steel balls, turned up to a perfectly spherical shape?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

March 21, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specification and drawings, 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

Alarm, burglar, P. Abrell ... 174,997
Auger, earth, J. Campbell ... 174,945
Baking powder, C. Arnois ... 174,890
Ball and socket joint, A. P. Webber ... 174,990
Barrel, H. C. Sheffield ... 175,177
Base ball cover, M. S. Ryan ... 175,172
Battery, galvanic, F. C. Kinemund ... 175,112
Bedstead, cot, G. L. Unverzagt ... 175,211
Bedstead fastening, J. W. Strong ... 174,984
Bedstead, sofa, D. Lovett ... 175,123
Bee hive, O. Colvin ... 175,034
Bird cage, A. B. Hendryx ... 175,089
Bit brace, Ives & Rutz ... 175,105
Bit brace, F. P. Pfleghan ... 175,151
Blind slats, tenoning, W. H. Doane ... 175,054
Boat-detaching hook, R. & A. McMaugh ... 175,130
Bobbin, I. Cundey ... 174,947
Boiler, sectional steam, V. D. Anderson ... 174,931
Boiler, wash, D. D. Hooper ... 175,10
Boiler, water tube steam, W. R. Parks ... 175,146
Bolting safe doors, C. O. Yale ... 174,995
Boot counters, skiving, O. Littlefield ... 175,121
Boot jack, J. Green ... 175,076
Bottle stopper, A. Luthy ... 175,124
Bottles, reducer for siphon, E. Deblieux ... 175,049
Bridge, J. J. Reicherts ... 175,165
Bridge, flying, D. M. Pfautz ... 175,150
Broom stay, J. H. Anderson ... 175,003
Bucket ear, F. L. Roy ... 174,980
Burial case, Case & Richardson ... 175,030
Burr dresser, J. Davis ... 175,045
Button, N. C. Newell ... 174,923
Button polishing machine, P. Cahill ... 174,89
Can schield, G. W. Banker ... 174,934
Cap pad, S. A. Taylor ... 174,985
Car brake, Waitt & Garrett ... 175,214
Car brake shoe, I. H. Congdon ... 174,898
Car dumping, G. A. Gregg ... 175,075
Car, dumping, I. B. Howe ... 174,960
Car mat, J. W. Groat ... 175,079
Car starter, J. M. Mayhew ... 174,966
Car starter, J. Putnam ... 175,162
Car truck, one rail, A. G. Buzby ... 175,027
Car signal, electric, D. Rousseau ... 174,979
Cars, ventilating, E. E. Hargreaves (r) ... 7,010
Carriage, child's, F. Traub ... 175,209
Chain link, ornamental, V. Draper ... 174,949
Chair bottom, W. E. Pruyne ... 175,16

© 1876 SCIENTIFIC AMERICAN, INC.

