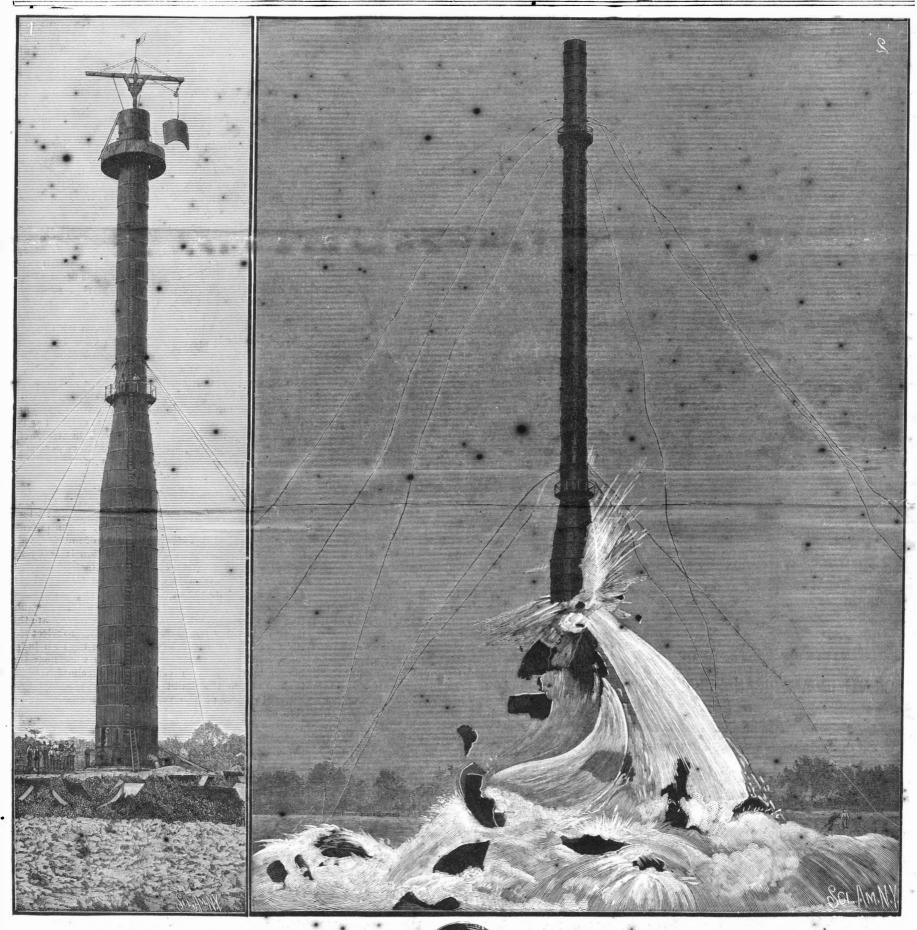
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LV.--No. 26.

NEW YORK, DECEMBER 25, 1886.

Price 10 Cents. \$3.00 per Year.





1. Appearance of the tower during the progress of its construction; from a photograph. 2. The tower at the moment of rupture. 3. Appearance of the tower after its fall; from a photograph.

RUPTURE AND FALL OF THE 250 FOOT STEEL PLATE WATER TOWER AT SHEEPSHEAD BAY, N. Y. [See page 405.]

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, six months, postage included.....

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 prenaid.

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, o 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 salendid peri odical, 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 AMERI-CAN. 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 an-

nouncements published in this edition at a very moderate cost.

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

NEW YORK, SATURDAY, DECEMBER 25, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Atmosphere of caves.
Barometer, xlycerine, Mill's*.
Books and publications, new.
Bubbles, mercury*.
Business and personal.
Car coupling Locke's*.
Cottor chopper, Puls'*. nd every week...

401 | Inventor, doubt must be resolved Inventor, doubt must be resolved in favor of. 401
Manatee, or sea cow* 407
Mercury bubbles, blowing* 404
Mercury film* 404
Mercury foam* 404
Notes and queries. 408, 409
Poratoes, large, how to grow 405
Rule, good, a 408
Scribner's Magazine for Jan., 1887
Sonow from streets, removal of. 400
Soap, textile. 400
Steam as motive power of aerostats, direct use of. 400
Steames, ocean, propulsion for,

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 578.

For the Week Ending December 25, 1886.

Price 10 cents. For sale by all newsdealers.

- PAGE I: ASTRONOMY.—Nebulæ and Planets.—By H. GOUPIL.—The nebular hypothesis of the formation of planetary bodies; the action of nebular masses under rotary and central forces; formation of rings; Saturn's rings.—14 ill ustrations......

eluding examples of calculations, and group and lateral applic and mathematical calculation of the factors.—1 illustra-

graphic and mathematical calculation of the Accountion.

On the Remarkable Effects of Adding Saccharine Matters to Mortars.—By SAMUEL CROMPTON.—A full review of this recently revived process of mortar making; the "aduable features of the addition of sugar to mortar; an eminently practical treatment of the dition of sugar to mortar; an eminetary practices subject.

The Hudson's Bay Railway.—The new railroad now in course of construction to connect the Canadian Pacific R. R. with Port Nelson on the west shore of Hudson's Bay.—Map of the route and connections.—I illustration.

IV. METEOROLOGY.—Thunderstorms.—The relation of barometric movements to thunderstorms.—The results of observations taken during the phenomenally frequent thunderstorms of July, 1884, in Germany.—A communication to the Berlin Physical Society by Prof. BORNSTEIN

V. MINING ENGINEERING.—Hand Stamp Mill.—Description of a small three-head stamp mill for prospectors use in grushing samples of grafts.—I illustration.

The History of Californian Borax.—By ARTHUR ROBOTTOM.—A full account of this important industry of California.—Economic details, analysis of product, and uses of same. . 9147

VI. PHOTOGRAPHY.—Improved Dark Room Lamp.—By F. C. BEACH.—A gas lamp for use in developing plates in the dark room, in which ventilation and the avoidance of heat are both provided for.—In use in the room of the Society of Amateur Photographers.—4 illustrations....

VII. TAXIDERMY.—The Mounting of an Elephant.—Full description of the mounting of the skin of the elephant Mungo.—A very remarkable triumph of the taxidermist's art.—The death of Jumbo and mounting of his skeleton and skin.—5 illustrations...............9151

Index for Scientific American Supplement, Volume XXII.

REMOVAL OF SNOW FROM STREETS.

The difficulty of cleaning the streets not only is perennial, but it is one that becomes more disagreeable, and yet more imperative, with the increase of traffic and the growth of population. The streets of New York are frequently chebed by the throngs of vehicles even in the best of weather, and of course a heavy fall of snow makes matters worse. In addition to the trouble thus caused, the accumulations of snow are sources of annoyance to pedestrians, and the filth collected in the slushy mass is a serious danger to health.

The expense of carting away the snow has been variously estimated to range from seventy-five cents to one dollar per cartload; but even at fifty cents per cartload it is manifest that to properly clear the streets would cost enormously. Take, for example, one street block 200 feet long and say 50 feet wide, having a surface area of 10,000 square feet. A moderate snowfall of three inches of snow will give 2.500 cubic feet on that one block of street. Assuming that in loading this is to the public. If errors are to be made, let them be in packed down to nearly half—say 1,350 cubic feet—there favor of the inventor. It is better to grant a hundred would be 50 cubic yards of snow to be carted; and erroneous patents, which are worthless, than to reallowing two cubic yards as the outside limit of each fuse a single patent for a new invention, however load, there would be 25 cartloads to be taken from each block, at a minimum cost of \$12.50, or \$250 per mile, for every snow storm.

The use of steam has often been suggested, and we have described in our columns various forms of steam apparatus, but they have generally failed to give satisfaction, in part because they are not sufficiently expeditious, and in part because they were too expensive. In New York, Lockport, and other cities where steam distributing companies have laid mains, attempts have been made to melt off the snow by turning upon it live steam. This plan melts the snow very fast, but in nearly every experiment there has been an enormous loss of free steam in proportion to the work done.

Recently, Mr. Charles E. Emery, C.E., Chief Engineer of the N. Y. Steam Company, has employed a novel apparatus with such success that it bids fair to solve the problem. While it is probable that it can be operated more expeditiously and economically by using steam taken from underground supply pipes, its use is keep the steam in contact with the snow without let-ting a great portion of it escape before touching the snow. For this purpose a broad, light, rough, and strong sled, with openwork runners, is fitted with a short pipe passing through the top con the sled, having a hose coupling at its upper end. A tarpaulin, or canvas spread, about 25 feet square, made steam tight, extends from the sled as a center, and the hose coupling passes through it. The tarpaulin is piled on the sled until it is drawn to the place for beginning work; the tarpaulin is then spread out upon the snow to its fullest spread, the edges are tucked into the snow, connection is made by hose from a boiler or steam pipe to the sled, and the steam is turned on, a pressure of 40 pounds being sufficient. The steam cannot escape into the air, but is held right down to the work required of it; and in a very few minutes the deepest snowbank or the iciest packed roadbed yields to the heat and runs off as water. By repeating this operation a street can be cleaned in a very moderate length of time and at small expense. The three inches of snow on 10,000 square feet of street on a block, if removed by carts, would be, say, \$12.50. The melting process would require that the tarpaulin should be shifted sixteen times to cover the street 200 feet long and 50 feet wide. Making the excessive allowance of 15 minutes for each shifting of the tarpaulin, the street would be melted off in four hours. The cost would depend upon the amount of and of the snow. The N. Y. Steam Co. charges \$1 for 2,000 pounds of steam, which would melt from six to seven tons of snow, and on that basis the steam would cost from three to four dollars per block, and the labor of attendants, etc., probably as much more, say \$8 per block, or \$160 per mile.

To carry out such an undertaking, even where there are steam mains already laid, would call for a consider- nary skill in the art would have been unable to proable outlay. Steam plugs, like fire hydrants, would be duce representations of cards by embossing upon needed on every corner, and each melting would re- paper, and the answer was: "If they happened to quire about 100 to 125 feet of steam hose, capable of think of it; probably they would not." Exactly so. sustaining a pressure of certainly over 40 pounds to the It is the presence of a thought like this which raises square inch, and preferably 80. It is probable that a an ordinary mechanic to the plane of the inventor. private company could be organized to do this work. Invention requires thought; mechanical skill does not. The plan has been successfully operated, and it seems to present a practicable and economical escape from the present disagreeable and dangerous condition of our streets during the winter months.

A GOOD RULE-DOUBT MUST BE RESOLVED IN FAVOR OF THE INVENTOR.

The question is sometimes asked why it is that the examiners of the Patent Office are so liberal in the allowance of patents, especially in simple things. The answer is obvious. It is clearly their duty, under the law, to exercise the greatest degree of liberality toward the inventor, and to do everything in their power to facilitate him in securing his invention by patent. The versible current of air by means of deflectors, seems

inventor is a man who supplies the country with new and valuable forms of industry: by means of his new inventions he enables the public to save time and money in the performance of labors, and he supplies the people with all manner of comforts and conveniences. In the earlier days of the Patent Office, the examiners did not so fully appreciate their relations to the inventor as at

Many of them were in the habit of officially acting against the inventor by finding flaws in his devices, and rejecting if the thing was simple, or if there was doubt of novelty or reality of invention. They used to act upon the idea that their chief duty was to refuse patents. This was all wrong. The constitution expressly provides that the useful arts are to be encouraged by the grant of patents. It is to grant patents that examiners are chiefly employed in the Patent Office. The simple inventions for which patents are asked are the most numerous and the most valuable simple.

Doubt should in every case be resolved in the inventor's favor. A recent trial before Judge Coxe in the U.S. Court, Indiana, well illustrates this.

This was an action in equity based upon letters patent No. 273,023; granted to Orlando W. Butler and Thomas W. Kelley, February 27, 1883, for an improvement in paper for cards and circulars. The purpose of the invention was to supersede the expensive and cumbersome method of pasting separate cards upon wedding invitations and similar papers by substituting therefor a card having two or more folds upon which the desired number of parels to represent cards are embossed or pressed out. On these raised panels the printing may afterward be done. When the invitation is folded, the unsightly cavities produced by the process of embossing are concealed from view by one of the flaps of the paper. The cords when finished have the same general characteristics as their pasted predecessors; but, in addition, they are more symmetrical not limited to this supply. Any locomotive or movable and uniform in appearance, can be manipulated with boiler could be employed. All that is needed is to greater ease, are less liable to become soiled, and are about fifty per cent cheaper. The invention has received the marked approval of dealers in stationery and of the public. The patented cards have gone into general use, displacing the old devices referred to.

The defenses were lack of novelty and invention, and that the complainants are not joint inventors.

Judge Coxe said the proof demonstrated that the field in which the complainants operated was at best a narrow one, and the question arises, Is the patent, though it cannot be defeated for want of novelty, void for lack of invention? To this question it is by no means easy to give an entirely satisfactory answer. Each case must depend upon its own facts and circumstances. The perplexities which surround such controversies cannot always be solved by an examination of adjudged cases. The serve to illuminate the paths to be traversed; but he who desires to select the right one must depend largely upon his own judgment. Although the present case is very near the border line between invention and mechanical skill, it is thought the doubt which arises should be resolved in favor of the patent. No one ever did before what the complainants did-viz., produce an invitation card with two or more folds having panels, to represent cards, embossed thereon, upon which the printing is afterward done. This particular structure is new, useful, and inexpensive. It soon became popular; it supplies a need. Time and thought were resteam used. That is a difficult matter to calculate, for quired in its development. The obstacles which thereit would vary according to the temperature of the air fore could only be surmounted by skilled labor were entirely eliminated. All this required something more than the labor of the mechanic. It amounted to invention.

> The whole matter is well illustrated by a question and answer, quoted with approval upon the defendants' brief. One of the complainants was asked if he thought that prior to October, 1880, persons of ordi-The one is the result of mental, the other of manual, action. Grant that the invention is a simple one, that when viewed from our present standpoint it is hard to understand why the idea did not occur to some one long before, and yet the fact remains that it never did, though something of the kind was long wanted.

> After giving the subject the best thought of which I am capable, I am convinced that to relegate these complainants to the condition of mere skilled workmen would be to do them a grave injustice. In the light of the present the idea of substituting hard rubber for other material as a plate for holding artificial teeth, or of providing tubular kerosene lanterns with an irre

simple enough, and yet the men who thought of these nothing was then known, by greatly retarding healthy but we will try to look for something better. We need things conferred lasting benefits upon the world and perspiration, doubtless hastened the fatal result. received the rewards of inventors.

In Crandall v. Watters (20 Blatchf., 97) the patent was for a box loop for carriage tops made of thin metal, from which the loop was struck up. It was used as a substitute for the old leather housing. In sustaining the patent the remarks of Judge Blatchford are so applicable to the case at bar that I quote briefly from the opinion. At page 102 he says:

Various old devices are introduced. . used without alteration and adaptation requiring inday that become the subject of patents are the embodiment and adaptation of mechanical appliances that before. No one produced it before.

"It supplies a need; it is at once adopted; all in have been perfectly obvious and not to have been patentable. Where an article exists in a given form and applied to a given use, and is taken in substantially the same form and applied to an analogous use, so as to make a case of merely double use, there is no invention; but it is very rarely that a thing of that kind secures a patent."

There should be a decree for the complainants for an injunction and an account, with costs.

THE ATMOSPHERE OF CAVES.

The largest volume of subterranean atmosphere with which we are acquainted is found in Mammoth Cave. Kv. This cave. or rather system of caves, is very extensive, greatly exceeding the other two notable caverns in our country: the Luray of Virginia and the Wyandott of Southern Indiana. The passageways of times. Mammoth Cave have a combined length of over 150 miles, and their area covers hundreds of acres. It is estimated that the entire volume of atmosphere thus inclosed exceeds twelve million cubic yards. In this underground world the ordinary atmospheric changes are unknown, summer and winter are unknown, and the heat of the sun never reaches its unbroken

Like all our larger caverns, the temperature is alike at all times and seasons. In the summer there is a brisk outward current, having a temperature of 53° to 54°. This current is doubtless fed by certain leakages of air which filter through the sinkholes, which discharge their moisture at certain points in the cave

In the winter, there is a current of air setting inward. This is not perceived at a distance of onefourth of a mile from the entrance. It nevertheless depresses the thermometer a few degrees, and its effect upon the humidity of the air is evident at the distance of three-fourths of a mile.

For the first time hygrometric observations have been carefully made as to this unique body of atmosphere. The dryness of the air has often been noticed, and the resultant niter beds were esteemed a matter of national importance during the war of 1812.

In the "Gothic Gallery," several miles underground, visitors have been wont to deposit their cards, and these cards have remained for years, fresh as new, save where moist finger prints have left behind them the germs of mould. The ground is seemingly dusty, but still the dust, if stirred, will not rise in the air, nor soil a polished shoe. In these portions of the cave, which seemed destitute of moisture, the wet and dry bulbs of the hygrometer showed the same figure, the the ballast is again shifted and the hydrogen heated, variations seldom exceeding one-fourth to one-half a so that by a succession of undulations the movement in degree. The humidity ranged between 96 and saturation. With the thermometer at 54°, the wet bulb would range between $53\frac{1}{2}^{\circ}$ and 54° , and the dew point would be between $53\frac{1}{10}^{\circ}$ and $53\frac{7}{10}^{\circ}$. The singular fact was noted that the same temperature prevailed at the roof as upon the floor of the cave; and where the thermometer would be depressed one or two de- every 30 miles.—Abridged from Revue Scientifique. grees at the higher as compared with the lower altitude. The humidity would, however, remain a con- PROPULSION FOR OCEAN STEAMERS BY THE STEAM stant quantity. This can be accounted for only on the supposition that the supply of air, slowly admitted from above, is chilled by the absorption of moisture during the first stages of its descent, and becomes slowly warmed before completing its full descent of 300 feet. Mould is rarely seen in the cave, but wherever it occurs, a snowy whiteness and luxuriance of growth are noted.

One avenue of the cave is devoted, with excellent success, to the growth of mushrooms, and no doubt such an atmosphere might have an industrial value ally seem restricted in its extension by its own terms. for other purposes.

well, in the cave. But the result was disastrous. The limit, and it must, of course, be narrow. A period of lack of light was, no doubt, one reason of this; but a few hours at the furthest is all that we can command. the hygrometric condition of the air, of which! This of itself is certainly of immense practical value; bach in 1640.

R. NORTON.

DIRECT USE OF STEAM AS MOTIVE POWER OF AEROSTA'.

M. Duponchel, Chief Engineer of Ponts et Chaussees, became convinced that the substitution of hydrogen for heated air as the source of ascensional power, while in some respects a progress, had operated to turn aside the new science of aerostation from its natural chanarticle like the plaintiff's, capable of being taken and nel. He believed that the modest Montgolfier balloon of used for the purposes for which the plaintiff's can be Pilatre de Rozier, carrying with it its own ascensional organ, was nearer to the solution of the problem than vention, existed before. Almost all inventions at this the great captive balloon, fresh in the memory of every one. General Meunier, member of the Institute at the beginning of the century, had fully determined the are old. In that consists the invention. When the construction of aerostats designed for the transformathing appears, it is new and useful. No one saw it tion of vertical into horizontal motion. For this end he gives the balloon an envelope of fixed shape, with two separate cavities of variable volume, not communthe trade desire to make and use it; yet it is said to licating with each other; but being so constructed that as one expands under any given conditions, the other contracts in exact proportion.

> M. Duponchel thinks that he thus will arrive at the solution of the problem of guiding balloons. The school of mechanical solution having only succeeded in constructing toys, and having reached their limit, the study of bird movements must give place to balloon aerostation. To-day, after the results obtained by MM. Tissandier, Renard, and Krebs, the velocity of aerial currents presents the principal difficulty. Upon the surface or under water, a steam vessel capable of reaching a velocity of 19 feet can be master of its movements in the midst of currents never exceeding one-half that velocity; but the aerostat, in the midst of winds whose ordinary velocity is 30 to 40 feet, and which may be as great as 130 or 160 feet in tempests,

> M. Duponchel has concluded that a velocity of 60 to 100 feet, enough for all ordinary conditions, could be obtained with a fish-shaped balloon of 700,000 cubic feet capacity, 282 feet long and 70 feet 6 inches high, half filled with hydrogen, and hence having an ascensional force of 26,460 pounds. For veties of 30, 60, or 100 feet, 60, 480, and 1,620 horse power will be respectively required. It is perfectly evident that no machinery known to us will be available for the production of such power as this in a balloon. But this enormous motive power, though beyond the scope of our machinery, can be obtained from the direct employment of steam as heating agent in a Montgolfier balloon, following in the footsteps of Pilatre de Rozier. Thus, if we inject into a volume of 35,000 cubic feet of hydrogen, contained in the aerostat just described, a quantity of steam sufficient to raise its temperature 78° Fah., its volume is dilated 22 per cent, giving an extra ascensional force of 3,000 pounds, or the equivalent of 700 horse power for one hour. Two systems are described by M. Duponchel. We shall only speak of the

> An aerial fish of the Meudon model, but with rigid envelope, is the base. Its interior is divided by a flexible membrane into two parts, the upper containing hydrogen gas, that can be more or less expanded by the injection of steam into the lower chamber. Vertical and horizontal fins are used to determine the movements. By shifting ballast the aerostat is inclined and steam is injected, expanding the hydrogen one-fifth of its volume. This causes it to rise and move forward, owing to its inclination. When the gas is cool, the aerostat is brought again into a horizontal position, or inclined the other way, by further shifting of the ballast, and allowed to descend. When near the ground, advance is obtained.

In the case of a balloon of 700,000 cubic feet capacity, the maximum elevation would be 9,800 feet, and the undulations in a distance of seven miles would be gone over in 33 minutes, thus giving a speed of 13½ miles per hour, nearly, with the expenditure of about 350 pounds of 200 to 300 feet of elevation occurred, of coal. This would necessitate renewal of fuel about

JET.

Having recently in our columns discussed the practicability of the propulsion of boats by using a jet or current of compressed air as our motive agent, the question very naturally occurs, Must we necessarily in this matter limit ourselves to small motors and small boats? If so, the application is somewhat limited, and we fail to take hold of a thing of really general in-

The plan which I suggested in that article does actu-It involves a reservoir, which is to be filed before Several consumptives once tried to live, and get starting, and the energy therein stored gives us our

to keep the open sea; we need a power which we can renew incessantly, as we now generate our steam. Can we do it, and still use, in the manner which I have suggested, direct propulsion? •

I belive the thing is practicable, and I will try to show it. We may, of course, make use of compressed air for driving our largest ships precisely in the same way as directed by me for the Whitehall boat. It is merely a question of the size of the jet or jets. One-sixthor onetenth of a horse power, as with the boat, or 1,000 or 5,000 horse power, as with the ocean steamer, what does it matter? If the smallest will do its work, the largest can be equally trusted for its full efficiency. We can certainly employ compressors by means of which the entire power of the steam generated constantly shall be as constantly employed in keeping up a steady pressure in a suitable reservoir, from which the air jet or jets beneath the ship's bottom are supplied, and by which the ship is driven forward, precisely as was the boat. This is surely possible, and if we can drive the boat, we can drive the ship; but this is by no means the plan which it is my object here to propose.

In the double transfer of energy which has been here mentioned, we encounter loss, and it is a loss that seems to me not necessary and not adviable. It is true, we have counteracting advantages which vastly overbalance in their gain the loss which we shall have made, and were there no other way but this, I should be prepared to advocate it most strenuously. We dispense with such an enormous amount of weight in engine and driving machinery, as well as saving the immense space which they now occupy. Our steamers, freed from the huge bulk with which they are now loaded down and lumbered up, would almost double their capacity by the very fact. But, as I stated, the loss by transferring the energy of the steam into that of compressed air I propose to save.

