SCIENTIFIC AMERICAN

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

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

Vol. LVI.--No. 3. [NEW SERIES.] NEW YORK, JANUARY 15, 1887. [Price 10 Cents. $3.00 per Year.]

IMPROVED ONE HUNDRED TON FLOATING CRANE.

This crane, which was constructed for the Mersey Dock and Harbor Board by Sir W. G. Armstrong, Mitchell & Co., Limited, of Newcastle-upon-Tyne, has a jib of sufficient rake and height to command the hatches of the largest ocean steamers, and is also adapted for lifting dock gates in and out of place for repair. For this latter purpose it was necessary to provide lifting power for 100 tons, with a projection of about 6 ft. over the side. The extreme rake of the jib is 49 ft., which gives a projection of 22 ft. 6 in. over the outside of the fender timbers when the jib is athwartship, and the weight which can be lifted at this rake is 30 tons. Any load between 30 and 100 tons can, of course, be lifted at an intermediate rake. The crane is mounted on rollers running on a roller path fixed on the top of a circular girder built into the barge, and the steam engine by which the lifting, turning, and "topping" gear is driven is planted on the crane, and revolves with it. To avoid the inconvenience of using an unnecessarily heavy block and chain when lifting moderate loads, the crane is furnished with two purchases, one for loads up to 30 tons, and the other up to 100 tons.

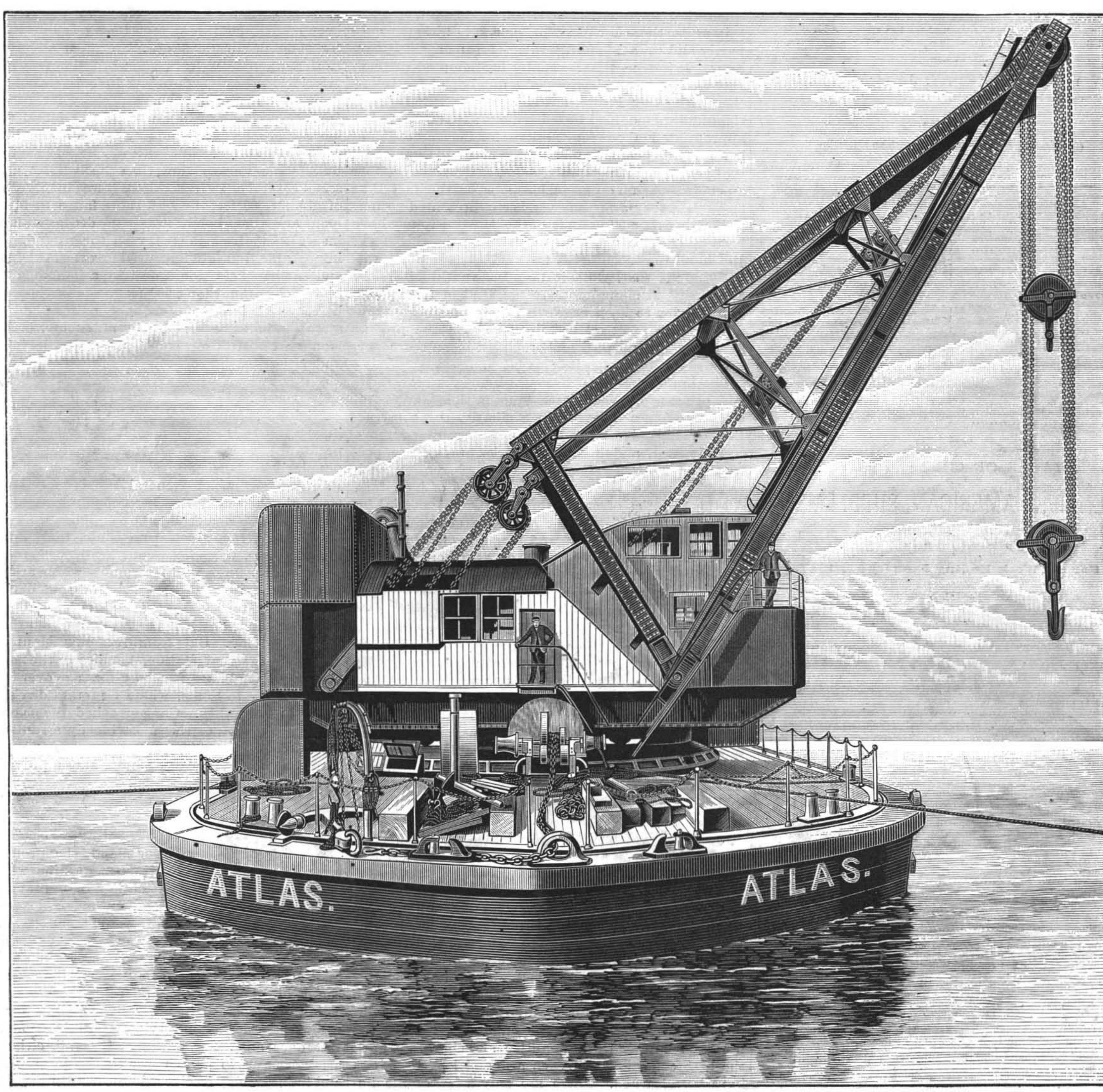
Great attention has been paid to the provision for counterbalancing the load lifted by the crane, so as to avoid change of trim in the vessel as the crane turns and as the weight upon it varies. The plan adopted is a combination of fixed and shifting ballast, so designed as to reduce the weight of the latter to a minimum, and so facilitate its manipulation. Water is used for the shifting ballast, a centrifugal pump driven by an independent engine being provided for pumping it from the front tank to that at the rear, while it returns by gravitation.

The barge upon which the crane is mounted is 130 ft. long and 48 ft. beam, the draught being about 5 ft. 6 in. Twin screws with independent engines are used in order to give greater handiness, and the after body of the barge being of twin form, the screws are well protected from injury when lying alongside a quay or another vessel. The forward part of the barge is strengthened, and a bed is formed on the deck on which a heavy load can be deposited. The speed over the measured mile was a little over five knots per hour. The London *Engineer*, to which we are indebted for our engraving, regards this as the most powerful floating crane in the world.

Electric Lamp.

Dr. Fleming says an incandescent lamp is not only a useful thing, but it has about it many points of great interest in physics. Many persons had the impression that the interior of a glow lamp was a place that was empty of all air particles, but this was not the case; it was as full as it well could be. Maxwell had shown that in a small cube of 1-100,000 of an inch there would be found 100,000,000 molecules of ordinary air, so that in a cubic inch of air there were a number of molecules represented by 100,000,000,000,000,000,000. In a Swan lamp when exhausted to one-millionth of an atmosphere, there remained some 400,000,000,000 molecules of air. As it took about ten days to count a million, a simple calculation would show that to count the number of molecules in such a vacuum would take 120,000 years of continual counting.

THE oldest person in France, perhaps in the world, is said to be a woman who lives in the village of Auberive, in Royans. She was born March 16, 1761, and is therefore 125 years old. The authentic record of her birth is to be found in the parish register of St. Just de Claix, in the Department of the Isere.



IMPROVED ONE HUNDRED TON FLOATING CRANE.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included $3 00
One copy, six months, postage included 1 50

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.00 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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

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

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

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

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, JANUARY 15, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 576.

For the Week Ending January 15, 1887.

Price 10 cents. For sale by all newsdealers.

WAR AND INVENTION.

In view of the possibility—not to say strong probability—of war between two or more of the great European powers, it is desirable to note the immediate effect of such a war upon American interests. Its influence upon grain, stocks, petroleum, cotton, and manufactures will be, or has already been, discussed by the daily newspapers; but its importance to American inventors would be very great, and they will naturally be alert to take advantage of every opportunity if war should come. At first glance, a superficial thinker might imagine that war would interest a limited circle of inventors, those who deal with arms, ammunition, projectiles, great guns, armor, war ships, torpedoes, and similar weapons or defensive devices; but this would be taking a narrow view of the field open to the fertile inventor. Indeed, it is impossible, in the limits of a single article, to particularize and discuss the great array of devices with which the inventor could profitably deal just before and during a great war. It will be necessary, therefore, to treat the subject of war inventions under classified heads, and extend this article over more than one issue.

Of course, as the primary object of war is to overpower the enemy, and as that result is reached by killing or disabling men and by destroying fortifications, ships, railroads, and other important public property, the first place in war invention is properly given to engines of war, their equipment and their auxiliary attachments. Then would naturally follow the defensive class of inventions—forts, armor, floating batteries, and guns, carriages, and shields for barbor protection. But connected with these in operation, though not necessarily a part of them, are a thousand and one devices in almost every channel of inventive research; and doubtless it will be necessary to do little more than to suggest them, or to imply their want, to induce hundreds of active minds to follow up the suggestion to a practical and profitable result.

In arms, there is a pressing demand—hitherto only partly and unsatisfactorily filled—for magazine small arms. It is true that Germany has adopted the converted Mauser, and has armed a number of her troops therewith; that France has also manufactured several thousands of modified breech loaders; that Austria has appropriated about four millions for the conversion of her present breech loader into a magazine gun; and that Great Britain is only deterred from expending an enormous sum on magazine guns by the fact that no satisfactory arm has yet been presented to her, although a few thousands of the Martini-Henry have been altered to carry seven cartridges in the stock. But in all these countries, military experts unhesitatingly admit that, while it may be, and doubtless is, a necessity to manufacture some kind of a magazine gun in order to keep pace with their possible antagonists, it is a practical certainty that all the present issues will be recalled and replaced by a more perfect weapon as soon as it is invented.

The improvement of heavy ordnance, armor, shells and other projectiles, fuses, ammunition, and fortifications, offers a wide field. Similarly, the construction of ships, both armor-clads, fast cruisers, rams, torpedo craft, and floating batteries, presents opportunities for novel designs and valuable invention, such as could make the fortunes of scores of inventors. All the varieties of mechanical contrivance needed for driving and working ships, pumping, steering, lighting, handling shot, shell, and torpedoes, and loading and pointing the heavy guns—all these openings for inventive talent are made more accessible to inventors by the outbreak of a war.

Of course, attention is centered on explosive substances. While new combinations may be worked out to produce greater explosive effect with more certainty of safety to the operator, there are numerous improvements possible in our mode of treating those explosives already known. A great deal is yet uncertain as to the proper kind of charge of gunpowder for both ordnance and small arms. It is claimed that even in field pieces a considerable quantity of powder is blown out of the gun unconsumed, and therefore wasted. There are many experiments needed to determine the proper size of grain and quality of powder used, and also the weight of charge for given weights of projectile, diameters and lengths of barrel. For small arms the test under water seems to present the most uniform and otherwise most satisfactory conditions. A tank strongly built, 12 feet long, 2 feet wide, and 3 feet deep, would enable a careful experimenter to make innumerable comparisons, such as: With a given charge of powder, to determine the weight of ball that will have the greatest range; with a given ball, to determine the most effective weight of powder; with given charge and ball, to compare the range of different rifles; to compare different lengths of bore in the same rifle, varying the powder charge both in quantity and character until the best conditions for each arm and length of bore have been learned. These are only a few of the important tests that may be made.

The comfort and health of soldiers and sailors have become among the most important conditions of military and naval success. The healthy, well fed, and well clothed man will be effective at the end of a campaign, while the same amount of labor and hardship might kill or disable three men whose welfare had been neglected. Consequently, improved food and clothing will be readily adopted by military authorities. It is not to be expected that any one will try to invent or discover a food like Zucci's mysterious liquid, to sustain life without other sustenance; and the mere preservation of food is already brought to high perfection; but it is not impossible that a condensed, but palatable, food, of great nutritive value in proportion to its weight and bulk, would be acceptable to a war-making power for use on forced marches, especially now that promptness and speed are so important, and that the rapid moving of great bodies of men has been rendered so difficult by the necessity of moving their supplies with them. Equipments and accouterments are also susceptible of improvement. In the first two years of the civil war thirty-five patents were granted for inventions connected with the slinging of accouterments alone, but a great advance on those ideas is still possible.

It is a well known fact that inventions for preserving the health of the soldiers and sailors in war time have not kept pace with the devices for killing and wounding them. The application of sanitary laws to camps and ships may profitably be studied. The demand for all the articles needed in hospitals and on the field for the treatment of the wounded and the sick would be enormously increased by a general European war. Ambulances, stretchers, tourniquets, bandages, splints, surgical instruments, disinfectants, anæsthetics, and artificial limbs are a few of the subjects deserving attention.

The limited, yet important, use of the balloon during the Franco-Prussian war, 1870-71, showed that much might be expected of this machine in future wars. It is true that little progress toward perfection has been made, and the balloon to-day is but little better than in the days of Montgolfier and Pilatre de Rozier, about 100 years ago; but this fact is all the more reason for encouraging inventive genius to devote itself to the balloon, especially for use in war. In the Franco-Prussian war it was found that balloons could be penetrated by bullets at a height of 3,000 to 3,600 feet; but the escape of gas from one bullet hole was so slow that the balloon might descend several miles from where it was hit. At a height of about 8,000 feet the best shots failed to hit the balloon, and that height was regarded as sufficient to insure safety from an enemy on the ground. It is not improbable that late improved firearms, machineguns, and shell rockets would destroy a balloon, even at a higher elevation than 8,000 feet; and anyhow it would be easy to invent counter balloons for attacking observation balloons sent up by an enemy, or shell balloons sent up to drop enormous projectiles into camps and cities. Some such devices are sure to be used in any great war if they give a reasonable promise of effectiveness.

All kinds of successful signal plans will be required in war time. During our civil war the Signal Corps performed work whose importance has never been popularly known or appreciated. Thus, at Allatoona Pass, in 1864, when General Hood swung back upon General Sherman's line of communication between Nashville, Sherman's base of supplies, and Atlanta, his headquarters, there is no doubt that, but for the Signal Corps, the pass would have been taken and held in such force that Sherman's whole army might have been unable to carry it. The Confederates held every road to the north, and there was a mere corporal's guard at the pass, upon which they were rapidly moving. But from Kenesaw Mount to the next Union signal station, 15 miles to the northwest, the little signal flags flashed a message over the heads of the enemy to Rome, where General Corse's brigade was waiting orders. Corse reached the pass just in time to repel one of the most bloody assaults of the war, and Sherman's communications were saved. Thus the importance of accurate and improved signal work has been demonstrated.

(To be continued.)

PROMOTION BY SENIORITY.

Whether or no an officer should be promoted because of seniority or merit is a question which just now is attracting some attention in military circles; and justly, too, for, in the present attempt at reorganization of army and navy, it would seem essential that some reward be offered for efficiency and diligence. The necessity was long ago seen for offering to the men in the ranks of the army some inducement for the exhibition of zeal and soldierly qualities, and a law was passed making it possible for merit, regardless of length of service, to obtain a commission. But once an officer, nothing will avail, either in the army or navy, to press merit to the front. Capacity and industry may receive acknowledgment by detached and special service, just as favoritism or influence often brings a staff appointment; but when the service is performed, the officer returns to his old place, and waits to get from time what faithfulness has failed to secure.

Those familiar with the military or naval station will scarcely fail to have been struck with the relative difference in the capacity and performance of the various officers. One devotes all his spare time to the study of some special department of the art of war; let it be small arms, heavy guns, torpedoes, powder, propulsion of ships, construction of forts, or the like. Another, and perhaps his superior officer, does not do anything save what is actually required of him in the discharge of his duties. He cannot find the road to diligence himself, nor is willing to take it when it is pointed out by others. But if his commission antedates the commissions of those who do work, he is secure. Let him devote a modicum of time to his studies—just enough to pass a possible or pending examination for promotion—and they cannot hope to pass him.

The annals of the civil war clearly illustrate how pernicious is this system of promotion by priority. Regular officers, of high rank too, were constantly found incapable of important command. They were slow and often stupid, neither progressive nor alert; their chief ambition and occupation was to see that the ordinary routine of discipline was maintained, wholly forgetful that this was but secondary, and not the main object of keeping men afoot and ships afloat in time of war.

They could let an enemy escape or neglect to follow up an advantage, and lay themselves down to rest with ardent satisfaction that at least good order and military discipline was being observed throughout their commands; that aboard their ships the daily routine of detail and assignment was working smoothly, or in their camps that the proper disposition and alignment of tents was rigidly enforced.

There is another side, however, to this question of promotion by seniority, and one that should not be overlooked in its discussion. There are evils and abuses in the system of promotion by preferment quite as menacing, perhaps, as those which inhere in that of promotion by seniority. They are caused by favoritism and political influence. It is surely less disheartening to an officer, less demoralizing to a corps, to see merit go unrewarded than to witness incapacity go forward through the pressure of political "backing," or because of the whim or favoritism of a commanding officer. In the navy, because of the technicality of the duty, favoritism could perhaps do little to press incapables into important positions. It might serve to give them easy and pleasant posts, and that much it does at present; but in the army, promotion by seniority being displaced, influence and favoritism might, up to a certain point, lead to gross injustice, while yet its effects would scarcely be discernible, save to those immediately interested. As an example of this, a second lieutenant in the army might be jumped over the heads of several files of more efficient officers, and made a first lieutenant, without such change materially endangering the proper ordering of a company or of the regiment of which it formed a part. But should an incapable naval lieutenant be promoted to a position where he was called upon to exercise the functions of navigating or executive officer, his incapacity would he at once apparent, might imperil the safety of his ship, and could not, therefore, be endured.

It would seem as if some means might be found of promoting, and thus encouraging, the efficient and faithful and industrious officer, whether in the army or navy, and, at the same time, maintaining a safeguard against unjust discrimination. Then, even the boy who is at Annapolis or West Point, and who to-day has little to look forward to, might, if possessed of soldierly qualities, ambition, and ability, be enabled, before his hair has turned white with age, to make a name for himself, and there would be nothing left for indolent officers, whether old or young, but to apply themselves to their profession or leave it.

MAN AND THE WILD ANIMAL.

Those who have carefully observed the management of wild animals in menageries, zoological gardens, and in the pens of the animal dealers, must, at times, have been astonished at the ease with which hired men, comparatively unarmed, subdue beasts which we have been taught yield only to the blazing rifle, and fight gamely until death. A lion escapes from his cage, and crouches at the darkened end of the menagerie. Remembering the stories we have read of the ferocity of this beast and of the terrible scenes at the lion hunt, we can imagine only one mode of action. The keepers should arm themselves with rifles, hide behind barriers, and open a rapid fire upon him. To our surprise, they don't do this. They simply wheel a great cage up to him, fall upon him with clubs, and thrash away until he enters it.

A few weeks ago, an anaconda 17 feet long broke away while being carried across a public park in New York city. With vivid pictures of the exploits of this reptile in the Amazon watershed before our eyes, we expect to see him fall upon the nearest human being, infold him in his toils, and crush him to a jelly. Surely, it will take armed and resolute men to capture him! No; on the contrary, this is not required; and it must have been with a feeling akin to disappointment that those who had read of the ferocity of the anaconda saw one man, armed only with a blanket, advance and seize him by the throat, while two others, also unarmed, grasp his tail, and then the trio, still holding on, carry him through the streets and thrust him back into the den whence he had been taken.

Not long since, the writer saw Mr. Thomson, a dealer in live animals, open a box containing an anaconda, quite as long as this one, take the reptile by the throat, and calmly examine his mouth, opened though it was in rage, to look for cancerous humors. Then from adjoining shelves he took python after python, each about 10 feet long, and examined them in like manner. Only last week, at the place of another dealer (Reiche), a big, powerful Syrian bear, a type known for its ferocity, was subdued without the firing of a shot. The bear broke through iron bars half an inch thick, and, standing up with his back against a cage of monkeys, thrust his terrible paws threateningly toward three keepers gathered about him. He didn't have a chance to use them, however, for he was belabored with clubs until glad to get back again into his cage. On a pedestal near the gate of the Cincinnati Zoological Gardens, there recently stood the stuffed figure of a donkey which, when alive, withstood the attack of a lion and beat him off. The lion, it seems, had broken out of his cage and escaped to a wood near by. On a grassy hillock adjoining, a donkey lay stretched in placid slumber—a slumber that was rudely disturbed by the lion, who, in a few bounds, was upon him. When the donkey felt the great mass of flesh descend upon him as if from the clouds, he was stunned and indignant, but not frightened, perhaps because he had never read any of the wonderful stories about the lion. He quickly recovered from the blow, and, rising, shot out both hind feet at the same time, and caught the lion squarely in the forehead. Badly hurt, the lion skulked off, and later the donkey died of the wound he received at the onset.

PHOTOGRAPHIC NOTES.

Development of Dry Plate Lantern Slides.—Plates having a sensitometer register of 12 or 13 are mostly used for making lantern slides, and it is generally advised that they be developed with the ferrous oxalate, or more commonly called iron, developer, if clear high lights and a warm brown color is desired.

The use of the pyro developer is now so general for negatives that it affords a great convenience to the amateur in case it can also be employed for the development of transparencies.

It is only within a recent period that it has been recommended for this purpose, one method being the use of dry pyro in connection with sulphite and carbonate of soda.

From some experiments we have lately made, we have ascertained that it is possible to obtain lantern transparencies of superior merit very easily and quickly by using Beach's sulphurous acid pyro and potash solutions.

We repeat the formula as heretofore published:

No. 1.—PYRO SOLUTION.