Chairs, spring-tilting, A. B. Stevens.......175,195, 175,199
Chair desk attachment, C. B. Sheldon............ 175,176
Chimney, fireproof, Bolton *et al*.................. 174,939
Churn, Brown & Colbert............................ 175,023
Churn, J. C. Daman................................ 175,043
Churn, rotary, H. E. Smith......................... 175,187
Cigar case, C. F. Rumpp............................ 175,171
Clock case, H. J. Davies (r)........................ 7,002
Cloth, measuring, Harrod & Ogden.................. 175,086
Clothes sprinkler, H. Fisher........................ 175,063
Coal screen, W. E. Phelps.......................... 175,155
Coffee pots, strainer for, A. M. Goldstone........ 175,072
Cofiee steeper, E. Spencer.......................... 174,983
Cooking utensil, F. Gates........................... 175,067
Cooler, milk, W. Hodgdon........................... 175,094
Cooler or warmer, milk, D. D. Whitaker 175,222
Corset, Whittier & Andrews......................... 175,224
Corset spring, C. A. Baldwin....................... 175,007
Cotton-opening machine, E. Buckley.............. 175,024
Cultivator, S. Walton................................ 175,216
Cultivator, wheel, O. C. Green..................... 175,077
Curry combs, C.A. Hotchkiss.174,907, 175,096, 097, 098, 099
Curtain fixture, D. E Kempster..................... 174,910
Cylinders, forming welded, M. Blakey............ 175,015
Dam, adjustable, S. Phillips 175,153
Demijohn, D. H. Shourds............................ 175,178
Dental articulator, G. G. Davidson................ 175,046
Dental mallet, electric, A. Spencer................ 175,189
Dental rubber dam, E. P. Brown.................... 174,942
Directory and desk. W. Walter...................... 175,215
Door check, S. R. Billings........................... 175,013
Drawer pull, S. A. Burns............................ 175,025
Drier, Lee and Geiger............................... 175,116
Drill, rock, W. H. Wright........................... 175.233
Drills, making twist, E. S. Taber 175.201
Eaves trough hanger, J. F. Hess.................... 175,092
Electroplating, C. S. Minchew...................... 175,134
Elevator bucket, S. Hughes 175,102
Elevator, hay, J. C. Cramer......................... 175,038
Elevator, portable, V. Andry........................ 175,002
Elevators, chain for, P. Anderson (r)............... 7,001
Engine frame, steam, L. D. Bartlett................ 174,935
Engine valves, E. Hill, Jr................. 174,954, 174,956
Envelope, H. E. Brown.............................. 174,940
Envelope fastener, B. F. Stephens 175,191
Excavating, submarine, C. Pontez.................. 175,158
Fabrics, ornamental, S. Barlow..................... 174,891
Feather renovator, L. W. Manning................. 175,126
Feed water regulator, J. S. Tresize *et al*......... 174,986
Felly expander, J. K. Minich........................ 174,970
Fence, L. Parker 174,973
Fence, iron, T. Robinson............................ 175.168
Fence, portable, D. S. Harner....................... 175,083
Filter for drugs. etc., C. E. Gates.................. 175,066
Fire arm, revolving, T. J. Sloan.................... 175,180
Fire extinguisher, etc., E. M. Crandal............. 175,039
Fire pot, J. Chartier................................. 174,897
Fishing rod reel, Winans and Whistler............ 175,227
Flowers, making stamens for, A. Giraudat....... 175,069
Flowers, dipping stamens for, A. Giraudat....... 175,070
Fluting machine, H. Albrecht....................... 174,999
Foot power, W. F. and J. Barnes................... 175,010
Foot powers, treadle for, H. Anthony.............. 174,933
Furnace. M. G. Fagan 175,059
Furnace, gas, H. Coll................................ 175,033
Furnace, gas, W. S. Gillen.......................... 175,068
Furnace, gas, W. L. McNair......................... 175,131
Game board, F. Homrighausen..................... 174,958
Game counter, J. Whitelaw......................... 174,992
Gas liquefying pump, J. Boyle...................... 175,020
Gas injecting apparatus. Van Kannel *et al* 175,213
Gas, illuminating, J. C. Tiffany.................... 175,206
Glass melting pot, A. Harcum...................... 175,081
Glassware, pressed, B. Bakewell, Jr................ 175,006