My plan is to propel the ship by jets of live steam direct from the boiler. To illustrate and enforce my meaning, I will take a ship of definite size, as I did in the case of the boat. It shall be a steamer which is using in her daily work a constant service of 5,000 horse power. Her boilers supply steam to that extent, and we have it at command. I propose to make no change in them; they go on doing their present work. All that I do is to change the direction of the steam pipe from each boiler. It no longer goes to the cylinder or cylinders. It goes to make its exit as directly as possible by the side of the keel.

This is a mighty change from all present plans. I am prepared to find my views rejected as being entirely unworthy of perhaps even investigation. I am prepared to find them presently adopted in, it may be, modified forms, for I believe that they embody true principles, which will prevail.

My designs in the case of the ship are identical with those which I specified in the case of the boat. The point of exit of the discharge pipe is lateral to the keel; the body of water on which the steam expends its projectile force is, in this instance, three feet in width, the longitudinal confining wall being at that distance from the keel.

In a ship of this size I propose that each . jet be matched by one on the opposite side of the keel, and that there be two of these pairs, the first pair being 100 feet from the stem, and the second pair 250 feet. This, then, gives us our system of propulsion. Four pipes of ejection, at the points designated, are pouring forth a torrent each of steam directed backward, and, as before, slightly downward. At each of the orifices the issuing steam exerts constantly a force of 1,250 horse power, for this is what the boilers are steadily supplying. This terrible energy, almost appalling to contemplate, is expended on the open, or rather the confined, water beneath the ship's bottom, and the inevitable result must be a rapid movement of the ship.

No plan can be more simple and compact than this. The theory seems to me without flaw. Its efficiency can be demonstrated only by actual trial. Any one having a steam yawl at command can put the matter to proof with the expenditure of a very few dollars. Without injuring the boat in the slightest, a steam pipe, connected with the boiler, can be passed through her bottom and arranged as specified, and a thorough test made of the principle, for, of course, what the yawl will do the ship will do, mutatis mutandis, as nearly as yawls and ships work alike in common experience.

The condensation of the steam at the point of impact may be held by some as a source of loss; but, practically, it will be of no moment. The propulsive force of the steam is exerted at the instant of ejection, and not later. The condensation of the steam requires two elements, time and expansion, which are not present.

The advantages to accrue from this mode of direct propulsion by live steam are so exceedingly great that I most earnestly hope the trial will speedily be made.

W. O. AYRES.

THE first almanac was printed by George von Pur-

IMPROVED HARROW.

The frame of this light and strong harrow is composed of flat bars of iron or steel, arranged diagonally in two series crossing each other, the bars of one series being arranged flatwise and those of the other edgewise, the bars being conflected with each other and with the harrow teeth by sockets placed on the bars at their intersections. The socket is a casting having a central vertical aperture, with a lateral recess for re-



CARSTENSEN'S IMPROVED HARROW. .

ceiving the right-angled end of the harrow tooth. The lower part of the hole is flared to permit a slight lateral movement of the tooth, which turns on its rightangled arm as a pivot. Upon opposite edges of the surface of the socket are formed ribs, between which is received the bar placed flatwise. Between the ribs a stud projects upward from the face of the socket for receiving the apertured bar and a nut by which the

wise above it. One socket is placed at each intersection of the bars. In addition to the diagonal bars, the studs of the end rows of sockets receive apertured bars, which are held in place by the nuts. One of these bars is connected by links or clevises, secured in bolt boles formed in the bar, with the eyener by which the harrow is drawn forward. It will be seen that by means of a simple socket at each intersection of the bars they are strongly clamped together, and the teeth are securely held in proper relation to the bars. By arranging the bars flatwise and edgewise, strength and rigidity are secured without undue weight. Any tooth may be readily removed and replaced without disturbing the others.* This invention has been patented by Messrs. P. C. & I. A. Carstensen, of Walnut, Iowa.

IMPROVED CAR COUPLING.

The car coupler herewith illustrated is particularly noticeable for the simplicity and admirable arrangement of its parts. The link is held in a horizontal position, so as to insure its ready entrance into the opposite coupler, while the pin is held elevated by a table which is pushed back by the entering link, through which the pin is then free to drop. The coupler is perfectly automatic in its action, and its reliability is assured, since the parts are so weighted that the force of gravity alone is depended upon. The drawhead opening is so formed as to permit the link to have all necessary vertical and lateral play without subjecting it to any but a tensile strain, thereby lessening the danger of breaking. As the only action required of the brakeman is to lift the pin, and as this can be done from either the sides or top of the car, he need not enter between the cars. The drawhead is provided with a wide flaring mouth

terminating in a narrow throat, which serves to readily pin above both tables, when, the link still holding of the textile industry. and certainly guide the link into position with reference to the pin. Beyond the throat the chamber for the link is enlarged to allow the rear end of the link to When the cars separate and the link is withdrawn, ed a process of reducing petroleum to a form of crysfreely play up and down and sideways, to accommodate itself to the swaying and springing of the cars. it the pivot of the upper table, which is thereby distance and then reconverted into liquid form.

Above this wide chamber is a narrow and parallelsided one opening at the top of the drawhead. This opening is covered by a removable cap as shown. Pivoted in this chamber is a table free to swing, and, being heavily weighted in the rear of its pivot, it gravitates so that its foot on ledge is pressed strongly forward against or under the pin. From the rear portion of the foot a heel projects downwardly into the path of the link as it enters the chamber. Pivoted to the first or primary table just below its trunnions is a second table, which is weighted to gravitate forward, and has a foot lying normally just above the foot on the primary table. When the link is in its proper position in the drawhead, the foot of the primary table rests on its rear end (Fig. 2), the rebyholding its exterior end out horizontally from the drawhead in the position most favorable for coupling with another car.

The construction of the parts is such that the weight of the tables is not always on the link, except when the cars are uncoupled and the link is presented for coupling. The weight of the tables never tends to carry the inner end of the link below the horizontal line; but the link, when the cars are coupled, may swing on the throat of the drawhead as a pivot-until its inner end is far below the tables, and so leave the latter entirely suspended on their trunnions in the bottom of the vertical slets, in which they are free to move up and down. These slots or cups are formed at the top and on either side of the chamber, and receive the pivots or trunnions formed on the main table. This construction of the tables, whereby they are pivoted at their top in vertical cups in which they are supported and guided, enables them, when the cars are coupled, to freely swing forward and back or to rise and fall to accommodate themselves without danger of breaking to the thrusting in or jerking out of the link, as well as its frequent sudden elevation or depression, incident to the rocking, swaying, and jumping of the cars.

The pin is operated from either the top or sides of the car by means of a rock shaft extending across the end, as represented in the perspective view.

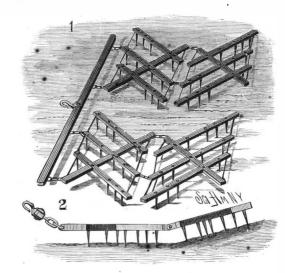
the foot of the primary table; the entering link spacing and brace irons. The tooth-carrying bars bar is clamped to the socket. Upon the side of the strikes the hub, crowding it back and withdrawing are set at an angle of about forty-five degrees with socket is formed a hook for receiving the other flat bar, the foot from anderneath the pin, which is then free the line of draught, the front series ranging back-which is clamped in the hook by the bar placed flat- to fall. To uncouple, it is only necessary to lift the ward toward the left, while the rear series range back-

pressed against a stop and swung backward to withdraw its foot from beneath the pin, which then falls upon the foot of the primary table, and the parts are again in their first position ready for coupling. It will be observed that the only manual action required is the simple momentary swinging of a side lever against its stop; and that, after it touches the stop, the hand may be instantly withdrawn, the whole operation thereafter, both of uncoupling and coupling, being entirely automatic.

This invention has been patented by Mr. S. D. Locke, of Hoosick Falls, N. Y.

IMPROVED HARROW.

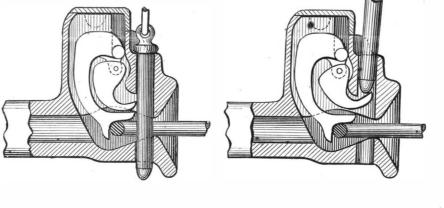
This harrow, the invention of Mr. James G. Owen, of Covello, W. T., is made in two double sections, each

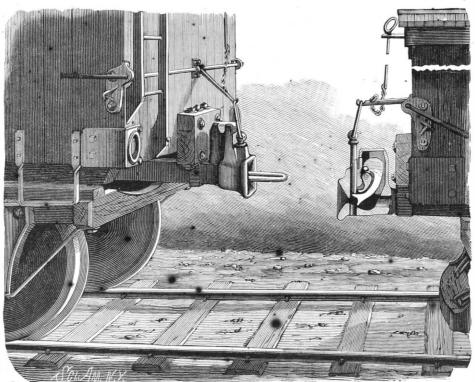


OWEN'S IMPROVED HARROW.

comprised of front and rear parts, consisting of a series of tooth-carrying bars braced by a diagonal When in position for coupling, the pin rests on bar, and all connected at the ends of each part by

> ward toward the right. The front and rear parts of each section are coupled together by hinges, allowing independent vertical movement of all four of the harrow sections, and the front parts of each double section are coupled by suitable flexible bar, link, and staple connections with the draught beam, to which the horses are hitched. The teeth are fitted in the bars in such relation to each other as will cause them to harrow the ground in lines about two inches apart. As the harrow is drawn over the ground, the sections will adapt themselves to any inequalities of the surface in all directions, and no part of the ground will escape the proper action of the teeth. The converging arrangement of the tooth bars, together with . the coupling of the front and rear parts by hinges, not allowing lateral play of one part on its connected part, causes the harrow to run truly and effectively on side hills, and without the tracking of one tooth in the path of the preceding one. This harrow is not liable to clog, and does not have a swinging motion from side to side; it may be made of either wood or iron.





LOCKE'S IMPROVED CAR COUPLING.

back the lower table, the secondary table is free to swing its foot beneath the pin, as shown in Fig. 3.

Textile Soap.

The firm of Trawitz, Dueringer & Co., Strassburg, Alsace, manufacture a soap for use in the textile industry which it is claimed meets the highest requirements and perfectly replaces the best Marseilles soap. This "Luetzelburg textile soap," as it is named, according to the analysis made in the laboratory of the Seifensieder Zeitung contains:

Fatty acid.....Soda....Water.... 100

The fat is completely saponified and the soap absolutely neutral, and therefore suitable for any purposes

A Russian engineer reports that he has discoverthe heavier lower table swings forward, taking with tals which may be easily and safely transported to any

.THE GLYCERINE BAROMETER,

known to be in existence at the present time. To ing to about 26 pounds, are here sustained. The vacuum, the bottom can be corked and the tube re-

4

MILLS' GLYCERINE BAROMETER.

avoid all trouble incident to the employment of joints, small aperture being left for the ata glass tube several feet more in length than the full height of the barometric column of glycerine was used. Some trouble was experienced in procuring the tubes. Two perfect ones were finally drawn by Demuth Bros., Brooklyn, E. D. They are upward of twentynine feet in length and of about one inch internal diameter. The section of one is shown in full size in the cut, Fig. 5.

Naturally, trouble was encountered in their transportation from the glass house. Mr. Mills took a personal part in this work. Three men were required to carry the tube in its case. This was not on account of its weight, but because of the danger of breakage if any flexure took place for want of support. Having reached the place of destination, the next problem was the erection of the great inflexible tube into a vertical position

It was taken up to the roof. Holes were made through the roof and floors beneath large enough to pass if through. It was carefully raised to the vertical and lowered, its lower end passing through floor after floor until it reached the position shown in Fig. 1. The hole in the roof, not over two or three inches in diameter, was then closed. Thus placed, the tube extended from the cellar floor up through intermediate floors and above the ceiling of the second story. The cistern had to

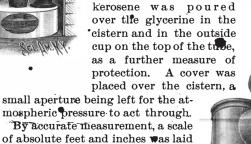
be in the cellar, or, rather, below the cellar floor. A watertight pit was prepared for the reception of a flat copper vessel, shown in a larger scale in Fig. 6. The support of the tube had next to be provided for. A collar of brass, with a projecting fillet or shoulder, was made slightly larger in diameter than the glass tube. It was secured to the tube by shellac and by a wrapping of string underneath it and between it and the tube. This collar is held in a wooden block, perforated, so

within the building.

as to catch the fillet, as shown in Fig. 2. The point of curial barometer, was placed upon the other side. Mr. Zopha Mills, Jr., a private merchant of this city, support is immediately below the scale. The tube and These scales, with the tube between them, are reprehas recently shown a most praiseworthy devotion to contained glycerine exert the stress due to their weight sented in Fig. 7. science in erecting in his office building, No. 146 entirely on this block only. Or, more correctly, the Front Street, a glycerine barometer. It is one of three weight of the tube and atmosphere, the two amount-lend of the tube. If any air tends to accumulate in the

> lower end of the tube was introduced into the cistern and a cork placed in it and supported by a block. This arrangement can be seen in Fig. 4. Glycerine was then poured into the cistern and into the top of the tube. The shape of the top is shown in Fig. 3. It is contracted, so as to receive a cork. A brass cap is to cover it, to keep out dust. The lower cork being in place, glycerine was poured in through an inclined funnel, about four feet being filled each time. Some fifteen minutes were devoted to this operation. After some hours' standing, in order that all air bubbles might rise to the surface, the next four feet were filled. In this way glycerine was introduced until it stood above the stricture and the tube was quite full. The cork, Fig.

parts of the instrument. A layer of it is remembered that the best mercurial barometers



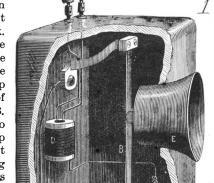
off on one side of the

tube. A calculated

scale of nominal

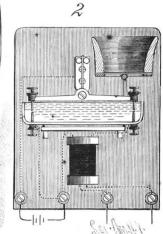
inches and fractions

thereof, referred to



Access can be had from the upper floor to the upper

filled. For this purpose a small trapdoor is provided in the floor above. The cistern is situated as nearly as possible on the exact sea level, a condition of theo-



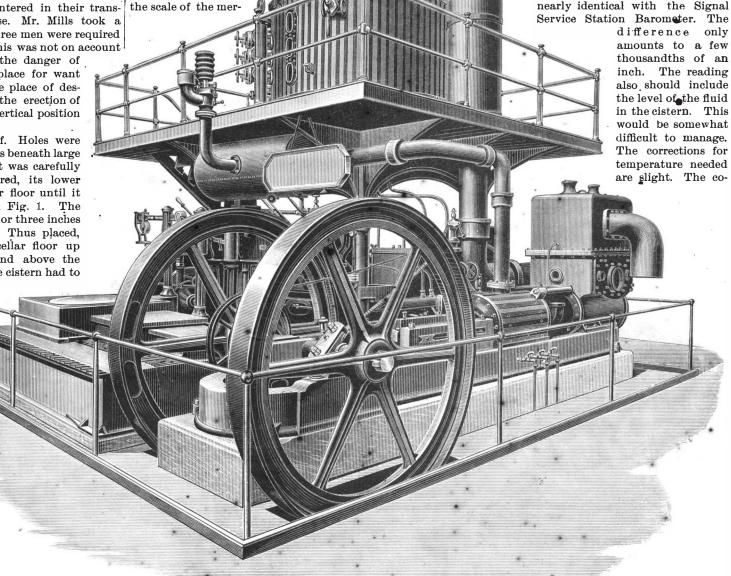
SARGENT'S TELEPHONE TRANSMITTER, (FOR DESCRIPTION SEE NEXT PAGE.)

3, which is of India rubber, was then retical interest as one rarely fulfilled in barometric tightly inserted, the lower cork, Fig. 4, stations. For constants in laying out the scale, the was withdrawn, and the column sank, specific gravity of glycerine was originally taken at leaving the Torricelli vacuum above it. | 1.250. This would be nearer the truth if 1.265 were This completed the main operating taken, assuming the glycerine to be pure. But when

> do not agree with each other, the chances of obtaining identical readings, as reduced, with a glycerine and a mercurial barometer seem very small. The readings have varied from 26

ft. 3 in. upward. A range of $9\frac{16}{100}$ in. corresponds to an inch of mercury. Thus a thousandth of an inch on the mercurial column becomes a tangible quantity of nearly the one-hundredth of an inch. By practice the barometer can be read by the unassisted eye as closely as the mercurial one with the sliding tangent pieces. Its readings are nearly identical with the Signal

> amounts to a few thousandths of an inch. The reading also should include the level of the fluid in the cistern. This would be somewhat difficult to manage. The corrections for temperature needed are slight. The co-



IMPROVED SUGAR EVAPORATING PAN. (For description see next page.)

efficient of absolute expansion of glycerine is 0.00045 ends are attached to the lower side bars of the frame. 152 Front Street, were the instrument makers who assisted in its construction.

. COMBINED HOOK AND BUCKLE.

The wire of which the main portion of the buckle is made is bent to form an oblong loop, with parallel arms projecting from one of the longer sides; these



arms are curved over toward the loop and provided at their extremities with eyes. The tongue is formed of a wire pointed at one end, and provided with an eye at the other end, which is placed between the eyes of the arms; a wire, forming the pintle of the buckle, passes through the eyes and has its ends bent over to hold the parts in proper position. The arms form a double hook for the reception of the link of a

chain, a ring, or a wire rope, while the tongue may be used in the same manner as the other buckle tongues loop in a wire cord or rope. This buckle is useful for application to harness and saddles, and for the temporary repairing of straps and various kinds of rigging. | contained in the non-conducting vessel, G. It is evi-

Further particulars can be obtained by addressing the inventor, Mr. James J. Pinkham, of Stillwater, the induction coil will be governed by the variations of Montana.

A Sure Investment-Dividend Every Week.

This issue closes the .fifty-fifth volume of the Scien-TIFIC AMERICAN, and with it a considerable number of subscriptions expire.

Notices to this effect have been sent to many thousands of our present subscribers. But the quick response and rapid rate at which the renewals are being made,. together with the accession of new subscribers, encourages The publishers to believe that before the middle lever, which is actuated by the diaphragm in the manof January they will have a larger list of old and new ner illustrated. Each end of the lever carries a screw subscribers than has ever before appeared on their subscription books.

The fact that the public have lost money and confidence in many ventures leads them to seek new and better paying investments. This paper, established of the current passing through the coil will be regulated forty years ago, provides an opportunity of making an accordingly. investment, the returns of which are sure and made weekly.

The security is unquestionable, and dividend guaranteed every week. The following are the conditions on which everybody can become a stockholder, and the public are cordially invited to examine the quotations herewith appended:

RATES FOR THE SCIENTIFIC AMERICAN PUBLICATIONS (Proportionate rates for half year.)

Now is the time to send in your names for the new volume of each publication, which commences next

The safest way is to remit by check, postal order, express order, or registered letter, made payable to the order of Munn & Co. Address all letters to 361 Broadway, New York.

COTTON CHOPPER.

This cotton chopper is so constructed that the cotton will be chopped to a stand as the machine passes



PULS' COTTON CHOPPER.

along the rows of the plants, leaving the hills of the plants at uniform distances apart. The axle revolves

for 1° C. In correcting a barometer, the absolute Upon the inner ends of the hubs of the drive wheels coefficient is the one to be used. Messrs. Black & are formed ratchet wheels, with which engage pawls Pfister, now of the Draper Manufacturing Company, of | pivoted to the outer ends of arms, and which are held against the wheels by springs. The other ends of the arms are held to the axle by set screws. To the axle is attached a large beveled gear wheel, which meshes with a wheel on a shaft mounted so as to have a movement in the direction of its length. The forward part of the the surface. Mercury is thirteen times as heavy as shaft is squared, and to it are secured two parallel slotted bars in which fit lugs formed on the ends of the shanks of the chopping hoes. The shanks are thus prevented from turning, and the hoes can be adjusted, by loosening the nuts of the holding bolts, to work deeper or shallower in the ground as may be required. By means of a suitably arranged lever, placed within easy reach of the driver, the shaft can be moved longitudinally, so as to throw the forward gear wheel into or out of gear with the main wheel mounted on the axle. The chopping hoes can thus be made to re volve or can be held stationary whenever required.

This invention has been patented by Mr. E. C. A. Puls, of New Braunfels, Texas.

TELEPHONE TRANSMITTER.

In the engraving upon preceding page, Fig. 1 represents a liquid transmitter, which is so wired that in its normal state the current circulates around the induction coil, D, with its full strength. The reason for this is that the vibrator is then nearer the screw, A, than the for engagement with the strap, a link of a chain, or a screw, C. The vibrator is actuated by the diaphragm of the mouthpiece, E, and its lower end enters, between the points of the screws, A C, the conducting liquid dent that the strength of the current passing around the distances of the vibrator between the screws, and which are due to the action of the diaphragm in the mouthpiece. One of the many ways of wiring the instrument is clearly shown in the engraving. Another is to connect the wire leading from the positive pole of the battery where the negative wire is shown connected, and connect the negative wire with the wire of the screw, A.

Fig. 2 shows another construction of the transmitter, in which the vibrator consists of a centrally pivoted that projects downward into the liquid, so as to face a screw passing through the bottom of the vessel. The distance between each pair of screws will thus be varied by the movement of the diaphragm, and the strength

This invention has been patented by Mr. F. G. Sargent, of Graniteville, Mass., who will furnish any further information.

IMPROVED SUGAR MACHINERY.

Among the exhibits in the machinery department of the Edinburgh International. Exhibition, one of the most conspicuous is that of Messrs. A. & W. Smith & Co., Eglinton Engine Works, Glasgow, a specialty of sugar machinery.

The most conspicuous object in the group is a vacuum pan for the finishing process of boiling and crystallizing the sugar, of which we give herewith an illustration from Engineering. The heat is imparted by steam to the contents of pan through an inner bottom of copper and by a series of copper coils or worms; and the operation is conducted in vacuo by means of a neatly designed horizontal vacuum pumping engine.

This pan is mounted on a elevated platform (for convenience in discharging its contents into the hopper of the centrifugal sugar-drying machines), and the body and top of the pan are lagged by ebony and whitewood; the fittings and gauges are of argozoid, a new white metal, which gives the whole apparatus a very attractive appearance. The discharge of this pan is equal to six tons of dry sugar. 'The sugar, after having been concentrated and crystallized in the vacuum pan, is run into the hopper or mixed over the centrifugal sugar-drying machines of improved construction.

These machines are on the well-known self-balancing suspended principle, the cylindrical baskets which receive the sugar revolving at a high speed, and purging the sugar from any molasses which it contains. Each basket dries one cwt. of sugar at a charge. The dried sugar is discharged from the bottom of the baskets on to conveyers or bogies, as the case may be.

MERCURY BUBBLES.

BY T. O'CONOR SLOANE, PH.D.

Lord Rayleigh, in one of his recent addresses before the British Association for the Advancement of Science, made an interesting allusion to soap bubbles. He declared that one of the unsolved problems in natural science is comprised in the question, why soap and water form almost the only solution out of which reasonably large bubbles can be blown.

water is poured over its surface to the depth of an inch. From a bottle more mercury is now poured into the vessel. The height of fall should about six inches. As the falling fluid strikes the mercury in the vessel it acts as water falling into water does, with one exception. The latter carries air under the surface, forming bubbles filled with air. The falling mercury, instead of carrying air in its descent, forces water under water. The water thus carried down instantly rises,



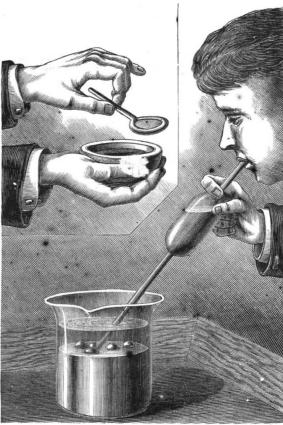
MERCURY FOAM.

and the exact reciprocal of the action described in the case of water and air takes place with mercury and water as factors.