Sulphite soda chem. pure .... 4 oz.
Warm distilled water .... 4 oz.

When cool to 70° Fah., add:

Sulphurous acid .... 8½ oz.

And finally:

Pyrogallol .... 1 oz.

No. 2.—POTASH SOLUTION.

A. { Carbonate of potash chem. pure .... 3 oz.
Water .... 4 oz.
B. { Sulphite soda chem. pure .... 2 oz.
Water .... 4 oz.

(437 grains to each ounce of salt.)

Combine A and B in one solution.

To develop four 3¼×4 lantern slide plates at one time, place them in a 6½×8½ developing tray, then prepare a developer as follows: 3 ounces of water and 40 minims of No. 1 and 80 minims of No. 2; flow it over the plates.

In the course of three or four minutes development will commence and the image will appear very slowly. Continue the development until the shadows look quite black, otherwise the plates will fix out too thin. In case the development hangs back, a few drops of the potash solution should be added.

If the exposure is correct, a clear, crisp, blackish brown transparency will result. The method we employed was to place the printing frame holding the sensitive plate in contact with the negative, at a distance of two feet from the flame of a oneinch wick of a kerosene lamp, making an exposure of from 25 to 40 seconds, according to the density of the negative. No staining of the plate appeared, which indicated that as long as sufficient sulphite of soda is employed, the pyro stain will be prevented; no after clearing solution of citric acid or alum was used. Several plates may be developed successively in the same solution. After a slight washing, the developed plate is fixed in a saturated solution of fresh hypo, then washed in changing water for one hour and dried. After mounting, it is then ready to be shown in the lantern. The process as a whole is exceedingly simple, and affords a pleasant and profitable amusement for long winter evenings.

The Holyoke Dam.

In a recent number of the *Transactions* of the American Society of Civil Engineers, an elaborate illustrated paper is given by Mr. Clemens Herschell, a member, on the work done for preserving the dam at Holyoke, Mass., in 1885. The dam belongs to the Holyoke Water Power Company. The second and present dam at Holyoke, that succeeded the first construction, which gave way in 1848, was begun and finished a year later. The length is 1,017 ft., or one-fifth of a mile. At the end are abutments of heavy masonry, between which the dam is composed of heavy timbers, which are built up so as to present on the upper side a surface of plank at an angle of 21 degrees 45 minutes to the water. The timbers, which cross the river transversely, are supported by other timbers at right angles, arranged in 170 sections, 6 ft. apart. The ends of these sloping timbers are spiked to the solid rock at the bottom of the river with 1¼ in. iron bolts, and 4,000,000 ft. of timber are contained in the structure, which, being under water, is protected from decay.

Gravel was filled in and pounded down at the foot of dam, which is protected also by concrete. The open spaces were packed solidly with stone to the height of 10 ft. The height of dam vertically is 30 ft. The sloped top is planked to a thickness of 18 in., in three layers of 6 in., all spiked and bound together. The rolling top or combing was covered with sheets of boiler plate extending the whole length of dam. The graveling on the bed of river begins 70 ft. above the dam, and is carried over 30 ft. of the sloping surface, which is 92 ft. in length from the foot to the crest.

A section of the structure shows the transverse and sloping timbers, and the filling of stone, and a description is given of the experiences of 1849 to 1868, and of the damaging effect of the falling water over the dam, which reached 12½ ft. in 1862. The fall of such a volume of water for 30 ft. naturally cut a seam in the layers of rock, and the falling over of logs of timber and ice did serious damage to the foundation and structure of the face of dam. It was found on inspection that the ledge had been washed out in places to a considerable depth, and caused the dam to be seriously undermined and the timbers to give way. To remedy these defects, an apron was built on the down stream in section exceeding the old dam. It was built of round logs laid up in perpendicular bins, 6 ft. square, and filled up to the top with stone, and covered at the sloped top with maple, beech, and other hard wood planks, 6 in. thick. The lower courses were built afloat, and in sections 150 ft. long, fitted to the irregular bottom of the river, and sunk by loading with stone. The effect of the apron has been to prevent further undermining action next the heel of the dam, though a new pool was formed below the dam.

The author goes on to describe the breaks in the crest of dam and the cribs used for repairing them. These cribs were sunk so as to inclose the breaks in the plank covering of dams, and consisted of boxes without top or bottom, the under side cut off on a level to fit the back of dam. Sketches of the large 40 ft. by 45 ft. crib used in 1884 to cover a hole in the dam are given. These are framed together with upright and horizontal pieces planked over.

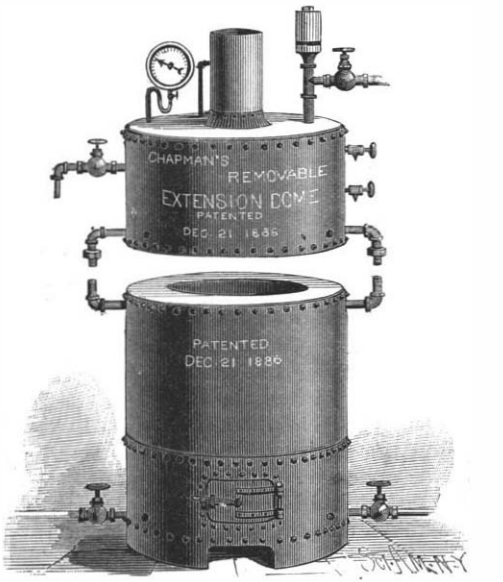
The author describes other plans to meet breaks in the dam covering by subcutaneous injection of gravel, and the use of coffer dams to reach the crest of dam, by which means a length of a hundred feet, 20 ft. wide, could be laid dry. Drawings of the coffer dams used, a design for a stone dam, and several photographic views illustrate the work.

The Green Ray.

The green ray is a flash of emerald colored light, said to be observed sometimes for a second or half a second at the moment the sun's disk disappears below the horizon, and just when one sees only a very small segment of its surface. Tourists in Egypt and the Red Sea testify to the phenomenon. Some consider it objective, and others believe it to be subjective. According to a letter of M. De Maubeuge to M. Mascart, the well known French physicist, the phenomenon has been several times observed in the Red Sea at the rising of the sun. M. De Maubeuge particularly noticed it, he states, in October, and the first impression of his eye and that of his assistant was a beautiful emerald green. He has also seen it at sunrises behind mountains elevated from 1 deg. to 2 deg. above the horizon. These observations tend to prove that it is an objective phenomenon. He has also observed it at the setting of the sun. There was not the least cloud between the orb and spectator, and the air was pure, but humid. The same phenomenon has not been observed by him from the moon, Venus, or any star, although he has often looked for it in the tropics.

IMPROVED STEAM BOILER.

The upper ends of the flues of vertical boilers, as commonly constructed, are exposed to hot steam upon one side and the heat of the fire upon the other, and the flue sheet is similarly subjected to the action of steam and fire. The result is that the flues become leaky, and are eventually destroyed. In the boiler here illustrated, and which is the invention of Mr. Wm. J. Chapman, of 97 Forest Street, Rutland, Vt., the upper ends and the flues are continuously submerged in water. The body of the boiler is formed with a recessed



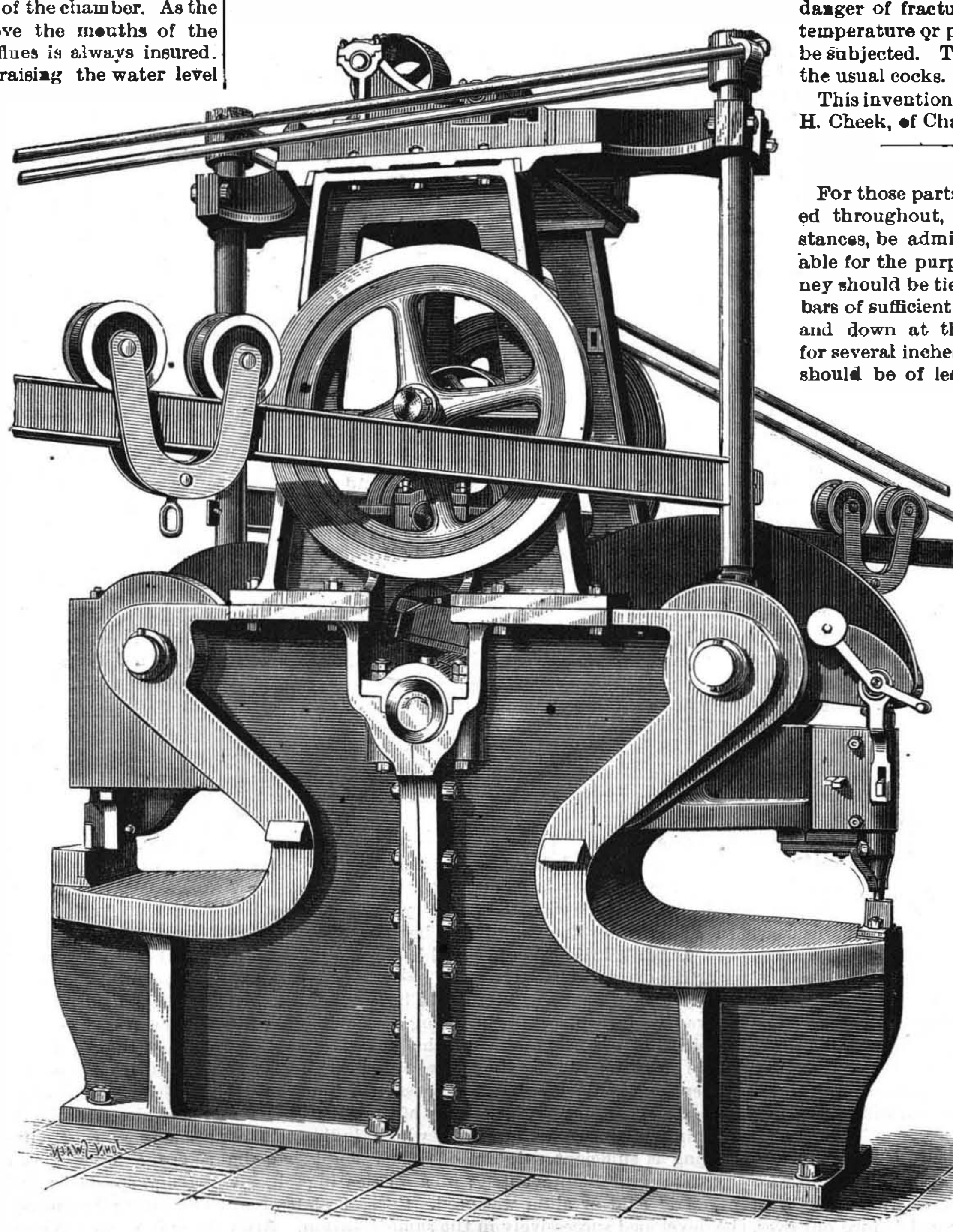
CHAPMAN'S IMPROVED STEAM BOILER.

head, surrounding which is an annular space provided with outlet pipes. Resting upon the head is a chamber of the same diameter as the boiler, and within which is a hollow cone. The internal diameter of the base of the cone is the same as that of the recessed head, and the cone and head together form a smoke chamber, in which are received the products of combustion passing through the flues. In the side of the chamber, near the bottom, are inserted tubes that connect with the tubes in the body of the boiler. These tubes establish communication between the upper part of the body and the lower part of the chamber. As the water level is maintained above the mouths of the tubes, the submerging of the flues is always insured. The chamber, in addition to raising the water level so that the flues are protected, provides efficient steam room, increases the heating surface, and utilizes the heat of the flues, which would otherwise pass directly to the smoke pipe and be lost. Whenever necessary, the chamber can be readily removed.

LARGE PUNCHING AND SHEARING MACHINE.

Owing to the great breadth, as well as length, of steel plates which shipbuilders can now procure, and which it has been found most advantageous in many ways to adopt—particularly in the plating of large vessels—a necessity has arisen for punching and shearing machines with gaps of a depth not hitherto thought of. The machine which we now illustrate has to punch and shear 1¼ in. steel plates, but the power required to do that is not the only element which renders necessary so large and heavy a machine. The depth of the gap, more than anything else, regulates the size and weight of such a tool; and as the gaps on the above machine are 42 in. deep, admitting of punching holes in the center of a plate 7 ft. wide, some idea may be formed of the proportions of the machine. Messrs. James Bennie & Co., says *The Engineer*, have just completed two of these for Messrs. Harland & Wolff's extensive ship yard at Belfast, and one of them has been at work for some weeks past. One peculiar feature in the arrangement is the design adopted for the cranes. In a machine of this kind, of course cranes are requisite with jibs having range enough to deal with plates up to 27 ft. length, and strong enough to carry upward of two tons at the point of the jib safely. But hitherto, with the "cam and lever" type of machine, now so greatly preferred by ship platers, it has been difficult to get cranes with freedom to swing in all positions without coming in the way of the driving belt. This difficulty has been overcome in the machine under notice by carrying the strap over guide pulleys on a framing up over the ordinary driving pulleys, and at such height as clears the cranes altogether. The latter are thus free to slew in all directions, without being interfered with by the driving belt.

The design will be readily understood from the illustration, although, to save space, the cranes are shown with the jibs cut off short. It is well known that, for obvious reasons, it is a bad practice to carry the upper end of a crane post up to the roof of the building for support there. By the above arrangement the framing carrying the guide pulleys is made to form a substantial support for the top end of the crane post, and thus the machine becomes self-contained, and might be placed in any outside shed or building.



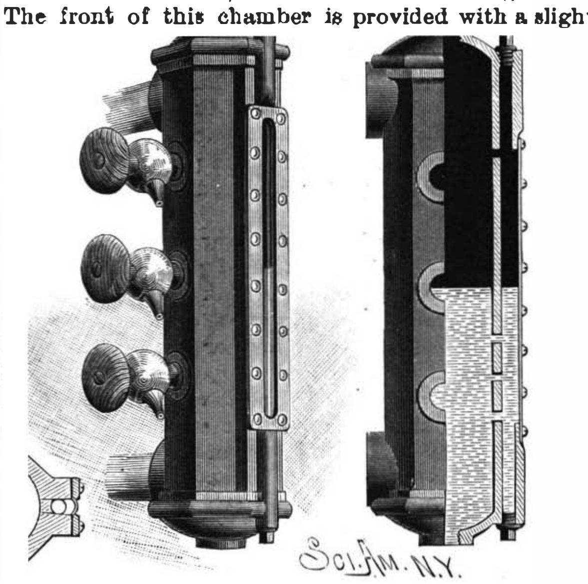
LARGE PUNCHING AND SHEARING MACHINE.

Alloys.

In a recent lecture, Professor Austen Roberts mentioned that the union of copper and antimony by fusion produces a violet alloy when the proportions are so arranged that there is 51 per cent of copper and 49 per cent of antimony in the mixture. This alloy was well known to the early chemists, but, unfortunately, it is brittle and difficult to work, so that its beautiful color can hardly be utilized in art. The addition of a small quantity of tin to copper hardens it, and converts it, from a physical and mechanical point of view, into a different metal. The addition of zinc and a certain amount of lead to tin and copper confers upon the metal copper the property of receiving, when exposed to the atmosphere, varying shades of deep velvety brown, characteristic of the bronze which has from remote antiquity been used for artistic purposes.

WATER GAUGE FOR STEAM BOILERS.

The body of the gauge consists of a hollow metallic shell closed at the ends, and made with side openings near the top and bottom, and having projecting flanges that form connections with the steam and water space of the boiler. A narrow chamber is formed in the gauge by a partition that is perforated near its top and bottom, to permit the entrance of steam and water, and equalize the pressure which preserves the equilibrium of the water, and also checks its agitation. The front of this chamber is provided with a slight



CHEEK'S WATER GAUGE FOR STEAM BOILERS.

opening, covered with a plate of mica, through which the height of the water can be seen. The mica is held in place by a flat metallic frame, secured to the body of the gauge by screws, and is swelled outwardly so as to present a convex surface, as shown in the cross sectional view, so that the water may be seen by the attendant when in a position at an angle to the gauge. Openings in the opposite ends of the chamber are closed by screw plugs, which can be removed when it is necessary to clear the chamber or clean the mica. The advantages attending the use of mica in this situation are manifest as compared with glass, there being no danger of fracture resulting from fluctuations of temperature or pressure to which the gauge may be subjected. The gauge may be provided with the usual cocks.

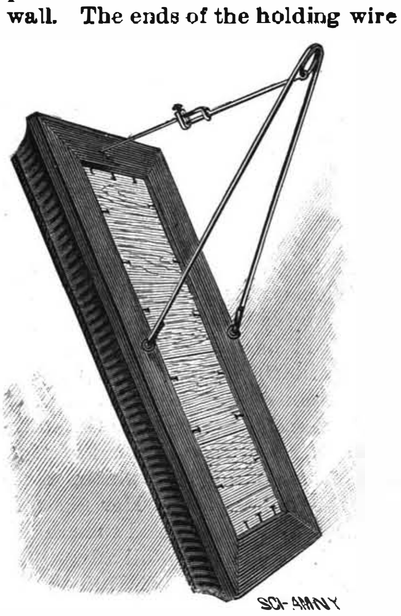
This invention has been patented by Mr. Thomas H. Cheek, of Chattanooga, Tenn.

Chimneys.

For those parts of a chimney which are supported throughout, stone may, under some circumstances, be admissible, but brick is always preferable for the purpose. The abutments of a chimney should be tied into the walls by wrought iron bars of sufficient number and strength, turned up and down at the ends, and built into the jambs for several inches on each side. No part of a flue should be of less thickness than half a brick, or 4½ inches. Where slabs of stone or slate are placed level with a floor before the opening of a chimney, they should invariably be laid in sound mortar, cement, or other incombustible and non-conducting substance, and it should be at a distance of not less than 4½ inches from the joists, flooring, or any other woodwork. A chimney built only up to the roof and stopping at that point is always dangerous. Every chimney in a house should be perfectly distinct and separate from every other chimney, from the hearth to the external opening. Chimneys may safely be built in stacks, but they should on no account have any connection within the stacks. Brickwork around flues should not be less than 4½ inches thick in any part. By the Code Napoleon it was not permitted to build a chimney against the wall of an adjoining house without isolating it by an intermediate wall of sufficient thickness to prevent heat passing to the neighboring premises.—*The Architect.*

PICTURE FRAME ATTACHMENT.

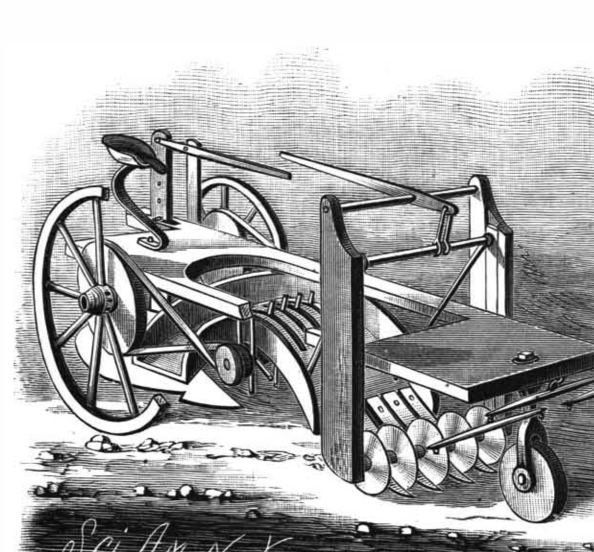
This simple and efficient device is for suspending picture frames and mirrors at a fixed angle against the wall. The ends of the holding wire are bent into the form of hooks, which engage with screw eyes inserted in the back of the frame. The middle of the wire is bent to form a spiral loop, upon which is received an eye formed on the end of a wire, provided at its free end with a slide having a set screw. Through a hole in the slide passes a wire having a loop bent at right angles at one end, and encircling the main wire. The opposite end of the wire is pointed, so that it will retain its position when brought into engagement with the back of the frame. In order not to injure the frame, the pointed end may be replaced by a rubber pad to bear against the frame. It is evident that by means of this device, the frame may be placed at any desired inclination in regard to the surface against which it rests.



This invention has been patented by Messrs. M. A. Gerber & E. J. Nicholas, of Lost Creek, Pa.

COMBINED PULVERIZER AND PLOW.

This combined pulverizer and plow is so designed as to cut the furrow slices into strips, pulverize them, and then turn them under. The forward end of the frame is supported by a wheel, and the rear part is attached to the axle of the driving wheels. To the opposite side of the forward part of the frame are attached wide standards, in the inner sides of which are vertical grooves, in which slide bars carrying the ends of a shaft upon which are placed loose circular colters which, as the machine is drawn forward, cut the furrow slice into narrow strips. Between the lower parts of the colters are placed the points of narrow, slightly curved plows, whose shanks are attached to the forward end of an arched trough, so that the narrow strips of the slice will pass through the trough and fall in front of the turn plow, which can be adjusted so as to govern the depth to which it enters the ground. By means of a suitably arranged lever, the forward end of the trough, the narrow plows, and the circular colters can be raised by one movement. The arched middle part of the trough has slots formed in it in line with the plows, to receive the fingers attached to a cylinder revolved by endless bands passing around pulleys on the drive wheels. These fingers move much faster than the strips of the furrow slice through the trough, so that they will tear in pieces and pulverize the strips. With this construction the furrow slice will be cut into strips, pulverized, and deposited in front of the plow, which will then turn it under. This invention has been patented by Mr. Daniel W. Evans, of Sherman, Ohio.