Glove stretcher, C. C. Wilson....................... 175,225
Grain, transhipping, W. Goodwin.................. 175,073
Grain drill, H. Garrett 175,065
Grain drill, G. M. L. McMillen...................... 174,967
Grass leveler, R. Newton............................ 175,141
Hank for jibs, etc., M. Pease......................... 174,975
Harness hame, Dodd and Brower 175,053
Harness trace, Slawson and Triphagen 175,179
Harrow, M. D. Lawrence............................ 174,913
Harvester, J. J. Piggott............................... 175,157
Harvester cutter, A. D. Hager....................... 175,080
Harvester dropper, P. H Marquette................. 175,128
Harvester finger catch, E. F. Herrington 175,090
Harvester journal box, T. S. Brown................ 174,941
Harvesters, divider for, S. D. Locke............... 174,964
Hasp, crate, J. De Lamater.......................... 175,052
Hat bodies, forming, Wharton *et al* 174,991
Hat ventilator, C. F. Abbott 174,998
Hay loader, Wilson and Bartlett.................... 175,226
Heater, feed water, J. C. Stead...................... 175,193
Hoops, shaving round, G. B. Selden................ 175,174
Hop boxes, shade for, H. N. Harrington........... 175,084
Horse boot, J. Fennell............................... 175,062
Horse sweat pad, etc., E. R. Jones.................. 175,108
Horse power, N. B. Brown.......................... 175,021
Horse power, D. Cushing............................ 174,948
Horse power, R. Leonard............................ 175,118
Horses' feet, toe weight for, S. Griffin............ 174,906
Horse toe weight, Selby and Spurck............... 174,925
Horseshoe blank, C. H. Perkins..................... 174,924
Hose coupling, A. J. Tyler........................... 174,988
Hose coupling, Work and Gilmore................. 175,232
Hubs and fellies, boring, L. Williams.............. 174,994
Hulling machine, G. H. Peabody................... 175,148
Ice creeper, Cone and Furniss....................... 174,946
Ind, indelible, D. M. Marshall...................... 174,917
Iron bars, polishing, B. Lauth (r).................... 7,004
Iron, making, B. Lauth (r)............................ 7,003
Ladder, step, S. C. Blauvelt......................... 175,016
Lamp, S. S. Newton 174,922
Lamp collar, G. W. Brown........................... 175,022
Lamp extinguisher, F. H. Furniss.................. 174,951
Lamp extinguisher, J. C. Schreyer................. 175,173
Lamp-filling cabinet, T. L. Harlow................. 174,953
Lamp stand and match box, E. R. Beach.......... 174,936
Lap rope and foot pocket, J. Milwain.............. 174,920
Lathe for turning rolls, T. S. Poole................. 175,159
Lever power, E. Fales................................ 175.061
Lock, time, C. O. Yale................................ 174,996
Locks, winding, chronometric, E. Stockwell...... 175,198
Locket, Woglom and Miller.......................... 175,230
Loom shuttle, M. S. Légaré........................... 175,117
Lubricator, H. Hughes............................... 174,908
Magnetic machine, J. Kidder........................ 175,111
Match safe, W. Dawson.............................. 175,047
Maul, S. M. Anthony................................. 174.932
Meat, preserving, A. Bertch......................... 174,938
Mechanical movement, W. McCombie.............. 175,129
Medical rubbing apparatus, G. H. Taylor.......... 175,202
Meter, water, J. J. Burrows.......................... 174,943
Mop wringer, H. D. Cooker.......................... 175,041
Motive power, transmitting, Goubet *et al*......... 175,074
Mower, E. F. Herrington............................. 175,091
Mowing machine, E. A. Peck........................ 175,149
Necktie holder, M. Rubin............................ 175,170
Needle threader, H. Wells........................... 175,210
Nut lock, J. A. Forster 174,993
Nut lock, H. Livingston.............................. 175,122
Nut lock, Miller and Davis.......................... 175,133
Oil squeezer, H. Olsen............................... 174,971
Oils, etc., increasing density of, W. H. Birge.... 175,014
Oils, making lamp, C. L. Morehouse.............. 174,921
Ore concentrator, F. J. P. Pascoe.................. 174,974
Ore from refuse, separating, O. D. Woodruff ... 175,231