As the water rises above the surface of the mercury on account of buoyancy, it picks up and raises a film of mercury. A hemispherical bubble is formed upon the surface of the fluid under the water. Water foam consists of incompletely spherical films of water filled with air. In the experiment just described, mercury foam is produced, the partial spheres of mercury film being surrounded by and filled with water. The fact that they are bubbles may be recognized by their shape. They form the characteristic line or angle of junction with the mercury on which they rest. They are evidently filled with water, for when they break no air escapes. They can be contrasted, with globlues that usually form upon the surface at the same time. These tend to run to the periphery of the vessel, and possess their characteristic spheroidal shape. Sometimes bubbles half an inch or more in diameter can thus be

To demonstrate still further the analogy with water films, bubbles may be blown. A tube or pipette is filled with water. Its end is placed beneath the surface of the mercury, and bubbles are blown by forcing the water out of the pipette. As a rule, a far inferior effect is thus produced, but the method is of interest, and shows more clearly to what action the formation of these bubbles is due.

Finally, a flat film can be formed, such a one as water



BLOWING MERCURY BUBBLES-MERCURY FILM,

forms across the opening of a pipe or within a wire Both the formation of bubbles and globules can be ring. A piece of copper wire about as thick as a steel produced with mercury exactly as with water. A knitting needle is bent at the end into a circle. The in bearings in the lower ends of hangers, whose upper | quantity of the metal is placed in a vessel of glass, and end must touch the wire at the bend, making a con-

tinuous circle. By bringing the bent portion in contact with a globule of mercury and some dilute sul-• phuric acie on a saucer, the wire loop becomes amalgamated or alloyed with mercury. Then, by sweeping it through mercury overlaid by water, with a quick skimming movement, a film can be picked up. Water will rest on its upper surface. This can be removed with blotting paper, leaving a pure mercury film. It must be held horizontal. It immediately breaks if an attempt is made to bring it into the vertical plane. BENJAMIN F. STEPHENS, ESQ., President: The loop should not be much over a quarter of an inch in internal diameter.

FALL OF A GREAT WATER TOWER.

In various parts of the country it has become common, in connection with local water works, to erect slender towers or stand pipes for the purpose of maintaining the required head or hydrostatic pressure in the distributing pipes. The common method is to erect a simple iron cylinder or stack of, say, 16 ft. diameter and a hundred feet or more in height, into which the of the cylinder being connected with one of the water distributing mains. In our paper for October 23, 1886; we gave an illustration of one of these stand pipes, as erected at Victoria, Texas, the upper end of which, not being at the time filled with water, had been damaged by a hurricane.

We now give illustrations of the far larger stand pipe of the Kings County Water Works, located at Sheepshead Bay, near Brooklyn, N. Y., which, at 1 P.M. on October 7, 1886, suddenly collapsed and fell, while being charged with water during a preliminary trial of

This stand pipe was 250 ft. high, 16 ft. in diameter at its base and for a height of 70 ft., then tapering upward for 25 ft., and then rising 8 ft. in diameter. A very strong and substantial foundation of concrete had been constructed, 33 ft. in depth below the surface of the ground. On this the stand pipe was built, the contractor being H. S. Robinson, of Boston, Mass.

In the construction of the work, the steel plates were hoisted to place by a derrick worked from within the tower, as indicated in the illustration at the left, which shows the structure partly completed.

As before stated, the explosion took place at 1 P.M., when the neighbors were startled by a rumbling noise followed by a crash like that of thunder. There was a slight vibration of the earth, but it was all over in less than thirty seconds. The people thought it was an earthquake, and rushed from their houses in terror. The shock was felt in all directions within a mile or two of Sheepshead Bay. A cloud of dust was seen rising from the locality, and when it had floated away the water tower was discovered lying on the ground, with tons of steel plates scattered in every direction. Great volumes of water rolled from and around the prostrate structure, and in a few moments nineteen acres of land was submerged.

Some water had been pumped into the tower a week previous to the explosion, but the real test was not made until the day of the explosion. It was supplied from drive wells in the immediate vicinity. The large engines were set in motion at the pumping station shortly after 11 o'clock. Two hours later the great tank was nearly filled, there being 227 feet of water in it, which would make about 400,000 gallons. The pressure was then 127 pounds to the square inch. It was noticed then that the tower leaked in some places, and Mr. Robinson prepared to mount the nar-· row iron ladder that led to the top of the structure, • and make an examination. He approached within about five feet of the tower when he heard a rumbling noise like that of a rushing train, as he expression it, and the plates for a distance of twenty feet from the ground parted and let loose the water. Others describe it as like the explosion of a steam boiler. The volume of liquid rushed with great force, and Mr. Robinson was caught in ... He was carried nearly fifty feet by the wave, and that saved his life. Almost in the same moment a large section of steel plate weighing a ton or more crashed down upon the spot where he had stood. Another section weighing five tons was thrown fifty feet in an opposite direction. Small pieces were tossed all around the base vibration lifted itself further from its bed. Meantime, of the tower.

Meanwhile, the tower, supported by the wire cables alone, tottered for a moment and then fell with a crash and roar in a northeasterly direction. The heavy steel plate, bolts, and braces were broken, bent, and twisted like so much paper. The rush of the water had stirred up clouds of dust, and for a time the scene was concealed from view. People in the immediate vicinity thought that the dust was escaping steam. When Mr. Robinson recovered himself, he was floundering in three feet of muddy water. His hat, coat, pocketbook, and a number of papers were gone. He struggled to his feet and waded toward a dry spot a quar-erected by the Sharon Boiler Works, of Sharon, Pa., ter of a mile away. Though considerably bruised, he under the direction of William Jones. The foundation ing were found some hours later near the wreck. The twenty-one feet in diameter, and rose about eight inches same time and fired simultaneously or consecutively, as soil about the tower was of a sandy character, and the above the surface of the ground except on the side towater quickly disappeared, except in places where the ward which the tower fell, where an excavation left fired and the other not.

had been planted by Mr. Stephens disappeared after superintendent of the Water Works Company, comthe explosion. No other damage was done.

The following from the contract gives the particulars of the structure. The general conclusion appears to be that bad work in putting up the great pipe and poor material were the causes of its failure.

ROBINSON BOILER WORKS, 28 STATE ST., BOSTON,

I will make and erect on a foundation prepared by you near Coney Island, New York, a stand pipe 250 ft. high, as described below:

Pipe will be 16 ft. diameter up to 70 ft., then in the next 25 ft. taper in to 8 ft. diameter. Bottom of % in. steel, 17 ft. diameter. Bottom course connected to bottom by $6 \times 6 \times \%$ in. angle iron, flange turned out; 15 braces on the inside.

First 5 ft. of pipe of % steel, with 3 rows of rivets in vertical seam; 30 ft. of pipe of ¾ steel, with 3 rows of rivets in vertical seam; 15 ft. of pipe of 3/8 steel, with water is pumped and held like a cistern, the lower end 3 rows of rivets in vertical seam; 20 ft. of pipe of 3/4 steel, with 2 rows of rivets in vertical seam; 25 ft. of pipe of % steel (taper), with 2 rows of rivets in vertical seam; 5 ft. of pipe of 5% steel (1st course above taper); 30 ft. of pipe of 1/2 steel; 35 ft. of pipe of 3/8 steel; 30 ft. of pipe of 16 steel; 30 ft. of pipe of 1/4 steel; 25 ft. of pipe of 18 steel.

For the first 75 ft. the course will be all inside, so at that height the diameter will be lessened by the thick-

In the taper, the course will be all inside, and above that they will be large and small.

All of the plates will be steel stamped 60,000 lb. tensile strength. All of the vertical seams above the first 50 ft., and all of the horizontal seams, will be double riveted, with sufficient lap to make a good job.

I will rivet on to the outside of pipe a ladder running from top to bottom. Lower half of sides of 2 in. by 1/2 in. iron, upper half of 2 in. by 3/4 in. bar iron, and rounds of 3/2 round iron 16 in. long and 12 in. apart.

I will rivet to pipe three manhole frames, position as shown on tracing, also two nozzles on bottom course.

I will rivet on to pipe two balconies (one under each of the upper manholes) with wrought iron brackets and floor as shown on tracing.

I will furnish and attach to the pipe twelve guys of 1 in. wire rope—six of them 100 ft. from the ground, ed by others, notably the application of an automatic and six 25 ft. from the top; the understanding being variable cut-off to a single slide valve, operated by a that you are to furnish and put down the anchors for

I will put around the top a 3 in. by 3 in. angle iron, and on the inside of the 25 ft. of $\frac{8}{16}$ iron I will rivet 4 in. by 4 in. T irons to stiffen the same. I will also rivet on 12 (twelve) 4 in. by 4 in. T irons to strengthen the joints where taper section of pipe joins the straight. Each piece to be 10 ft. long, and extend five feet above each joint and five feet below, eight of these T irons on lower joint, and four on the upper.

Price for the "stand pipe" completed as above, water-tight, and to your satisfaction, \$16,625 (sixteen thousand six hundred and twenty-five dollars).

In the above price I have accepted your proposition to do the teaming from the dock at Bay Ridge or Long Island City to stand pipe site of all the material and tools used in the construction of said pipe for \$350 (three hundred and fifty dollars).

Signed, H. S. Robinson,

.By J. M. Robinson.

FALL OF A WATER TOWER AT KANKAKEE, ILL

During a gale of wind on October 14, 1886, the water tower at Kankakee was overturned. The wind began blowing very strongly in the early morning, and reached an estimated velocity of sixty miles an hour. By 9 A. M. the tower was observed to be swaying slightly; the vibrations increased until the successive wind gusts raised it on one side or the other several inches at the foundation. An unsuccessful attempt was made to arrest this movement by tightening the nuts on the anchor rods, but the tower soon fell.

We quote the following particulars from the Kankakee Gazette:

As the gale grew stronger, the tower with each the top of the tower inflated and contracted like the influence over a wide range of engineering practice in sides of a panting horse. Then the windward side collapsed, forming a pocket extending downward from the top twenty-five or thirty feet, and the fall of the massive structures which bear his name as builder. In tower soon followed in a direction from the wind.

"The tower was 124 feet high and 20 feet in diameter. It was constructed of plates of % inch boiler iron, four | Engineering. feet wide and ten feet long, diminishing in thickness to No. 9 iron (one-eighth of an inch thick) at the top. It was intended to have iron rods across the top to act as is said, but taken off for some reason. The tower was

sand was mixed with clay. Several acres of rye that the wall exposed for about a yard. Mr. Shannon, puted the resisting or supporting capacity of the foundation at 160,000,000 pounds, while the tower when filled with water would have weighed only 22,000,000 pounds. Six anchor rods, two inches in diameter, extended from about six feet above the foundation into the foundation a distance of two feet, where they turned at right angles and ran laterally into the stone about two feet. One-third of the foundation, on the side toward which the tower fell, is broken down and sloughed off to a depth of three feet. Whether this crumbling began before the fall of the tower, or was caused by the weight of the tower as it leaned far over, we cannot say. On the windward side the rods were broken off."

John C. Hoadley.

On the 21st of October, 1886, death brought to a close the career of John Chipman Hoadley, of Boston, U. S., an American engineer whose breadth of attainments rendered him one of the leading men in the profession, especially in steam engineering, in which he was an authority equaled by few.

He was born in the State of New York in 1818, and his first engineering experience was in connection with the system of State canals, which was founded by the Dutch settlers in the seventeenth century, and increased from time to time as the needs of the day demanded. Leaving the State engineers' corps at the age of twenty-six, he became engineer for the construction and equipment of a number of mills at Clinton, Mass., devoting himself to the wide range of work necessary to build up a variety of industries, a task which could not be accomplished except by one possessed of unusual force, skill, and versatility.

Later, he became manager of a large machine shop in • Lawrence, and for a number of years was engaged in the manufacture of locomotives and textile machinery. His experience with locomotives led him into an analysis of the dynamical relations which speed bore to the operation of engines; and the result of his investigations, partly mathematical and partly experimental, resulted in the invention of the Hoadley portable engine, which was probably the first application of scientific principles to the design of high-speed engines. These engines contained numerous radical features, since appeopriatgovernor attached to the side of the driving pulley of the engine. We do not speak by the letter as to the exact limitations of Mr. Hoadley's inventions in this respect, as measured by the patents issued to him, but the fact remains that he was the pioneer in the successful application of the methods of construction of the Headley engine, which was manufactured in great numbers for many years.

During the later years of his life he separated from commercial and manufacturing affairs, and confined his attention to the practice of his profession in consulting engineering and as an expert in patent causes. In this latter capacity his services were held in highest repute, his retentive memory rendering an extended reading and wide experience tributary to a power of keen analysis which would set forth the measure of each patent's merits or the worth of the mechanical features of an invention.

His acquirements were not limited to technical matters, but extended through a wide range of general culture. The transactions of the American engineering and scientific societies contain frequent contributions from his pen; the members of the British Association may recall among these his paper on "American Steam Engine Practice in 1884," read at the Montreal meeting, and which was the first step in the recent polemical engineering papers respecting English and American railway practice.

Mr. Hoadley was always interested in public affairs, but he held few offices. He was, however, the engineer member of the Board of Health of the State of Massachusetts. He also visited England and the Continent. in 1862, on the part of the State Government, making an examination of fortifications for the purpose of devising a system for American sea coast defences.

The professional work of Mr. Hoadley is shown by its mill work, applications of steam, sanitary engineering, and methods of expert evidence, rather than in any his personal address he was especially genial, and endeared himself to a large number of friends.—London

Improved Lock for Firearms.

In our issue of December 11 we described and illusbraces and prevent a collapse. These were put on, it trated an improved lock for firearms, invented by Mr. Charles E. Goodwin, of Saybrook, O. We omitted one important feature: A single pull of the trigger will fire both barrels consecutively. By properly adjusting the was not seriously injured. His pocket-book and cloth- was of stone and concrete, seven feet deep, about arms of the sears, both barrels can be cocked at the may be desired; or, when both are cocked, one can be

RECENT TYPES OF THE GATLING GUN.

The accompanying illustrations represent improved Gatling guns; one mounted on a tripod and the other on a carriage, and showing different methods of supplying cartridges to the gun.

Fig. 1 shows a small six-barreled gun, mounted on a tripod. This gun weighs 78 pounds. It uses what is known as the Accles' positive feed, which eliminates the liability of the jamming of the cartridges, and which has increased the rapidity of fire to the extraordinary rate of 1,200 shots per minute. One hundred shots have been fired from the gun in two and twotenths seconds. The fire can be made continuous, or the delivery can be made in salvos of 30 or 40 shots per second. The latter mode of firing would prove beneficial when the gun is being fired on shipboard in a rolling sea, a pointing lever being attached to the gun to enable the gunner to give it proper aim.

With the introduction of the positive feed to the

Gatling gun, two kinds of high angle fire are made effective. These may be classed as direct and indirect; direct when the gun is aimed and fired at any elevated object; indirect when the bullets are fired up in the air, in order to hit the object in their fall. This latter mode of firing can be made very effective in getting men out of intrenched positions. Musket balls when fired from the gun at high elevations remain up in the air for 57 to 58 seconds, and when they fall they strike the ground with sufficient force to penetrate two inches of timber. This high angle fire greatly increases the power and value of the gun as a weapon of war.

The Gatling is the only machine gun •that can deliver high angle or mortar fire, and is doubtless one of the most effective arms of its size in the world. Official reports say: "The feed is positive in action and entirely independent of the force of gravity. The feed is all that is claimed for it. It is believed the modified Gatling gun with the new feed has reached the utmost limit of improvement."

This light gun is designed for naval service, for mountain warfare, for cavalry service, for police use in cities for suppressing mobs, for use on board of railway

worked by men inexperienced in its use.

by express, etc. With this new feed, the firing and loading can go on uniformly and incessantly, even when the gun is

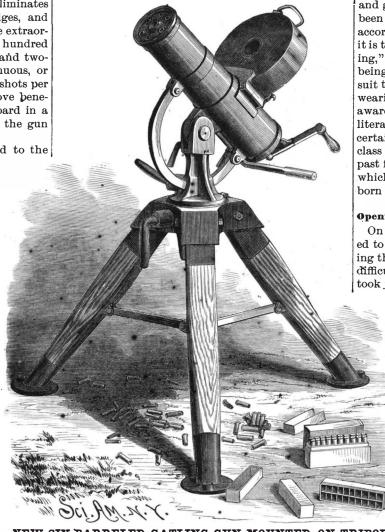
This gun would prove of great service in defending such positions as villages, field entrenchments, and for the defense of caponniers, for covering the approach to bridges or tetes-de-pont, for defending a in field works where economy of space is often of the Gun Company, of Hartford, Connecticut, U. S. A. utmost importance; for use on shipboard to clear the enemy's decks or open ports, and from top-gallant forecastle, poop deck, and tops of vessels of war, for the defense of sea coast batteries against the attack of boats, for assisting in keeping down the fire of ships engaging forts at close quarters or attempting to force a passage by pouring an incessant fire in their ports, and in clearing breaches and other proposed places for landing from boats, it would be most effective. Fig. 2 represents a light ten-barreled Gatling

gun, mounted on a carriage. This gun uses what is known as the Bruce feed. This improved feed allows the cartridges to be fed to the gun at the rate of over 1,000 shots per minute, directly from the paper boxes in which they are originally packed. For continuous and direct fire this kind of feed makes the gun very effective. Various calibers of Gatling guns are made.

Among the advantages of the usket caliber Gatling gun may be enumerated: The lightness of its parts, the simplicity and strength of its mechanism, the rapidity and continuity of its fire without sensible recoil, and its accuracy and effectiveness against troops at all ranges attainable by rifles. Also its peculiar power for protecting roads, defiles, and bridges; for silencing field batteries and batteries of position; for increasing the infantry fire at the critical moment of a battle; for supporting field batteries and protecting them against cavalry or infantry charges; for covering the retreat of a repulsed column, and its economy in men for serving

it and animals for transporting it. The relation which the machine gun is to occupy to the different arms of the service will, no doubt, ere long be prescribed and settled by competent authority.

The superiority and great value of the Gatling gun

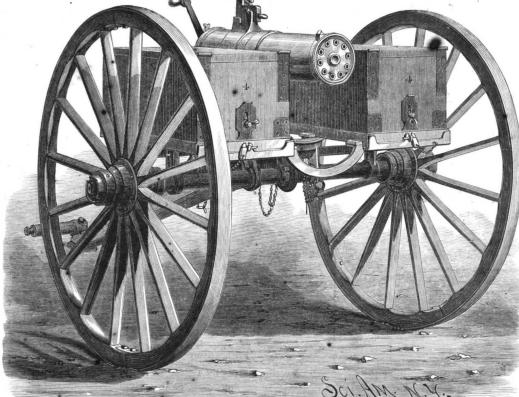


NEW SIX-BARRELED GATLING GUN MOUNTED ON TRIPOD.

vice having been clearly demonstrated, it is evident it will be extensively employed in any future wars

The day is not far distant when machine guns in large numbers will be considered indispensable on the battle field, in forts, and on shipboard, and the nation that is best provided with these arms, and has its soldiers and sailors drilled to serve them in the best manner, will best preserve the welfare and lives of its peobreach, and for employment in advanced trenches, or ple. Gatling guns are manufactured by the Gatling





LIGHT TEN-BARRELED GATLING GUN ON CARRIAGE.

Scribner's Magazine for January, 1887.

The appearance of a new first-class monthly magazine, issued by a firm of such high standing as Messrs. Charles Scribner's Sons, under whose name had already been achieved one of the most conspicuous successes of modern magazine literature, is an event of considerable moment in the world of letters, and the contents and general style of make-up of the new monthly have been the subject of a degree of public attention seldom accorded to any literary venture. Of the first number it is to be said that the contents are all "good reading," and that the typography is excellent, the type being rather large, and of a style just calculated .to suit the eyes of those who are beginning to think of wearing glasses. There is nothing to which we would award the palm of superlative excellence, either in the literary matter or the illustrations, but the whole is certainly up to the high average which readers of this class of literature have been favored with during the past few years, and there is about the magazine a look which seems to say plainer than words that it was not born of yesterday, and that it has come to stay.

Opening of the Severn Tunnel to Passenger Traffic.

On Wednesday, Dec. 1, the Severn Tunnel was opened to passenger train service. The ceremony of turning the first sod in the commencement of this, the most difficult bit of tunner engineering ever entered upon, took place in March, 1873, now nearly fourteen years

ago. The passenger service would, however, have been commenced some time since, but for the delay in the completion of the lines connecting the tunnel with the main system, a delay dictated by prudence when the stupendous difficulties in the prosecution of the work caused the delay in the completion of the tunnel itself, and some fear that considerable time might elapse before the whole of the difficulties could be overcome. The greatest caution has been exercised, and although the very able contractor. Mr. T. A. Walker, had completed the tunnel, the engineers deemed it advisable to start with goods service only for a short time. In his report to the Board of Trade, Colonel Rich says: "The works appear to be very good and substantial, and to have been carried out with great care and judgment. The difficulties of dealing with the large quan-

trains, for protecting and guarding treasures shipped an auxiliary arm of both the military and naval ser-tities of water, and particularly of dealing with the underground stream, which runs at a great velocity, have been considerable, but have been successfully overcome, and the result is a tunnel of unusually large dimensions which is particularly dry. The top of the tunnel is about 145 ft. under the level of high water spring tide, and about 50 ft. under the bed of the river at the deepest point. The means of ventilation are ample." The fan for the latter purpose, we may mention, is 40 ft. in diameter, and is made, like those for the Mersey Tunnel, by Messrs. Walker Brothers, Wigan, to exhaust 400.000 to 500,000 cubic feet of air per minute. The difficulties which have been encountered in this work we have from time to time described, and we need not now refer to them. The pumping machinery for keeping the enormous water influx down is of remarkable capacity, capable, it is said, of raising over 25,000,000 gallons per day. The tunnel has been lined with vitrified bricks set in cement, about 75,000,000 bricks having been used for this work alone; but with a head of 170 ft. some good work is necessary to keep

water out. The passenger service was commenced without ceremony, as some connecting lines for the main service have yet to be made. This tunnel is about 4¼ miles long, and has cost nearly \$10,000,000. For illustrations and full description see ScI-ENTIFIC AMERICAN SUPPLE-MENT, No. 539.

MR. L. TIETJENS, of Stassfurt, Germany, has recently patented an ingenious method of damming back the flow of water in shafts by the application of. the well known fact that certain salts increase their volume very materially by the absorbing of water of crystallization in hardening. To accomplish this, he takes either calcined soda, anhydrous alum, kieserite, or oxychloride of magnesium, mixes them into a paste, and then immediately injects them through a suitably arranged pipe into the fissures through which the water flows. It is said that as this paste hardens, it swells enough to fill all the interstices of the rock and to render it water tight.

TRICHECHUS AMERÎCANUS-MANATEE.

BY W. O. AYRES.

Strange-looking animals these are which we have here represented. They have been classed by some writ- riety. ers near to the whales, that is, among the cetaceans;

cetaceans. And then, again, others have ranked them with the pachyderms, and in alliance with the elephants, etc. But the most recent writers, of suitable authority, set them by themselves in a designated group, to which is given the name of Sirenians. Of these are now existing but two genera, though one other has become extinct within a little more than a hundred years. These two are the dugong, Kalicore dugong, and the manatees, Trichechus, one species of which is figured for us. here.

A common name, which is sometimes applied to them all, of the various types is sea cow; and the

total disappearance of the sea cow of Behring's Island is a curious instance of the rapid and complete extermination of an animal of huge size, which at its discovery was abundant.

The facts are these: When Behring discovered the island to which he gave his name, a very large Sirenian fairly swarmed in the creeks and shallow waters of its shores. It was well described by Steller, the naturalist who accompanied him, and the specimens which he took home to St. Petersburg were, until quite recently, the only ones available. But

Stejneger a very valuable collection of skulls; in fact, almost complete skeletons. The animal was larger than either of the Sirenians now in existence-20 to 28 feet long. It constitutes the genus Rhytina.