EVANS' COMBINED PULVERIZER AND PLOW.

SOMEBODY has compared the world to a beehive. The empty comb represents the possibilities of life, which may be filled with honey or stuffed with bee bread; and as in gathering honey the bee uses the sting as a spatula, and mingles a portion of its sting poison with the sweet for the sake of preserving it, so the wealth which the human bee accumulates lasts all the better when deposited little at a time at an expense of much care and labor.

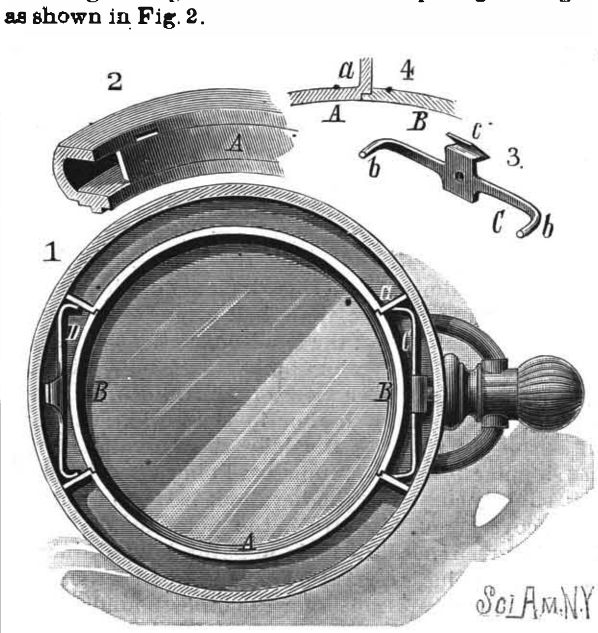
Creeping of Varnish.

We often meet with this trouble, especially in light colored gears, where oil has been used in the colors, and in almost every case where oil and varnish are combined in the varnish and color. One way to get over the difficulty is to give the job two coats of the true color, and then a light coat of pure varnish without any in; but when you cannot take the time for that, and are compelled to have your varnish and color strong, you can adopt the following two plans, which we have found have answered the purpose. As creeping is caused principally by sweating, which throws off from it instead of attracting to it, we must try and get rid of that false tack, which is nothing but a thin crust of oil held in its place by the other ingredients in the color, just as gold sizing standing over night exposed to sulphur from the stove will have a thin coating of sulphur; and although you might lay the gold on, and to all appearance it would be all right, yet if you attempted to wash it off, you would find it would leave solidly.

The oil in the color acts in conjunction with the varnish just the same; the oil, being lighter in body than the varnish, rises to the surface, and, although seemingly hard, has that false gloss and tack which must be taken away before you can proceed. Where you cannot with safety rub it off, without running the risk of marring the looks of the job, take castile soap, and, instead of rubbing it, wash it. It is best, if you can, to take each part separate, except when you are varnishing, which in that case involves the washing of the whole job at once. You should always wipe off with a medium damp chamois skin, one not too dry, so as to retain enough dampness to insure safety. Even after you have gone through the above, if, after all your trouble, you still find places that have probably been missed or slighted in the washing, and detect the creeping, just throw a little pure water into your varnish, stir up thoroughly, and proceed just as you would if you had no trouble. Sometimes the creeping will occur in spots, and can, in striping, be stopped by breathing heavily upon the place, running over it at once with the stripe.—*Carriage Monthly.*

IMPROVED SPRING AND DUST GUARD FOR WATCH CASES.

The object of this invention, which has been patented by Mr. Robert L. Stufft, of Scottdale, Pa., is to provide for watch cases a dust guard which may be readily applied and removed, and which will support the lifting and catch springs. The strips, A, forming the side pieces of the guard, are of sufficient width to fit into the band of the case, and their ends, *a*, are bent outward and fitted into the space in the central part of the watch case body. Between the ends are fitted the curved strips, B, which complete the metallic circle around the movement. In the chamber opposite the pendant is fitted a flat spring, C, having its ends, *b*, turned backward and resting against the ends, *a*, of the strips, A. Upon the middle of the spring is formed a catch, *c*, which engages with the rim of the cover. This spring is acted on by the push pin in the usual way. In the chamber in the opposite side of the case is a flat spring, D, provided with a curved arm which engages the shoulder of the case cover. The springs are light, easily applied, and readily replaced in case of breakage, it being only necessary to remove one of the curved strips, B, to gain access to the chamber. The sections of the dust guard, being closely fitted and pressed into place between the flanges of the center ring of the case, afford a strong protection, and add to the stiffness and strength of that part of the case. The sections can be removed by inserting an edged tool in a small opening arranged as shown in Fig. 2.



STUFFT'S IMPROVED SPRING AND DUST GUARD FOR WATCH CASES.

FOLDING STEP LADDER.

The accompanying cut represents a folding step ladder, opened and closed, made of hard wood and ingeniously bolted and braced in such a manner as to form a strong, complete, useful, and handy ladder.

When folded it occupies a space of only four inches, so that it may be put in the pantry or behind any door where it will be out of the way, and yet be within convenient reach, thus saving the trouble of searching the cellar and garret, and perhaps finding the ladder in the yard in a condition unfit to be brought in the house. This compactness is of advantage to dealers, owing to the small amount of space occupied and the low cost of transportation. When used by painters, it can easily be carried under the arm, and for use as an article of household furniture it can be converted into a very neat hall rack.

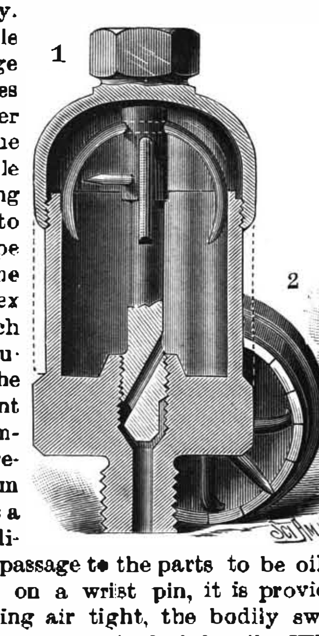
RUSSELL'S FOLDING STEP LADDER.

This invention has been patented by Mr. H. C. Russell, of 240 Robert Street, Toronto, Canada.

IMPROVED OIL CUP.

This oil cup may be applied to the journal bearings and moving parts of machinery, but is especially adapted to the lubrication of the rod and wrist pin connections of locomotive and other engines. It can be easily adjusted to regulate the feed of oil. The body of the cup is chambered to receive the oil, and has a neck by which it may be attached to the bearing. At the bottom of a central hole in the base is a tapering seat, below which is a passage through which the oil flows. The hole is threaded to receive the lower end of a spindle, which is beveled to fit the seat. The upper end of the spindle is steadied by bent arms or elastic wires, which bear against the inner part of the body. The end of the spindle has an oblique passage which communicates with the oil chamber and with the hole, the threads on the spindle below the opening being cut away, to allow the oil to escape freely. Fixed to the spindle is an index finger, or pointer, which indicates on a graduated scale, on top of the oil cup body, the extent of opening of the spindle at the seat. A recess around the bottom of the chamber forms a pocket to hold sediment and prevent its passage to the parts to be oiled. When the cup is used on a wrist pin, it is provided with a screw cap fitting air tight, the bodily swing of the cup then insuring proper feed of the oil. When the cup is used on stationary bearings, it is fitted with a slip cap or cover, having a vent hole to insure flow of the lubricant. It is obvious that the cap can be removed to replenish the oil or clean the cup without altering the adjustment of the spindle, while the index finger and scale provide for almost instantly resetting the spindle to continue the same feed of oil, should the spindle be removed for any purpose.

1



2

This invention has been patented by Mr. Herman A. Todd, of Evanston, Wyoming.

A SCIENTIFIC FISH STORY.—An Italian has discovered that fishes are fond of music. To one Signor Garetti the honor of the discovery is said to be due; and recently, with a party of friends, he is said to have tried the experiment on Lake Geneva, which proved quite successful. Musical notes, especially those produced by the human voice, attracted the fishes in great numbers around the boat. Fishermen should try the experiment.

Trial of the Spanish Twin Screw Torpedo Cruiser Destructor.

The development of high-speed vessels is one of the features of naval architecture of the present day. This development is due to improvements in the system of construction of hull, improvements in forms of vessels, improvements in forms of propellers, and, more than these, in the development of the locomotive type of boiler for marine purposes and in the increased speed at which engines are now run. The most recent development of this combination has been made in the Destructor.

She was projected by Admiral Pezuela, who was then the Spanish Minister of Marine, who requested several British shipbuilders to submit a design of a sea-going vessel of about 350 tons displacement, with as high a speed as could be obtained. Messrs. Thomson's design was accepted, on account of the high speed promised. The vessel has since been built, and was put through her first official trial successfully. The conditions of trial proposed by the builders, and accepted by the Spanish Government, were that she was first to be run three times upon the measured mile, then to run at full speed for three consecutive hours; after this she was again to be run three times upon the measured mile. From the results of the mile runs the speeds upon the three hours' run were to be determined.

This severe trial was successfully carried out on Dec. 13, in the presence of a commission of Spanish naval officers appointed by the Minister of Marine. The following were the members of the commission: Commodore Casariego, Commodore Montojo, Captains Villaamil, Romero, Elduayen, and Goitia. The vessel was tried at the Admiralty knot, at Wemyss Bay, Firth of Clyde, and afterward ran out to sea about thirty-five knots. The results of the whole day's running show that the Destructor attained a mean speed of 22·65 knots (a little over 26 miles) per hour continuously for four hours, including the time occupied in running the mile. The weights carried on this trial were equivalent to having the vessel's armament of one 9 centimeter gun, four 6 pounder rapid firing, and two 47 millimeter Hotchkiss revolving cannon, with all ammunition complete, five torpedo tubes, and ten torpedoes; the crew and their provisions and effects, all spare gear, tools, and fresh water for machinery; the vessel complete in all respects for sea, and with sufficient coal on board to carry her at 11½ knots for 1,800 knots.

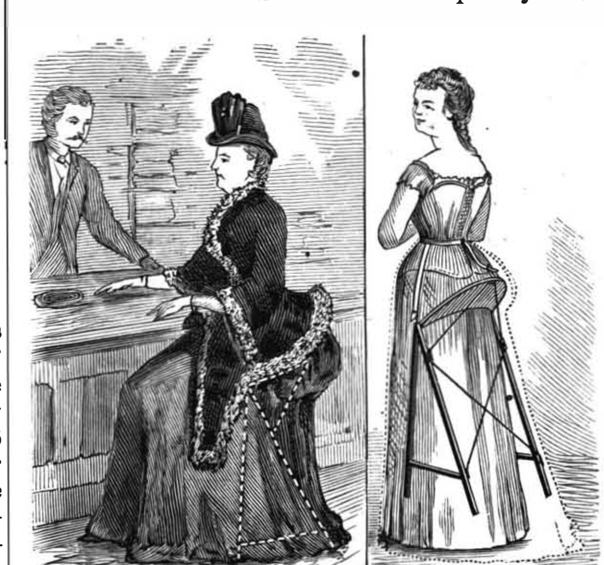
The machinery of this vessel is of the high-speed torpedo boat type, but is very much larger. There are two sets, each developing 2,000 indicated horse power. They are triple expansion, and have been designed to run at 350 revolutions per minute. The engine room is divided into two separate watertight compartments, each side being protected by a three-quarter inch bulkhead and coal bunkers. The boilers are of the locomotive type, but have several important improvements introduced by the builders. They are four in number, each in a separate watertight compartment. The advantage of this minute subdivision is obvious, not only for purposes of buoyancy, but for subdivision of effects of accident of any kind. These boilers are protected by coal bunkers in the same way as the engines. There is a transverse bunker before the boilers, and before this is a bulkhead 1¼ inches thick, which protects the machinery from raking fire. Abaft of the engines is a cross bunker, which affords similar protection from aft. The machinery worked very successfully, the boilers showing no sign of priming or leakage. The forced draught was very moderate, being only 2 inches. The results of these trials will be particularly interesting to war-ship engineers at the present time, as attempts have been made by the Admiralty to introduce this type of machinery more generally into war ships, but they have not yet been very successful. It is only by great care and fortunate experience that it is possible to avoid disaster in this type of boiler and engine when worked in groups in large ships.

The vessel had a run of 185 knots, in order to determine her consumption at about 11 knots; and it was determined that with the amount of coal she can carry in her bunkers, she can steam 5,100 knots at 11½ knots per hour. This same quantity of coal will carry her 700 knots at full speed. In addition to the members of the Spanish commission, there were present at the trials Mr. Bakewell and Mr. Bennett, of the Admiralty, Mr. J. R. Thomson, Mr. G. P. Thomson, Mr. Parker, Mr. C. D. Haynes, Mr. Biles, Captain Celies.

This vessel is interesting in many respects. She is not the first high-speed twin-screw vessel built in this country, but she is the second, the first being the Russian torpedo boat Wiborg, of 168 tons displacement, which also was built by Messrs. Thomson. The Destructor's value consists not only in her high speed, but in the fact that she is able to maintain this speed in a seaway. Recently she was taken to sea with the Spanish commission on board, and in a heavy sea she maintained a speed of 22 knots for four hours. The duplication of her machinery is an enormous advantage to her, compared with a single-screw ship. Her turning powers are good, as she has a very large after-rudder, and also an auxiliary bow rudder. She turns a complete circle in about 1¾ minutes and of less than three times her length. The protection by thick plates of the vital parts will be of value to her if she is ever attacked by machine guns. As it seems to be almost certain that high speed cannot be maintained in a seaway in a vessel of smaller size than this, we may confidently look to the Destructor as the forerunner of a large number of other similar vessels, whose chief characteristic will be their speed at sea. It is to be regretted that this vessel is not the property of our own Admiralty, but we have no doubt that the Grasshopper type, though slower, will, if their machinery is successful, be useful ships of the same type.—*The Engineer.*

COMFORT AND STYLE TOO.

So long as it is the fashion for ladies to wear bustles of the pronounced amplitude now favored by so many of the fair sex, we do not see why the fact may not be taken advantage of to introduce an invention calculated to make it convenient for them frequently to rest

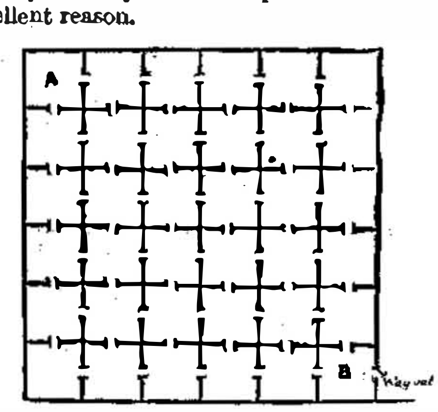


COMBINED STOOL AND BUSTLE.

from the fatigue of long standing or walking. Such, at least, we presume to be the idea of the inventor of the device shown in the accompanying illustration, for which a patent has recently been issued. The transformation the style has effected in the appearance of a lady properly fitted out in walking costume is something really wonderful, and we are not surprised, therefore, that several other inventors have rushed into the same field, with devices which would not otherwise have been thought of.

A PUZZLE.

The following I *believe* has a solution, but what that solution may be I by no means promise to tell—for a most excellent reason.



The figure represents the plan of a prison with intercommunicating cells (bless the Latin); a prisoner in A is offered his freedom if he can make his way to B after passing once, and once only, through all the 36 cells. How is he to do it?—*Knowledge.*

What About Duluth

Duluth is a side hill city. There is nothing gentle about the slope. The hill commences at the edge of the lake. Ten minutes' climbing from the docks takes one through the railroad yards, the business section, and into the suburbs. Still there is plenty of hill ahead. You are not much more than half way up when you reach the outer fringe of the handsome residences. But there is no need of going higher just now, for an "about face" presents a view of all Duluth, and at your feet lies the finest harbor in the world. On the left as you stand facing the lake there stretches out that singular formation, Minnesota Point. Seven miles long, slightly curved, averaging about 700 feet in width, with a covering of pine trees, the point looks like a gigantic green needle. It is a natural breakwater. Outside the point is a great lake. Inside, with the ragged shore line of Wisconsin for the other boundary, is a harbor. At your feet on the right, Rice's Point juts out and curves toward the Minnesota Point, making an inner harbor. Away in the distance a headland from the Wisconsin shore extends into the lake toward the extremity of Minnesota Point. That is Wisconsin Point; and between the two points was formerly the entrance to this harbor, seven miles long and from two to three miles wide.

But Duluth saw an opportunity to improve upon nature. She cut a canal 200 feet wide and 30 feet deep across Minnesota Point a few furlongs out, and now the largest steamships move into the improved harbor between Minnesota and Rice's Points, and take their places at elevator or warehouse or dock, as business requires, while the sailing vessels furl their canvas at the mouth of the canal and in five minutes are towed to their destination. This was a natural harbor, but it was susceptible of considerable improvement. Dredges have worked out slips and basins, piling the gravel within the shore line until the harbor is deep water, and the docks are to a considerable extent of solid earth. The largest lake vessels lie alongside the warehouses and elevators, and all around is a network of railroad tracks. It matters little to Duluth, commercially speaking, if the bill is steep. Her gigantic trade is handled on the water fronts, and such facilities never were surpassed. When the full advantage is taken of what nature has here provided, Duluth will have fifty miles of dock line.—*Coal Trade Journal.*

How Gold is Exported.

The process of shipping gold across the ocean is thus described by the Boston *Commercial Bulletin:*

Each keg contains $50,000 in clear gold. It is from the Bank of America, at New York, that most of the gold is shipped from that city. The foreign steamships sailing from Boston now carry little or no gold, although the reverse was the case years ago.

The shipments of gold are not generally on the bank's account. At a first glance, persons might well suppose that when the demand arises for gold to send abroad, the shipper would only have to send in his order for his hundreds of thousands to the sub-treasury, where millions of specie are on deposit. But there are sufficient reasons why this plan will not work. The sub-treasury can pay out its coin only to creditors of the government. With the Bank of America the associated banks keep on deposit constantly an enormous sum of gold, sometimes amounting to $40,000,000. To the members of the bank association the Bank of America issues its own certificates against these deposits, redeemable on demand. So, when there is occasion for making a gold shipment, the coin is prepared for that purpose in the rear office of that bank; here it is bagged and kegged and made ready for shipment.

Kegs in which gold is packed—"specie kegs" as they are called—are made of extra hard wood. They must have an extra iron hoop. Specie is not thrown loosely into a keg, nor, upon the other hand, is it carefully wrapped in tissue paper and piled up one coin upon another. The keg serves only as a protection for canvas bags, into which the gold is placed in the ordinary hit and miss fashion of pennies in a man's pocket. Into each bag go $5,000, and ten bags fill a keg.

In the interests of security, each keg is treated to what is technically known among the shippers as the "red taping" process. At each end of the keg, in the projecting rim of the staves above the head, are bored four holes at equidistant intervals. A piece of red tape is run through these holes, crossing on the head of the keg, and the ends finally meet in the center. At the point of meeting, the tape is sealed to the keg's head by wax bearing the stamp of the shipper.

Gold crosses the ocean very much as does every other kind of freight, without any special looking after. The average rate of insurance is about $2,000 on a shipment of $1,000,000. There are shippers who do not insure. Having to ship $1,000,000, they give it in equal parts to half a dozen different vessels. It is a strict rule with some firms never to trust more than $250,000 at a time on any one ship.

A certain party furnishes all the kegs for gold, and packs them. The man who does this is a monopolist in his way. Shippers of large amounts always lose a few dollars by abrasion, but not exceeding sixteen ounces on a million dollar shipment. The only protection to be found against abrasion lies in the shipment of gold in bars instead of coin. Gold bars are not readily obtained.

Culture of Asparagus.

Mr. Joseph Harris argues, in the *American Agriculturist*, that "the plants which contain comparatively little nitrogen require a 'sap of the soil,' rich, rather than poor, in nitrogen. Turnips contain comparatively little phosphates, and yet soluble phosphates are found of special value as a manure for turnips. Wheat and barley contain comparatively little nitrogen, while clover, peas, and beans contain a high proportion of nitrogen; and yet it is a well known fact that to produce a good crop of wheat or barley, the sap of the soil must be richer in nitrogen than for clover, peas, and beans."

Correspondence.

Remarkable Runaway of an Engine.

To the Editor of the Scientific American:

We had a runaway of an engine here Friday afternoon, Dec. 17, about 1 o'clock. As engine No. 27 of the C., H. & D. R.R. was backing around the curve from the bridge for the purpose of taking water, the second section of train No. 17, engine 73, in charge of engineer George Long and fireman George Reaves, was sighted. Engineer W. G. Stump, of 27, reversed his engine and threw her wide open, in hope of getting her out of the way, but was too late, and the engine, coming down, crashed into the other, stove in the rear end of the tender and broke the tender loose from the engine, whose throttle valve had been thrown wide open. The men jumped to save their lives, and the engine proper, not being hurt, started forward at a frightful speed, tearing down the main track toward the Union Depot at the rate of about 55 or 60 miles an hour. When she struck 6th St., she jumped the track and ran along on the ground, breaking the heavy steel rails and knocking off five switch standards, finally finding her way back on the C., C., C. & I. track, on which she rushed through the depot out to Carlton, seven miles distant, where she stopped on account of steam going down. No one was killed or injured by this remarkable runaway.