Oven, baker's, A. Crumbie.......................... 175,042
Oven, Dutch, A. J. Dejey............................ 175,050
Packing for axle boxes, lubricant, J. B. Boone.. 175,018
Paper barrel head, W. H. Murphy................... 174,139
Paper barrel joint, W. H. Murphy................... 175,138
Paper barrel making, W. H. Murphy............... 175,137
Paper, calendering, G. Duncan...................... 175,056
Paper pulp bag, J. P. Pultz........................... 175,163
Pavements, roughening, J. W. Starr................ 175,190
Pen drawer, blotter, etc., O. S. Baldwin 175,008
Pen extractor, J. A. Hard............................ 175,082
Pen, fountain, D. Mackinnon........................ 174,965
Pile driver, Roehrs and Kohler...................... 175,169
Pipe tongs and cutter, J. S. Stewart................ 174,927
Planing machine, A. Cant............................ 174,944
Planter, corn, T. Eldredge........................... 175,058
Planter, corn, M. Whisler............................ 174,993
Planter, cotton, A. T. Batcher........................ 175,088
Plow, double corn, W. A. Van Camp............... 175,212
Plow, root-cutting, J. S. Swaney.................... 175,200
Plumb line holder, W. Beckwith.................... 174,892
Postage and revenue stamp, J. E. Winner 175,228
Press, cotton, O. H. Belden.......................... 174,937
Press, cotton, H. B. Jones............................ 175,109
Press, hay, D. C. Green.............................. 174,952
Printing press, C. B. Cottrell (r)...................... 7,009
Printing presses, C. B. Cottrell 175,036, 175,037
Printing surfaces, producing, J. H. Banks........ 175,009
Pump, J. Bewsner..................................... 175,012
Pump, J. Kimes.. 174,911
Pump, H. Van Doren.................................. 174,989
Pump, P. Wineman (r).................................. 7,006
Pump, double-acting, C. P. Howard 174,9 9
Pump, force, G. W. Gilmore 174,904
Pump, steam, E. Hill, Jr.............................. 174,955
Pump, steam vacuum, J. R. Paddack 174,972
Pump, valve, E. Hill, Jr............................... 174,957
Purifier, middlings, E. N. and J. Lapham........ 175,114
Raft, life, N. H. Borgfeldt............................ 175,019
Railway switch, C. Thompson....................... 175,205
Railway, one rail, A. G. Buzby...................... 175,028
Rake, horse hay, Lane and Field.................... 174,912
Ram, hydraulic, W. W. Grier........................ 175,078
Rattan maehine, J. M. Goddard..................... 175,071
Reaper expansion reel, A. W. Shaw................ 175,175
Refrigerator, J. O. Beck.............................. 175,011
Refrigerator, C. B. Page 175,143
Resinous gums, cutting, J. Davis................... 175,044
Ring, finger, W. Eisele................................ 175,057
Rings, etc., bending, G. Litchfield, Jr............. 175,120
Road rammer, steam, S. Johnson 174,961
Saddle tree, gig, J. Theobald........................ 175,204
Sand, raising and screening, H. Schultz......... 174,981
Sash fastener, T. Karutz............................. 175,110
Sash holder, J. A. Adams............................ 174,889
Saw jig, P. Hughes................................... 175,101
Sawmill head block, H. Aleslagl................... 175,000
Sawing machine, Frank and Spire.................. 175,950
Sawing machine, scroll, E. Brown................. 174,894
Scaffold, painter's, W. Hoehn 175,095
Scraper, rod, T. Major.............................. 175,125
Screw-cutting machine, Burleigh and Putnam... 175,026
Scrubber, J. Deasey................................. 175,048
Seeder and cultivator, I. Turman................... 175,210
Separator, grain, H. H. Velie 174,929
Sewing case, R. and L. A. Philip.................... 174,976
Sewing machine, E. Moreau (r)........................ 7,005
Sewing machine fringer, G. Frame................ 175,064
Shears, angle iron, H. D. Slagle.................... 174,926
Sheet metal cup, J. Solter............................ 175,188
Shirt, M. Popper...................................... 175,160
Shirt, W. H. H. Tracy................................ 175,207
Shirt, C. C. and L. Tuttle............................ 174,987
Shoulder brace and suspenders, H. C. Whitmarsh 175,221