Like all the 'Sirenians, it was very gentle and affectionate in its disposition, and Behring's sailors tamed them readily; but, alas! for the poor sea cows, their flesh was excellent for food, and the sailors took advantage of their gentleness, and by 1768 not a single Rhytina could be found on Bhering's Island—the only nostrils opening as it rose to the surface and closing as known place of their residence—and none others have it went below. This species grows to the length of 12

ever since been seen. Steller's sea cow is, without doubt, extinct.

The Sirenians, as already noted, are of very peculiar formation. They have no hind, limbs whatever externally manifested, resembling the cetaceans in that respect; but their fore limbs are very strong, large, flat, flipper-like, and remarkably flexible. The bones of the entire skeleton are denser and heavier than those of any others of the mammalia. The flesh of all is. like that of the Rhytina, much prized as an article of food.

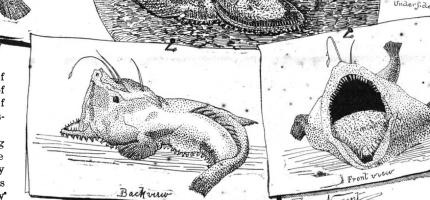
The skin is coarse, heavy, and resembles that of an elephant, having short, stiff hairs scattered about on it. but nowhere thickly, the general color being dark, almost black. The eyes are small, the nostrils large, provided each with a valve.

These characters are common to the dugong and the manatees. Of the latter— Trichechus—there are two species, an African, T. senegalensis, and an American, T. americanus, which is the one before us, and of which only I will here speak.

Trichechus americanus is a native of our whole eastern coast from the southern to the northern tropical limit and a little beyond, that is, from Brazil to Florida, including the West India Islands and the Gulf of Mexico. It should be mentioned that an attempt has been made to but it is perhaps more probably only a climatic va-

The manatees have seldom been captured and

and yet they are by no means closely allied to the brought away for exhibition, though it might easily be done, for they are of such mild disposition that they would make small resistance, and they are by no means timid. They



THE FISHING FROG (LOPHIUS PISCATORIUS)—A STUDY FROM LIFE

in 1883 the Smithsonian Institution received from Dr. | frequent the shallow lagoons, and an easy arrange- around its entire circumference, and which enables it ment of nets could capture them. Two small ones, about to conceal itself easily among the seaweeds and mosses six feet in length, were exhibited in 1875, and one smaller still was shown only a month or two since by Messrs. Reiche Brothers, of New York, importers of tims, such curiosities, from which our representations are

> Its attitudes are well shown by the figures. It was in one to one and a quarter minutes, the valves of the

separate the northern type, those of Florida, as a dis- to 15 feet. It ascends the South American rivers tinct species, under the name of Trichechus latirostris, | freely, following the Amazon far up into the mountains

> The dugong is found in the Red Sea, the Indian Archipelago, Mauritius, Australia, etc.

> It is closely allied to our manatee, and is of about the same size, and very similar to it in habits.

THE FISHING FROG.

The fishing frog, or sea devil, as t is sometimes

called, owing doubtless to its repulsive appearance, is conspicuous principally for its peculiar method of alluring its prey. Its head is of enormous size, and the feature that is not least pronounced is its prodigious mouth, which extends, not from ear to ear, but half way around the front part of its head, and is fortified with rows of teeth which may be raised or depressed at will, according as the prey is e tering or striving to escape from its place of captivity. Along the top of the head

are found three long filaments, the first of which terminates in a bait-like appendage, and which may be waved in any direction.

Fishes are attracted by the motion of ·this object, and when sufficiently near, the mouth is opened and the prey is sucked in to its own destruction.

The stomach is distensible to an extraordinary degree, and frequently fishes are discovered therein which are nearly equal in weight and size to the fishing frog itself.

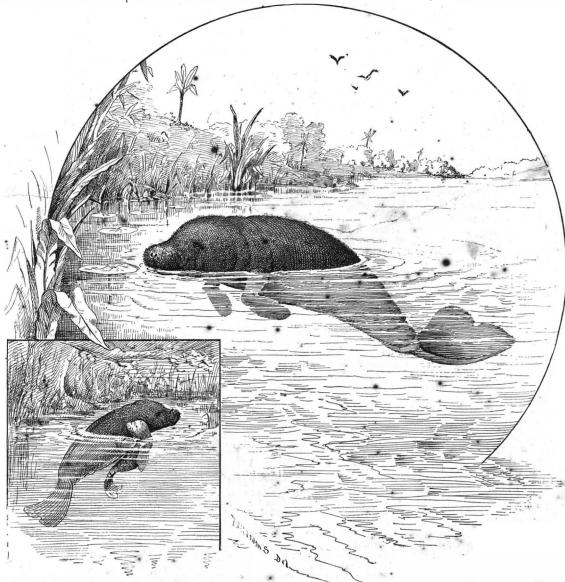
The head is provided with a moss-like fringe, which extends on the bottom of the sea, where it is its pleasure and custom to extend and bury itself in wait for its vic-

The specimen from which the drawing was made. was captured near Flushing, Long Island, by Dick Hill, son of the celebrated sporting man Harry Hill, said to have been brought from Brazil. It breathed of this city. It was 5 feet long, and weighed 125 pounds.

EQUALITY.—That all men have equal rights is a cardi-

nal doctrine in the theory of democratic government, but it is possible to expand the claim to a point beyond the bound of rights simply, and apply it to the results of the exercise of our inalienable endowments. Human beires are not born with equal gifts and powers. Wherever there is an upper and middle, there must be an under. The weak must seek the wall and be the stile from which the ambitious strong will vault toward the top. Nor can those appointed by nature for the pyramid's base serve in any other position To press the wall as little as possible, get all the pay for service that it demands, and make the "best of now and here," is the bound of their possibilities. Without a foundation there can be no superstructure, and the position is as truly honorable as any other, though universal mankind have held it to be less desirable. All theories for the help of those who serve must proceed upon an admission of inequality.—The Carriage Monthly.

THE American Forestry Commission, at its annual meeting held at Denver, Col., September 15, recommended to Congress the establishment in the District of Columbia of an agricultural and forestry experimental station, and the passage of a bill for the protection of the government timber lands.



THE MANATEE, OR SEA COW.

ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. Jacob W. Baker and George A. Prescott, of Dover, N. J. This invention relates to the construction of a novel form of drawbar and connections, to be used with the ordinary form of coupling link.

A boiler feed regulator has been patent ed by Mr. Charles O. Wyman, of Anoka, Minn. The invention consists of a tank with pipes connecting it with the boiler above and below the water line of the latter, and with pipes leding to the pump, with various novel features, to keep the water at all times at the proper height.

A reversing mechanism for engines has been patented by Mr. Lorin C. Forwood, of Shipmah, Ill. It consists in an eccentric held between collars secured to the main shaft of the engine, with sliding wedges arranged to move the eccentric transversely across the shaft, by which the reversing of the valve motion is effected, without the ordinary joints and rods required where links are used.

An automatic water feeder for steam boilers has been patented by Mr. Charles O. Rabut, of New York city. It embraces a system of valves operated by a float controlled by auxiliary floats, and also in an arrangement of an air valve to permit the escape of air during the filling of the float chamber, all of the working parts being inclosed by a casing, except when registering mechanism is employed.

🗣 valve for hydraulic elevators has been patented by Mr. Parker F. Morey, of Portland, Oregon. This invention comprises a system of differential valves controlled by an auxiliary valve, and thus governing both the admission and the escape of water from the ram of the elevator, with provision for arresting the motion of the ram, as required, to stop the elevator, the design being also to prevent excessive wear from sand or grit. •

MECHANICAL INVENTION.

A machine for making whiffletree bolt ·blanks has been patented by Mr. John Stacker, of Winsted, Conn. In this machine a new form of anvil or die is employed, on which the heads of the bolt blanks are flattened, split, and spread or opened, in connection with a new device for splitting and opening the bolt, so that all the operations may be conducted with dispatch on the same machine.

AGRICULTURAL INVENTIONS.

A combined corn planter and cultivator has been patented by Mr. John C. Weiss, of Sheldon, Mo. The object of this invention is to improve the construction of a machine heretofore patented, involving novel features and combinations, to render the machine more convenient in use and more reliable in operation.

A harvester for sugar cane, corn, etc. has been patented by Mr. Samuel H. Pearcy, of Franklin, Tenn. This invention covers a novel construction and combination of parts in a machine to be drawn by teams on fields of standing crop, and automatically cut the standing canes and strip them of their tops and leaves, and drop them in bunches while passing along the cane rows.

----MISCELLANEOUS INVENTIONS.

A rein muff has been patented by Sarah J. Hull, of Stella, Neb. One end has a flap secured to one side and constructed to be folded over the end and secured to the opposite side, so that the reins and whip may be held in the hands and the latter be at the same time protected by the muff...

A carpet stretcher and tacker has been patented by Messis. Adelbert H. Noyes, of Jefferson, and Frederick G. Noy, of White Water, Wis. It has a staff and barrel, to the lower end of which is attached a toothed carpet stretching and holding head, in connection with a tack holding tube, and a cont pedal so arranged that the tacks may be driven thereby.

A mould for soles and heels of boots or shoes has been patented by Mr. Darius Banks, of Morrisville, Pa. It is for forming the heel and sole together of rubber or other plastic material, by simply pressing the latter into the mould by hand and permitting it to harden, the form being shaped and withdrawn from the mould in a manner not attainable with a solid mould.

A clevis has been patented by Mr. Arthur W. Rumsey, of New Kiowa, Kan. It is more especially designed for attachment to agricultural implements or machines, and provides a simple, inexpensive, and effective device, which may be quickly and easily coupled or uncoupled, but which will not uncouple ac-

A moulding machine has been patented by Mr. Samuel C. Burris, of Victoria, British Columbia It has upper and lower cutter beads for simultaneously surfacing and grooving opposite sides of timber, with cutters arranged at an angle to the line of motion of the timber, and other novel features, to improve the con struction of woodworking machines

A miner's safety lamp has been patented by Mr. August J. Becker, of Mount Carmel, Pa. The invention consists of various parts and details, making a lamp which cannot be opened by the operator without extinguishing the light, and in which the light is ex tinguished when brought into contact with the fire damp.

A facing tool has been patented by Mr. Alfred H Donnally, of Foxburg, Pa. The invention consists of a face plate carrying cutters and having ratchet teeth, a ratchet lever and pawl operating on the face plate, and there being a feeding device for the face plate, the tool being specially adapted for truing up the faces of oil well joints.

A combination ladder has been patenta step ladder connected with an auxiliary section by ents of precious stones. The book has a full index.

separable hinges, the auxiliary section having one or two additional sections, and one of the sections having a short ladder acting in conjunction with the section to form a trestle for supporting a stage.

An ax has been patented by Mr. Nichoas Goodier, of Dardanelle, Ark. The ax body has a transverse groove, and a deeper slot at right angles thereto, to receive a corresponding tongue and projec-tion on a detachable bit, the parts being rigidly united by a bolt passing through the projection, so the cutting blade is detachable and can be renewed when worn or destroyed.

An adjustable balcony has been patented by Mr. Gottlieb D. Husemann, of St. Louis, Mo. This invention covers a novel construction of folding balcony, which can be readily removed and folded in small space for storage, especially designed in washing the outside of mindows, being so constructed that it can be easily adjusted in operative position in any window of any story.

A bicycle handle has been patented by Mr. Robert Rodes, Jr., of Nashville, Tenn. Combined with the bicycle handles are curved levers pivoted thereto, having hooks on their shorter arms, which are received in holes formed in the under side of the cross arm, to which the handles are jointed, the invention being an improvement on a former patented invention of the same inventor.

A dumbwaiter has been patented by Mr. James Murtaugh, of New York city. It consists of two counterbalanced carriages arranged in the same shaft, one above the other, each having means for operating it independently of the other, thus making a waiter in which the upper carriage can be conveniently used for the upper and the lower carriage for the lower floors of a building.

A bag fastener and tag holder has been patented by Mr. Austid Leyden, of Atlanta, Ga. It has a plate with a hook or hooks, over which a tightened bag cord may be drawn, a plate with a slot to receive the cord, an adjustable latch bar, and other novel features, being especially adapted for use on mail bags of the second class and on bags containing general merchandise.

A feeding mechanism for grain, flour, etc., has been patented by Mr. Charles A. Andrus, of La Grange, O. It is a mechanism which secures a positive discharge from the bin, subject to regulation as to and applicable to a large range of work, from the natural grain to the softest stock, which is fed so that it cannot sift or dust and waste.

An inhaling device has been patented by Mr. Marmaduke W. Hobbs, of Richmond, Ind. It is an inhaler or respirator in which an adjustable disk or valve is employed for regulating the admission of air into the instrument when in use, and for closing one of the air openings when not in use, there being shallow trays for holding the substances to be inhaled, and a movable air induction tube.

A window cleaner has been patented by Mr. Carl B. Von Schenk, of Frankfort-on-the-Main, Germany. The invention consists of a pad attached to a bracket secured to a block, with a powder holder secured to the bracket, and a detachable pad, being designed to clean and polish windows, looking glasses, etc., without the use of water, the specially described pow der consisting of silicic acid, magnesia, aluminum, and sulphuret of calcium, prepared as set forth.

A piano forte damper cover has been patented by Mr. Emil Hofinghoff, of Barmen, Prussia, Germany. It is fastened to the back or to the bottom of a grand piano, and is hinged to the instrument so that it can be conveniently opened or closed by hand, and fixed to any desirable amount of opening, being designed to facilitate controlling the power and to improve the tone of the instrument, and also to guard against hurtful influences of temperature and dampness.

NEW BOOKS AND PUBLICATIONS

ELECTRICITY IN THE SERVICE OF MAN. From the German of Dr. Alfred R. Von Urbanitzky. Edited by R. Worrell. 859 pp. London and New York: Cassell & Company.

This is a very comprehens re popular, and practical treatise on the application of electricity in modern life, referring to and describing, with nnmerous illustrations, a large proportion of the hitherto published experiments and investigations in nearly all branches of electrical development. I rt I. treats of the principles of electrical science, and Part II. of its technology, including generation and conduction, the electric light (noticing all the different systems that have attained any degree of success), electro-chemistry and metallurgy, electricity as a motive power, the telephone and the telegraph.

CATECHISM NGINE By Robert Grimshaw. New York: John Wiley & Sons.

This little volume, really issued as a supplement to a former brief catechism of the same author, is a continuation of the same style of giving information in regard to steam engine practice, through the form of question and answer.

PRECIOUS STONES IN NATURE, ART, AND LITERATURE. By S. M. Burnham. Boston: Bradley Whidden.

The author has put together in this volume 400 page of very readable matter touching precious stones and their imitations, as a sort of supplement to his former work on "Limestones and Marbles," published in 1883. The chapters relative to collections of precious stones, crown jewels, and prices, trade, pawns, etc., engraving on stones, and their secular and sacred uses, are full of interesting anecdote and detail drawn from a wide field of investigation. Nearly one hundred pages are devoted to the diamond alone, and the appendix has tables of sizes of remarkable diamonds, and the reed by Mr. Christian Koerner, of Rochester, N. Y. It is lative hardness, specific gravity, and principal constitu-

Special.

A WELL KNOWN SOCIETY LADY'S LIFE SAVED.

Mrs. Colonel Fleming, an accomplished lady, well known in Philadelphia, in Western Pennsylvania, and in Washington, has been spending a considerable time in Philadelphia, preparatory to going to Washington, where it is understood she is to have her future home. Graceful in her movements, elegant in form, and the very picture of health in her features, Mrs. Fleming would not be taken for one who had suffered a long experience of illness, and who had so completely lost her health that her friends had given up all hope of her recovery.

The writer recently met Mrs. Fleming, and had a con versation with her as to her illness and restoration

"For many months," said Mrs. Fleming. "during the protracted illness of my husband, which resulted in his death, I was with him night and day, undergoing a very severe strain, both physically and mentally. While he lived I was able to bear up under all this, but when he died then came a reaction, and I was taken with a severe catarrhal fever. This brought me down very low. After a while I rallied, but did not recover my health. I fell into a state of nervous exhaustion, with neuralgic pains almost beyondendurance. My head was so sensitive that I could not touch it with a comb. My hands were so disabled that I could not bar my own window shutters. I had difficulty in recognizing my best friends during some of the time while I was at my worst. Day and night I suffered more than I can tell. This was at my home in Franklin, Pa. Finding that the best physicians there were unable to relieve me, I came to Philadelphia to consult physicians who were specialists in nervous dises. Following their advice. I went to the University Hospital, where I had a private room and the most skillful medical attendance. But it was in vain. From all this I received no advantage.
"Soute years ago I had heard of what was then a new

remedy, but was said to do wonderful things in the cure of stubborn and chronic nervous diseases. It was Compound Oxygen.' I thought I could do no werse than to try it. Unable to walk even a short distance, I went in a carriage to the office of Drs. Starkey & Palen. On reaching there I was so exhausted that I was unable to state my case to Dr. Starkey. After resting, I had a full conversation with him, and he gave me encouragement to hope that Compound Oxygen might give me some re-lief. It was with some apprehension of possible failure that my first inhalation was taken. But as soon as I re-alized what it was, I was delighted with the soothing and strengthening effect of the treatment. Dr. Starkey thought that in about three weeks some permanently good result might be expected. Rooms were secured near the office, for I was too weak and nervous to go any Treatment regularly every day. In about two weeks I experienced a marked improvement, which now daily increased. My exhausted brain began to be itself again. and my body received new vitality. With improvement came hope of entire recovery. For the first time since my husband's death I found relief from the pain and prostration which had borne so heavily on me.

"With changing weather, I would sometimes receive

a partial setback for a few days. But this did not dis-courage me. Friends of mine, in Franklin, had been cured of severe and protracted illness, and why should not I? I kept regularly on for months, not as an experiment, for I found that I was receiving solid and practical good from the treatment.

"Not a particle of any other medicine but Compound Oxygen did I take. This was doing the work for me, and I determined to give it a fair chance."
"I suppose I need hardly ask you, Mrs. Fleming, if

your health is now perfectly restored?"

"I am as you see me. I have neither ache, pain, nor weakness. I sleep well, and my appetite is hearty. I am as active as I ever was, and in as good spirits, and I lay it all to Drs. Starkey & Palen's care of me, and treatment with Compound Oxygen. Without this I think I should have been dead long before this. It is now nearly two years since I began taking the Compound Oxygen. If I should ever be sick again, I will again take it; but happily I have no need of it now."

The whole story of Compound Oxygen is pleasantly told in a little brochure of 200 pages, issued by Drs. Starkey & Palen, 1529 Arch Street, Philadelphia, Pa. This will be mailed freely to all who write requesting it.

Business and Personal.

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

Prof. Vose, in the preface to his "Manual for Rail road Engineers," says that Trautwine's "Civil Engineer's Poketbook" is "beyond all question the best practical manual for the engineer that has ever appeared." See also Trautwine's "Railroad Curves" and "Earthwork."

A prominent mechanical engineer makes the statenent that the loss from the absence of a covering from steam pipes and boilers is astonishingly large. square foot of exposed surface of engine, boiler, or steam pipe, will condense, per hour, an amount of steam equal in foot pounds to one-third of a horse power. In available work, the loss is fully one-twentieth of a horse power per hour for each sq. ft. of exposed surface. In view that all his steam-heated surfaces are properly covered with a good, durable, non-conducting covering. For the past eighteen years the, H. W. Johns Mfg. Co., of this city, has made a special study of this branch of their business, and are supplying materials which, for dura bility and efficiency, stand superior to all others in the

Mechanic's Own Book. Full instructions for drawing, casting, founding, forging, soldering, carpentry, carving, polishing wood and metals, turning, roofing, etc. 702 pages; 1,420 illustrations. \$2.50, post paid. E. & L. N. Spon, 35 Murray St., N. Y.

The Railroad Gazette, handsomely illustrated, pub lished weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Friction Clutches from \$2.25 on. J. C. Blevney, Newark, N. J.

Protection for Watches

Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any Experimental exhibition and explanation at Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F.S. Giles, Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Complete-Practical Machinist, embracing lathe work. vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. By Joshu#Rose. Illustrated by 356 engravings. -Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo. 439 pages. \$2.50. For sale by Munn & Co., 361 Broadway, New York.

Concrete patents for sale. E. L. Ransome, S. F., Cal. Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. \$2.50. Sent on receipt of the price by Munn & Co., 361 Broadway.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

" For contemplation he, and valor formed, For softness she, and sweet attractive grace,'

John Milton, in his "Paradise Lost," thus distinguishes woman from man. Diseases fall to her lot that do not to man's, peculiar to her soft and more refined nature. A remedy adapted to the cure of her peculiar diseases is found in Dr. R. V. Pierce's "Favorite Prescription," for women. Thousands who have used it attest its great

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.-Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. \$100
'Little Wonder." A perfect Electro Plating Machine. ole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Wrinkles and Recipes. Compiled from the Scienti-FIC AMERICAN. A collection of practical suggestions, processes, and directions, for the Mechanic, Engineer, Farmer, and Housekeeper. With a Color Tempering Scale, and numerous wood engravings. Revised by Prof. Thurston and Vander Weyde, and Engineers Buel and Rose. 12mo, cloth, \$2.00. For sale by Munn & Co., 361 Broadway, New York.

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, \$40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Rubber Belting, all sizes, 771% per cent regular list. All kinds of Rubber Goods at low prices. John W. Buckley, 156 South Street, New York.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence, Co. 419 East 8th Street, New York.

Curtis Pressure Regulator and Steam Trap. See p. 142. Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 Emerson's 1886 Es Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., 112 Liberty St., New York.

"How to Keep Boilers Clean." Send your address or free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y. ${\bf Pays\,well\,on\,Small\,Investment.--Stereopticons,\,Magic}$ Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusements. 138 page illustrated catalogue free.

McAllister, Manufacturing Optician, 49 Nassau St., N. Y. Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleve-

Split Pulleys at low prices, and of same strength and appearance as Whole Pations. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.



HINTS TO CORRESPONDENTS.

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

References to former articles or answers should

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.

price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. F. P. asks if a diamond will give light in the dark. A. No; unless by phosphores after exposure to sunlight or the electric arc light.