O. E. V.

Dayton, O., Dec. 18, 1886.

Planing Mill Explosion.

To the Editor of the Scientific American:

The recent explosion at East Cambridge, Mass., said to be attributable to the ignition of "minute wood dust," has suddenly become important to planing mill owners. Whether wood dust is explosive or not is a question to be considered.

I think it was settled not long ago that the dust in flouring mills is explosive, but I have never heard that wood dust, whether fine or otherwise, is explosive. Judging from my own observation for the last twenty-five years of the firing of steam boilers with shavings, the most reasonable theory that I am able to form is this. That the East Cambridge furnace was stuffed so full of shavings as to smother the flame; the furnace door was closed before the flame had started; the grates being completely covered, the fuel smouldered, accumulating gases for some little time, which, if left to itself, would soon have exploded without the intervention of the puff of air from the trapdoor which "bulged out."

If dust had anything to do with the explosion (which I doubt), it may have been like the priming in an old-fashioned flint lock gun, which explodes the charge in the barrel; and, in the case referred to, the trap door was the flint that struck the spark.

WM. W. HUBBARD.

Manchester, N. H., Dec. 20, 1886.

Important to Inventors.

To the Editor of the Scientific American:

In your issue of Nov. 13, 1886, in an article on the "Bell Telephone Monopoly," you use these words, when descanting upon the House Telephone of 1868: "*But a device is protected by letters patent for all possible uses.*"

What I desire to know, and what others would like to have your opinion upon, is whether it is a settled, unquestioned principle of patent law that an inventor is the absolute owner under his patent of every use to which his invention may be put, in case his specifications and claims do not mention them? To illustrate: An inventor makes a new and novel hen's nest—one that the egg, to prevent the encroachment of egg-sucking dogs, rats, "varmints," etc., falls through a little trap door in the bottom into a close receptacle. Now if it should be found that said hen's nest was an excellent rat trap, and proved better for that business than for the object claimed in his specifications, would he be entitled to go on and manufacture rat traps under his hen's nest patent? In other words, Royal E. House, in 1868, made a delicate receiver for receiving the Morse ticks or pulsations, and nearly twenty years afterward some inquiring mind discovered that it was a machine that would take on and convey sounds made by air waves of breath. Now are the late discovered possibilities of his invention public property by reason of the expiration of the patent? Or, would the subsequent discovery of the possibilities of such instrument be the subject of a true and valid patent? It seems to me that the only thing an inventor can claim would be the use to which it could be applied, as eliminated and described by himself, and that if the *same mechanical contrivance*, as in the case of the House telephone, should by some one else be used for another purpose, the discovery would belong to him. It seems that the courts will rule in this way. Let us hear from you.

A. R. C.

Lincoln, Ill., Dec. 9, 1886.

ANSWER.—If a man patents a hen's nest, the patent secures to him the exclusive right to make, use, and sell the article. How could he enjoy such right if another party could step in and obtain a patent for using the article, no matter for what purpose? If the hen's nest will serve equally well as a rattrap, such fact adds to the merit and value of the original patent. The man who used it for rats did not invent anything, and therefore is not entitled to a patent. The courts have decided that the mere use of a well-known device in a well-known way is not sufficient to support a patent.

The patent of Royal E. House, of 1868, has expired, and its use is free to the public. Any one has the right to make, use, and sell it, and purchasers may use it as a telephone if they so desire. It was not new when House's patent was granted to operate the diaphragms of electro-magnetic instruments by the human voice. This was done by Philipp Reis, with his electric telephone, prior to 1862.

Labrador.

To the Editor of the Scientific American:

In your issue of November 20, I notice an article headed "The New North." It has set me thinking; and a flood of recollection comes over me. It was once a dream of my childhood, a realization, in part at least, of my more mature manhood, and

"The memory of that summer dream
Is pleasant to me yet."

I hesitate to speak the name of my subject, for, as I have talked of it and written about it until it is well nigh threadbare, I actually fear that at its mention your readers, or some of them, may crook their arm and revolve their hands with a rotary motion, while a slightly sarcastic smile illumines their countenances, as they recognize a familiar friend. "Can any good thing come out of Nazareth?" they ask; or "Old friends with new faces;" though most likely an audible sigh or expression akin to sadness will result from its disclosure. Yet old as it is, there may be a drop in the bucket to some poor thirsty seeker after "something new." So I will proceed. And why go searching about for latitude 0, longitude 0, or something equally at present inaccessible, monstrosity of nature, when you can find all the beauties of an Arctic winter, with none of its startling horrors, or see the peaceful moon arise, or the generous sun set upon placid ripples, as the moment's glimpse might truly call them, of old ocean stretching far away into apparent nothing but a halo of beautiful light; and all this within the pale of humanity? Why seek a *new* "New North," when there be such a grand *old* "New North" attainable with no pain and one-tenth the cost? Now this is not an advertisement. I have made four trips to this region, and know it pretty thoroughly by this time; but there are, to my mind, certain invincible arguments why I cannot again plow these seas and coast these mains. I have led three expeditions thither and returned in safety, but these lovely scenes now only recall, they do not possess my memory.

Now the great pity is that some enterprising person does not establish a yearly summer excursion to this region. It is easy of access, and it is beautiful when viewed without fog, rain, or black flies. Go to your New North, or Alaska, or your own seashore, in fact, and you are liable to these pests, though here we will substitute mosquitoes for the black flies; and the chances are that you will have enough days clear to show you the sights. Icebergs in summer! I have counted over two hundred in plain sight, the farthest one scarce half a mile away—some of them bigger than the hugest pile of single buildings in New York city. It was in this region that Mr. Bradford gathered the materials for his famous iceberg scene, which brought him so much renown. I have seen them of all shapes and sizes, heard them go to pieces with a noise like thunder, viewed them covered with a basso-relief of seals and turreted with sea birds, and felt their cold breath. I have caught cold fish in their own homes, trout in an angler's paradise, birds in a hunter's heaven, and eaten, slept, and talked Labrador until I am already a veteran in my youth, and almost in my second childhood regarding it. Some time ago, your pages put forth a scheme for diking the straits of Belle Isle, to change the climate of Canada and the Atlantic seaboard, at the cost of forty millions of dollars. Time and again have I passed the sounding lead over the very path marked out for this gigantic scheme. Gigantic humbug? I will not even venture an opinion. Spend that money and buy Canadian North America, and the enemies' bullets will not reap a harvest of widows and orphans who will clamor for pensions to feed their hungry mouths, while the day will surely come when we may utilize every foot of sea and soil. But why proceed? My object is accomplished if my words are read, even if they are not acted upon. Yet, to my mind, they cannot be acted upon too soon. Labrador is much nearer than Alaska. It is a valuable and beautiful region in spite of its barren rocks and "rock bound" coast, and certainly deserves the attention of gamers, fishers, pleasurers, and the American Republic.

* *

Philipp Reis, Inventor of the Telephone.

There has been much discussion whether the Reis telephone was able to transmit only tones or also words. From the documents at hand, we consider it beyond all doubt that words were also transmitted; and as a proof of this, we would add to the material which Thompson, in his biography of Reis, has most carefully collected, a letter written by Reis to F. J. Pisko, on the 18th of October, 1863:

MOST HONORED SIR: In answer to your distinguished favor of the 16th inst., allow me first to express to you my thanks for your friendly interest in my invention, and for kindly sending me your interesting article.

Your wish regarding the sending of articles and drawings I can fulfill only very imperfectly, as my time does not permit me to comply with the demands in this regard that are made upon me from all sides.

I therefore refer you to the only article published by me (*Bericht des physikal. Vereins zu Frankfort a. M.*, 1860-1861), which you surely can obtain there. Furthermore, the apparatus of the latest construction will be described in Pouillet-Mueller's "Lehrbuch der Physik," last edition (in press). Moreover, I add description, as is done with each instrument, and would say to you that Mr. Hauck, mechanician in your place, has ordered an instrument, and can certainly give you information.

Regarding the explanation upon page 15 of your programme, I must say that the conclusions drawn, although rightly based upon former suppositions, are totally false (simply because the suppositions are false). The apparatus produces whole melodies, the scale between C and *c* very well, and I assure that, if you will visit me here, I will convince you that one is able to understand also words.

How is it that the tympanum of our ear can reproduce all tones with their quality (Klankfarbe), accords, etc.?

It would certainly be best if you would convince yourself of the simplicity and correctness of the facts.

With especial regard, yours obediently,

(Signed) PH. REIS.

Friedrichsdorf, 18-10-63.

Far in advance of his age, misunderstood, and poorly encouraged, a disease of the lungs completed what sickness and discouragement had begun. In 1873 his illness brought the inventor to his sick bed, after he had already, in 1871, lost his voice. He seemed, however, to recover, and again took up his duties as teacher.

He died January 14, 1874, and rests in the churchyard at Friedrichsdorf, where a monument was erected to him by the Physical Society of Frankfort-on-the-Main.

French Industrial Prizes.

Among the prizes offered for 1887 by the French *Societe d'Encouragement* for discoveries and inventions of value to French industry, the following have been quoted in the Continental press: Prizes of 1,000*f.* (£40) each: 1. For the utilization of residue in factories. 2. For the discovery of a new alloy for industrial purposes. 3. For the industrial utilization of a cheap and abundant mineral substance. 4. For the useful application of metals which have hitherto been only used to a limited extent for industrial purposes. 5. For the construction of a heating appliance to produce, in small industrial workshops, elevated temperatures by a quick and economical method.

Prizes of 2,000*f.* (£80) each: 1. For a small motor for workshops, acting for itself or in connection with a larger factory. 2. For suitable improvements in the mechanical spinning of flax. 3. For improvements in the usual form of grain mills. 4. For a motor for heavy oils. 5. For the economical production of ozone, and its application.

Prizes of 3,000*f.* (£120) each: 1. For a mode of transmitting natural mechanical forces over long distances, when their immediate utilization is impossible. 2. For the manufacture of glasses for chemical purposes. 3. For the manufacture of fine stoneware. 4. For the construction of a simple and solid appliance which will indicate the progress of a train at any distance, in a reliable, automatic, and regular manner. 5. For the construction of an appliance which will indicate, at a distant point, the temperature of a heated room. It is stated that models, etc., must be sent to the secretary of the society, 44 Rue de Rennes, Paris, by January 1. Competitors are reminded that the communication of processes to the society does not afford them the protection of a patent, which should be applied for before the competition.

THE *Pharmaceutische Rundschau* gives the recipe for an excellent disinfectant: Four pounds of crude sulphate of iron or two pounds of sulphate of copper are dissolved in hot water, to which two ounces of sulphuric acid are added. Mix with the solution while still hot eight ounces of carbolic acid, filter, and fill in bottles. When this powerful remedy cannot be applied in its fluid state, dry sawdust thoroughly moistened with it may be scattered over the floor of a dark room or other places to be disinfected.

MIXING OF FLUIDS—EXPANSION BY HEAT.

T. O'CONOR SLOANE, PH.D.

The phenomena of diffusing fluids have already been alluded to, in an early article of this series. The mixing of thick silicate of soda solution with water was used as the illustration. To a suggestion from Mr. C. Trautwine, Jr., of Philadelphia, the experiment here illustrated is due. He observed that, in dropping whisky into glycerine, a peculiar effect was obtained. The whisky by its energy, due to falling, penetrated deep into the thick and heavier glycerine, and immediately tended to rise to the surface. In so doing, it subdivided the glycerine into veins, and seemed incapable of mixing perfectly with it.

In the illustration, a glass containing some glycerine is shown. From a height, in order to obtain impetus, alcohol is poured into the center of the surface. The effect described above is produced. If rightly done, the veins of subdivided glycerine will extend quite deeply into the center of the fluid, and produce a very curious and striking effect.

THE MIXING OF GLYCERINE AND ALCOHOL.

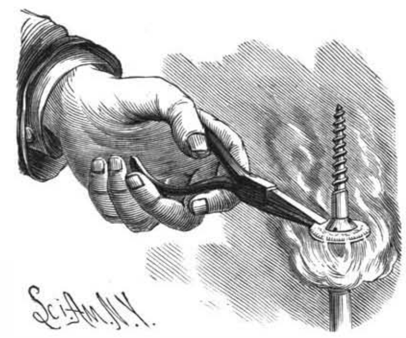
The subject of heat is susceptible of illustration by a number of experiments. Until reduced to the absolute zero, —273° Cent., the constituent molecules of all substances are assumed to be in intense and rapid vibration. This implies that they do not touch each other. By their oscillatory motion under the influence of the kinetic force, or objective heat, they are not allowed to rest touching each other. Hence, it follows that by applying more heat, their paths of vibration should be lengthened, and they should occupy more space. An *a priori* consideration would therefore lead to the conclusion that bodies increase in size as they grow hotter. Such is actually the case. The statement that heat expands and cold contracts is so old as to be known to all. It is a crude expression of a universal law.

To illustrate its universality, it should be shown experimentally as applying to all three states of matter—the solid, the liquid, and the gaseous. The expansion of solids shall first be considered here.

In general terms it is the most difficult of the three forms to use as the basis of a satisfactory experiment. Iron, per degree Centigrade, only expands 0·000012, brass 0·000018, and zinc 0·000029. Non-metallic substances are not so available as the metals, because they cannot, as a rule, be heated so highly. If a bar of metal is adopted, its expansion can only be shown by multiplying its movements very largely.

From the coefficients of expansion given above, it will be seen that zinc is a very suitable metal for the purpose. It is fusible at a rather low point, but not so much so as to impair it for experimental use where the temperature need not rise very high. The apparatus for exhibiting the expansion of metals is shown in the cut.

A wooden base, provided with two standards, is first constructed. It may be about twelve inches long and three wide. The standards are best mortised into the base, and glued or keyed so as to be free from shake, or they may be screwed or nailed directly to the ends of the base piece. These uprights should be about four inches high. Through one of them, the left hand one in the cut, a hole is bored, near the top, through which a wood screw passes freely, screwing in and out. In the inner face of the opposite standard, at the same height, two sharply pointed pieces of wire (about one-sixteenth inch in thickness) are inserted, whose points project about an eighth of an inch from the wood.



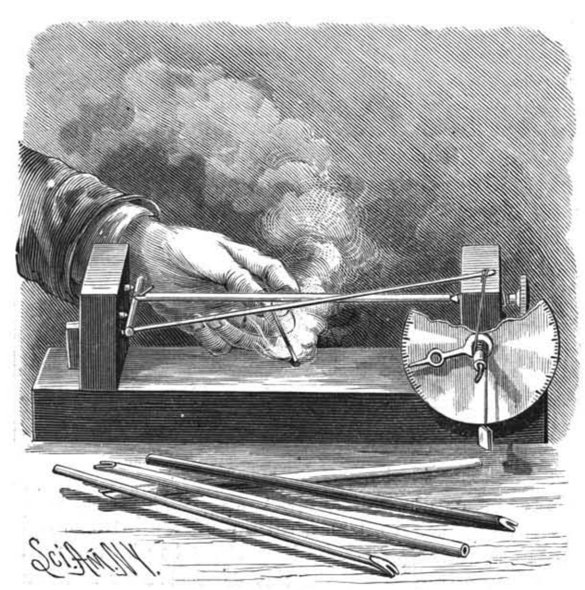
SOLDERING HEAD ON SCREW.

The rod or piece of metal to be expanded comes next. Several are shown lying in front of the apparatus. A perfectly straight piece of brass, copper, or iron wire, or a corresponding rod of zinc is needed. The piece should be of slightly less length than that of the space between the standards. One end is filed off square, and a slight excavation is drilled or punched in its center. This is to receive the point of the wood screw. The other end is filed off obliquely, and a slit filed in the center axis of the rod. If the rod is very thin, less than a quarter of an inch, its end may also be slightly upturned, so as to produce a larger oblique surface. One of the pieces is shown thus constructed. In any case, a shape is given the end somewhat similar to that of the claws of a carpenter's hammer.

A short piece of wire has two holes punched or drilled in its surface, to receive the two points projecting from the right hand standard. Another very fine hole is drilled almost or quite through its center, in which a pin about the diameter of a ladies' hair pin is soldered. This pin should project a quarter of an inch, and should be about 135° from the two holes, as referred to the circumference of the wire. Finally, in the end of this short piece of wire another hole is drilled, and the long arm seen in the drawing is soldered therein. The experimental rod is placed in the position shown, and adjusted by screwing in or out the screw until the least motion affects the movements of the long index wire. Now if the rod be heated, it will expand, and raise the index wire perceptibly.

To still further multiply the extent of motion, the index attached to the left hand standard is provided. A wire axis is thrust into the wood. A thin tube, which may be of glass, is placed over this axis, a paper index is secured thereto by sealing wax, and the end of the wire is bent to secure all. If desired, a graduated dial may also be pasted to the standard. A thread is attached to the end of the wire index, is carried three or four times around the tube. At its end is a small weight.

By the wire index every movement of the rod in the direction of its length is multiplied, perhaps eighty or a hundred times. This, by the paper index, is again multiplied probably twenty times, giving a total increase of motion of two thousandfold. Hence the sensitiveness is very great. A match held under the rod will produce a visible movement in the index, while a candle or alcohol lamp will produce more than a full rotation of the index.

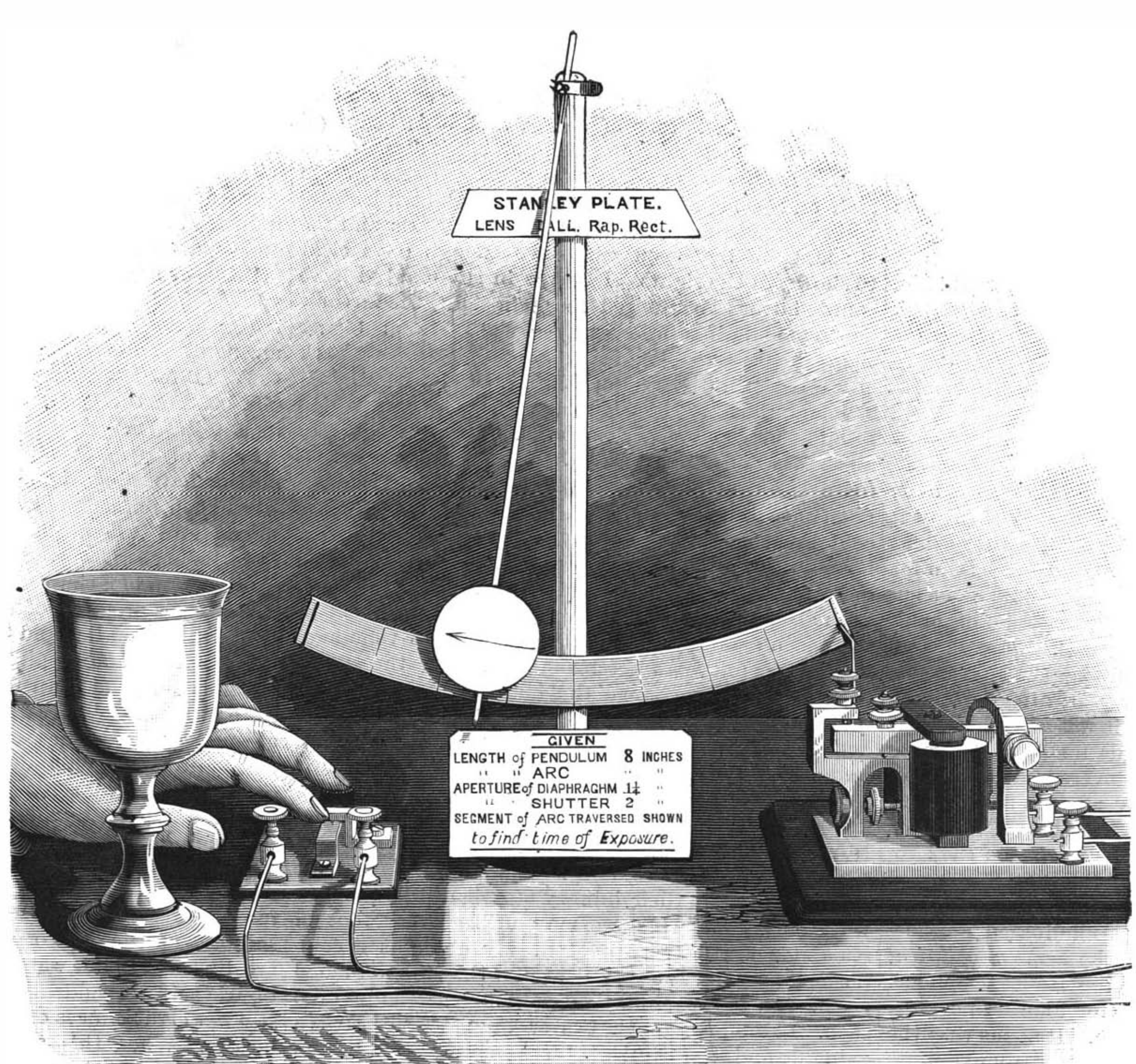


APPARATUS FOR ILLUSTRATING THE EXPANSION OF METALS BY HEAT.