Shutter worker, W. M. Lanphere.................. 174,963
Sign, H. J. Blowney.................................. 175,017
Skirt facings, machine for making, F. G. Burley 174,895
Speeder and fly frame, T. Mayor.................. 174,918
Spinning ring traveler, N. I. Allen 174,001
Squares, gage attachment for, E. Kuhns.......... 175,113
Stair rod, W. T. Mersereau 174,919
Stamps and postmarking, canceling, F. Meyers.. 175,140
Staples, making corrugated, H. A. Harvey....... 175,087
Stave machine, band saw, J. H. Hobson.......... 175,093
Steels, striping cutlery, A. H. North.............. 175,142
Stereoscope, E. Bierstadt............................ 174,893
Stove, cooking, J. R. Hyde........................... 175,103
Stove, heating, M. C. C. Church 175,031
Stove, magazine, W. W. Baldwin (r).................. 7,007
Stove pipe damper, J. H. Rhamy.................... 175,166
Stove, ash sifting, J. R. Hyde........................ 175,104
Straw cutter, Slusser & Schmidt 175,182
Table, folding, J. E. Arnold.......................... 175,005
Table, ironing, J. R. Jackson 175,106
Table leaf, support, E. J. Wolfrom................. 175,229
Table slide, extension, R. H. Arnold 175,004
Tag fastener, C. C. Stevens.......................... 175,192
Telegraph apparatus, electric, W. & J. M. Smith 175,183
Temple teeth, assorting, Dutcher & Church...... 174,902
Thill coupling, W. W. Anderson.................... 174,930
Thill coupling, S. Harrison........................... 175,085
Thill coupling, Lee & Ostrander.................... 175,115
Thill coupling, L. Moore............................. 175, 35
Ticket case, S. Simons............................... 174,982
Tobacco machine, plug, T. F. Morrin.............. 175,136
Toilet case, H. F. Marsh.............................. 175,127
Toy cap exploder, C. Coester, Jr. (r)................ 7,008
Toy money bank, C. C. Johnson.................... 175,107
Trace joint, elastic, B. F. Rea....................... 175,164
Track clearer, Phipps and Quinn 175,156
Trap, animal, Thrapp & Hindman.................. 175,203
Trap, hog, J. Phillips................................. 175,152
Trunk, I. L. Plumer (r).................................. 7,011
Trunk, C. L. Tresize.................................. 175,208
Trunk, stay, F. E. S. Crane.......................... 174,040
Truss, E. A. Campbell................................ 175,029
Truss, D. L. Kennedy................................. 174,962
Type case, S. W. Green............................... 174,905
Type distributers, C. W. Dickenson.......174,899, 174,900
Type-distributing machine, W. A. Lorenz......... 174,915
Type-distributing machine, W. D. C. Pattyson... 175,147
Type. printing, J. Lindsay........................... 175,119
Type-setting machine, C. W. Dickinson.......... 174,901
Type-setting machine, W. A. Lorenz.............. 174,916
Type-writer, P. Deming.............................. 175,051
Umbrella. U. G. Steinmetz........................... 175,194
Under waist, E. W. Philbrook....................... 175,154
Valves, W. Painter.......................175,144, 175,145
Vegetable slicer, A. C. Slocum..................... 175,181
Vehicle seat lock, G. E. Robison.................... 175,167
Vehicle wheel, A. J. Rice............................ 174,978
Vise, joiner's bench, G. H. Wheeler............... 175,220
Wagon, side bar, D. McVaw 174,968
Wash tub stand, J. J. White.......................... 175,226
Washer, spring, W. Metcalf.......................... 174,969
Washing machine, J K. Dugdale.................... 175,055
Washing machines. H. E. Smith...175,184, 175,185, 175,186
Water closet valve, T. Conaughton................. 175,035
Water wheel, turbine, W. M. Mills.................. 175,132
Weft stop mechanism, F. O. Tucker................ 174,928
Wind motor, G. S. Strong............................ 175,199
Wind power, E. Cleaver.............................. 175,032
Windlass locking gear, Remington *et al* 174,977
Wood, treating, R. Lockwood....................... 174,914
Wrench, A. T. Hyde.................................. 174,909
Wringer, R. H. St. John.............................. 175,197
Wringer, F. Way 175,218
Wringer, F. & M. Way................................ 175,217
Yoke, ox, E. A. Farr.................................. 175,060