(2) B. D. asks how to preserve some nole skins without injuring the fur-an easy method. A. Supposing the skins are dry, they should be softened throughout by soaking in pure water; soft water is best. but any ordinarily pure water may be used, and care must be taken that the skins are thus soaked only a sufficient time to soften them. Then clean off any bits of flesh that remain on the flesh side, rinse all well,

shake off the loose water, and gently stretch out and tack on a board, flesh side up. Then sprinkle with a mixture of powdered alum and salt, about two-thirds alum and one-third salt, enough to just cover every part. As the skin dries it takes up the mixture, but if any be left on the surface the second day, sprinkle on a little more water, otherwise put on more alum and salt, and sprinkle. Two to three days should be sufficient for such small skins, the idea being to give the skin all of the alum and salt it will take up while in a moist condition. This tawing process makes the hair firm, a gentle rubbing and beating softens the flesh side, and it is preserved from decay, although tawed skins are never calculated to stand much wetting. This process is well adapted for all small skins, al though those which are heavier require more time, and the fiesh sides are sometimes folded together, and the skins rolled up. When the skins are freshly taken off, no soaking is needed, but more care is then called for in thoroughly washing off and cleaning them, and the first application of salt and alum should be in the proportions of one-half each. It requires the judgment of a tanner to deal with skins in a dry state which may have become partly damaged before drying, and it re quires special knowledge also to tell whether a dry skin

- (3) A. T. G. asks what is the process of fastening rubber rolls on clothes wringer. A. Clean shaft thoroughly between the shoulders or washers, where the rubber goes on. 2. Give the shaft a coat of copal variash, between the shoulders, and let it dry. 3. Give shaft coat of varnish and wind shaft tightly as possible with five ply jute twine at once, while varnish is green, and let it dry for about six hours. 4. Give shaft over the twine a coat of rubber cement, and let it dry for about six hours. 5. Give shaft over the twine a second coat of rubber cement, and let it dry for sout six hours. 6. Remove washer on the short end of shaft, also the cogwheel if the shaft has cogs on both ends. 7. See that the rubber rolls are always longer than the space between the washers where the rubber goes on, as they shrink or take up a little in putting on the shaft. 8. Clean out the hole or inside of roll with benzine, using a small brush or swab. 9. Put the thimble or pointer on the end of shaft that the washer has been removed from, and give shaft over the twine and thimble another coat of cement. and stand same upright in a vise. 10. Give the inside or hole of roll a coat of cement with a small rod or stick. 11. Pull or force the roll on the shaft as quickly as possible with a jerk, then rivet the washer on with a cold chisel. 12. Let roll stand and get dry for two or three days before using same. Cement, for use should be so thick that it will run freely; if it gets too thick, thin it with benzine or naphtha.
- (4) W. H. H. asks the best known receiptfor purifying the best sweet oil sufficiently for watch oil. A. Put thin sheet lead into elive oil in a bottle, expose it to the sun for a few weeks, and pour off the clear liquid.
- (5) J. R. S. asks (1) the composition of a cheap paint suitable for rough work. A. Grind powdered charcoal, oxide of iron, or any convenient pigment in linseed oil with sufficient litharge as drier, and thin for use with well boiled linseed oil. You will find it, however, cheaper to purchase a ready made paint from some reputable dealer. 2. A good work on the manufacture of paper from wood. A. See "Technology of Paper Trade," in Scientific American Supplement, Nos. 109, 110, 116, 117, 118, and 123.
- (6) A. R. H. asks the receipt for making the Sozodont tooth powder. A. Take of potassium carbonate 1/2 ounce, honey 4 ounces, alcohol 2 ounces, water 10 ounces, oil wintergreen and oil rose sufficient to flavor. 2. A good stove polish. A. Take of black lead pulverized 1 pound, turpentine 1 gill, water 1 gill, sugar 1 onnce
- (7) S. G. asks: Is there any way to mark white dishes permanently? A. We know of no means except by grinding suitable pigments in proper vehicle, painting the china, and then burning it in
- (8) L. S. B. desires a receipt for making a good black lacquer. A. Take of burnt umber 8 ounces, true asphaltum 3 or 4 ounces, boiled linseed oil I gallon: grind the umber with a little of the oil; add it to the asphaltum, previously dissolved in a small quantity of the oil by heat; mix, add the remainder of the oil, boil, cool, and thin with a sufficient quantity of oil of turpentine.
- (9) D. W. McD. asks how to restore rancid butter so that it will taste and smell well. A. Wash well first with some good new milk, and next with cold spring water.
- (10) A. H. W. writes: I want to have twelve triangles made from bar steel, each one to be of a different tone from the other. What sizes should each be, and what sizes of steel should each be made of, to make the best sounds? A. As you cannot depend upon getting steel of small and exact variations in size, your only course is to make a trial of a bar, and make a second trial with a shorter bar for the next note. Then make a trial on the next size steel. Commercial steel varies enough from its normal size to prevent any computation of lengths for chimes or chords or single notes
- (11) W. H. R. asks: 1. How can I construct a simple hygrometer to ascertain the moisture of a room when steam vapor is used? A. You may make a very good hygrometer by hanging a piece of well twisted catgut, that has not been oiled, to a hook with a disk or pointer attached to the lower end just heavy enough to straighten the catgut, using an eye of wire to keep it from swinging. The whole may be fastened to a small strip of wood, to hang upon the wall. The catgut may be a few inches or a foot or two long, according to the amount of twist. The index will swing with the hygrometric changes, and may be adjusted to proportional parts by comparison with a "Mason's hygrometer." Supplements 571, 334, 14, 379, 155. 2. Give me the best recipe you can for a casehardening compound, to be used on open fires. A. Casehardening in the open fire is a very poor and superficial process. We know of nothing better than a mixture of cyanide of potassium and hoof shavings thoroughly pulverized

and mixed. 3. What is the best welding compound for working steel? A. There are a great many welding compounds in use, with as many claims to superiority. We have found nothing better than borax with a little sal ammoniac-about 10 per cent-all pulverized to-

- (12) O. A. B. asks for a preparation or composition used to bleach hair. A. Use hydrogen peroxide, a description of which and its method of manufacture is given in Scientific American Supplement, Nos. 184 and 239. Wash the hair thoroughly, and when perfectly dry, apply the bleach with a small sponge, rubbing well into the roots of the hair. Use as often as may be necessary to obtain the desired shade.
- (13) J. T. C. asks (1) a receipt to bleach sponges. A. Soak in diluted muriatic acid 10 or 12 hours, then wash with water and immerse in a solution of hyposulphite of soda to which a small quantity of diluted muriatic acid has been added, and wash out. 2. How to kill ringworm or barber's itch? A. Wash the part affected with a little remon juice: then rub in with the finger a little gunpowder which has been bruised in a porcelain mortar. Do this gently about twice a day. Be very careful not to make the skin sore. 3. A good receipt for hair dye? A. Take of silver nitrate 1 ounce, copper nitrate 1 drachm, distilled water 2 ounces. Dissolve the salts in the water, and add water of ammonia to the solution until the liquid becomes of a clear blue color.
- (14) M. A. M. writes: I wish to preserve a portion of a polished steel surface and etch or eat away the remainder to a depth sufficient to re eive a thick electro plate of silver, so that when plated, and the plating polished, it will be even with the preserved steel surface, so the whole surface will be even, but a portion steel and a portion silver plated. A. This is what is called electro inlaying, and is only successfully practiced by experts in this style of art. The etching process is the same as for engraving steel plates. The protecting material is asphalt varnish, which may be used with pencil brushes for ornamental work or for stopping off any parts not required to be acted upon by the acid. Asphalt, resin, and beeswax about equal parts, varied for hardness to suit the temperature, is suitable to cover the surface, warmed by dabbing with a small pad. This allows of the figure being scratched in with a point. Nitric acid 1 part, water 2 to 4 parts. is generally used for biting in the figures. This, followed by a dilute muriatic acid dip for removing oxide and cleaning the surface, will probably prepare the piece for electro plating. If not, you will have to make prepared. A. Take vaseline (post-day) and piece for electro plating. If not, you will have to make prepared. A. Take vaseline (post-day) and prepared. Take vaseline (post-day) are prepared. Take vaseline (post-day) and prepared. Take vaseline (post-day) are prepared. Take vaseline (post-day) are prepared. Take vaseline (post-day) are prepared. take the silver; possibly a few trials cyanide of silver or potasso-cyanide may give you success. For electroplating, see details in SUPPLEMENT, No. 310.
- (15) F. S. S. asks whether the last drops of a liquid dropped from a bottle are larger than the first, and why? A. The size of drops depends on the shape of the surface on which they form and on the rapidity of delivery. Hence they may be either larger or smaller when a bottle is nearly empty than when it is full, generally we think larger, because the flat surface of the mouth or lip is then the forming surface
- (16) J. G. asks (1) how to make a good cheap varnish for furniture. A. Melt 120 parts of yellow wax and a little pulverized resin, and compound this with 60 parts of warm oil of turpentine or spirits of turpentine. Rub the furniture with this by means of woolen rag. 2, A receipt for cleaning window glass. A. Tie up some finely powdered whiting in a small piece of muslin. Dab it over the glass thoroughly. The dirtier the glass, the more whiting will adhere to it. Next smear it evenly with adamprag, and let it remain until perfectly dry; then rub it off with a leather.
- (17) W. G. S. asks: How is the bisulphide of tin amalgam prepared for frictional electric machines? A. It is not an amalgam. Powdered bisulphide of tin is spread over the greased cushions. An amalgam of one part of zinc, one of tin, and two of mercury is highly recommended.
- (18) Lux asks: Is there any solution in which I can soak paper to make it a conductor of electricity when dry, also a method of putting an elec trically conductive surface on paper? A. The electrically conducting solutions depend generally on the moisture they retain for their efficacy. 'For a surface Dutch leaf or some metallic bronze powder is available
- (19) F. H. asks: 1. Will the micro-telehone, Fig. 5, described in Scientific American Sup-PLEMENT, No. 163, work on telephone described in Sup PLEMENT, No. 142 where no battery is used? A. The micro-telephone requires a battery. 2. Can a telephone made with permanent magnet be used with battery A. It can. 3. Will it do to make bobbins of permanet magnet telephone of metal instead of wood? A. Metal is quite objectionable, as tending to shield or mask the current effects. Use wood or ebonite.
- (20) E. B. asks: 1. Could water be temperature of twelve h eated to a that is, could a boiler be constructed strong enough, and a fire of ordinary coal be made hot enough to pro duce a temperature of twelve hundred degrees, no steam to be used, but simply to see how hot the water could be made? A. Water could be heated to any tempera ture short of dissociation. No boiler and fire could be constructed that would stand the pressure. 2. What would be the pressure per square inch on the boiler in above question? A. The pressure would be enormous. If steam space existed, it would be in the neighbor hood of three hundred thousand pounds to the square inch (by Weisbach's formula). If it were solid water, the pressure would be still greater. 3. Would a tuning fork vibrate as long under an air pressure of ten atmospheres as it would under a pressure of one atmosphere? A. A tuning fork would vibrate longer in a vacuum than in air, and longer in one atmosphere than
- (21) D. A. B. asks a receipt for dissolving mica, such as is used in stoves? A. Mica cannot be dissolved without complete decomposition. 2. In what way is rubber polished after vulcanizing, in the manufacture of combs and other rubber goods? A. By the ordinary finest grade of polishing powders, such as

glass flour, emery, or rotten stone, and the use of Boiler. See Steam boiler. cloth buffs or hand appliances to do the work. 3. Is there any method of preparation that can be used fo coating plaster of Paris models that will leave the rub ber smooth and bright after vulcanizing? A. Oi and blacklead and soapstone powder are recommended as facing for moulds. The SCIENTIFIC AMERICAN SUP PLEMENT, Nos. 249, 251, 252, which we can send yo for tencents apiece, treat the subject exhaustively, mor especially the last number.

- (22) B. F. R. asks: Can you add any harmless substance to milk that would make a copiou and permanent foam on being beaten with an eg beater? A. You might take the following, which is used with soda water: To each gallon add from two t four ounces of gum arabic dissolved in its own weigh of water; or use the following: Quillaya bark 4 ounces alcohol 4 ounces, glycerine 4 ounces, and water 8 ounces Exhaust by percolation to make 1 pint of tincture. Two to five drachms of this tincture to be used to every ga lon of fluid.
- (23) G. F. asks why the planet Mercury is so much more flattened at the poles than the earth. A. There is no flattening of the poles of Mer cury that has ever been measured, except at its transits and then it is not observable in common telescopes What you have probably seen is the gibbous phase duto its position in relation to the sun and earth. Thi might appear like an extreme flattening in a poor tel
- (24) C. R. B. writes: I intend to make a dynamo three times larger than the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and wish to know its capacity in furnishing a current for incan descent lamps (without battery). How many lamps of 20 candle power will it run, how many lamps of 2 candle power will it, run, and how many lamps of 3 candle power will it run? Also please quote the addi tional lamps of 20, 24, and 32 candle power it will run with 6 medium sized Bunsen cells additional? A. A dynamo three times the size of that described in Sup PLEMENT, No. 161, would probably not run more than two or three 20 candle lamps. The six Bunsen cell would help it a little if used to charge the field. We do not recommend this dynamo for practical, every day We hope soon to describe a larger dynamo
- (25) B. L. R. asks how the ribbons used n writing machines, daters, etc., are made, that is what material is used for making the different colors, how they are compounded, and how the ribbons ar prepared. A. Take vaseline (petrolatum) of high boilincorporate by constant stirring as much lampblack or powdered drop black as, it will take up without becoming granular. If the fat remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil o turpentine, in which dissolve the fatty ink, introduced in small portions by constant agitation. The volatile solvents should be in such quaftity that the fluid ink is of the consistence of fresh oil paint. One secret of ecess lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most con venient, and lay it flat on the paper. Apply the ink after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a tooth brush. Hardly any ink should remain visible on the surface. For colored inks, use Prussian blue, red lead,

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for pa tents at home and abroad, enable us to understand the laws and practice on both continents, and to possess un equaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our ex-tensive facilities for conducting the business. Address MUNN & CO. office Scientific American, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

December 7, 1886,

AND EACH BEARING THAT DATE.

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

Aerated water fountain, J. C. Johnson.....

Air and gas for delivering the mixture to carbu

retors, apparatus for mixing, R. S. Lawrence	354,06
Air brake, A. G. Easton	354,01
Alarm. See Fire alarm.	
Album stand, F. Seipelt	
Almond huller, J. Hobart	353,85
Almond paste, machine for rolling, M. E. Thieme	35 3,76
Animal releasing device, J. Pehrs	
Animal trap, J. Bean	353,65
Artery ligator, J. Trulinger	354,02
Astrakhan warp threads, machine for preparing,	-
T. Harrison	353,939
Bag. See Feed bag. Shipping bag.	
Baking sugar waser cakes, etc., machine for, G. S.	
Baker	353,737
Bar. See Harvester cutter bar. Pinch bar.	(
	(
Bar. See Harvester cutter bar. Pinch bar.	•
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell	10,787 353,948
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r)	10,787 353,948
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell	10,787 353,948 353,848
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes.	10,787 353,948 353,848 354,082
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator. Belting, machine, G. Mezcom Bioycle, E. L. Winey	10,787 353,948 353,848 354,082 853,878 353,904
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator. Belting, machine, G. Mezcom Bioycle, E. L. Winey	10,787 353,948 353,848 354,082 853,878 353,904
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator Belting, machine, G. Meæcom	10,787 353,948 353,848 354,082 353,878 353,904 353,725
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator. Belting, machine, G. Meæcom. Bicycle, E. L. Winey Blacking box, handled, I. H. White	10,787 353,943 353,848 354,082 353,873 353,904 353,728 353,963
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator Belting, machine, G. Mezcom Bicycle, E. L. Winey Blacking box, handled, L. H. White Blacking case, E. R. Roehm	10,787 353,948 353,848 354,032 353,878 353,728 353,728 353,968 353,686
Bar. See Harvester cutter bar. Pinch bar. Battery. See Voltaic battery. Bearing for shafts and axles, roller, J. Gibbons (r) Bed, folding cot, Herrinton & Russell Bell, call, H. A. Dierkes Bell, letter box, M. W. Ator. Belting, machine, G. Meæcom. Bicycle, E. L. Winey Blacking box, handled, If H. White Blacking case, E. R. Roehm Blacksmith's furnace, H. D. King	10,787 353,948 353,848 354,032 353,878 353,728 353,728 353,968 353,686

or Is or	Boiler. See Steam boiler. Boiler cleaner, I. T. Hardy Boiler furnace, J. Ham.	354,016. 354,057
b- il	Bolt. See Flour bolt. Bolt dressing machine, W. E. Ward	353,902
ed P-	Bone, ebony, marble, etc., making artificial, L. R. Mestaniz Book case, revolving, G. V. Nauerth.	353,697
u re	Boot or shoe, C. A. Erdman Boot or shoe burnishing machine, E. M. Park-	353,740
y	hurst	853,753
ıs	Borting machine, J. Swan	554,073
is o	Bottle capsule, W. Lawson	853,751
nt s,	brushing, and rinsing, W. W. Horner Box. See Blacking box. Draw box. Boxes, securing covers on, C. & E. H. Morgan	
, 0	Bracket. See Scaffold bracket. Sink bracket.	
.1-	Brake. See Air brake. Car brake. Carriage brake. Power brake. Wagon brake. Brooder, E. S. Renwick	353,968
y ie	Broom holder, H. P. Spencer	353,810 353,912
r- 8, 8.	Buckle suspender, T. O. Potter	353,812 353,854
ie is	Burner. See Lamp burner. Vapor burner. Bustle, E. T. Phillips	353,881
1-	EatonButton attaching machine, J. Lamoreaux	353,928 353,791
e	Button fastener, H. A. Church Button, lever, R. H. Lewis	353,921 3 4 ,068
h 1-	Button or stud, L. P. Conrad	
of 24	Buttons, machine for making shoe, F. H. Hard- man	353,677
!2∙ i-	Cabinet and show case, combined, L. Wormser Cable grip, roller, G. A. Polhemeus Cable gripping device, J. Hellings	353,809
n A	Canning fruits, meats, etc., apparatus for, Ackerman & Wagner	353,911
n ls	Camera stand, J. J. Higgins	353,737
e y	Car brake, air, J. B. Gathright	853,678
d	Car brake, electro magnetic, H. S. Park Car coupling, Baker & Prescott	8 53,880 3 5 3,838
3,	Car coupling, H. A. Barnard	354,008
e l-	Car coupling, J. B. Nixon	353,804 353,826
d k	Car coupling, E. G. Sessions	353,977
t e	Car, railway, Riordan & Martyn Car signal, S. Forman	353,884 353,78 5
e e	Car starter, B. C. Pole	353,759 353,982
f d	Car, stock, Smith & Van Orman	353,878
e k	Car wheel, L. R. Brooks	353,918 354,077
f		
e	Cars by electricity, system of lighting, J. H. Marshall	
e l,	Cars, heating apparatus for railway, W. C. Baker Cards, etc., suspension device for express, C. G. Pfingsten	353,8 39
e l, ı-	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,839 354,071 353,869 353,879
e l, ı-	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,780
e l, i- t	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik Carriage brake, C. E. Luburg Carriage spring, Silter & Bazzett Carriage top, shifting, F. S. Brand Carriage wheel, C. Coolidge Case. See Blacking case. Book case. Music case. Watch case.	353,889 354,071 353,869 353,879 353,980 353,780 356,779
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,780 358,779
el, i; thel,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik Carriage brake, C. E. Luburg Carriage spring, Silter & Bazzett Carriage top, shifting, F. S. Brand Carriage wheel, C. Coolidge Case. See Blacking case. Book case. Music case. Watch case. Casting type, mould for, C. Hochstadt et al Chair, J. E. Crook Chair, See Tilting and rocking chair. Chairs, spring attachment for, M. D. & T. A. Con-	353,889 354,071 353,869 353,879 353,980 353,780 858,779 353,060 354,046
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik Carriage brake, C. E. Luburg Carriage spring, Silter & Bazzett Carriage top, shifting, F. S. Brand Carriage wheel, C. Coolidge Case. See Blacking case. Book case. Music case. Watch case. Casting type, mould for, C. Hochstadt et al Chain, J. E. Crook Chair, See Tilting and rocking chair. Chairs, spring attachment for, M. D. & T. A. Connolly Chuck, lathe, J. H. Curry Churn, test, J. K. Komp	353,889 354,071 353,869 353,879 353,980 353,780 354,046 354,046 354,044 353,786 354,065
el,; thel,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,790 353,060 354,044 353,786 354,044 353,786 354,057 353,967 353,967
el, i., the , free lands	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,879 353,790 353,790 354,046 354,044 353,736 354,065 353,907 358,866 358,866
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,990 353,780 354,046 354,044 353,786 354,045 353,007 353,907 353,907 353,907 353,907
el, i. ; the , fee Allsr, s	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,780 354,046 354,044 353,786 354,065 354,065 353,907 353,907 353,907 353,907
el, list, fee Allsry, s	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,790 353,790 354,044 353,736 354,044 353,736 354,065 353,907 353,954 353,726 353,726
el,; the, fee-Allsry, -s-	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,990 353,790 353,790 353,790 353,796 354,044 353,736 354,045 353,907 353,866 353,945 353,976 353,954 353,954 353,954 353,954 353,850 354,021
el,; the, fee-Allsry, -s-	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik Carriage brake, C. E. Luburg. Carriage spring, Sliter & Bazzett. Carriage spring, Sliter & Bazzett. Carriage wheel, C. Coolidge Case. See Blacking case. Book case. Music case. Watch case. Casting type, mould for, C. Hochstadt et al Chain, J. E. Crook Chair, See Tilting and rocking chair. Chairs, spring attachment for, M. D. & T. A. Connolly Chuck, lathe, J. H. Curry. Churn, test, J. K. Komp. Cigar machine, J. R. Williams. Cigarette bundling machine, Kinney & Butler Cigarette machine, F. Higgrave. Clamp, J. G. Wilber. Clasp. See Hitching strap clasp. Suspender clasp. Cleaner. See Boiler cleaner. Cloak, gossamer, M. J. McCarthy Clock for traismitting signals, electric, J. S. Bailey Clock, soft ractinggas, G. Nobes Cock, self-actinggas, G. Nobes Cock, self-actinggas, G. Nobes Coffee pot, Wilson & Coe Coffin, Breed & Ober	353,889 354,071 353,869 353,980 353,980 353,799 353,060 354,046 354,046 354,046 354,046 354,046 354,046 354,046 353,986 354,057 353,945 353,726 353,945 353,726 353,945 353,726
el,; the, fee-Allsry, -s-	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,780 354,046 354,044 353,786 354,045 353,952 353,726 353,954 353,726 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,958 353,726
el,, thee, fee-Allsry,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,980 353,799 353,980 354,046 354,046 354,046 354,046 353,786 354,075 353,967 353,967 353,967 353,963 353,962 353,963 353,962 353,963 353,963 353,963
el, lithe, free Allsry, s- s- 2	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,990 353,799 353,990 353,790 354,046 354,044 353,736 354,045 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,958 354,021 353,802 353,958 354,021 353,802 353,958 353,978 353,958 353,958 353,958 353,978 353,968 353,978 353,978
el, lithe, free Allsry, s.	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik Carriage brake, C. E. Luburg. Carriage spring, Sliter & Bazzett Carriage wheel, C. Coolidge Case. See Blacking case. Book case. Music case. Watch case. Casting type, mould for, C. Hochstadt et al Chain, J. E. Crook Chair. See Tilting and rocking chair. Chairs, spring attachment for, M. D. & T. A. Connolly Chuck, lathe, J. H. Curry Churn, test, J. K. Komp Cigar machine, J. R. Williams Cigarette bundling machine, Kinney & Butler Cigarette machine, F. Hipgrave. Clamp, J. G. Wilber Clasp. See Hitching strap clasp. Suspender clasp. Cleaner. See Boiler cleaner. Cloak, gossamer, B. & T. E. Goodrich Cloak, gossamer, M. J. McCarthy Clock for traismitting signals, electric, J. S. Bailey Cock, self-actinegas, G. Nobes Cock, self-actinegas, G. Nobes Cock, stop, C. J. Mortimer Coffee pot, Wilson & Coe Coffin, freed & Ober Coffin, freed & Ober Collar, norse, J. L. Campbell Collar, norse, J. L. Campbell Collars, sweat pad for horse, S. Barstow Conduits or pipes, die for forming, D. N. Hurlbut. Copying of pictures, apparatus for facilitating, E. Charman Cord and rope holder, O. Crocker Cork corkerew, C. H. Hudson	353,889 354,071 353,869 353,879 353,980 353,780 354,046 354,046 354,046 354,046 354,046 353,786 354,065 353,954 353,726 353,866 353,974 353,866 353,973 353,8680 353,972 353,8680 353,772 353,8680 353,973 353,8680 353,973
el, lithe, free Allsry, s- 2 74 37	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,990 353,790 353,990 353,790 353,796 354,046 354,044 353,736 354,065 353,977 353,866 353,945 353,954 353,726 353,954 353,954 353,850 353,951 353,951 353,951 353,951 353,951 353,951 353,951 353,951
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,990 353,990 353,790 353,060 354,046 354,046 354,046 354,046 353,956 353,786 353,786 353,786 353,726 353,840 353,854 353,860 353,954 353,860 353,954 353,860 353,958 353,786 353,786 353,786
el, lingth he fee Allsry, ss - 2 74 3775	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,990 353,990 353,790 353,060 354,046 354,044 353,736 354,075 353,966 353,945 353,967 353,960 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,954 353,955 353,976 353,976 353,977 353,860 353,978 353,978 353,978 353,978
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 363,879 363,980 353,780 354,044 353,786 354,045 354,045 353,786 354,075 353,866 353,945 353,976 353,866 353,945 353,976 353,860 353,872 353,860 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,873
el,	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,879 353,980 353,780 353,060 354,044 353,786 354,044 353,786 354,067 353,954 353,726 353,945 353,743 353,945 353,726 353,840 353,726 353,840 353,726 353,840 353,772 353,866 353,772 353,868 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874 353,772 353,874
el,, the, free Allsry,2 74 37753379 3	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,889 354,071 353,890 353,990 353,790 353,960 354,046 354,044 353,736 354,065 353,736 354,065 353,954 353,3954
el, the , = free Allsrs, -ss - = 10	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,889 354,071 353,889 353,980 353,980 353,790 353,060 354,046 354,046 354,046 354,046 353,786 353,786 353,976 353,866 353,945 353,872 353,860 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,972 353,983 353,784 353,772 354,003 353,874 353,772 354,003 353,874 353,772 354,003 353,885 353,784
el,, the , = f ce-Allsry, -s 2 74 37753379 8 77 7832231	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,869 353,980 353,980 353,793 353,980 354,046 354,044 353,786 354,046 354,044 353,786 353,786 353,976 353,866 353,974 353,866 353,974 353,860 353,860 353,860 353,860 353,860 353,872 353,872 353,872 353,872 353,872 353,872 353,872 353,973 353,872 353,973 353,873 353,988 353,784
ellisthes, = free-Allsry, -s. = 702 74 37753779 3 77 78323150	Cars, heating apparatus for railway, W. C. Baker. Cards, etc., suspension device for express, C. G. Pfingsten	353,889 354,071 353,889 354,071 353,890 353,990 353,790 353,960 354,046 354,044 353,736 354,065 354,045 353,964 353,961 353,860 353,872 353,860 353,872

E. A. Sperry. 353,989
Electric motor, E. A. Sperry. 353,989

Electric regulator, E. A. Sperry...... 353,990

Scientific American.