The soldering is very easily done. A little hydrochloric acid is neutralized with zinc. The places to be soldered are cleaned and filed up bright, and a little of the "soldering acid," as it is called, is placed on them with a wire or a match. On heating one of the pieces in an alcohol lamp, with a bit of solder resting on it, the solder will melt and flow over the metal. This is done to both pieces separately, and afterward they are heated until the solder melts, and pressed together while held in the flame, removed, and allowed to cool. In the cut the operation is shown of attaching a head, which may be a copper cent, to the wood screw, to facilitate its manipulation. After tinning or coating with solder one side of the cent and the screw head separately, the screw and cent are placed as shown, are heated until the solder melts, and allowed to cool, when the union will be secure.

PHOTOGRAPHY OF A MOVING PENDULUM.

We represent in the cut accompanying this article an interesting achievement in photography. It is not only of value in itself as a perfect production of the art, but is very suggestive. It opens the question as to how much movement can be allowed to an object which shall not be detected in the blurring of its image, and also as to the relation between the distance, speed of object, and time for instantaneous exposure in photographing a moving object. Thus the one-hundredth of an inch is a distinctly visible quantity. A movement during the time of exposure which would, on the plate, produce this amount of displacement would tend to cause a blur. By one high authority the amount allowable is placed at 1-10 millimeter, or the 1-250 of an inch. It is uncertain how far this can be accepted as an absolute law.



PHOTOGRAPHY OF A MOVING PENDULUM.

If a moving steamer were photographed so as to be reduced to 1-1000 of her size, a displacement on the plate of 1-250 inch would represent on the part of the steamer a movement of 1000-250 inches, or four inches. At a speed of 15 miles an hour, this would occupy a period of 1-66 second. This reduction would represent the City of Rome as a little over six inches long.

In photographs of distant objects, there would be a certain difficulty in determining the blur. The grain of the paper would tend to conceal it. When a near object is photographed so as to be reduced to one-half only of its natural size, any displacement in the time of exposure is much more easily detected. It is such subjects that test most rigorously the limitations of the photographic art as affected by the shutter mechanism and sensitiveness of the plate.

The cut represents almost of full size a photograph of a swinging pendulum. It was taken by Dr. J. J. Higgins, an amateur photographer of this city. The conditions were as follows:

The pendulum was eight inches long as regards the distance from its point of suspension to its center of oscillation. Thus its period for small arcs would be about 0·4 sec., and for a longer arc such as indicated by the divided circle a very little more. It was held at one extremity of the graduated arc by a catch attached to the telegraphic sounder, so as to be released when a current of electricity was passed through the magnet. In the circuit with the sounder were included a key, a resistance coil, and an electrical detent of similar character to the sounder, for holding and releasing the shutter of the camera. The paper arc was divided into inches, and the general data of the experiment were written on the cards seen attached to the standard. The apparatus was set upon the roof of Dr. Higgins' residence. To make the print a certificate of its own authenticity, a goblet of mercury was placed by the side of the apparatus, and was photographed with it. This proved that the table was level. Otherwise, by inclining the apparatus, the pendulum could be taken by a time exposure in any desired position. At the upper end of the rod, two threads were used for suspending the pendulum. This precluded the possibility of the pendulum being mechanically held to one side, as it would be impossible to do this and keep the threads aligned with the rod. The camera was then placed a short distance from the apparatus, focused, the shutter detent arranged, a mirror was placed so as to reflect the sunlight directly upon the pendulum, and all was ready.

A touch of the finger on the key released both shutter and pendulum. The pendulum swung down, passed the lowest point of its arc, consuming very nearly ¼ second in the journey, and just as it was rising on the opposite side was photographed. The sharpness of the image is surprising. Absolutely nothing can be detected to indicate the motion of the pendulum. The length of the pendulum is known; the divisions of the arc can be reduced to degrees, so as to give its angular displacement, and thus we are in possession of the data necessary to arrive at an idea of the time of exposure.

The pendulum in its journey from starting point to the place where it was photographed had spent about ¼ second. It was at this point moving at the rate of 25·8 inches per second. Taking the reduction as one-half, which is not far from the truth, and allowing for a displacement of image on the plate of 1-200 inch, this would give for time of exposure $\frac{1}{12{\cdot}9\times200}$ second or 1-2580 second. For Mr. Muybridge's exposures the time of 1-500 of a second has been claimed. Mr. E. J. Marey, who in France has done the most important work of the last few years in photographing moving men and animals, has used a regular exposure period of 1-2500 of a second. Dr. Higgins, therefore, seems to have about reached the same limit, for when the sharpness of the image is considered, it is not easy to admit a greater displacement than that used in the calculation.

Again, it is necessary to distinguish between the efficient period and mechanically opening period of a shutter. Little effect is produced upon the plate until the shutter is partly open, and the light ceases to a great extent to act before the shutter is fully closed. The exposure, however, was wonderfully short. When the nearness of the object to the camera is taken into account, the perfection of the photograph produced is very remarkable.

Hydraulic Jack Patent.

In the U. S. Court, Southern District of New York, in the case of Richard Dudgeon v. Watson & Stillman, for infringement, Judge Coxe sustained the plaintiff's claims and granted an injunction. The defense was want of novelty and non-infringement. The Judge in his opinion describes at length the workings of hydraulic jacks, and says there is no doubt as to the infringement of the patent, as the jack made by defendants works in substantially the same manner.

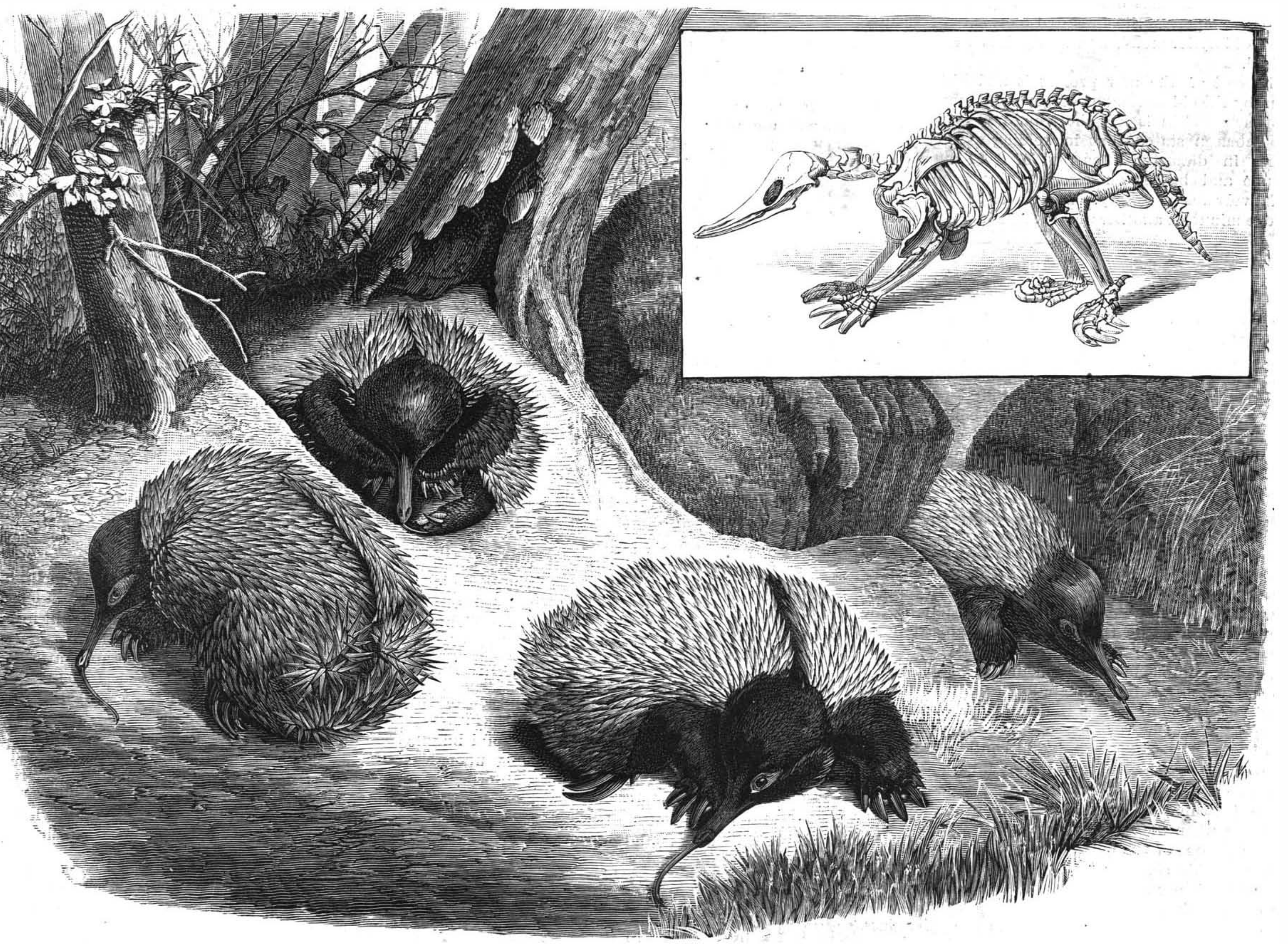
SOME one truthfully asserts that it is cheaper to get a good engineer and a good engine than to procure an inferior quality of both articles.

THE PORCUPINE ANT EATER.

An important question in natural history can now be answered. There are egg-laying mammals. This fact, which has long been believed by scientists, has finally been proved, and the link between mammals and birds, which, according to the saying that "Nature makes no jumps," must necessarily exist, has been found. It is worthy of note that Darwin was interested in this question.

August 25, 1884, Dr. Wilhelm Haacke, former assistant of Haeckel and Director of the South Australian Museum in Adelaide, discovered that the porcupine ant eater (*Echidna hystrix*) laid eggs, and the same discovery was made a few days later by W. H. Caldwell, a young English naturalist who went to New Holland to study the development of animals of the duckbill species. The anatomical construction of these animals and their position in the zoological system has been a subject of discussion among naturalists, but they have finally been classed as mammals. The particular animal to which we wish to call attention (see accompanying cut, taken from the *Illustrirte Zeitung*) is the porcupine ant eater (*Echidna hystrix*). It is the smallest of the monotremes, and reminds one of the porcupine. Its body is plump, and its short legs are each provided with five strong toes armed with sharp nails, well adapted for burrowing. Its beak resembles closely that of the woodcock, being thin and tube-shaped. The mouth is very small, only large enough for the passage of the worm-like, rough-pointed tongue, which can be extended some distance beyond the beak and is used for drawing in food (ants and other insects). No ears are visible, but there are hearing passages, which can be opened and closed by folds of skin. The upper part of the body is covered with black, pointed quills, the roots of which are surrounded by short hair, and the head, legs, and other parts of the body are also covered with hair.

This ant eater lives in mountainous districts and in high, dry woods in South Australia, where he burrows under the roots of the trees. In his hole he makes a nest which he lines with parts of plants. To protect himself from an enemy, he rolls himself up like a porcupine.



THE PORCUPINE ANT EATER.

The Northwestern Miller, of Minneapolis, Minn., is a weekly publication which has attained a deservedly high position as a representative of the milling interests of the country. It celebrated the holiday season this year by issuing an unusually attractive number, a prominent feature of which was the presentation of pictures of a large number of leading members of the trade.

Welding by Electricity.

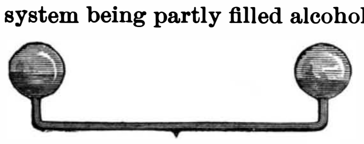
Recently, at the Institute of Technology, Boston, Professor Thomson, of the Thomson-Houston Company, of Lynn, made known to the public his new and remarkable method of welding, by which a broken bar of metal can be easily reunited, or bars of different metals welded together; and those materials which previously resisted welding most strenuously are now joined with ease, while those previously easily welded remain the same by the new process. Differences in specific electrical and heat conductivity are the properties which are most troublesome. The method consists in simply forcing the ends to be welded together tightly and passing a sufficiently powerful current of electricity through the joint. The resistance raises the metal to a welding heat, and the pressure makes the joint. The speaker enumerated some of the practical results obtained personally within a recent period. Iron and copper wires of varying dimensions have been joined end to end. Steel or iron bars nearly an inch in diameter have been solidly welded together, and steel has also been joined to brass. A copper rod nearly one-half an inch in diameter has been welded, requiring a current of 20,000 amperes. Steel pointed tools may be cheaply made of inferior metal, and new points welded on as desired.

The cost of the new process is undoubtedly less than by the old method of forge and hammer, while the time required is very short and no heat is wasted. Mr. Thomson stated that in welding a steel bar 1½ inches in diameter, a current of 6,000 amperes in volume and having an electromotive force of one-half a volt was necessary. The use of 35 horse power for one minute is another way to state it.

SCIENCE IN TOYS.

II.

The pulse glass, shown in the annexed engraving, is due to Franklin. It consists of two glass bulbs, formed on opposite ends of a tube bent twice at right angles, the system being partly filled alcohol or ether, the air having been expelled by boiling the inclosed fluid before sealing the tube. When the bulb containing the liquid is held in the hand, and the tube is placed in a horizontal position, the rapid evaporation of the liquid by the warmth of the hand creates a pressure which causes the transfer of the liquid to the cooler bulb. The quick evaporation of the liquid adhering to the sides of the now empty bulb increases the pressure, and causes a rapid ebullition of the liquid in the full bulb, and at the same time carries off the heat to such an extent as to produce a very decided sensation of cold.

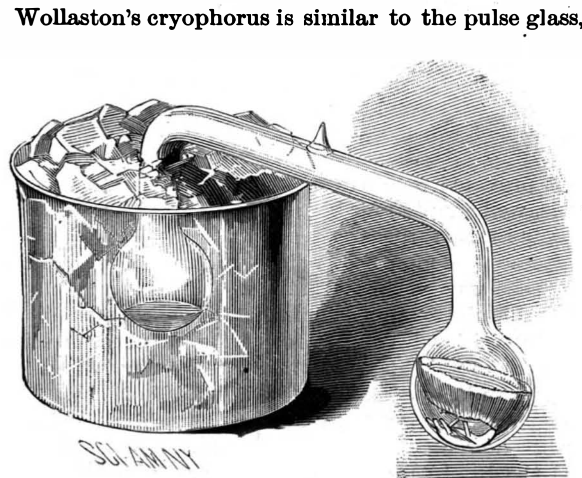


PULSE GLASS.

When the bulb is held at an inclination of about 40°, the liquid pulsates from one bulb to the other. The expulsion of the liquid from the bulb in the hand produces cold, which is quickly dissipated; and when equilibrium is restored, the liquid contained by the tube condenses the vapor in the empty bulb, and enters that bulb, to be again expelled as before.

The instrument operates continuously and very regularly when placed in a horizontal position upon a table, with one of the bulbs in the vicinity of a lamp, that is, within eight or ten inches of the flame, the other bulb being placed as far as possible away from the flame and shaded.

Wollaston's cryophorus is similar to the pulse glass,



WOLLASTON'S CRYOPHORUS.

the only difference being that the tube connecting the two bulbs is made much larger, to avoid choking by ice, a thing sure to occur when the tube is of small diameter—the water vapor which is drawn toward the empty bulb (in a manner presently to be described) being condensed and frozen on the walls of the tube to such an extent as to entirely close it.

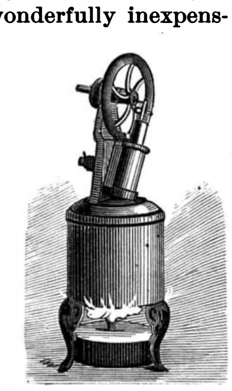
The cryophorus in process of construction is partly filled with water, which is boiled in the bulbs before sealing, to drive out the air. When the empty bulb of the apparatus is placed in a freezing mixture of ice and salt, for example, the evaporation of the water in the filled bulb, due to the cooling and condensation of vapor in the empty bulb, is so rapid as to carry off the heat to such an extent as to cause the water to freeze. Instead of employing the freezing mixture, a spray of ether or bisulphide of carbon may be projected upon the empty bulb with the same results.

This is a very interesting experiment, illustrating the principle of freezing by evaporation. It is the opposite of the popgun experiment illustrated and described in the last article on this subject. That was heat by compression. This is cold by rarefaction.

The candle bomb, shown in the annexed engraving, exhibits in a forcible way the explosive power of steam. It consists of a small bulb of glass filled with water and sealed. When held in a candle or lamp flame by means of a wire loop, it soon explodes violently.*

CANDLE BOMB.

The least expensive machine for applying to mechanical work the force exhibited by the candle bomb is the fifty cent engine, shown in the engraving below. It is a small and simple machine, but it is far more perfect than the steam engines of our forefathers. It will readily make 800 to 1,000 revolutions per minute. It is a wonderfully inexpensive example of the world's greatest motive power. Its construction is so well known as to require no description.



FIFTY CENT ENGINE.

The radiometer is one of those instruments which should perhaps be classed with scientific apparatus, but it may, nevertheless, be properly called a toy. It is a heat engine remarkable for its delicacy as well as its great simplicity. It illustrates a class of phenomena discovered by Crookes, which are complicated and difficult to explain in a brief and popular way.

RADIOMETER.

The instrument consists of a very slight spider of aluminum, supporting on the end of each of its four arms a very thin mica plate blackened on one side and silvered on the other side.

The aluminum spider is provided with a jewel, which rests upon a delicate needle point supported at the center of the glass globe.

The spider is retained on its pivot by a small tube extending downward from the top of the globe. When placed in sunlight or near a gas or lamp flame, the vanes revolve rapidly. Crookes' explanation of the radiometer is as follows: "The interior of the glass vessel being highly vacuous, the light or the total bundle of rays included in the term light, falling upon the blackened side of the vanes, becomes absorbed, and thereby raises the temperature of the black side. This causes extra excitement of the air molecules which come in contact with it, and pressure is produced, causing the fly of the radiometer to turn round." G. M. H.

* When experimenting with candle bombs, a guard of some sort should be provided, to prevent injury to the experimenter.

Encouraging Inventors.

Until very recently the propriety of rewarding inventive genius, by securing to the originator of a public benefit certain rights, by which he might obtain remuneration for the labor and time expended by him in perfecting his invention, has not been questioned. A uniformly healthy sentiment has prevailed on this subject, which has materially assisted in increasing novelties of a useful character. The incentive of a pecuniary reward has stimulated the efforts of men of ability in every walk of life, and as a consequence there has been a marked improvement in the domestic economy of all civilized peoples.

The advantages of the patent right system are probably more apparent in the United States than in any other country. No nation has produced so many useful inventions as this, and to the efforts of American genius may be ascribed the complete revolution in several fields of labor which has rendered it possible for men who were once slaves of toil to work and at the same time enjoy life. This has a forcible illustration in the changed system of farming brought about by the patent agricultural implements now in general use. Before the introduction of these useful articles every grain of wheat was paid for, literally, by a drop of sweat; but now, although the farmer is still compelled to labor, he does it under such improved circumstances that it scarcely seems burdensome, and agriculture, as a consequence, has become a favorite pursuit, instead of being avoided, as it was at one period.

It would be idle to attribute the great strides made in mechanics to any other cause than the protection afforded to inventors by the patent laws. It is unfortunately true that the deserving originator is often deprived of his just rights by his inability to comply with the requirements of the law governing the granting of patents, or, as sometimes happens, through ignorance; but this does not affect the general result. It has been asserted, also, that irregularities occur in the issuance of patents by the commissioner, by which inventions are rejected as valueless on the ground that they do not possess sufficient novelty to entitle them to the protection of a patent, and subsequently another applicant is awarded letters for substantially the same thing originally declined. Such mistakes should not militate against the system.

The truth of the matter is, that the law in its present shape is a very good one, and it has the indorsement of all who are interested in the prosperity of the nation. That it may sometimes be abused is no argument against its advisability, for very few acts are absolutely perfect. So long as a reasonable protection is accorded to inventors, no one will have cause for fault-finding. Public opinion is strong enough, as was evinced recently in the sewing machine case, to restrain those having the power to give extensions from using their privilege when it is liable to work injury to the country at large. Those who have commenced a senseless opposition to the entire system because a few grasping men, following the natural instincts of human kind, have attempted to derive more benefit from it than they deserve, will see their error, and unite with us in expressing the belief that the encouragement of genius is the product of an advanced state of civilization, and for that reason merits the friendship of sensible men.—*The Manufacturers' Gazette.*

Snow Melting Apparatus.

A system of snow melting has been devised by Mr. F. Lyon, of 94 Harleyford Road, London. When it is considered that a fall of snow 6 inches deep, over one mile of road 60 feet wide, amounts to 5,866 cubic yards, the impossibility of removing it promptly by means of horses and carts is at once apparent—the more so when it is remembered that some metropolitan vestries have from 50 to 100 miles of road, and thus would have to deal with from 300,000 to 600,000 cubic yards of snow, assuming a 6 inch fall to occur. The principle of Mr. Lyon's invention is that the snow can be dealt with in the roads on which it falls when it is in a light and fleecy condition, and therefore easily melted. The apparatus consists of a wrought iron tube about 35 feet long, having a furnace at one end and a short length of vertical pipe for a chimney at the other. The tube is made in lengths of 6 feet, and each length is tapered so that they all fit into each other and are closely packed for transport on wheels. When a fall of snow occurs, the apparatus is to be laid along the gutters of the roads to be cleared, the width occupied being about 4 feet. A fire is then to be lighted in the furnace, the heat from which will pass along the horizontal tube, which has a flatly arched top. The snow is then to be shoveled on to the heated tube, which will melt it, the resulting water flowing away to the nearest gully. A trial of this apparatus took place in the St. Marylebone district in February, 1885, on some snow which had fallen long previously and had been twice carted. Notwithstanding the solidified condition of the snow and the imperfect condition of the experimental apparatus, it is stated that 21 yards of the consolidated snow, weighing 10 tons 8 cwt. 3 qrs., and equal to 198 yards of freshly fallen snow, were melted in 10 hours with a consumption of coke of the value of 1s. 7d., or under 1¾d. per ton.