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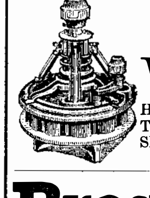

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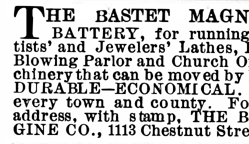

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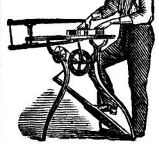

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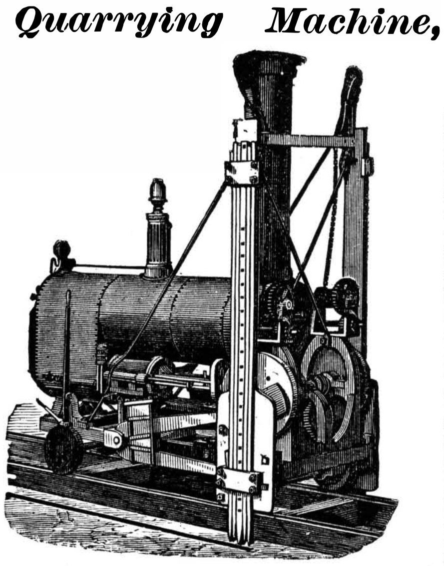

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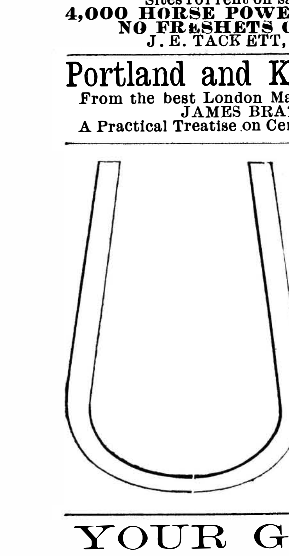

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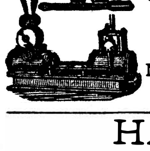

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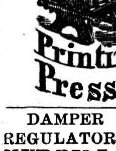

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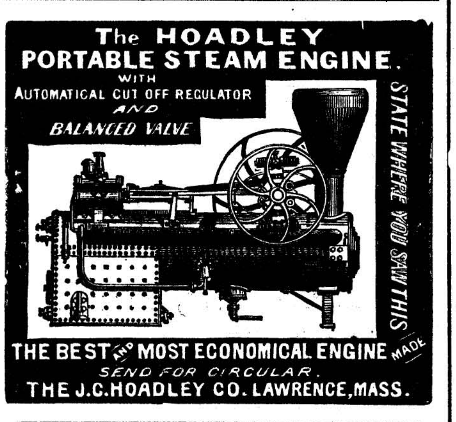

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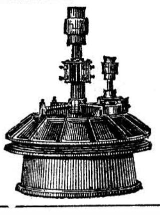

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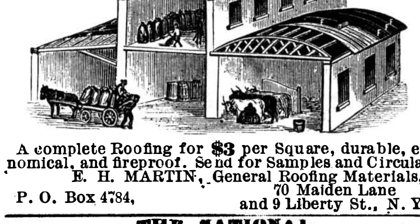

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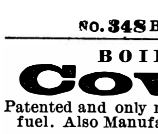

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