	410		•		<u> </u>
,	Electrical conductors, coupling for, W. F. Smith. 3 Electrical testing, C. S. Bradley		Hasenclever (r) Oil cloth, making stair and table, A. F. Buchanan.	10,788 353,777	Tank. See Flush tank.
	Engine. See Direct-acting engine. Engine reversing mechanism, L.,C. Forwood 3 Envelope, C. Gulath			353 , 823 353,727	Telegraph transmitter, J. W. Shryoc
	ards	354,066	Orthopedical appliance, I. Zacharie Pad. See Truss pad. Paper pulp digester, C. Bremaker	353,910 353,731	Telephone apparatus for divers, H. Telephone transmitter, J. W. McDor Telephones, conductor for mechanisms
	Fabric. See Woven fabric. Fan apparatus, rotary, J. S. Walker <i>et al.</i>				
	Farm gate, E. H. & A. E. Adams	354,005	Pencil sharpener M. Rush		Tie. See See Railway cross tie. Tile, H. A. Daniels
	head	354,050	Photographic print washer, W. G. Entrekin	353,8 4 9 353,960	Tilting or rocking chair, M. D. & T. A Tobacco bag fastener, F. E. Heinig Tobacco stripping and booking mach
	Rabut	353,665	Pipes, boilers, etc. covering for, H. M. Small Piston meters, register connection for, L. H. Nash	3 5 3,981	den
	Fence, G. W. Holmes 3 Fence, King & Highfield 3	353,859 353,950	Planter, corn, N. O. Starks	351,025	Trap. See Animal trap. Fish trap. trap.
	Fence, RL. Whittington	353,953	Planter and cultivator, combined corn, J. C. Weiss Planter and fertilizer distributer, seed, W. B.		Tricyle, Lloyd & Priest Trunk, wardrobe, Meurer & Klein Truss, B. Bannister
	Fire alarm, B. J. Antrim	354,006 353,733	Simpson Planter, seed, G. F. Johnson	353,949	Truss pad, B. Bannister Turret lock, F. H. Richards
	Fire extinguishing apparatus, automatic, Thompson & Ritchie		Planter, sulky corn, W. Newhall	353,668	Twist drills, machine for making, S. I Type writing machine, J. W. Peck Umbrella, U. G. Steinmentz
	Flour bolt, O. M. Morse		Plow, J. E. W. & C. W. Smith	353,828	Umbrella or parasol tie, J. T. Smith. Umbrella, parasol, or sunshade, T. Bi
	ing, L. H. Nash		Pot. See Coffee pot. Power. See Horse power.	050.000	Umbrella runner, J. H. Simpson Undergarment, R. H. Paine
	mingling flowing, L. H. Nash 33 Flash tank, J. Wilson 33 Flash tank, F. F. Conwell 32	54,000	Prower brake, R. Solano		Valve, air, J. S. Walker et al
	Folding table, E. E. Conwell		Printing machine, hand roller, J. H. Eiermann Printing machine inking apparatus, H. Lee	353,670	Valve, sewer pipe back pressure, W. 1 Valve, straight way, E. Lunkenheime Vapor burner, Armour & Bielefeld
	Furnace. See Blacksmith's furnace. Boiler furnace. Locomotive furnace.		Printing machine with addressing attachment, C. H. Hanchett		Vapor burner, Z. Davis Vehicle wheel, F. W. Starr
	Furnace grate, H. Lencke	•	Printing presses, etc., alarm counter for, J. Ruesch	354,024	Vehicles, electrical propulsion of, F., Velocipede, R. G. Britton
	Gas, air mixer for, J. L. Brown 36 Gas meter register, J. Deutschbein 36 Gas regulator, J. H. Helm 36	53,781	Puller. See Stump puller. Pulverizer, H. S. Howard Pulverizer, E. J. Schuman		Velocipede, Gibbons & Meneely Vessels, leak stopper for, 1. Meisler . Vessels, side and deck light for, W. H
	Gate. See Farm gate. Gate, S. L. Ingham		Pump, L. Teague. Pump valve, P. L. Weimer	352,897	Voltaic battery, A. F. W. Partz Wagon brake, Keever & Remy
	Generator. See Steam generator. Glass, cement for use in manufacturing stained,		Pumps, governor for circulator, W. H. Brooks Punch, F. H. Richards	353,817	Wagon standard, L. L. Welsh Wagon wheel, A. C. Hall
	R. McKee. 36 Glove fastener, W. R. Comings. 36		Quilting machine, I. Deutsch		Wall paper, shades, etc., rack for holhibiting, W. H. Hazzard Washer. See Photographic print was
	Glue from marine animals, obtaining, C. A. Sahl-strom 35 Governor, steam engine, Bancroft & Lewis 35		Radiators, loop pipe for, G. W. Walker	353,900	Washing machine, R. & H. Joel Waste pipe trap, G. Veale, Jr
	Governor, steam engine, Miller & Frey	53,957	Railway cross tie, S. D. Locke	353,691 353,771	Watch case, D. O'Haratch case center, W. H. Fitz Gerald
,	Grain products, preparing, G. H. Cormack	53,875	Railway rail joint, W. F. Gould	353,847	Watch case centers, manufacture of Gerald
•	Grinding mill, G. & A. Raymond		Railway switch, J. F. Penrod		Watch cases, manufacture of, W. H. Watch cases, manufacture of crown Fitz Gerald
•	Gun, magazine, M. E. Gregg		Railways, grip for cable, C. Scholz		Watch, stem winding, A. L. Keller Watch, stem winding, C.V. Woerd
1	Gun sight, F. E. Halladay	[Rakes, making, A. D. Myers	353,871	Watch, stop, H. A. Lugrin Watches, pendant stem for, A. L. Kell
	Harness, W. Olewine	3,734	Reflector attachment for lanterns, J. Hirth	53,678	Water closet cisterns, etc., pull for, W Water gauge, T. H. Cheek
1	Harvester cutter bar, J. H. Van De Water	53,899 53,758	chine regulator. Feed regulator. Gas regulator. Rein muff, S. J. Hull.	259 961	Water meter, oscinating, L. H. Nash Water meter with revolving non-rots L. H. Nash
]	Hats, ventilating, H. C. Zerffi	54,004 53,951	Revolver, J. C. Howe	353,914 353,948	Water meter with revolving pistons, J Weight motor, H. A. Spencer
1	Hinge, gate, D. J. Olinger	53,962	Robe, lap, T. Hawley	354,040	Wheel. See Car wheel. Carriage who wheel. Wagon wheel. Wheel, J. S. Black
	Hitching strap clasp, C. B. Bristol	3,842	Rocking chair spring attachment, M. D. & T. A. Connolly	354, 043	Whiffietree bolt blanks, machine fo Stacker
	Hook. See Draught hook. Snap hook. Horse power, G. & A. Raymond	53,967	Roller. See Land roller. Rotary sprinkler, I. W. McGaffey		Winding yarn, machine for, W. T. Ha Windmill, G. & E. Wallenbeck Windows and shutters, fastener for, F
1	Horses, foot rasp for, A. P. Williams		Sad iron handle, J. F. Bless. Sad dle, harness, A. L. Liston.	353,660	Wire drawing apparatus, S. H. Byrne. Wire drawing drum, W. W. Shearer
	A. L. Navone		Sawdust and other material by centrifugal action, apparatus for washing and separating, J. V.		Wrench for twisting wires, A. L. Zuck
. 1	Hydrant and fire plug, H. E. Earle		V. Booraem	•	DESIGNS.
]	Incubators, heat regulator for, H. Killam		Sawmill, band, W. H. Dodge	53,669 53,886	Badge, Lukanitsch & Cosman Branding iron, J. G. Kostmayer
]	Iron. See Sad iron. Ironing machine, L. H. Watson		Saw plant, portable rail, W. L. Clements	53,6 5 9	Brush, crumb, W. K. Northall
•	Jar. See Fruit jar. Joint. See Railway rail joint.	10,1.70	Scraper and snow plow, rail, E. B. Durfee	53,738	Carriage body, H. C. Sears
1	Knapsacks, means for carrying, A. Mendel	3,868	Seal, lead, F. W. Brooks	54,036 53,946	Tile, J. H. Hankinson
]	Ladder, extension, M. C. Walls. 35 Lamp, Z. Davis. 35 Lamp, E. L. Winey 35	1,048	Seat fastener, J. H. Giesey	53,720	Wall paper, W. N. Peak
]	Lamp brackets, etc., clamp for, H. J. Meuflier 35; Lamp burner, A. Geiss	3,956 3,674	Sewing machines, device for controlling the driving wheels of, D. W. Goodell	- 1	TRADE MARK
]	Lamp, car, W. H. Briggs	3,661 3,783	Sheller. See Corn sheller. Shipping bag, safety, G. H. Magee 3	53,692	Belting of canvas, duck, and woven copeake Belting Co
]	Land roller, Horey & Marsh	3,814	Shirt, G. A. Gane	53,746	Corsets, Warner Bros
]	Lemon squeezer, R. Onderdonk	4,022 3,846	Shutter, window, L. G. Comparet	53,735	horn
]	Level, spirit, E. E. Webb	4,076	Signal. See Car signal. Sink bracket, F. Taylor	53,991	braids, and twists, I. Einhorn Cotton fabrics, J. R. MacColl Meats and lard, cured and canned, A
]	Locomotive furnace, J. B. Barnes	3,714	Skelp bending machine, Pierce & Sandford	54,072 53,891	ing Co
1	Loom shuttle, McGee & McMahon	3,872 • 3,671	Sole and heel nailing machine, F. F. Raymond, 2d 3 Sole channeling machine, H. H. Cummings 3	53,883 53,012	Remedies in solid form for bronchic diseases, Synvita Company
1	Marble, composition for use in the manufacture of artificial, C. Straub	3,896	Spinning machine, W. E. Sharples	53,887	Remedy for apoplexy and kindred di Hutchinson & Co
1	Mattress, leak stopping, J. H. L. Tuck	3,851	spring. Sprinkler. See Rotary sprinkler. Street sprink-		Soap, toilet, Graham Bros. & Co Tooth paste and tooth wash, Curran &
I	Mechanical movement, F. H. Richards	4,074	ler. Square for bookbinders' use, T. Statter & Hauser, 3 Stand. See Album stand. Camera stand. Rail-	54.026	Whisky, Stein Bros. & Baumgartl Whisky, rye and other, Sour Mash Dis
I N	Mill. See Grinding mill. Sawmill. Windmill. 1 oulding machine, sand, A. Rige	3,712	way switch stand. Steam boiler, E. D. More	00,100	pany Wire, barbed, California Wire Works.
N	Moulding machine, sand, S. P. M. Tasker	3,972	Steam generator, W. P. Crater	53,667 53,996	A printed copy of the specification any patent in the foregoing list, also
N	Nover, W. Van Wyck	3,993	Stove, heating, J. Bierley 3	54,009 53,992	issued since 1866, will be furnished from cents. In ordering please state the n
N	W. S. Williams	3,908 3,794	Stove, regenerative hot blast, J. M. Hartman 3 Stove top, oil, C. W. McCutchen 3	53,7 4 7 53,798	of the patent desired, and remit to Broadway, New York. We also furnish granted prior to 1866; but at increase
	1 Stone	3,894	Street sprinkler, J. A. Bancroft	54,011	specifications, not being printed, mu hand.
N	Vail holding receptacle, Spath & Remick	4,052	Stud and magnifying glass, combined shirt, J. F. Leighton	53.668	Canadian Patents may now be inventors for any of the inventions na
	freedie, J. R. Krieg		Suspender clasp, T. O. Potter	53,813 53,811	going list, at a cost of \$40 each. Fo address Munn & Co., 361 Broadway, N
N	ut blanks, machine for forming, W. E. Ward 858		Suspenders, fastening device for, G.W. Stewart &		foreign patents may also be obtained.

		_
planks for hexagonal, F. A.	Switch. See Railway switch.	
10,788	Table. See Folding table.	
and table, A. F. Buchanan. 353,777 als, extracting, C. A. Sahl-	Tank. See Flush tank. Telegraph instrument, printing, A. Wirisching 354,0	M1
	Telegraph, railway, E. B. Ives	
lbury 353,727	Telegraph transmitter, J. W. Shryock 353,7	715
e	Telephone, N. F. Palmer	
, 11 240,410	Telephone transmitter, J. W. McDonough 353,6	
Bremaker	Telephones, conductor for mechanical, J. S.	
. Crane, Jr	Jones	
tern.	Thill coupling, P. J. Baumgartner 353,6	
ush	Tie. See See Railway cross tie.	
manufacture of, C. Scheib-	Tile, H. A. Daniels	
sher, W. G. Entrekin 353,849	Tobacco bag fastener, F. E. Heinig	
ton	Tobacco stripping and booking machine, G. Row-	
oring for, H. M. Small 353,981	den	
er connection for, L. H.	Torpedo service, marine, C. S. Aylesworth 353,7	
rks	Track gauge and level, J. L. Barnett 353,6	55
1	Trap. See Animal trap. Fish trap. Waste pipe trap.	
or, combined corn, J. C.	Tricyle, Lloyd & Priest	
	Trunk, wardrobe, Meurer & Klein	
353,979	Truss pad, B. Bannister	
mson	Turret lock, F. H. Richards	
Newhall	Twist drills, machine for making, S. Moore 354,0 Type writing machine, J. W. Peck 353,9	
	Umbrella, U. G. Steinmentz354,0	27
Smith	Umbrella or parasol tie, J. T. Smith 353,7	64
• • • • • • • • • • • • • • • • • • • •	Umbrella, parasol, or sunshade, T. Bierley 353,8 Umbrella runner, J. H. Simpson 353,9	
er.	Undergarment, R. H. Paine 353,9	63
353,892	Valve, air, J. S. Walker et al	
ne for, L. Roth 353,762	Valve for hydraulic elevators, P. F. Morey 354,0 Valve, sewer pipe back pressure, W. H. Simpkins. 353,8	
roller, J. H. Eiermann 353,670	Valve, straight way, E. Lunkenheimer 354,0	19
g apparatus, H. Lee 353,792 addressing attachment, C.	Vapor burner, Armour & Bielefeld	
	Vehicle wheel, F. W. Starr 353,8	31
, alarm counter for, J.	Vehicles, electrical propulsion of, F. J. Sprague. 353,8	29
er. 354,024	Velocipede, R. G. Britton	
rd	Vessels, leak stopper for, 1. Meisler	00
an 3 53,973 i 352,897	Vessels, side and deck light for, W. H. Douglas 354,01	
ner 353,997	Voltaic battery, A. F. W. Partz	
culator, W. H. Brooks 353,776	Wagon standard, L. L. Welsh:	36
utsch	Wagon wheel, A. C. Hall	4
ding manuscript or other	hibiting, W. H. Hazzard	58
S. B. Costen 354,045	Washer. See Photographic print washer.	
, G. W. Walker 353,900 Nathan 353,754	Washing machine, R. & H. Joel 354,00 Waste pipe trap, G. Veale, Jr 354,00	
Locke	Watch case, D. O'Hara353,706, 353,96	
3. Atwood	tch case center, W. H. Fitz Gerald	3
Gould	Watch case centers, manufacture of, W. H. Fitz Gerald	so
enrod 353,708	Watch cases, manufacture of, W. H. Fitz Gerald 353;93	
nd switch connection, T.	Watch cases, manufacture of crowns for, W. H.	, İ
, C. Scholz	Fitz Gerald	
	Watch, stem winding, C. V. Woerd 354,00	2
yers	Watch, stop, H. A. Lugrin	
r lanterns, J. Hirth 353,678	Water closet cisterns, etc., pull for, W. Burrows 353,84	4
r register. e regulator. Electric ma-	Water gauge, T. H. Cheek	
ed regulator. Gas regu-	Water meter, oscillating, L. H. Nash	
	Water meter with revolving non-rotating piston,	1
353,861 353,914	L. H. Nash	
	Weight motor, H. A. Spencer 353,71	
nt W T Rupkor 954 039 354 040	Wheel See Car wheel Carriage wheel Vehicle	
nt, W. I. Bunker354,038, 354,040 . I. Bunker354,039	wheel. Wagon wheel. Wheel, J. S. Black	0
ttachment, M. D. & T. A.	Whiffietree bolt blanks, machine for making, J.	1
854 ,043	Stacker	
McGaffey 353,955	Windmill, G. & E. Wallenbeck 353,721	ιĮ
353,976	Windows and shutters, fastener for, R. P. Hall \$53,936	6
ess	Wire drawing apparatus, S. H. Byrne	
rial by centrifugal action,	Woven fabric, D. B. Kerr	0
ng and separating, J. V.	Wrench for twisting wires, A. L. Zuck 354,079	9
353,775 a of gas, automatic appa-		
E. W. Rathbun 353.966	DESIGNS	
	Badge, Lukanitsch & Cosman	
	Branding iron, J. G. Kostmayer	
the teeth of, G.S. Blach 353,659	Cable cord, ornamental, T. R. Lees et al	
rafton	Carriage body, H. C. Sears	3
Kaelin 353,863	Grate, fire, J. Burkhardt	
	Tile, J. H. Hankinson)
	Type, font of printing, W. F. Captain	
ker 353,720	Wall paper, W. N. Peak 17,016 Watch case, Bapst & Falize 17,012	
S. A. Rosenthal 353,970		ĺ

TRADE MARKS
Belting of canvas, duck, and woven cotton, Chesa-
peake Belting Co
Corsets, Warner Bros
Cotton and silk on spools, yarns, and twists, I. Ein-
horn
Cotton and silk on spools, yarns, buttons, tapes,
braids, and twists, I. Einhorn 13,856
Cotton fabrics, J. R. MacColl
Meats and lard, cured and canned, Armour Pack-
ing Co
Medicines, astringent, Synvita Company 13,850
Remedies in solid form for bronchical and other
diseases, Synvita Company 13,851
Remedy for apoplexy and kindred diseases, F. S.
Hutchinson & Co
Remedy for constipation, A. M. Walrath 13,852
Soap, toilet, Graham Bros. & Co
Tooth paste and tooth wash, Curran & Goler 13,854
Whisky, Stein Bros. & Baumgartl
Whisky, rye and other, Sour Mash Distilling Com-

A printed copy of the specification 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.

Capadian 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 instruction address Munn & Co., 361 Broadway, New York. Other

Aldvertisements.

Inside Page, each insertion - - - 75 cents a line. Back Page, each insertion - - - \$1.00 a line. The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisement, at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

SEBASTIAN, MAY & CO'S Improved Screw Gutting LATHES Foot & Power Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. Lathes on trial, Catalogues mailed on application 165 W. 2d St., Cincinnation

THE USE OF TORPEDOES IN WAR.-THE USE OF TORPEDUES IN WAR.—
A paper by Commander E. P. Gallert, U.S.N., glving a clear presentation of the present state of efficiency of the torpedo, the degree of perfection that it has now reached, and describing the kinds which are in ordinary use in all naval services. With 3 plates, containing many figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NOS. 536 and 537. Ten cents each. To be had at this office and from all newsplealers.

Square, Oval, or Round Smooth Holes. For carpenter, cabinet, and pattern work. ½in. 50c., set \$4.00, mailed free. Bridgeport Gun Implement Co., 17 Maiden Lane, N. Y.

Lamps for Christmas tree and other decorations. THE LARGEST STOCK OF LAMPS IN THE UNITED STATES, ranging from ½ to 100 candle power, for both battery and dynamo.

CHRISTMAS PRESENTS

for your scientific children or friends. Magic Lantern, Electric Lamp and Battery, \$40.00

"B" Battery and 3 Candle Lamp, 5.00

"B" Battery and 6 Candle Lamp, 7.00

Electric Railway, complete, 8.50

Surgical Illuminator, complete, 12.00

Ano Kato, the children's electrical toy—no battery—lots of fun, and cannot get out of order. 75

By mail, 90

Electric Motors, Primary and Storage Batteries, etc. Statue of Liberty, mounted with 3 Candle Lamp, with battery complete, 12.00

Do. with 6 Candle Lamp and Battery, 12.00

For care logue send 5 cent stamp for postere.

For catalogue, send 5-cent stamp for postage.

The Stout-Meadowcroft Co., 82 & 84 Fulton Street, NEW YORK.

Authorized Agents of the Edison Lamp Co.

SCIOPTICONS, MAGICLANTERN SLIDES MARCY'S ELECTRIC FOCUS LIME LIGHT MADE EASY, SEND FOR CIRCULARS, L.J. MARCY, 1604 Chestnut St., Philada.

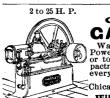
THE BACTERIA OF DISEASE.—BY DR. Henry Hun.—The contents of the air we breathe. The nature of bacteria. Classification of bacteria. Useful bacteria. The bacteria of disease. With 16 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 545. Price 10 cents. To be had at this office and from all newsdealers.



A fire-proof insulator of heat and sound. Samples and price list free. U.S. MINERAL WOOL CO.,
22 CORTLANDT STREET, N. Y.

EXCELLENT BLACK COPIES of anything written or drawn with any Pen (or Type Writer) by the Patent AUTOCOPYIST Only equaled by Lithography. Specimens Free. AUTOCOPYIST Co., 3 Thomas Street, New York.

The great work of Bartholdi, the largest statue ever erected by man, just inaugurated on Bedloe's Island, New York Harbor, fully described. The history of its inception, how the work was carried out, chronology of the operations and full engineering and popular details as to construction, mode of erection, size, thickness of metal, etc. Fully illustrated by drawings, showing the work as completed, the elevation of the pedestal and framework, and the statue as it appeared in process of construction. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 584. Price 10 cents. To be had on application, or by mail, at this offlice and from all newsdealers. The STATUE of LIBERTY, NEW YORK.