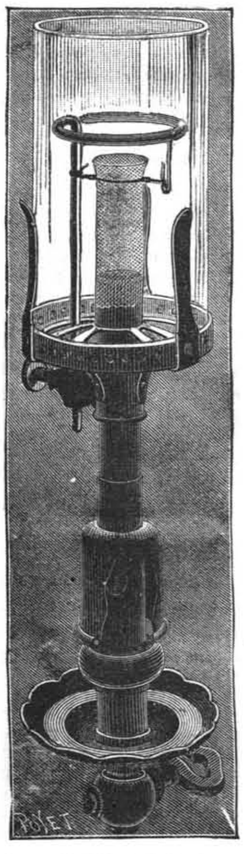
Talcum Filter.

Talcum as a filtering medium, recommended by Dr. Fr. Hoffmann, is reported by the Committee on the National Formulary to be better, cheaper, and affording quicker filtration and clearer filtrates than other media previously used. Finely powdered white talcum should be well washed with hot water, slightly acidulated with hydrochloric acid, and again washed with pure hot water until no trace of acid can be detected. It is then dried, and may be used by adding the dry powder to the cloudy mixture, and filtering through paper; or the talcum filter may be constructed in the following manner:

Make a double filter out of white filtering paper, and insert it in a quart glass funnel; mix about half an ounce of talcum with one pint of hot water in a bottle and shake well, then pour it immediately upon the paper filter, taking care so to distribute the mixture that the entire filter from bottom to top is evenly covered with the fine powder. The water will be found to pass off rapidly and perfectly clear, after which the filter is ready for filtering any cloudy mixtures. The same filter may be used frequently for the same substances; but after it has been used the funnel should be covered with a glass plate, to exclude the dust and preserve the filter clean for the next operation.

INCANDESCENT BURNER OF DR. AUER.

The peculiar feature of the gas lamp of Dr. Auer von Welsbach consists in the incandescence of certain metallic salts placed in the middle of the flame of a Bunsen burner. The principle is not new; it is the same as that in the Clamond lamp, in which, as may be remembered, the incandescent substance is formed by a little thimble of magnesia threads. On the other hand, the arrangement of the Auer burner is very simple, and appears to possess many advantages. It consists of an ordinary Bunsen burner, the end of which is covered by a hood of cotton or woolen tissue washed in a special preparation. The hood, about 6 or 7 centimeters in height, is slightly flaring and is held by a platinum thread which passes around it and is fixed to two rods of iron connected with a ring above. The longer of the two is held by a thumb screw to the pipe which supports the burner.



NEW INCANDESCENT GAS BURNER.

As soon as the burner is lighted, considerable heat is generated within the hood, which, in a few seconds, becomes aglow with a whitish blue light, remarkable for its steadiness and intensity.

It is not perfectly well known how the hood is made, but here are a few details from the patent of Dr. Auer, which throw some light on the subject: Take a solution of zircon and nitrate or acetate of lanthanum or yttrium, and soak in it the woolen or cotton that is to form the hood. The tissue is then carbonized, and leaves a sort of network, which is applied to the Bunsen. The nets thus procured appear more favorable to the production of light than the massive cylinders of zircon tested in 1868 by Tessie de Mottay on oxyhydrogen burners.

According to the inventor, each hood costs about 1 cent, and will last 1,000 hours, or until the dust of the atmosphere is sufficiently incrusted thereon to diminish the strength of the light. Finally, with equal lighting power, the consumption of gas in the Auer burner will be about one-half less than that of an ordinary burner, which should show an economy of 50 for 100, but these figures ought to be verified. The durability of the hood ought also to be determined by exact tests.—*La Nature.*

JOSEPH ECHTELER'S DESIGN FOR A GRANT MONUMENT.

Fourteen competitive designs for a monument to General Grant, to be erected in New York, have been sent in, and among these the design of a German who has lived in America for two years is especially noteworthy. Thinking that many of our readers may be interested in the design of Joseph Echteler, we give a cut of it, taken from the terra-cotta model.

The monument is to be about 71 or 72 ft. high, the lower part consisting of a mausoleum. It will cost about half a million dollars. The memorial is crowned by an equestrian statue of Grant. This represents the General as commander, riding to battle on a rearing horse, his cloak flying, and his head turned to look back, while he points in the direction of the enemy with a field glass held in his right hand.

At the four corners of the cap or upper part are four female figures representing Peace and Prosperity, Industry and Invention, Commerce and the Marine, Statesmanship and Law. On the front is a battle scene, Grant with outstretched sword riding at the head of a column of infantry, while at the left the cannoneers are busy firing the guns. At the back of this upper part, the North and South are represented as engaged in a mortal hand to hand combat, and in the midst of the confusion of the battle rises the imposing figure of a commanding general of the Southern army.

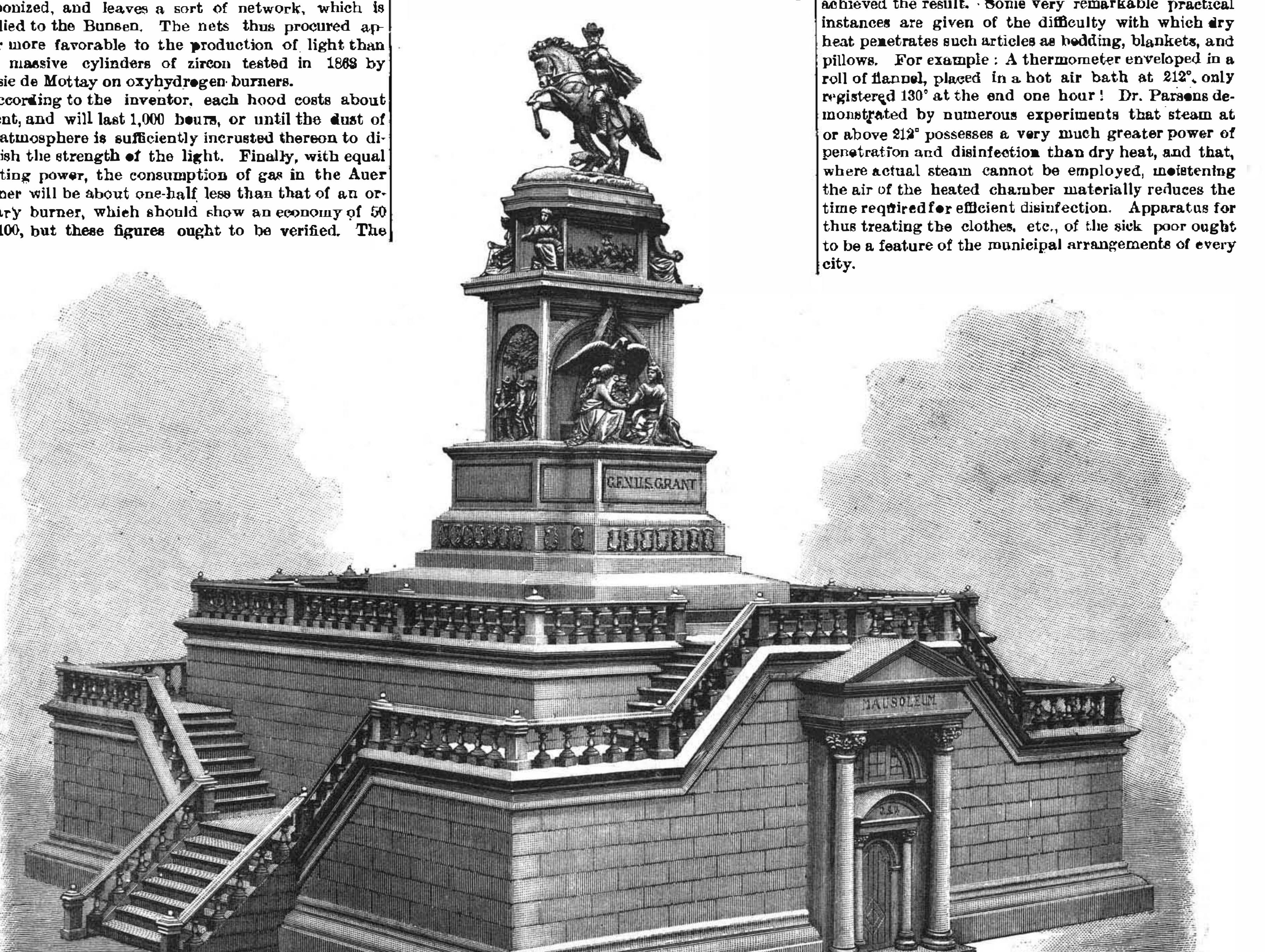
The group in the middle part of the monument is specially well conceived; two female figures, the North and the South, grasp hands in token of eternal friendship. The North is represented as having beautiful classic features and wearing the Phrygian cap—she is laying the palm branch of peace on the shattered weapons of war; while the South is characterized by features of the Southern type and light clothing, the figure being partly nude—she is laying a laurel wreath at the feet of an eagle whose outstretched wings spread over the scene. The background of this principal group is filled with an architectural design of arches.

On the opposite side of this part of the monument is the figure of General Grant in uniform and fully equipped for war. He is seated with his left hand on his sword, and about him and on a staircase behind him are grouped the members of a negro family. The negress, on whose wrists the fetters are still visible, raises her hands to Grant, praying him to deliver her from slavery, while the negro tries to express his gratitude by pressing the General's hand, resting his left hand on the forearm of his deliverer. In the foreground a little negro boy is playing with the broken chains. The left face of this portion represents, in high relief, the scene under the memorable tree at Appomattox, where General Lee surrendered his sword to the victor Grant. In high relief, at the right, the artist has shown the steps of the White House at Washington. On the upper step Grant is taking the Presidential oath before Chief Justice Chase, while in the background stand Grant's predecessor, Johnson, and several Senators, as witnesses. The front of the principal part of the monument bears the inscription, "Gen. U. S. Grant." The coats of arms of the different States are arranged on the under socle.

The mausoleum, which is 59 feet in depth, is provided in front and at the back with three terraces. The cap of the monument, the main part of the mausoleum, the portals, and the balustrades are to be made of polished granite, the foundation of rough-hewn stone, and the figures and coats of arms of the best bronze. The completion of the work would require about five years. —*Illustrirte Zeitung.*

Disinfection by Heat.

The disinfection of articles of clothing, and of dwellings, after infectious ailments, is admittedly one of the most important duties which attends the work of preventing disease. A recent report of the medical officer of the local government board, London, presents the entire question of the destruction of germ life in a new aspect, including, as it does, a memoir on disinfection by heat, from the pen of Dr. Parsons. The degree of dry heat necessary to kill the germs of diseases well known to be infectious was first investigated. The bacilli of splenic fever, for example, were killed by exposure for five minutes in a dry heat varying from 212° to 218° F., but their spores did not yield to two hours at 220°. One hour at 245°, and four hours at 230°, achieved the result. Some very remarkable practical instances are given of the difficulty with which dry heat penetrates such articles as bedding, blankets, and pillows. For example: A thermometer enveloped in a roll of flannel, placed in a hot air bath at 212°, only registered 130° at the end one hour! Dr. Parsons demonstrated by numerous experiments that steam at or above 212° possesses a very much greater power of penetration and disinfection than dry heat, and that, where actual steam cannot be employed, moistening the air of the heated chamber materially reduces the time required for efficient disinfection. Apparatus for thus treating the clothes, etc., of the sick poor ought to be a feature of the municipal arrangements of every city.



ECHTELER'S DESIGN FOR THE GRANT MONUMENT NEW YORK

ENGINEERING INVENTIONS.

A locomotive spring has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The construction is such that hangers are dispensed with, the invention being an improvement on a former patented invention of the same inventor, touching a special construction for use in connection with the frame supporting the driving wheels of a locomotive.

A steam condenser has been patented by Mr. Talmadge Bliss, of Millerton, N. Y. It is so designed that every part is accessible, that clogging by foreign matters may be prevented, being intended for the exhaust of steam engines, for producing a high vacuum without the use of a pump, and to so regulate the flow of water that the temperature of the hot well can be kept as desired.

A steam condenser has been patented by Mr. John McIntyre, of West Hoboken, N. J. This invention relates to surface condensers of the Lighthall type, wherein water pipes are used, and consists principally in dividing the pipes into nests or tiers by the intervention of plates that compel the steam to spread and circulate more perfectly among the pipes, together with other novel features.

A railroad cattle guard has been patented by Mr. Delvin S. Lermond, of Delphi, Ind. It is so made as to be bolted down on common track ties without disturbing the roadbed, with slats arranged to slant from the center toward each end, so that when stock step on the guard their feet will slide down between the slats, and thus prevent their walking on the guard, while there is nothing to prevent their backing off.

A water or other engine has been patented by Mr. Parker F. Morey, of Portland, Ore. The engine has a system of automatically operating differential valves controlled by the action of a mechanically actuated auxiliary valve, the reciprocating piston being also a differential one, in combination with a general receiving chamber, whereby all valves for directly controlling the supply and discharge of water to and from the smaller end of the piston are dispensed with.

AGRICULTURAL INVENTION.

A seeder has been patented by Mr. William H. Holcomb, of Cora., Mich. This invention covers a novel construction of a machine which may be used to plant almost any kind of seed, irrespective of its size, and which may also be adjusted to deliver a certain required amount of seed to the running foot or yard.

MISCELLANEOUS INVENTIONS.

A pneumatic dredging machine has been patented by Mr. William P. Lewis, of Oroville, Cal. It consists of an agitator, an extensible cylinder, and a vacuum chamber provided with induction and eduction ports, and a means for producing the vacuum required to operate the machine.

A water closet indicator has been patented by Mr. Joseph H. Potts, of Toronto, Can., Canada. The indicator has a suitable inscription and is adapted to slide between guides fastened in the upper inner face of the door, to indicate from the outside simultaneously with the bolting of the door that the room is occupied.

A drum tightener has been patented by Mr. Robert Buchanan, of Sioux City, Iowa. Single and double apertured hooks are used, in connection with a cord or rope and straps, with the drum body, whereby the rope employed to tighten the drum heads and bind the hoops may be passed in parallel lines from hoop to hoop.

An automatic grain measure has been patented by Mr. Samuel E. Crosbaw, of Three Oaks, Mich. This invention covers novel features of construction and combination of parts in a machine for measuring grain and similar substances delivered by a spout or chute, and is calculated to measure by weight or stroke measure as may be desired.

A fence has been patented by Mr. Lafayette Sams, of near Wolcottville, Ind. It is a portable fence, in which each panel is made separate, and it has an iron post support to prevent the wood from touching the ground and decaying, with adjustable connections for holding the panels together, and various other novel features.

A wagon seat has been patented by Mr. John W. Busch, of Keokuk, Iowa. Combined with the seat are L-shaped supports, pivoted to the sides of the wagon box for holding the seat in position for use, and for supporting it out of the way of the load of the wagon when it is desired to employ the entire wagon box for carrying purposes.

A washing machine has been patented by Sabina W. Cook, of Dayton, Wash. Ter. The invention consists in a tube connected at one end with an inverted funnel, and having a flaring mouth at the opposite end in which is an air valve, allowing air to enter the tube and funnel, but preventing its escape, forcing air and water through the clothes to carry off the dirt.

A clamp for holding gun barrels while being cleaned has been patented by Mr. Frank M. Everett, of Washington, D. C. It is a portable apparatus consisting of a bar to which are applied clamps formed of laterally adjustable rigid metal parts having standing and horizontal portions, with vertical screw bolts passing through the bar, and other novel features.

A stovepipe holder has been patented by Mr. Edwin Hayes, of Kirklin, Ind. It consists of a wire band, with angle plates having apertures to receive the ends of the band, a binding screw and hook formed with an eye upon one side of the body to receive the binding screw between the angle plates, making a simple device for holding a stovepipe in a flue.

A milk pail holder has been patented by Mr. Granville Abbott, of Harrison, Minn. The holder is made of a single piece of wire or other suitable material bent to form a pail-holding hoop, with arms and loosely attached catches, making a simple device for holding milk pails while milking, and relieve the milker from the fatigue of holding the pail between the knees.

A reel for barbed wire has been patented by Mr. Matthias Kampf, of Minier, Ill. It consists of a suitable frame to be attached to a sled or other convenient vehicle, carrying a reel and ratchet wheel, with other novel features, and operated by a handle, whereby barbed wire can be readily wound and unwound, or easily stretched, as may be required in making fences.

Dress trimming forms the subject of a patent issued to Mr. Joachim Maidhof, of New York city. The invention relates to ball edgings such as used for ladies' dress goods, and provides for apertured cores strung on beads on the cord, so as to be free to turn transversely to the length of the trimming, to expose different portions as the flock becomes rubbed or worn off.

A paper box has been patented by Messrs. John F. Diemer, of Elizabeth, N. J., and Paul E. Gonon, of New York city. Combined with a body having flaps is a metallic slide and a locking plate, the metallic slide being held in place by the flaps on the ends of the sides, and a locking plate holding all the parts in position, making a box which is simple and durable.

An adjustable seat for vehicles has been patented by Mr. Michel Goiet, of Paris, France. This invention covers means of controlling and securing the sliding or movable seats of two-wheeled vehicles which have a front seat and a rear seat, one fixed and the other adjustable relatively thereto, to balance the vehicle or regulate the position of the load, making the adjustment quick and easy.

A scraper has been patented by Mr. James Hocking, of Denton, Neb. Adjustable shovels are mounted on a rotating frame, to be raised and lowered, there being a device for imparting the rotary motion from the driving wheel, and a device for raising and lowering the rotating frame, the dirt being deposited in a drum which can be readily opened and closed by the operator.

A tamping bar has been patented by Mr. Timothy Gleason, of Red Wing, Minn. It has a yielding handle which lessens the labor in use and obviates the jar and shock usually experienced by workmen, having in suitable position adjustable collars with spiral springs inclosed in a casing or hollow handle, by which movement is imparted to the bar through the medium of the springs.

A safety helmet has been patented by Messrs. Gustav Runge and Alexander Stude, of Bremen, Germany. It has a double lining, and fits the head closely, but leaves part of the face uncovered, there being means for forcing fresh air into the double lining, to pass to the uncovered part of the face, and keep off poisonous smoke or gases, so that a person wearing the helmet can safely work in a room filled therewith.

Automatic safe boltwork forms the subject of a patent issued to Mr. Thomas W. Brintnall, of Maryville, Mo. This invention relates to locks arranged to be opened by clockwork, and combined with the bolts and springs is an intermediate mechanism, with a cylinder and piston connected with the parts, whereby a gradually diminishing resistance is offered to the bolts in both directions of movement.

A velocipede has been patented by Mr. George W. Rodecap, of Middletown, Ind. This invention covers a novel construction, arrangement, and combination of parts, in which the power is transmitted from the pedals by wheels or pulleys and levers to the main drive wheel, making a machine which can be easily guided, and economically operated with a minimum expenditure of power.

A cigar wrapper cutter has been patented by Mr. Ledyard D. Bailey, of Central City, Neb. It is a circular rotary cutter of novel design, a ferrule projecting beyond the handle to form a shield or guard to the blade, the knife being intended for cutting the tobacco leaf for wrappers, and to cut near the edge of the leaf and across the stems and veins without tearing the leaf.

A wheelbarrow has been patented by Mr. Joseph Annin, of Brooklyn, N. Y. This invention covers novel features of construction and combination of parts touching the handles and wheel bearings, the legs, and devices for attaching both handles and legs to the body of the barrow, making a firm and rigid attachment, but so that the legs and handles can be easily and quickly detached when desired.

A road cart has been patented by Mr. William R. Church, of Yorkville, Ill. The shaft coupling consists of rods to which the thills are to be pivoted, with clips at their rear ends, and sectional braces connected by a turn buckle, the forward sections of the braces being pivoted to the thills and the rear sections rigidly secured to the rods, making it convenient to raise or lower the shafts to suit the height of the horse.

A shoe fastener has been patented by Messrs. Samuel S. Knapp and Elliot Browne, of Abington, Mass. It consists of a wire bent in oppositely directions at each side of its center to form two side rings, for use in connection with a single lace, being adjustable upon the lace at such distance from the end that sufficient length only intervenes to properly lace the boot or shoe and unite it at the top.

A sandpapering machine has been patented by Mr. Daniel Doncaster, of Mechanicsville, N. Y. The machine is so constructed that its working head has a universal movement which accommodates itself when in operation to the wind or twist in doors or the springs in panels, or to an uneven bench that is not horizontal or level, for doing all kinds of sandpapering rapidly and economically.