P. O. Box 148.

CHARTER'S CAS ENGINE.

Warranted equal to any in Power and Economy, and Superior to all in Simplicity and Compactness. Gives an Impulse at every Revolution.
H. H. LATHAM,
Chicago Agent, 115 Monroe Street.

Williams & Orton Mfg. Co.,

STERLING, ILL.

PERFECT **NEWSPAPER FILE**

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN.





ILLUSTRATIONS.	Engine, Hord's	6 Mercury bubbles 40 Mercury fountain 26		Arms, small, manufacture 325 Arthur, Chester A 337	Clip coupling, Tylee's*67 Cliff of glass
Adding machine. 1 Air in pores of wood. 22 Air pump experiments. 19 Air pump, inexpensive. 18 Apertures in vessels. 32 Apes at home. 25 Aquatic arena, l'aris. 28 Aqueduct, New York. 31 Ash sifter 13	Engine, six cyin der Engine, steam, Lonque's. Engine, steam, Mennig's. Engine, steam, Rush's. Engine, steam, Rush's. Engine, steam, Rush's. Engine, winding, colliery. Engine, steam, little steam, s	i Meter, gas, great 35 i Mica cones and wheels 1 5 Milk can refrigerator 11 6 Milk cooler, new 14 8 Milk cooler, new 14 8 Milk, Daker's 20 3 Mink, the 20 4 Minneapolis Exposition 2 4 Mirror, shaving, new 3 3 Model shaper, ship 19 9 Monitor Peacemaker 35 Moscow, burning of 6	Stopper rastener	Asphaltum in building 231 Asphaltum in building 231 Asthma remedy 354 Asthma remedy 354 Asthma remedy 354 Atmosphere of caves 401 Audubon, reminiscence of 341 B Bacteria in the air 217 Bakusine 130 Baltusine 130	Clip coupling, Tylee's. *67 Cliff of glass. 278 Clock, electric. 307 Clock magnetic 162 Clock movement frame. *372 Clock novel. *389 Clock, polaf, Wheatstone's. *262 Clock, polaf, Wheatstone's. *262 Cloth, how to tin 146 Cloth, waterproofing. 247 Clubs, Indian, home made. 106, 277 Coal, at on of . 374 Coal, atthracite, discoverer of. 372 Coal dust. ignition of . 169 Coal formation, theory 245 Coal products of . 196 Coal receptacle. *131 Coast defense ordnance. 96 Cock, cylinder. *306 Cod liver oil . 8
Ash sifter 13 Artillery firing 361 Ball, projected 55 Balls, collision 33 Balloon trip, a 244 Banjo frame, Dobson's 51 Barometer, glycerine 405 Barrel cover, new 244	Facing machine	Mowers, cutting apparatus for 21 Mowers, cutter for 30 Mummy of Rameses 16 Mushrooms on shelves 27 Music holder, Smith's 27 Music holder, Smith's 31 Natural history notes 31 Naval maneuvers, French 15 New York harbor 2 New York	1 Table, sheep shearing 371, 25 Tag, address 132, 4 Tanks, repairing 344, Target, revolving 257, Tarsiers 255, Telephone, low-distance 133, Telephone transmitter 403, Terrawerra Lake 57, 2 Thermometer, alarm 39, 2 Thermometer, alarm 39, 2 Time register 388	Balance, spring. 66 Ball, projected. 577 Balls, collision *38 Balloon photography 166 Balloon trip, a. *249 Balloon voyage, a. 132 Balloons, steam for 401 Banjo frame, Dobson's 51 Barfi, Prof. 275 Barometer, glycerine 4403 Barometer, whistling 114 Barrel cover, new 274 Barytesin white lead 273	Coal formation, theory
Baseball, pitching in	Filter, rain water	O Oil can attachment 6 Oiler, Moat's 14 Ordnance, heavy 19 Ore concentrator 24 Ore separator 80 Ougan, electric 8	9 Ties, cross, railway. 40 Tires, wagon, setting. 149 Toboggan, improved 243 Tongs, tourmaline 262 Top, centrifugal. 392 7 Tool, combination 211 7 Top, chameleon. 239 1 Top, home made. 137 2 Top, scientific. 230 5 Torpedo boat, new. 387 Torpedo boats, new. 387 Torpedo sanchoring 150	Baseball 94 *168	Color, analysis of 227 Colors, influence of light on 147 Colors, water effect of light 285 Combustion, heat of 209 Combustion slow 213 Comet. Winnecke's 226 Compass affected by a truss 277 Compressed air powerscheme 376 Condenser, surface *148 Congress, adjournment 97 Connecticut, health in 17 Converters, Bessemer 312
Ball. projected	Force, centrifugal 88 Forces, physical, trans'lion of 31 Fork, filling, for looms 194 Fountain, Herod's 86 Fountain, mercury 255 Frog. fishing 407 Fruit jar cover, new 148 Fruit picker, new 184 Fruit pulper, Brodling's 18 Furnace for boilers 290 Furnace grate 386	P Padlock, Richard's	Torricelli's principle	Belting experiments 105 Belting experiments 105 Belts, leather, slipping 341 Bert, Paul 321 Bird life in Central Park 352 Bird, shadow, and nest *167 Birds, a ball of *230 Birds, destruction of 230 Birds, destruction of 154 Bismuth, fluorescence 385 Blind, dreams of 312 Blake, Eli W 127 Blower, blacksmith's *166	Cork
Buckle, Scovil's 196 C Cable grlp, Miller's 376 Calle lily, triple 9 Camera, pinhole 52 Capillarity 297 Car coupling, Bire's 328 Car coupling, Branan's 34 Car coupling, Carruther's 34 Car coupling, Carruther's 34	Galvanometer, Deprez's 358	Pipe, discharge, for vaults. 66	U Umbrella support	Boat electric. 188 Boat electric. Volta 290 Boat torpedo new *88 Boats torpedo *887 Boats torpedo *887 Boats torpedo *887 Boats 1½ pound 130 Boiler cleaner, Millar's *227 Boilers, cold zone in 369 Boiler description *317 Boiler explosion *719 Boiler explosion *279 Boiler explosion *287 Boiler explosion *328 Boiler explosion *3	Coupling, car, Brennan's. *34 Coupling, car, Carruther's. *34 Coupling, car, Hoover's. *258 Coupling, car, Requa's. *339 Coupling, car, Springer's. *258 Coupling, clip, Tylee's. *67 Couplings, car, tests of. 36 Couplings, car, tests of. 36 Couplings, car, tests of. \$6 Couplings, car, tests of. \$74 Cover for barrels. *274 Cover for truit jars. *148 Cow, scarlet fever in. 53 Cracker, box cover . *99 Cracks in floors, filling. 149
Car coupling, Hower's 288 Car coupling, Locke's 402 Car coupling, Requa's 329 Car coupling, Requa's 329 Car torake, Morrow's 288 Car brake, Morrow's 288 Car lock, How 104 Car, railway, Estrade's 135 Car sead. 4 Car siarter, Gercke's 211 Car, tramway, electric 215 Cars, construction 274 Cart, dumning 164	Gate, drawnings, Gole's 194 Gauge, pressure, for leakages 165 Gauge, printing press 288 Gauge, water 371 Generator, steam 232 Gass perforated 292 Glass, straining by pressure 1 Glycerine barometer 438 Grain conveyor 555 Grain weighing machine 195 Grate, furnace 388	Press, cotton	Vessel, novel form of 386 Vulcanizer, Cawl's 115 W	Boiler sweeper, Levi's.	Cloth, waterproofing
Carillon, improved. 227 Carriage, child's 49 Carriage screen. 130 Centerboard for vessels. 275, 324 Chevreul, E. 177 Chicago. 120 Chimney cowl. 131 Chimpanzee Crowley. 263 Chladni plates. 151 Churn, Basswell's. 194 Churn, Wagner's 227 Clamp, fence, Kirby's. 377	Grip, cable, Miller's. 376 Guard for cars 148 Gun, blow, Guiana 121 Gun, English, new 279 Gun, Gatling 406 Gun, Jansen's 104 Gun, walking stick 153 Guns, fine 51 Guns, mammoth 197 Gymnotus 391 Gyroscopes 335	Quadrumana, the	Water gauge. 371 372 373 374 374 375 3	Brass, work, lubricant 5 Brass work, lubricant 151 Brewery, Guinness', sale 372 Brick making 9 343 Bricks, how to stain 17 Bridge, arch, steel 255 Bridge, double parabolic 278 Bridge, how, London 50 Bridge, Niagara 106 Bromidia 185 Brush, rotary 115 Bubbles, mercury, 404 Buckle, Scovil's 1996	Cuttlefish. 51 Cycling, hygiene of 341 Cycloid \$528 Cyclorama \$296 Cyclore, an ancient 200 Damaskeening. 261 Damming water. 406 Danger signal, Phillip's. \$72 Dangers, unnoticed. 184
Bubbles, mercury. 444 Buckle, Scovil's. 196 Calle grip, Miller's. 376 Calle lily, triple. 9 Camera, pinhole. 52 Capillarity. 277 Car coupling, Bire's. 323 Car coupling, Brennan's. 34 Car coupling, Brennan's. 34 Car coupling, Carruther's. 34 Car coupling, Locke's. 402 Car coupling, Locke's. 402 Car coupling, Springer's. 255 Car lock, flew. 104 Car, railway, Estrade's. 135 Car seat. 4 Car, railway, Estrade's. 135 Car seat. 4 Car, tamway, electric. 215 Cars, construction. 274 Cart, dumming. 164 Carillon, improved. 227 Carriage, child's. 40 Cardage screen. 275 Carlage, Carloid's. 40 Cardage screen. 275 Carloid, flew. 151 Chicago. 137 Chicago. 137 Chicago. 137 Chicago. 137 Chicago. 137 Chicago. 137 Churn, Madsen's. 32 Churn, Wagner's. 37 Clock, electric. 37 Clock, movement frame. 377 Clock, movement frame. 377 Clock, movement frame. 377 Clock, movement frame. 377 Clock, collectric. 377 Clock, movement frame. 378 Coupling, car, Hennan's. 388 Coupling, car, Hennan's. 383 Coupling, car, Hennan's. 384 Coupling, car, Hennan's. 385 Coupling, car, Hennan's. 385 Coupling, car, Hennan's. 385 Coupling, car, Hennan's. 385	H Hanger, eaves trough 210 Harbor, New York 22 Harrow, improved 402 Harrow, Owen's 402 Head rest, chair 131 Heater, steam 99 Hinge, gate, Cole's 194 Hippopotamus 313 Hook and buckle, new 404 Hook sans, Stahl's 82	Railway car lock 104 Railway collision, Pearful 231 Railway coss ties 240 Railway sigmal, Martin's 118 Railway sigmal, Martin's 258 Railway track 250 Railway track Noonan's 242 Reapers, cutter for 366 Refrigerator for fruits 115 Refrigerator, milk can 118 Register, botel 386 Register, time 388	Wheel, measuring. 66	Bullet post. 177 Business amiability 388 C Cabbage flies. 245 Cable grip. Miller's. 376 Cable roads, Chicago. 359 Cal zuli, new solvent of 153 Calla lilly, triple. 90 Callorimetry with oxygen, 81 Cameo cutting. 399	Deer hunting with steam 354 Depot, Erie B. B. *246 Derrick, improved *115 Desk, attachment, new *50 Developers, photo 2 Developer, sulph, acid 85 Diamond industry, Arrican *339 Diamnonds 360 Diarrhoca, remedy 106 Diffusion process 148 Diplograph, the *99
Cotton chopper, Puls'. 404 Cotton planter 274 Cotton press. 213 Coupling, car. 323, 402 Goupling, car. 675 Coupling, car. 675 Coupling, car. 675 Coupling, car. 675 Coupling, car. 775 Cover for fault ars 148	Hoop and disk experiment. 89	Regulator, feed water	Y Yacht Eureka, propulsion. 47 Yacht Galatea. 175 Yacht Mayflower. 182 Yucca, remarkable. 135 Z Zarabatana, the 139	Camera, paper. 144 Camera, pinhole. *52 Canal, Panama. 67 Canal, ship, Manchester. 99 Canals important. 1177 Canials, new Russian. 97 Canine reason. 233 Cannon ball, torpedo. 389 Capillarity. *297 Car brake, Morrow's. *323 Car coupling car coupling. *402 Car coupling. *402 Car coupling. *323 Car coupling. *402 Car coupling. *323	Disasters at sea 258 Disease, cattle, remarkable 384 Disease, grins in milk 96 Disease, sleeping 40 Disinfectant, new 147 Disinfecting apparatus *134 Diversity of opinion 34 Doctors, German 273 Door securer, Simon's *34 Doubler, Norremberg *1 Doubling small amounts 25 Drain tie protector *40 Drainage, main 276
Cracker box covers. 99 Crane, steam. 290 Cruiser, French, Tonnant. 291 Crystal, rock 103 Cultivator, Brigg's 98 Cup of Tantalus. 297 Currents of New York Harbor. 23 Cuttain fastener. 164 Cutting app. for mowers. 211, 306 Cycloid 328 Cyclorama. 287	Impact, harmonic	Sash balance, Lennon's 114	MISCELLANY. Figures preceded by a star (*) refer to illustrated articles. A	Car coupling, Brennan's. *34 Car coupling, Carruther's. *34 Car coupling, Hoover's. *258 Car coupling, Hoover's. *258 Car coupling, Requa's. *339 Car coupling, Springer's. *258 Car coupling, Walton's. *210 Car doors, seal for. *258 Car lock, new. *104 Car, railway, Estrade's. *135 Car seat, new. *4 Car starter, Gercke's. *211 Cars, construction. *274 Carbon electric pacistones. *339	Drainage scheme, Florida. 117 Draught equalizer. *338 Drawbridge gate. *990 Drawer check. *66, *118 Drawing apparatus. *162 Drawings reproduction of. 145 Dredger, double. *294 Drin. Hercules. *149 Drinkers' diseases. 66 Driving apparatus. *73 Drinking, scie nee of. 288 Drowned, resuscitation. *215 Draw & Sack Africa. 344
Dam, coffer 844	Key, watch, pendant	Sheep shearing table	Academy of Sciences	Carles. dental, in bakers. 307 Carillon, improved. *227 Carnegle, Andrew 58 Carriage, child's. *40 Carriage screen. *130 Carriages screen. *241 Cart, dumping. *164 Casting, centrifugal. 37 Castings, Ipdian, peculiarity of 7 Casts, plaster, how made. 388 Cataract, treament of 73 Cattle disease, remarkable. 384	Dust, dangers of. 99 Dyes, yellow, for cotton. 182 Dynamite cruiser. 336 Dynamite gun, pneumatic. 16 Dynamo colossal. 127 Dynamo Colossus at work. 305 Dynamo, 61, efficiency of. 7 Dyspepsia, prescription. 216 E Ear for palls. 258
Drain the protection	Liberty, Statue of. 100 Light, polarized. 28, 55, 70 Light, polarized, experiments. 1, 19, 38, 55, 70 Light, yellow, for dark room. 275 Lily, calla. triple. 4 Lock for trearms. 372 Lock, railway ca. 104 Lock, seal, Allen. 388 Lock, spring. 178 Locomotive attachment. 327	Sileigh Beswick's 307	Albany, bicentennial of 34 Alcohol, for and against 197 Alcohol from turpentine 155 Alcohol poppy 149 Ale, clarifying 149 Alloy, a useful 305 Alloy, lechesne 340 Alum, clarifying by 3 Aluminum tin 242 Amazon River, descent 380 American Association 40, 114, 154 American Association 40, 114, 154	Caves, almosphere of 201 Cedar oil 201 Cellar, frow to cool 33 Cement and lime 261 Cement in Ireland 231 Cement, magnesia in 37 Cement, new, from slag 371 Cement, Paris 357 Cement, Paris 357 Cement, slag 388 Centerboard for vessels 275, *324 Centrifugal top 382 Centerboard for vessels 332 Channelways of New York 112 Channelways of New York 114 Checking apparatus 194	Earthquake. Charleston, 181, 229, 308 Earthquake, effects of. *327 Earthquake, great. 176 Earthquake, great. 176 Earthquake, effects 181 Earthquake, effects 181 Earthquake, effects 181 Earthquake, savannah. 309 Earthquake, savannah. 309 Earthquake waves. 52 Earthquakes 277 Eel, electric. *391 Eclipse of sun. recent. 225 Egg beater, Vicker's. *274 Eggs diseased. 135
Ear for pails	Log jam, great. 161 Log ism, great. 161 Log ism, great. 161 Log ism, great. 162 Log ism, great. 162 Macadamsfins. 159 Machine, Jacquard. 238 Magnetic curves. 102 Manatel, sumptuous. 313 Marmosets. 41 Mat, door, steel wire. 7, 55 Medicine chest. 324	Steam engine, Datn's. 183	Anierran Institute Fair 170, 388 Angonia, large 248 Anguillaise, life of 394 Animais and plants 394 Animais, blue color of 234 Animais, blue color of 123 Animais, care of 122 Animais, eveless 234 Animais, fear in 274 Anthracite, discoverer of 372 Ants, to destroy 41 Apertures in ships 323 Aquatic arena, Paris 220 Aquatic arena, Paris 220 Architecture and mechanics 23 Armorelads, French and British, 341	Chevreul entenary 165	Cuttlefish of Howers 51 Cycloid. 931 Cycloid. 932 Cycloid. 932 Cyclorama. 236 Cyclorama. 236 Cyclorama. 236 Cyclorama. 236 Cyclorama. 236 Cyclorama. 236 Cyclorama. 230 D Damaskeening. 261 Damming water. 406 Danger signal, Phillip's. 952 Dangers, unnoticed. 184 Depot, Erie R. E. 246 Deer hunting with steama. 334 Depot, Erie R. E. 246 Deerriek, improved. 151 Desk, atkachment, new 56 Developers, photo 2 Developers, photo 3 Diamond industry. African 339 Diamonds remedy 366 Diletetic fallacies 399 Diffusion process 148 Diphograph, he 25 Disasters at 82. 258 Disases, garms in milk. 96 Disasters at 82. 258 Disases, garms in milk. 96 Disasters at 82. 258 Disases, garms in milk. 96 Disasters at 82. 273 Doubler, Norremberg. 147 Disinfecting apparatus. 147 Disinfecting apparatus. 147 Doubling small amounts. 25 Drain tile protector. 260 Drainage scheme, Florida. 117 Draught equalizer. 276 Drainage scheme, Florida. 117 Draught equalizer. 283 Drawbridge gate, 293 Drawer check. 468 Drawing apparatus. 469 Drinkers' diseases. 65 Driving apparatus. 473 Drinking, science of 288 Drawing spaparatus. 473 Drinking, science of 288 Drynamite gun, pneumatic. 16 Drynamo Colossal 477 Dyspepsia, prescription 276 E E E E E E E E E E E E E
		•• •		·	•
		© 1886 SCIENTIF	TIC AMERICAN, INC		