A riding saddle has been patented by Mr. Joseph F. Bennett, of Pellville, Ky. It has wire springs to render the saddle easy to the rider, the springs being attached to strips, and over them placed a shield connected at its sides and rear edge to the tree by means of straps, the saddle to contain about twenty springs, or as many more or less as required.

A heating attachment for cooking stoves has been patented by Mr. Richard A. Rew, of Pomeroy, Wash. Ter. It consists of a peculiarly constructed chamber, with smoke drums, and in combination with the smoke flue, for converting cooking stoves and ranges into hot air and ventilating stoves, to utilize them for the double purpose of cooking and heating the rooms above.

A drying machine has been patented by Mr. Joseph Hanson, of Philadelphia, Pa. This invention relates to a machine formerly patented by the same inventor, and covers a double construction or duplicate arrangement of the swifts and rods or reels, with a central arrangement of main bars, ways, and operating mechanism, whereby the capacity of the machine is doubled, and a desirable equipoise of parts effected.

A bottle washer has been patented by Mr. Peter A. Bennett, of New York city. It is a device for washing the interior of bottles with a brush, the brush being attached to a spiral spindle adapted to be moved longitudinally in a suitable apertured plate for causing it, while the brush is revolved axially, there being a fixed and a spring-actuated sliding frame carrying the spiral spindle.

A bottle stopper has been patented by Mr. Theodore G. Maier, of Camden, N. J. It is an elastic stopper, with an eccentric for forcing it into a bottle neck, means for attaching the eccentric, and a wire connected to the eccentric at one side of its pivotal point and passed through and connected to the lower end of the bottle stopper, being particularly adapted for bottles containing effervescing liquids.

An incidence window, for lighting basements, vaults, etc., has been patented by Mr. Isidor Schoenberg, of Baltimore, Md. It is composed of a frame with a parallel series of glass blocks of right-angled triangular shape, with their long sides in the plane of the frame, the blocks projecting upwardly to expose their two sides, so as to give the greatest amount of exposed reflecting surface without shoulders, while the faces of the prism are readily accessible for cleaning.

A ladder has been patented by Messrs. John McDonough and Walter B. Cox, of New York city. It is composed of sections hinged together, each section having a joint clasp or sleeve for locking the sections in line with each other, the sleeves being operated automatically, and there being an automatically operated locking device attached to each sleeve, making a flexible fire ladder adapted to be wound upon a drum and elevated by turning a drum.

A frame for drying houses has been patented by Mr. George E. Mills, of No. 612 Pacific Street, Brooklyn, N. Y. This invention relates to a drying frame in which horizontal trays are arranged to support the fruits, vegetables, etc., to be dried, the trays to be guided between vertical parts and held in parallel position in series, with novel means for raising and lowering and dumping them; the frame is also well calculated for drying malt.

A sash holder has been patented by Mr. James P. Hendrick, of Flemingsburg, Ky. The catch bar of the holder consists of a lower portion to be secured within the outer sash groove of the window frame, and an upper part which has an outward top or head plate, with various other novel features, making a device which can be readily applied, and will hold the sashes open at either the top or bottom, or at both places.

A sad-iron has been patented by Mr. August F. Chable, of Evansville, Ind. It is adapted to be reversed or turned on the handle, so that any one or two or more working faces may be used, and these faces are heated by the burning of fluid or gasoline from a perforated tube connected with a small reservoir, the flow being easily regulated, and the heating arrangement of the iron being such that it can be conveniently used for many other purposes.

A method of purifying water has been patented by Messrs. William J. Morrison and John C. Wharton, of Nashville, Tenn. The invention covers a method of adding to the water a mixture of lime, soda, and sand, and then a mixture of alum, permanganate of potassium, and sand, the method being advantageous for all waters to be used for domestic purposes, as also in the preparation of various beverages, and for steam boilers, laundry and bathing purposes.

The construction of sash windows forms the subject of a patent issued to Messrs. Vaclav Klan and Rudolf Seitz, of Prague, Bohemia, Austria-Hungary. The invention is for windows having an upper and lower outer and an upper and lower inner sash, all the sashes being mounted to slide and to swing on pivots, and counterbalanced by weights in such manner that they can be swung inward on hinges to facilitate cleaning or repairing.

A rotary system of stage scenery has been patented by Mr. Roderick G. Guptill, of Chicago, Ill. The construction of this scenery is such that it may be shifted by simply turning a pulley, so the scenes may be changed very easily and rapidly; and when the scenery is taken down it may all be rolled upon the rollers that support it, and the bars and braces being made in sections, the whole may be packed in small compass and easily transported.

A shingle-sawing machine has been patented by Messrs. Francis M. Hanks and Horace N. Sibley, of Midway, La. It is a band saw machine, with a reciprocating carriage carrying two sets of block holders, two sets of set works, and a mechanism whereby one set is actuated to feed its block forward while the block of the other set is operated upon by the saw, with other novel features, the invention particularly relating to a former patented invention of the same inventors.

An exhibitor for wall papers, borders, and ceiling decorations has been patented by Mr. Lewellen A. Ely, of Minir, Mich. It has interchangeable wings or frames, which can be removed instantly and held together for comparison of samples, the apparatus being light, strong, and durable, and one that can be worked and operated very easily, so that without change of position a customer can see samples of borders in combination with different styles of paper, etc.

A device for sorting horseshoe nails has been patented by Messrs. William M. Stone and Henry Dundas, of Keeseville, N. Y. This invention consists of a ring revolving on a block, and having recesses, with an adjustable stationary cam attached to the block, and a bent arm for separating the nails and leading them to a discharge opening in the block, making an improved device for sorting long and short nails rapidly and accurately.

A photographic apparatus has been patented by Mr. David H. Houston, of Hunter, Dakota Ter. A removable box with sliding shutter fits in the rear of the camera, and contains the sensitized paper wound upon two spools so that a straight part of the sensitized film passes over a plate or partition directly behind the sliding shutter, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

A grub catcher has been patented by Mr. Frank Hulse, of Goshen, N. Y. The body of the implement is a sort of sheet metal pan, over which extends a wire spring in such way that, as the pan is pushed between rows of onion and other plants, the spring will act as a finger to jar and knock the grubs off into the pan, a small lantern stand being also attached to the implement for holding a lantern in position to aid in the work.

A picture-exhibiting musical box has been patented by Mr. Charles E. Juillerat, of New York city. The box has a ring or circular frame carrying pictures, the same being operated by the mechanism that produces the musical tones, so that the pictures are made to show through openings in the sides of the box, the idea being also applicable to the rotation of a disk, and exhibition of pictures in the top instead of the sides of a box.

The purifying of water for steam boilers forms the subject of a patent issued to Mr. Wilhelm Friede, of Hamburg, Germany. The invention consists in the use of a composition of matter to be dissolved in the water to prevent the formation of scale or incrustation, the composition including catechu, caustic soda, sodium hyposulphite, glycerine, and tanner's bark, the use of the compound not affecting the taste, smell, or purity of the steam, and not affecting it for any purpose for which steam is ordinarily applied.

A watch regulator has been patented by Mr. Jules C. Levasseur, of Milianah, Algeria. This invention provides means for adjusting the balance regulator of a watch without opening the case, and consists of a segmental gear wheel attached to or formed upon the regulator, and mechanism in gear therewith, whereby the regulator may be adjusted by means of the winding stem, when arranged for setting the bands, or by an independent stem fitted in the case, with other novel features.

NEW BOOKS AND PUBLICATIONS.

MODERN ARCHITECTURAL PRACTICE. No. 1. A LARGE COUNTRY HOUSE. Bruce Price, Architect. New York: William T. Comstock.

This book is a large and beautiful quarto, containing perspective views, elevations, plans, and detail for a large country house, to be built in California. The specifications are given in full, the general conditions being put in the form of an actual contract, the mason work commencing with the excavation, and describing the stone masonry, cut stone, and brick work; the plastering and iron work come next in order, and the carpenter work is described with much detail, accompanied by many sketches; the inside finish and trim, the tin, copper, and galvanized iron work, the cabinet work, mantels and fireplaces, the painting and glazing, plumbing, gas fitting, hardware, and heating, all are treated with a minutiæ which would seem to make a complete working chart for the intelligent workman in the building of a large and beautiful country mansion.

DIE GALVANOSTEGIE. Jos. Schaschl. Vienna, Pesth, Leipsic, 1886. 72 cuts. pp. 224.

This is the thirtieth volume of the "Elektrotechnisches Bibliothek," published by A. Hartleben. It is a useful little work, treating in a very practical way of the art of electroplating with the different metals. The general division of the subject includes the fundamental principles; the chemicals need; sources of electric currents; their measurement and control; preliminary treatment of the objects; composition of baths and after treatment of the plated articles. The baths given comprise, besides those of the more ordinary electro-plating metals, baths of zinc, iron, lead, cobalt, antimony, cadmium, and aluminum. The work throughout bears the mark of practicability and sufficient thoroughness. A concluding section speaks of the sanitary features of the business, of poisoning, and antidotes therefor.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. McF. asks: 1. Do certain sounds produce silence? If so, how can it be illustrated? A. Two sounds may come from sources so situated that a deadening of both by interference will be produced. It is hard to produce absolute silence thus. Apparatus for the experiment is illustrated in text books. 2. Does sound exist without an ear to hear it, or is sound produced by vibrations on the ear? A. Scientifically speaking, it does. 3. Where can I get a thorough description with engravings of the combination lock? A. There are many patented combination locks. 4. What, if any, is the present variation of the magnetic needle from the true north pole? A. In Boston in 1880, 11° 41'; in New York, same year, 7° 84'.5. How many crematories in the United States, and where are they situated? A. We believe three crematories are now in operation, and several others proposed. 6. Are colors carried to the eye by vibrations, or is it by other means? A. Colors it is assumed are carried to the eye by vibrations of the luminiferous ether. It is all theory. 7. What is the office of the little cylinder on the right hand side of a locomotive, just in front of the cab? A. The cylinder is the air pump of the air brake. 8. Is the moon farther away from the earth when directly overhead than when just rising? Why does it look larger when rising than when setting? A. It is not. It is not known why the rising moon looks larger, unless by association and comparison with objects on the horizon, or between it and the observer.

(2) G. E. P. asks: 1. Are there any locomotive works in this country turning out as many as two complete engines in one week? A. Yes. In building a large number of locomotives there are shops that can turn out two locomotives a week, but they are not built from the raw material within the week that they are finished. The various parts may have been several weeks in passing through the various stages of the work. 2. Is there such a process as photo-electro, or photo-electrotype, for printing or copying? A. There is a process of engraving or reproducing prints or drawings by photo-electric manipulation, and is called "photo-electrotype" and "photo-engraving."

(3) M. L. W.—We recommend you to make a study of what has been done in the way of compressed air motors for street railways and other purposes. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 18, 176, 177, 238, 248, 309, 328.

(4) N. A. H. asks: Why does placing a vessel of water on a stove in a close room prevent a headache or feeling of closeness in the room? A. Any beneficial effect from placing a vessel of water on a stove is due to the imparting of moisture to the air.

(5) R. L. D. asks: 1. Can I make a telescope finder by putting hair lines across the diaphragm of a small spyglass? Do I want two or four lenses for the eyepiece? A. Yes, provided it has an eyepiece formed of convex lenses. 2. Can the dynamo in SUPPLEMENT, No. 161, be arranged so as to give a shuttle current by drilling the journals of the armature and running terminals from the armature through, so as to connect with contact springs? If so, how should these contact springs be connected? Would like it arranged so as to give either current by simply changing a switch. A. Excite the field magnet by means of a direct current from a battery or another dynamo. Connect one terminal of the armature wire with the armature shaft and attach the other terminal to a sleeve carried by the shaft, but insulated therefrom. One collecting brush or spring should press on the sleeve, the other should touch the shaft, or better, a brass or copper ring driven on the shaft. To secure a direct current you will need the ordinary two part commutator, which may be arranged beside the two rings for alternating currents. 3. Have you ever given directions for making a diagonal eyepiece for a telescope? If so, where will a small piece of mirror answer? A. A piece of mirror will not answer, as it will yield two images, one being reflected from the front, the other from the back of the glass. Use a plate of speculum metal or a glass plate silvered on its face.

(6) M. H. asks: 1. Can dynamo described in SUPPLEMENT, No. 161, be used for a motor as well as a dynamo? A. It can be done by making the total resistance of the motor equal to one of the lamps which it is to replace in the circuit. 2. If so, what size wire and how much should be used to wind armature and field magnets to make motor fit to run on ordinary Edison (100 volt) circuit? A. Wind the field magnet with 225 feet of No. 26 wire, Am. W. G., and the armature with about 500 feet of No. 32. Place the armature and magnet in series.

(7) J. B. K. asks: 1. Is there a dynamo made just big enough to furnish six to ten 16 candle power incandescent lamps? A. Any of the electric manufacturing companies can furnish such a machine. 2. Will dynamo described in SUPPLEMENT, No. 161, have power enough for 16 candle incandescent lights, and how many? A. It is not adapted to lamps of high resistance. 3. Could one man, with crank on large band wheel, turn it for ten minutes fast enough to make light? A. He could run it so as to light two or three 5 candle lamps.

(8) H. A. D. asks what sheet metal, some inexpensive kind, say of thickness of about twice that of heavy writing paper, will bear the most bending at a given line without breaking. A. Soft Bessemer steel or copper.

(9) W. S. B. asks: 1. In a dynamo having only electro magnets, what first generates the current in the field magnet coils to cause them (the field magnets) to become electro magnets, there being no permanent magnets in the machine? A. The magnet cores retain a little "residual" magnetism, which is enough to start the current, which then increases until it reaches the maximum. 2. What is the difference of arranging electric lamp in parallel and in series? A. In parallel arrangement the current is divided among a number of lamps; in series it goes successively through the lamps.

(10) E. L. B. asks: 1. Can you give me a receipt for making a solder that may be used without acid or resin? A. We cannot give any receipt for a solder that will work satisfactorily without a flux. 2. How many Fuller batteries will it take to run a 16 candle power lamp? A. It would take about 100 cells of Fuller battery to give satisfaction. 3. Is the Fuller battery well adapted to electro plating? A. The Fuller battery is not recommended for plating purposes.

(11) T. E. K. asks: 1. How can I make a simple and good hair pomade? A. Take ½ ounce each good washed lard and clarified beef suet, balsam of Peru ¼ ounce, melt them together in a pot placed in boiling water, stirring the mixture all the while, adding ½ fluid drachm oil of nutmeg or a little oil of lavender. When thoroughly mixed pour the mixture into pots while hot. 2. How to make the right kind of paper hanger's paste, something that will stick on whitewashed or calcimine walls? A. Any way of pasting over whitewash or kalsomine is tedious, and may turn out unsatisfactory. Better soak and scrape off to the plaster and on this good flour paste will stick.

(12) H. M. E. asks how to treat wood for cells so that it will satisfactorily resist the action of electropoion? A. Use white wood boiled in paraffine. 2. How should steel be tempered and otherwise treated in making compass needles and other small magnets? A. Steel for magnets should should be of good quality, such as used for tools, and made hard by heating to a cherry red and dipping in water. For compass needles or any magnet always plunge endwise, to avoid springing. They may be draw-tempered to a straw color and sprung straight if required. 3. How to pronounce dynamo? A. Accent on the first syllable.

(13) J. M.—You cannot harden cast iron to be of any value. It has already too much carbon. Wrought iron that has been cleaned from scale will only take a very thin hard surface by heating with ferro-cyanide of potassium, covering the surface before the article is made red hot and has gathered a scale. Treatment with shavings of horse hoofs, with the ferro-cyanide in an iron box, in which the article to be case-hardened is placed, and heated red hot for an hour, is better.

(14) F. W. B. asks how the black is put on parts of optical instruments, as on the inside of telescopes. A. Very thin shellac varnish and lampblack is used for this purpose. Mix the lampblack with alcohol and add a few drops of shellac varnish, not enough to make it shine when dry.

(15) F. M. asks: Can a fly wheel 32 feet in diameter be speeded to 100 revolutions per minute with safety. Can the shaft and bearings be made strong enough to stand it? A. Any shaft and bearings that will carry the fly wheel at any speed is strong enough for 100 revolutions per minute, provided the wheel is balanced and strong enough in the rim to resist centrifugal force with a large factor of safety. Such a speed is high for so large a wheel. See article on the Strength of Fly Wheels in SCIENTIFIC AMERICAN SUPPLEMENT, No. 574. We do not know the size of the largest fly wheel in the world.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 28, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adjustable hanger, C. O. Yale 355,288
Air, drying compressed, G. R. Cullingworth 355,002
Air or other fluid under pressure, apparatus for exhausting or delivering, H. Davis 354,888
Alarm. See Burglar alarm.
Alarm, J. R. Branden 354,884
Alloy, M. A. Wheeler 354,996
Animal trap, E. S. Hotchkiss 355,016, 355,017
Baby walker, S. E. Gleason 354,895
Bag. See Paper bag.
Bar. See Splice bar.
Barber's pole, M. H. Wilson 354,961
Bark cutter, R. C. Kirby 355,179
Barrels, means for attaching heads to, T. P. Walsh 355,040
Basket, floating minnow, D. B. Weightman 354,958
Beating and mixing machine, F. V. Raymond 354,984
Beltgearing, Wittmann & Yingling 355,239
Bit stock, A. W. Morgan 355,278
Blast cupola, hot and force, M. Hamm 354,899
Blind, inside, W. A. Holbrook 355,168
Blind, inside window, J. Auld 355,045, 355,046
Blinds, spring strip for inside, W. A. Holbrook 355,167
Block. See Fodder block.
Blower, pressure, W. C. Winfield 355,111
Boiler. See Steam boiler.
Bolt. See Track bolt.
Bolt machine, A. W. Rose 355,103
Book, copying, L. E. Whiton 354,959
Books with metallic staples, machine for stitching, W. J. Brown, Jr 354,885
Boot and nailing machine, H. S. Bacon 354,117
Boot or shoe stretcher, J. Donovan 355,008
Box. See Journal box. Music box. Musical box. Splice box.
Bottle, mucilage, E. R. Cahoone 355,000
Bottle stopper, T. G. Maier 355,096
Bottle washer, P. A. Bennett 355,054
Brace. See Heel brace.
Bracket. See Wall bracket.
Bracket, L. E. Hastings 354,908
Braid roll and case therefor, J. Keleher 354,984
Brake. See Car brake.
Broom, Smith & Yaeger 355,223
Broom, wire bound, Smith & Yaeger 355,225
Broom wiring machine, Smith & Yaeger 355,224
Brush shield and binder, W. L. Barnes 355,120
Buckle cover, J. P. Scollay 355,107
Bung for cans, O. H. Perkins 355,025
Bungs in cans, implement for inserting, Perkins & Transom 355,204
Buoy or beacon, J. M. Foster 355,157
Burglar alarm, H. Ferris 355,250
Burner. See Gas burner.
Butter, machine for printing or moulding, P. L. Kimball 354,985
Butter package, G. W. Bradley 355,262
Button, H. B. Robinson 355,029
Button attaching machine, J. C. F. Dick 354,989
Buttonhole stitching and barring machine, Reed & Beale 355,028
Buttons, implement for making covered, T. G. Roebuck 355,030
Cabinet, filing, P. J. Schlicht 355,219
Cabinet for holding spools of thread, etc., J. A. Law 354,912
Cane, cutting sugar and sorghum, H. A. Hughes 354,905
Capsule cutting machine, T. C. Mers 355,193
Car brake, L. Dube 354,891
Car brake attachment, R. Quatermass 355,100
Car brake, automatic, K. H. H. Leineweber 354,915
Car coupling, H. C. Horoish 355,089
Car coupling, H. A. Jukes 355,174
Car coupling, H. Kees 355,175
Car doors, adjustable attachment for freight, T. H. Duran 354,973
Car driving mechanism, E. Dederick 354,889
Car, dumping, S. B. Spence 355,228
Car spring, G. W. Morris 355,197
Car, stock, O. Newell 355,277
Carpet lining, C. H. Cole 355,140
Carpet sweeper, W. T. Johnston 354,908
Carpets, etc., roll stick for, Davis & Rath, Jr 355,145
Carriage curtain fastening, W. S. Dunn 355,089
Carriage seat, S. M. Hardenbergh 354,979
Carrier. See Trace carrier.
Cart and weighing scale, combined coal, Arteaga & Del Valle 354,998
Cart, delivery, C. Kipp 355,177
Cart, road, W. R. Church 355,060
Cartridges, resizing implement for, T. G. Bennett 355,122
Case. See Packing case. Show case. Ticket case.
Cask, L. Minch 355,195
Casks, head staying device for, T. P. Walsh 355,039
Caster, S. T. Lamb 355,030
Casting machine, type, G. Rettig 354,935
Centrifugal extractor, W. & C. L. Cairns 355,138
Chair. See Nursing chair. Tilting and swivel chair.
Chart for draughting garments, E. Gartland 355,100
Cheese cutter, S. P. Hodgen 355,081
Cholera, remedy for, A. T. Estabrook 354,975
Chuck, lathe, J. C. Williams 355,237
Cigar wrapper cutter, L. D. Bailey 355,051
Circuit closer, W. B. Manny 354,919
Cloth cutting machine, P. Howe 355,086
Cloth cutting machines, sharpening mechanism for, P. Howe 355,085
Cloth laying and cutting machine, A. J. Tower 354,952
Clothes drier, J. J. Steel 355,135
Condenser, steam, T. Blass 355,250
Condenser, steam, J. McIntyre 354,987
Conveyer, spiral, R. Birkholz 355,124
Coop, folding, A. Gamard 354,894
Corn sheller, C. Roberts 355,211
Corn sheller elevator, C. Roberts 355,212
Corset fastening, M. Seitert 354,939
Corset stays, machine for covering, Nettleton & Littlejohn 355,158
Corset stays, machine for covering, W. A. Nettleton 355,199
Cotton gin cylinder, C. R. Valk 354,955
Coupling. See Car coupling. Shaft coupling. Thill coupling.
Creamer, centrifugal, C. A. Backstrom 355,048
Cultivator and plow, combined wheel, C. Wahrmund, Jr 354,956
Cultivator, wheel, J. C. Schwaller 355,105
Culvert or water-way, J. C. Goodridge, Jr 354,897
Cutter. See Bark cutter. Cheese cutter. Cigar wrapper cutter.
Cutting or severing device, J. A. Bunnell 355,136
Decorticating machine, E. Lycan 355,188
Dental flexible support, G. L. Field 354,976
Dish washer, centrifugal, A. G. Ingalls 355,088
Dish washing machine, J. G. Cochran 355,139
Door, L. S. Enos 354,289
Door and window casing, H. Lucht 354,918
Door check, Hinkle & Jeffery 355,010
Dough raiser, G. A. Williams 354,960
Draught equalizer, A. M. Livelsberger 355,184
Draught equalizer, J. F. Tait 355,046
Dredging apparatus, hydraulic, A. B. Bowers 355,251
Dredging machine, pneumatic, W. P. Lewis 355,094
Drier. See Clothes drier. Malt drier.
Drill. See Rock drill.
Drum tightener, B. Buchanan 355,057
Dyeing machine, J. Hanson 354,980
Ear rings, ear wire for, L. Dreyfus 355,067
Egg beater, F. A. Houck 355,170
Egg tester, H. Clipp 355,059
Electric machine, dynamo, R. A. Sperry 354,945, 354,946
Electric motor, H. M. Paine 355,024
Electrical conductor, underground, F. B. Crocker 355,060
Electro-therapeutic appliance, J. Charles 355,059

Elevator. See Corn sheller elevator. Hydraulic elevator.
Elevator, H. Albert 355,114
Elevator, W. Greb 355,162
Elevator, Ward & Mead 355,285
Elevator gate, V. E. Paulin 354,990
Elevator guard, P. H. McWilliams 355,191
Engine. See Cylinder engine. Gas engine. Rotary engine. Water and other engine.
Engine crosshead, G. R. Cullingworth 355,003
Engine, safety device for, J. Rothchild 354,938
Envelope sealer and opener, J. W. Turner 354,954
Evaporating and distilling apparatus, vacuum, H. T. Yaryan 355,289, 355,290
Extractor. See Centrifugal extractor. Revolver extractor.
Fabric. See Vulcanized fabric.
Fabric trimmer, J. W. Dewees 355,148
Fabrics, machinery for manufacturing felted and end napped, J. Broadhead 355,130
Faucets in beer coolers, air excluder for, T. G. Saxton 355,218
Faucets, leveling attachment for measuring, J. O. Boggs 355,127
Feather renovator, H. B. Doolittle 355,151
Fence, W. M. Berry 355,249
Fence, L. Sams 355,217
Fence post base, J. D. S. W. P. Tilton 354,950
Fender, W. F. L. Gentry 354,978
Fertilizers, manufacture of, J. T. Jullien 354,983
Fiber, machine for cleansing and extracting, J. Garcia 355,073
Files, making, J. W. Denmead 355,147
Filter, W. M. Deutsch 355,004, 355,005
Firearm, breech-loading, A. Dickerman 354,890
Firearms, sight for, T. G. Bennett 355,121
Fish trap, J. S. Johnson 355,269
Fodder block, E. F. Dieterichs 355,257
Furnace. See Heating furnace.
Gauge. See Micrometer pipe gauge.
Gas burner, J. M. Foster 355,158
Gas burner, incandescent, Dalopin & Evans 354,977
Gas engine, N. B. Randall 355,101
Gas engines, electric igniter for, F. Bain 354,881
Gate. See Elevator gate.
Generator. See Steam generator.
Grub catcher, F. Hulse 355,087
Guard. See Elevator guard. Railway cattle guard.
Gun barrels while being cleaned, clamp for holding, F. M. Everett 355,154
Hammer, power, M. Deering 355,146
Handle. See Tool handle.
Hanger. See Adjustable hanger. Lamp hanger.
Harrow, H. W. Alshouse 354,968
Harvester reel, E. A. Peck 355,202
Hat, T. W. Bracher 354,882
Hat bodies, etc., fulling or felting, J. T. Waring 355,041
Hat bodies, etc., machine for fulling, J. T. Waring 355,049
Hat sweat band, V. Moeslein 354,924
Hats, machine for blocking, A. T. Clark 355,254
Hay loader, F. Luther 355,187
Hay rack, A. J. Wright 355,241
Hay stacker, J. H. & T. K. Barley 355,119
Heat regulator, electric, R. L. Oulon 355,164
Heating furnace, A. Hopkins 355,169
Heel and attaching the same, F. F. Raymond, 2d 355,027
Heel brace, C. J. Edney 355,258
Heel, spring, C. H. Martin 354,966
Hinge for boxes or trunks, J. V. Snyder 355,227
Hinge mortising machine, S. A. Mackenzie 355,272
Hoeing and weeding machine, J. S. O'Brien 354,926
Holder. See Mop holder. Pail holder. Photographer's plate holder. Stove pipe holder.
Horseshoe, C. S. Canfield 354,886
Horseshoe nails, device for sorting, Stone & Dundas 355,109
Hosiery exhibiter and sale rack, G. E. Slaughter 355,943
Hub, wagon, Conrad & Hots 355,141
Hydraulic elevator, W. T. Fox 355,159
Ice breaking vessel, R. Romaine 355,214
Impalement trap for house breakers, E. Fisher 355,070
Indicator. See Station indicator. Water closet indicator.
Insulators, pin holder for electric wire, M. Hanks 355,165
Jack. See Lifting jack.
Joining metallic sections, A. McKellar 354,988
Journal box, anti-friction, W. S. Sharpneck 354,941
Kiln. See Lime kiln.
Knife. See Nail cutting machine knife. Undercutting knife.
Knitting machine, J. Auredenn 355,047
Label, cigar box, C. B. Hensehel 355,015
Label, shoe box, S. Goodman 354,896
Ladder, step, Q. Macnider 355,095
Lamp, J. Kirby, Jr. 354,910
Lamp, F. Meyrose 355,194
Lamp, electric arc, J. Brady 355,129
Lamp, electric arc, R. F. Jones 355,172
Lamp hanger, adjustable, C. O. Yale 354,962
Lantern, L. B. Wood 355,240
Lantern globe support, F. Dietz 354,970
Leather loop fastenings, manufacture of, E. Feldsberg 355,068
Lifter. See Transom lifter.
Lifting jack, R. Jones 355,173
Limekiln, A. Weber 355,043
Liquid separator, centrifugal, C. A. Backstrom, 355,049, 355,050, 355,246, 355,247
Lock. See Nut lock. Permutation lock.
Locomotive spring, J. R. Fish 355,069
Lubricator, R. Fleming 355,155
Malt drier, C. Brada 355,128
Measure, automatic grain, S. E. Crowshaw 355,064
Metallic plates, tool for interlocking the edges of, E. Small 355,109
Meter. See Water meter.
Micrometer pipe gauge, D. G. Brown 355,999
Mining machine, coal, G. Ednie 355,153
Mining machine, coal, J. Walton 355,284
Mop holder, C. Sness 354,949
Motor. See Electric motor.
Mower attachment, lawn, J. Given 355,074
Mower, lawn, G. R. Tyrrell 355,234
Mowing machines, clutch mechanism for, G. G. Hunt 354,906
Music, apparatus for use in teaching, W. L. Fitch 355,261
Music box, H. Zumstég 355,244
Musical box, picture exhibiting, C. E. Julliérat 355,089
Musical instrument actions, pneumatic engine for, F. Stone 355,229
Musical instruments, air engine for mechanical, W. D. Parker 355,201
Nail cutting machine knife, Z. W. Dean 355,065
Nail cutting machine knife, W. D. Young 355,113
Nail plate feeder, R. Hersey 354,980
Name plates, adjustable inscription for, Brown & Roller 355,132
Nursing chair, E. H. Taliaferro 355,230
Nut lock, L. D. Warner 355,236
Nuts, die for making ratchet, E. R. Procter 354,933
Oiler, piston rod, Todd & Smith 355,289
Ore concentrator, H. N. Nichols 354,969
Ore feeder, W. S. Sharpneck 354,940
Ores, apparatus for desulphurizing, F. Sibley 355,222
Ores, extracting nickel and cobalt from, D. Mindeleff 354,923
Overalls, C. V. Osborn 354,928
Packing case, C. F. & J. A. Schoeberlein, Jr. 355,105
Packing for piston rods, C. Rohn 355,936
Pad. See Writing or blotting pad.
Pan holder, milk, G. Abbott 355,044
Paint composition, G. Jordan 355,019
Pants, L. Decker 355,256
Paper bag, H. M. Farnsworth 355,010
Paper calendering roll, B. F. Perkins 355,026
Paper from continuous rolled sheets, device for tearing wrapping, A. W. Jerome 354,981
Paper, making tracing, reprinting, and transfer, J. Leidl 355,022
Paper pulp from wood, manufacture of, G. H. Pond 354,881
Pavement, asphalt, M. Macleod 355,023
Perforating machine, Laymen & Hansen 354,913
Permutation lock, A. J. Haley 356,076
Photographer's plate holder, N. S. Bowdish 355,056
Photographic apparatus, D. H. Houston 355,084
Piano-forte, upright, J. Casey 355,001
Pipe wrench, P. Johnson 355,270
Plane, bench, S. D. Sargent 355,031
Plant protector, M. A. Sutton 355,282
Planter, corn, J. C. Schleicher 354,983
Planter, corn and cotton, Armstrong & Lowrey 355,115
Planter, corn and pea, L. F. Edwards 355,009
Planter, cotton seed, H. D. Spangler 354,944
Planter, pea, J. T. Martin 355,273
Plates, manufacture of compound, Manly & Taylor 355,274
Plug, vent, M. Schuetz 355,033
Power, device for transmitting, G. H. Potter 355,206
Printing, M. A. Bancroft 355,118
Printing machine, platen, O. M. Howard 354,171
Protector. See Plant protector.
Pump, S. W. Martin 354,920
Pump, cylinder, H. Jones 354,982
Pumps, winding up mechanism for rotary air, C. F. Hovey 355,018
Rack. See Hay rack. Wagon rack.
Radiator, C. E. Safford 355,216
Railway cattleguard, D. S. Lermond 355,183
Railway crossing, E. Fontaine 355,156
Railway curve, horse, A. Brecken 354,883
Railway signal, S. T. Street 354,992
Railway train signaling apparatus, J. H. Bickford 355,055
Recorder. See Watchman's time recorder.
Reel. See Harvester reel. Wire reel.
Refrigerator, J. Lindle 354,916
Regulator. See Heat regulator. Watch regulator.
Revolver extractor, D. L. Tower 355,283
Ring. See Earring.
Rivet, L. O. Dion 354,971
Rock drill, P. Rader 355,278
Rock drill, double acting, H. G. Walker 354,957
Roller mills, feeder for bagasse, A. Haueberg 354,900
Roof, glazed, T. W. Helliwell 355,079
Rotary engine, Brockie & Mackie 355,131
Rowing apparatus, J. B. Heibecker 355,266
Saddle, riding, J. F. Bennett 355,123
Saddle tree, S. E. Tompkins 354,951
Sandpapering machine, D. Doncaster 355,066
Sash-fastener, A. Y. Leake 354,914
Saw, R. E. Poindexter 355,295
Saw mill feed mechanism, Frick & Penney 355,071
Sawlog machine, circular, W. H. Gray 355,011
Scaffolds, safety attachment for, L. Amon 354,880
Scarf pin and other pinned jewelry, C. H. Morrell 355,196
Seat. See Carriage seat. Wagon seat.
Seeder, W. H. Holcomb 355,062
Separator. See Liquid separator.
Sewer system, C. E. Gronsky 355,163
Sewing machine, W. F. Beardslee 355,068
Shaft coupling, G. F. Barker 355,052
Shaft coupling, J. S. Cook 355,062
Shaft coupling, C. S. Higgins, Jr. 355,267
Shears, L. L. Sagendorph 355,103
Sheller. See Corn sheller.
Shingle sawing machine, Hanks & Sibley 355,077
Shoe, A. T. Cushing 354,968
Shoe fastener, Knapp & Browne 355,092
Shoe, low cut or Oxford, B. W. Hayes 355,265
Show case, J. E. Fox 354,898
Signal. See Railway signal.
Sink trap, J. R. Pike 354,990
Slate, machine for dressing, F. Shenton 355,279
Smoke bonnet, W. Rose 354,937
Spice box, A. W. Cram 355,255
Spinning machine, Rivers & Wright 355,210
Spinning machine, spindle bearing for, H. P. Chase 354,887
Splice bar, H. Greer 354,898
Spooling machine, S. W. Goddard 355,161
Spring. See Car spring. Locomotive spring.
Stage scenery, rotary system, R. G. Guptill 355,075
Stand. See Toilet stand.
Starching machine, J. H. Toof 355,232
Station indicator, W. H. Pierce 354,929
Steam boiler, Kellogg & Kirby 355,176
Steam boiler, W. A. Kirby 355,178
Steam boilers, header for, J. Hartley 354,902
Steam generator, J. B. Doolittle 355,152
Steam generators, separator for, M. W. Hanley 355,166
Stopper. See Bottle stopper.
Stove, J. Orr 354,927
Stove, air heating, W. Tuttle 354,994
Stove boards, machine for forming corner pieces for, I. Van Hagen 355,235
Stove, cooking, W. H. Miller 354,922
Stove, dual gas and spirit, W. P. Houchin 355,268
Stove, gas, C. A. Cushing 355,143
Stove pipe holder, E. Hayes 355,078
Stove, regenerative hot blast, H. A. Laughlin 355,181
Stoves, automatic sliding shelf for cook, M. Kuehnle 355,180
Stoves, heating attachment for cooking, R. A. Rew 355,208
Suspender attachment, J. T. Budd 355,133, 355,134
Switch. See Telegraphic switch.
Tablets, device for gauging and binding, J. D. Tracey 354,953
Tack sorting machine, double pointed, J. F. Kingwill 354,909
Tailor's chalk, implement for sharpening, R. Wyatt 355,242, 355,243
Telegraphic switch, J. Absterdam 354,996
Telephone appliance, J. F. McLaughlin 355,190
Telephone check apparatus, Smith & Sinclair 355,226
Telephone exchange, mechanical, G. F. Shaver 354,942
Telephone receiver, A. E. Dolbear 355,149
Telephone reciver, H. A. Schneekloth 355,032
Telephonic apparatus, J. F. McLaughlin 355,189
Tent and wagon, combined, B. S. Tomkins 355,231
Thermometer, metallic, G. B. St. John 355,281
Thermometer, recording, Black & Pfister 354,965
Thill coupling, A. McHugh 355,275
Thread, etc., machine for twisting, J. J. & J. A. O'Connor 354,926
Ticket case, J. A. Reinfeld 355,207
Tilting and swivel chair, combined, A. B. Stevens 355,280
Time check, J. Millar 354,921
Time recorder, watchman's, A. C. Howard 354,904
Toboggan, H. F. Stearns 354,947
Toilet stand, H. C. Lowrie 354,917
Tongue and shovel, cultivator, J. M. Sanders 355,104
Tool handle, J. Donoghue 355,150
Tooth, artificial, C. E. Blake, Sr. 355,126
Trace carrier, D. R. Cotner 354,967
Track bolt, C. C. Wrenshall 355,112
Transom lifter, W. W. Neuer 355,200
Trap. See Animal trap. Fish trap. Impalement trap. Sink trap.
Tree. See Saddle tree.
Trimmer. See Fabric trimmer.
Truck, Merrill & Wing 355,192
Truck, D. S. Wing 355,238
Truck, W. S. G. Baker 354,964
Tubes, coupling for connecting a series of, H. Bushnell 355,137
Type writing and other machines, paper holding attachment for, C. Haven 355,264
Umbrella, T. A. Crabtree 355,142
Undercutting knife, W. M. Dwight 354,974
Underground conduit, J. S. Du Bois 354,892
Urn, coffee, C. Halstead 355,013
Valve controller and thermostat combined, electric, F. A. Price 354,932
Valve gear for steam engines, G. S. Strong 355,035
Valve, water gauge, Nelson & Lauderholm 355,098
Velocipede, A. Burdess 355,258
Velocipede, O. Unzicker 355,038
Velocipede saddle, T. B. Jeffery 354,907
Ventilating sewers, drains, mines, hospitals, etc., R. S. Ash 355,116
Vulcanized fabric from gums and ramie and similar fibers, W. A. Torrey 354,963
Wagon, buckboard, E. H. Rousseau 355,215
Wagon rack, H. G. T. Glazebrook 355,262
Wagon seat, J. W. Bunch 355,058
Wall bracket, pneumatic, W. Lang 355,021
Wall papers, borders, and ceiling decorations, exhibitor for, L. A. Ely 355,067
Warp threads, machine for drawing in, L. P. Sherman 355,221
Washer. See Bottle washer. Dish washer.
Washing machine, S. W. Cook 355,061
Washing machine, A. Stuart, Jr. 354,948
Watch crown cores, device for capping, A. C. Dalzell 355,144
Watch regulator, J. C. Levasseur 355,093
Water closet indicator, J. H. Potts 355,099
Water meter, piston, E. C. Terry 355,037
Water or other engine, P. F. Morey 355,097
Waterproof garment, B. Robinson 355,213
Weeder, hand, F. G. Lafavour 355,182
Weigher, grain, G. D. Baird 355,248
Weighing machine, automatic grain, D. D. Kuhlman 354,911
Welding plow shares and landsides, device for, L. A. Weyburn 355,110
Wheel. See Wind wheel.
Wheelbarrow, J. Annin 355,245
Wheelbarrow and barrel truck, combined, J. S. Gourlay 355,263
Windwheel, T. Schulze 355,084
Windlass, oyster dredge, H. Lawson 355,271
Windmill, Dodds & Inman 354,972
Windmill, G. W. Penn 355,203
Windmill, W. C. Westaway 355,236
Windows, construction of sash, Klan & Seitz 355,091
Wire and pipe supporting and snow removing apparatus, S. D. Locke 355,185
Wire drawing device, T. P. Straup 354,991
Wire reel, barbed, M. Kampf 355,090
Wire stretcher, E. Bunch 355,135
Wire stretching machine, Hann & Thoma 355,014
Wood surfacing machine, W. H. Gray 355,012
Wood working machine, H. M. Albee 354,997
Wool combing machine, W. Lund 355,186
Wrench. See Pipe wrench.
Writing or blotting pad, J. M. Rimington 355,209
Yoke center, neck, C. R. Furey 355,072

DESIGNS.

Bag, J. Lyall 17,041
Bridle bit, F. M. Gilham 17,040
Curtain fabric, C. Wheeler 17,045
Doll, E. S. Peck 17,042
Fork or spoon handle, E. T. Schoonmaker 17,043
Necktie, J. H. Fleisch 17,039
Oil can head, L. E. & D. F. Bowker 17,038
Spoons, forks, etc., handle for, G. W. Shiebler 17,044
Stove, G. O. Bergstrom 17,036, 17,037

TRADE MARKS.

Boots and shoes, Wearing plates for, A. W. Greenwood 13,926
Carriage top dressing, Dodge's clarified petroleum, W. D. Dodge & Co. 13,923
Cement, Portland, London Portland Cement Company 13,930
Flour, S. W. Weidler 13,936
Gas burners, G. K. Cooke 13,921
Hair tonic, J. Bodin 13,917
Jet goods, Veit & Nelson 13,935
Looking glass plates, P. Semmer & Co. 13,931
Oil, lubricating, Fiske Brothers 13,924
Perfumery and cosmetics, H. Whiting 13,937
Perfumery and powders, McKesson & Robbins 13,933
Ranges, cooking, Janes & Kirtland 13,927
Rubber goods, Boston Rubber Company 13,918, 13,919
Sauce, Crosse & Blackwell 13,922
Sewing machines, buttonhole attachment for, Smith & Egge Manufacturing Company 13,932
Soda and potash, manganate of soda, chlorate of potash, and bleaching powder, caustic, Widnes Alkali Co. 13,938
Stirrups and bridle bits, V. Brodhurst 13,920
Underwear and boys' shirts and waists, ladies' and children's, A. L. Singer 13,934
Washing or soap powders, J. C. Kellogg 13,929
Wine, Rhine, F. Handrich 13,925
Yarns, woolens, Kammgarn Spinnerei 13,928

A Printed copy of the specifications and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

PROSPECTUS

OF THE

Scientific American

FOR 1887.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.00 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE
Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of MUNN & CO., 361 Broadway, New York.