	1				23, 1000.
Glectric railway	Grasses, first appearance	Liquid emptier*4 Lithographers, hints for	Patents and gas industry 128 Patents, decision relating to 7, 56, 85, 122, 152, 216, 264, 289, 309, 257, 385	Sawdust for cleansing. 275 Saw swage, Ward's \$372	Tilden trust
Electric thermometer. *39 Electric tramway, Hamburg*215	Grindstones, scoring of	Lock for firearms 405 Lock, railway car *104	90, 83, 122, 152, 216, 204, 289, 309, 357, 385 Patents, points on	School, manual labor. *373 School, canual labor. *373 Science Assoc., American. *. 80, 114	Time, fast
Electric wires, Brooklyn. 384 Electric wire insulator *178	Guard for cars 148 Gum, kauri 129	Lock spring *178 Locomotive attachment *327	Pavements, slag 384 Pecan tree 202	Screw driver, Allard	Tinkers and their tricks
Electrical subways, New York 36 Electrical subways, New York 36	Gun, blow, Guiana*121 Gun, dynamite, pneumatic 16	Locomotive building	Pendulum noist	Seat, car, new *4 Sea, power of the 198 Seat, vehicle, Steele's *833	Toolgan, improved *248 Tool combination *211 Top, centrifugal *392
Electricity, experiment in 200 Electricity of the lightning flash 8 Electricity, positive and negative, 68 Electricity, positive by	Gun, Gatling 406 Gun, Jansen's 404	Locomotive, gas, successful 193 Locomotive headights 193	Petroleum as Iuei 339 Petroleum engine 328 Petroleum fountain, great 340	Sea, rise at Sabine Pass 277 Sea water as a preservative. 40 Seeing and thinking. 260	Top, chameleon
Electrotyping solution, new	Gun, monster 326 Gun, walking stick *153 Gun works, Maxim 225	Locomotive, small 250 Locomotives, soda 154 Log jam, great	Petroleum in Egypt	Severn Tunnel, ovening	Torch, magnesium
Elevator, fire engine*170 Elevator, take the	Gun, 13 ton, new	Looms stop motion*245 Lord, Jesse H	Petroleum pipe line	Sewage, hotel 262 Sewer gas, danger of 339 Sheep shearing table \$\frac{1}{2}\$	Torpedo boats in the gale48 Torpedo boats, new*387 Torpedo cannon ball309
Enfery wheel dust*83 Limulsion plates, rapidity	Gunpowder, unburned, explos*361 Gymnotus*391 Gyroscope, the*335	Lubricators 151 Lubricators 153	Photographers, convention of 36 Photographic notes 2, 17, *52, 73, 85, 106, 112, 129, 144, 170, 216.	Ship Benbow*271 Ship canal, Manchester99 Ship Fearless241	Torpedoes, motor for
Emulsions, gelatine 170 Endorsing, evils of 289 Engine gas 385	н	M	229, 241, 257, 385 Photographs, enameling	Ship Mayflower. 279 Ship model shaper. *195 Ship railway 184	Torricelli's principle*265 Tower, Fifel's proposed
Engine, Herd's*356 Engine, petroleum	Habits and work	Macadamsfins*159 Machine, Jacquard*328 Machinery banefits*328	Photography, color tone, 17 Photography, color tone, 17 Photography, color tone, 17	Ship transit across the isthmus . 64 Ships, forty knot	Tower, water, fall of
Engine, six-cylinder*86 Engine, steam, Louque's*338	Harbor improvements. 45 Harbor, New York *22	Machinery, what it does. 153 Magazine, Scribner's 406	Photography, phosphorescent. 241 Photometry	Ships, wentilation of	Track, railway 50 Trade-mark case 166. Trades in France 72
Engine, steam, Rush's	Harrow, Improved	Magnesium torch, a	Photo-printing on silk	Shipping convention	Train fast. 309 Tramway, electric, Hamburg. *215 Transmitter, telephone *404
Engines of ship Ozone*243 Engines, triple expansion	Headlights 153 Head rest, chair *131 Health in Connecticut 17	Magnetism, influence of	Photo-silver waste	Shoes, straw, Chinese	Travelers, hints for
Engineers, locomotive	Health, ministry of	Making and manufacturing	Phosphorescent materials 376 Pigeons, homing, collection of 165 Pile driver, new	Shutters, drop	Tree growth, remarkable
Equality 407 Equalizer, draught *338 Equalizer of fluids *311	Heart, mechanism of	Manatee .*407 Manger, cleansing . 275 Mantel, sumptious .*813	Pile driving by dynamite 50 Pile, discharge for vaults *66 Pines, feed water 313	Signal railroad, new	Tricycle, steam*390 Tubes, metal, machine for*374 Tunnel, new Berlin *310
Erysipelas, treatment	Heater, steam, new	Maps, railway, large 341 Marmosets	Pipe, steel 337 Pipe wrench, Fatkin *84 Piston area and heating surface 257	Silk, adulteration	Tunnel, Rocky Mountain
Eureka, yacht, propulsion *47 Evaporating pan *404 Exhibit woodmaking 159	Henrietta, steam launch. 16 Hiccough, cure for	Mat, door, steel wire	Piston valves, locomotive340 Pitching, baseball, art *229 Pitching, curve art of *123	Silo cutter, electric	Tunneling by freezing*259 Turtle, snapping*870 Turtles longevity of 311
Exhibition, Edinburgh	Hinge, gate, Cole's*194 Hinge, Wheeler's, *34 Hondley tohn C	Mechanic arts of Cornell 225 Mechanics and architecture 23 Medicine short	Pitching in baseball *71 Planter, a large 129 Planot Mare*	Skeg attachment for vessels 355 Skin, beautifying 224 Sky night *2 *81 *161 *900	Twine
Exhibition of three Americas 23 Exhibition telephone 374	Hoist, pendulum	Men, great, occupations 387 Mercury bubbles 404	Plant protector, new, *114 Plant tendrils 394	Slag, basic, as manure 231 Slag cement 308	Type writer, Hall
Exposition, Cincinnati. 132 Exposition, Minneapolis. *20	Hone, owning a 244	Message, President's 384 Metals, coloring of 353	Plants, comicalities in 41 Planting, spring 328	Slag pavements 384 Slaven, Moses A 257	U
hyes, enect of paper on 520	Hornbills *73 Horse collar *18	Metals, elects of heat 21 Metals, reducing 41 Metals, varnish for 385	Plaster casts, now made	Sleeping disease	Umbrella support*324 Umbrellas, care of
Fabric, woblen, cleaning 69	Horse, shying \$4 Horseshoe, Monsoe's *82 Hospital, cholera, model 276	Meteorite of May 10	Pneumatics, experiments. 214, 228, *247 Pneumonia, cause of 2	Snow, removal of 400 Soap to clean clothes 195	University, Corneil, progress
Fabrics, woolen, to clean	Hotel register *386 Hotel sewage 262 House bill 4,458 6	Meteor, struck by a 65 Mica cones and wheels *19 Microscope 100	Pneumonia, treatment	Soap, textile	v
Fastener for stoppers*180 Fear in shimals	Houses airing and lighting *292 Houses stone, construction 257 Hub wheel *338	Milk as an absorbent	Polariscope*70 Polariscope for crystals*55 Polariscope objects for*19	Social waste of cities	Vacuum, capillary
Feed water regulator *371 Fence clamp, Kirby's	Humming bird, the 209 Hydrogen, peroxide 176 Hydrophobia cure of 183	Milk, disease ge rms in	Pomade for the hair	Soda, nitrate	Valve, check, Glace's*178. Valve, slide, to set
Fence, railroad *306 Fence wire tightener *67	Hydrostatics*297	Mill, Barker's 4. *297 Mill, Quaker City. *166 Millingry simple 990	Posy, a sweet	Sound, experiments in*105, *119 Sound, telegraphing 32 Spark erresters wanted	Varnish for metals
Fever, scarlet, in cow. 53 Fever, scarlet, prevention. 388	I	Mine drainage 276 Mineral products of U.S. 289	Power, compressed air, scheme, 376 Power, sources of 380	Spectrum, solar, photography 53 Spider, mimicry, by 234	Ventilation of ships
File stand, Parson's. •	Inagination, can it kill? 40	Mineral specimens, Spanish	Power, transmission of 80 Preservative winted 309 President's message 384	Spirals, lathe to turn	Verbena oil, source
Films, thin, study of*38 Filter, rain water*104 Filtration of water354, 386	Impossible, the	Mink, the *200 Minneapolis Exposition *20 Mirror, shaving, new *34	Pressure, atmospheric	Spring lock	Vessels, centerboard for*275 Vessels, centerboard for*275 Vessels, naval*886
Financiering, ingenious 359 Firearms, lock for 405 Fire at chemical works 7	Indicator, water level*35 Indigo, African ·	Mocking bird food	Prints, bromide	Springs, tinned	Vinegar, sharpness of
Fire damp indicator	Indigo, African 196 Induction, telephonic 245 Industries, American 100 Insects and epidemics 394 Insect powder 245 Insect s wings, separation 104 Insulator for wires *118, *275 Invention, rewards of 118, *275 Inventions, agricultural 42, 59, 90, 138, 155, 136, 203, 218, 234, 266, 282, 298, 314, 331, 437, 382, 373, 394, 408	Monitor Peacemaker. *354 Monkeys, rare 176 Monument interesting 312	Prints, photo, stains in 17 Problem, great, the nation's 32 Professions in France 72	Springs, tinned. 32 St. Sophia 293 Stag beetle, tropical *217 Stains in photo prints. 17 Stamps, rubber, making. 58 Statues of Pamian *377 Statue of Liberty *400, 272, 288, 320 Steam bollers, cold zone in 389 Steam engine, Belt's *98 Steam engine, Belt's *98 Steam engine, Dann's *183	Volcanic ducts 909 Volcanic ejections 178 Volcanic eruptions *57 Vulcanizer, Cawl's *115
Fire extinguishing apparatus 85 Fire from steam pipes 82 Fires theater	Insect's wings, separation 104 Insulat or for wires*178, *275 Invention rewards of	Morrhuol 8 Mortar, hydraulic 55 Mortar sweetened 901			
Firearm lock *372 Fireproofing wood 311	Inventions, agricultural. 42, 59, 90, 138, 155, 136, 203, 218, 234, 266, 282, 293, 314, 331, 346, 362, 378, 395, 408	Mortar, the Fere 240 Moscow, burning of *69	Publication prior 372	Steam engine, Belt's	Wages, century's rise
Fish drying machine wanted. 7 Fishes, brainless	282, 298, 314, 331, 346, 382, 372, 395, 408 Inventions engineering 70, 26, 42, 59, 74, 90, 107, 138, 155, 171, 186,203, 218, 235, 266, 282, 293, 314,	Mosses, club, development	Pulper, fruit *18 Pump, air, carperiments *199	Steam engine, Mennig's *25 Steam engine, Rush's *25	Wakley, Jas. G. 279 Wall, party, law as to 297
Fishes, swim-bladder of 394 Flax, retting process for 258	186,203, 218, 233, 235, 282, 298, 314, 331, 346, 362, 378, 395, 403 Inventions, mechanics 235, 266,	Motor, Dait	Pump, force, new	Steam for balloons	War ship design. prize 226 War ships, protection 212
Fireproofing wood 311 Fireworks 499 Fish drying machine wanted 7 Fishes, brighless 394 Fishes, brighless 393 Fishes, Majavan 323 Fishes, symb-bladder of 324 Filaz, retting process for 258 Files, propagation of 256 Floods in India 259 Flour chest 397 Flour, decline in 31 Flower post, novel 340 Flowers 345 Flowers, preservation 214 Fluid, preservative 354	298, 314, 362, 378, 408 Inventions, miscellaneous. 10,26, 42, 59, 74, 90, 107, 138, 155, 171,	Motors, gas	Prints, blue, changing	Steam pyroscope	War steamer, Spanish*359 Wardrobe attachment*196 Washbeerde*297
Flour, decline in	42, 59, 74, 90, 107, 133, 155, 171, 136, 203, 218, 235, 282, 298, 314, 231, 346, 362, 378, 395, 408 Inventions, unpatented	Mummy of Rameses*169 Museum, Kensington*343 Mushrooms on shelves*275	Pyrofuxin 375	Steam tricycle 390 Steamer Etruria 214 Steamer, ocean, hold of 272	Washing machine *274 Watch pendant key *386
Flowers, preservation	Inventions, some ancient*360 Inventor, rule in favor of	Music holder, Smith's *4 Muspratt. James	Quadrumana, the*263	Steamers at low cost	Watches, de magnetizing
Fluorescence of bismuth, 385 Fly catcher*324 Food, preservation of 201	Inventors, boy	Mowers, cutting app. for *211	Quadrupeds, skinning. 151 Quarrying, Greek. 58 Quilting frame, Wright's *67 Quinine, artificial 210	Steamers, propulsion of	Water, damming
Foods liable to adulteration. 208 Foolhardiness 248 Foot warmers, electric 195	Iron and steel production 96 Iron, cast, disintegration *105 Iron clad Benbow *271	Natural history notes 234, 250, 394	Quinine, artificial	Steel forging, a great	Water gauge
Force, centrifugal*89 Forces, physical, transforma, of. *31 Forehead, noble, fallacy	Ironelads, fast	Naturalists, German	R • Rabies, treatment of 136, 168	Steel, tempering	Water, heating rapidly*279. 369 Water in steam pipes
Forges, portable*132 Forging, steel, great	Iron, protection of	Naval maneuvers, French*150 Navies of Britain and France 341 Navigation aerial 53, 201	Race of steam yachts	Step, length of	Water mains, leaks in
Fork, filling, for looms #194 Foundations 89 Foundation Hero's \$360	Ivy poisoning 273	Navy, the new 305	Rafters, measure for. *242 Rails, cast glass 259 Railroad fence *306	Stone, a sacrificial	Water pipes, arrangement 257 Water, polluted, dangers 238
Fountain petroleum, great340 Fruit jar cover, new*148 Fuel petroleum as *300	J	Negative, a great	Railroad signal, new	Stop for engine*5 Stop motion, loom*244 Stopper fastener*180	Water power in cities
Frog, fishing	Jack, human, not evolved	Negatives, paper 216 Negatives, retouching 241	Railroads in Mexico	Stoppers for varnish bottle 106 Stove order act invalid 272 Stove order act invalid 276	Water tests, simple
Flour, decline in	opic goods muustry 281	New Orleans. *212 New York Harbor . *22	Railway brakes. 56 Railway car doors. *148	Straw shoes, Chinese	Water works, Paris*163 Water works, system of*276 Water proofing c oth247
Furnace for boilers	Keep on the alert	Nichols, Ripley	Railway car lock*104 Railway collision, fearful*231	Sugar as anti-incrustator	Wedge paradox 57 Welding by electricity 208 Well, artesian, bot water 52
rurnaces, mast, U.S	Kitauea again active. 133 Kite, gigantic. *810	North, the new	Railway improvement needed 357 Railway electric 339 Railway man alarma	Sugar making	Well, artesian, remarkable 168 Well, hot, artesian 115 Wells, artesian. Denver 147
Galatea and Mayflower*181	Krakatoa 87	. 0	Railway motor. Daft. 192 Railway mountain. 169	Sun, eclipse, recent	Wages, century's rise
Game carrier, Steven's*358 Game carrier, Steven's*243 Gapes in fowls	L	Obelisk, decay of the	Railway signal, martin s	Swage, say, Ward's	Whale, right
Garment hanger. * *194 Garment hanger. *	Labels, paste for	Oil can attachment	Railway track. *50 Railway track, Nooman's *242	Switch stand, new	Wheel hub, new
Gas	Lakes, drying up of	Oil, government payments	Reapers. cutter for	sword, electric	Wheat exports of 66 Whiffletree improved 550 Wilmorth Sath
Gas engines	Lamps, electric for miners 250 Lamps, management of 390 Lamps, petroleum 53	Oil on the water	Refrigerator, milk can *118 Register, hotel *386 Register, time 388	Table, sheep shearing*371	Wind pressure
Gas industry, and patents 128 Gas industry, the 2 Gas lighting by incondescence 237	Lathe toturn spirals*376 Launch, steam, fastest	Ointment, neuralgia, 341 Oleomargarine 118 Ouistes avoid 894	Regulator, feed water*371 Reservoirs, repairing*944 Residua, recovering	Tadpoles, polarity of	Window blind*114 Window sash opener*114 Wire painting machine*50
Gas locomotive, successful 193 Gas meter, great 351	Lawsuits avoid 280 Lead, tea chest 182	Opium Minnesota 181 Optical illusion 183	Respiration, artificial	Tanning in China	Wires, electric, Brooklyn
Gas, natural, and coal	Leaks in water mains 276 Leather belts, slipping 341	Qre separator. *306 Ordnance, coast defense. 96	River improvements. 154 Riveting tool *242 Rock horoza	Target, revolving *307 Tarsiers, Malayan *295 Taxidermal art *120	Woman, engineer
Gas, natural, Michigan	Leaves, cotyledinary	Organ electric '83 Osteome, electro	Rock crystal *103 Rootlets, growth of 394	Tea drinker's disease	Wood working machine
Gas stove, Bisbee's	Lecnesne alloy	Oxygen, solidified	Rubber milk. 234 Rubber, old, to dissolve. 185	Telegraph circuit, ocean	Wood, jarrah 293 Work and habits 336 Work out of 180
Gas, weighing a	Leidenfrost's drops	P ·	Rudders, supplementary	Telephone, Cushman 208 Telephone exhibition 374	Wrench, Dean's
Gate drawbridge *290 Gate hinge. Cole's *194 Gauge, printing press *298	Life boats, motor for	Padlock Richard's*210 Pail ear, Wing's*258 Painting machine. wire*50	Rum, Bay, recipe for 58	Telephone of 1664	Wrench, Wood's
Gauge, water	Life, our, length of	Palms, cocoa, and lightning	Saccharine	Telephone patent, Bell 304, 320 Telephone transmitter*404 Telephonic induction 245	**118
Girders, cast iron 169 Girders, weights and strengths. 17	Light, electric, value of	Paper, bromide 58 Paper, sensitizing 118 Paper, transparent	Saccharine, inventor of	Telephoning, long distance 69, 208 Telescope, Lick 35 Tempering steel 369	Y Yacht, Eureka, propulsion*47
Glass, perforated	Light, polarized	Paradox, wedge	Safety fastening for pins*355 Salt mines of Nevada	Terrawerra Lake	Yacht, Galatea
Glycerine barometér \$23 Gold is king 201	Light, velocity of	Paste for labeling	Sandpapering machine*355 Sanitary precautions,	Theater fires. 52 Theosophy explained. 181 Thermo-electric materials. 278	Years, one hundred
Grafting, heterogeneous 41 Grain conveyor \$35	Lightning stroke, a	Patent office 384 Patent office cecipts 25	Sash fastener, Davis'	Thermometer, alarm*39 Thunder storms	z .
Force, centrifugal. **89 Forces, physical. transforma of *31 Forehead, hoble, fallacy. **247 Forges, portable **132 Forging, steel, great. **83 Forgings, gun, called for **193 Fork, filling, for looms. **194 Formation. **194 Foundations. **89 Fountain, Hero's. **930 Fountain, Hero's. **930 Fountain, petroleum, great. **340 Fruit jar cover, new **148 Fuel, petroleum as. **330 Frog, fishing **407 Fruit joker, new **194 Fruit pulper, Bradley's. **18 Freel, oil, not economical **67 Fruit oleker, new **194 Fruit pulper, Bradley's. **18 Freel, oil, not economical **67 Fruit oleker, new **24 Fruit pulper, Bradley's. **18 Freel, oil, not economical **67 Fruit oleker, new **234 Fruit pulper, Bradley's. **18 Freel, oil, not economical **67 Frunces, colories. **290 Frunace, electric, Cowle's. **14 Furnace, plast, U.S. **392 G G Galatea and Mayflower **181 Galvanometer, Deprez's **233 Game carrier, Steven's **243 Gapes in fowls. **306 Garden tool, Rankin's **194 Garment hanger **196 Garment hanger **196 Garment, protective **118 Gas. **344 Gas belt, natural **113 Gas, distribution of **357 Gas engines **358 Gas holders, Birmingham **146 Gas industry, and patents **128 Gas industry, and patents **128 Gas industry, and patents **128 Gas industry, the **2 Gas ighting by incandescence **377 Gas engines **366 Gas, matural, suitchism **17 Gas, natural, suitchism **17 Gas, natural, suitchism **17 Gas, natural, oloid **33, 51 Gas, weter, new method **266 Gas, weighing a **370 Gasight Association **272 Gases, diffusion of **72 Gases, water new method **266 Gas, weights and strengths **730 Griders, weights and strengths **730 Griders, weights and strengths **730 Griders, weights and strengths **730	Liniment, earache97	Patent rights libel as to 394	Saw, drag, Griswold's*210	Ties, metallic	Zarabatana, the*121

Joshua Rose's Great Treatise on Steam Engines.

Modern Steam Engines.

An elementary treatise upon the Steam Engine, written in plain language, for use in the workshop as well as in the drawing office: giving full explanations of the construction ot modern Steam Engines, including diagrams showing their actual operation: together with complete, but simple, explanations of the operations of various kinds of valves, valve motions, link motions, etc., thereby enabling the ordinary engineer to clearly understand the principles involved in their construction and use, and to plot out their movements upon the drawing board. By Joshua Rose, M.E. Illustrated by 422 engravinus. In one volume, quarto, 320 pages. Price \$6.00, free of postage to any address in the world.

BY THE SAME AUTHOR.

Mechanical Drawing Self-Taught. Comprising Instructions in the Selection and Preparation of Drawing Instructions in the Selection and Preparation of Drawing Instructions in the Selection and Preparation in Practical Mechanical Drawing: together with Examples in Simple Geometry and Elementary Mechanism. Including Screw Threads, Gear Wheels, Mechanical Motions, Engines and Boilers. By Joshua Rose, M.E. Illustrated by 330 engravings. 8vo, cloth, \$4.00

The Complete Practical Machinist: Embracing Lathe Work, Vise-Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, Tool Grinding, Marking out Work, etc. By Joshua Rose. M.E. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. 12mo, 439 pages, \$2.50

The Slide Vaive Practically Explained. Embracing Simple and Complete Practical Demonstrations of the Operation of each element in a Slide Valve Movement. By Joshua Rose, M.E. Illustrated by 35 engravings. 12mo, cloth, \$1.00

engravings. 12mo, cloth, \$1.00
The above or any of our Books sent by mail, free of
Postage, at the publication prices, to any address in the

rostale, at the pantaction prices, to this duties it the world.

B Our Catalogue of Practical and Scientific Books of pages, 800, and our Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and other Catalogues. he whole covering every branch of Science applied to the Arts, sent free and free of Postage to any one in any part of the world who will furnish his address.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS 810 Walnut Street, Philadelphia, Pa.,

Techno-Chemical Receipt Book:

The Techno-Chemical Receipt Book.

Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and Industries. Edited chiefy from the German of Drs. Winckler, Elsner, Heintze, Mierzinski, Jacobsen, Koller, and Heinzerling, with additions by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Frussia, and William H. Wahl, Ph. D. (Heid.) Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated by 78 engravings, in one volume, over 500 pages, 12mo, closely printed, containing an immense amount and a great variety of matter. Elecantly bound in scartet cloth, gilt. Price \$2, free of postage to any address in the world.

the world. **

LF A circular of 32 pages, showing the full Table of Contents of this important Book, sent by mail, free of postage to any one in any part of the World who will furnish his

HENRY CAREY BAIRD & CO., Industrial Publishers, Booksellers, and Importers, S10 Walnut St., Philadelphia, Pa., U. S. A.

ELECTRICAL Edward P. Thompson, Solicitor of Electrical Patents, 3 Beekman Street. Write for testimonials and instructions.

FOREIGN PATENTS Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inven-

CANADA.-The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Mani

toba.

The number of our patentees who avail themselves of the chear and easy method now offered for obtaining patents in Canada is very large, and is steadily increas-

ENGLAND.—The new English law, which went into force on Jan. 1st. 1885, enables parties to secure patents in Great Britain on very moderate terms. A British pa-tent includes England, cotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a pa-tent in Great Britain, where his rights are as well proected as in the United States.

OTHER COUNTRIES .- Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India Australia, and the other British Colonies.

An experience of FORTY years has enabled the

ublishers of THE SCIENTIFIC AMERIC competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and proper ly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for eack and othe information useful to persons contemplating the procuring of patents abroad, may be had on application to

MUNN & CO., Editors and Proprietors of THE SCI ENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly

Address,

MUNN & CO.

Publishers and Patent Solicitors, 361 Broadway, New York. Branch Offices: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

Instantrellef. Final cure and never a ratife, purge, salve or suppository. Liver, kidner and all bowel troubles—especially constipation—cured like magic. Sufferers will learn of a simple remedy free, by addressing. J. H. REEVES, 78 Nassau St., N. Y.



Emery Wheel

SOLID VULCANITE EMERY WHEEL WHEELS

All other kinds Imitations and Interior. Our name is stamped in full upon all our standard BELTING, PACKING, HOSE, and WHEELS: Address for new circular,

NEW YORK BELTING & PACKING CO.,

Warehouse: 15 Park Row, opp. Astor House, New York. Branches: 308 Chestnut St., Phila., 167 Lake St., Chicago, 52 Summer St., Boston. JOHN H. CHEEVER, Treas. J. D. CHEEVER, Dep'y Treas.





ARTESIAN

Pierce Well Excavator Co. New York.

AMERICAN O Specimens. Polished WOODS.

CARY & MOEN STEEL WIRE OF DESCRIPTION & STEEL SPRINGS. NEWYORK CITY

\$\frac{10.00}{10.00}\$ to \$\frac{50.00}{10.00}\$ per night. A light and property of the property of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. L. MANASSE, SS Madison Street, Chicago, Ill.

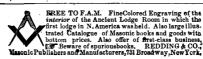
Two-Horse Power Engine. \$150. WITH STEEL BOILER



WITH STEEL BOILER.
Cheap, Reliable, Safe.
Automatic Boiler Feed,
Automatic Pop Safety Valve
Steel Boiler, Cost of running
guaranteed not to exceed
one and one-half cents per
horse power per hour. Less
than half that of any kerosene engine of equal efficiency. Nothing equal to it
ever before offered for the
price. Send for free discriptive circular.
CHAS. P. WILLARD & CO.
284 Michigan Street, Chicago, Ill.

MAIR BRUSH. men's tool. Frankin Institute Silver Mede' 1885. Economizes time. Use in bloke and white, and water colors. Source of elegant and remunerative employment in the arts. Alt BRUSH MFG. CO.





INVENTIONS (good) thoroughly worked in Eu-chant (now in N.Y.). Branches in Manchester, Liver-pool, etc. Address "Z," P. O. Box 773, New York.

TRANSMISSION OF STEAM.—A LEC-TRANSMISSION OF STEAM.—A LECture by Chas. E. Emery, delivered in the Sibley College course.—The properties of steam which make it well adapted for a transmission to a distance. The methods adopted to maintain pressure and provide for condensation. The nature of the mechanical devices necessarin a successful street system of steam pipes, with methods of insulation, of supporting and securing the pipes, of overcoming street obstructions, and of making service connections, methods of measurement; and a statement of precautions necessary in operating long steam pipes, of the cause and prevention of water rams, of the nature of the repairs required, with general remarks upon the whole subject. Contained in Scientific American Supplications, and of measurements and a transmission of the nature of the repairs required, with general remarks upon the whole subject. Contained in Scientific Omerican Scientific American Supplications, No. 543. Price 10 cents.

WANTED TO PURCHASE-A Grain Dryer. Manufacturers will please enclose circulars to W., Box 2045, New Orleans, La.

GRATEFUL-COMFORTING.

COCOA

GUARANTEED TO CONSUME 25 to 78-OTHER GAS ENGINE POT BRAKE-HORSEPOWER PHILADELPHIA and CHICAGO.

ICE & REFRIGERATING Machines. Work MFG.



Mineral Lands Prospected. rtesian Wells Bored. Superior Stationary En-ines, specially adapted to Electric Light purposes. Full by PA. DIAMOND DRILL CO., Birdsboro, Pa.

CPECIAL MACHINER**y** For Grinding and Polishing Manufactured by The Somersworth Machine Co.,

E. R. WARE, Agt., 154 Lake Street. CHICAGO

Write for Circulars. .

BIG OFFER. To introduce them, we self-Operating Washing Machines. If you want one send us your name, P. O. and express office at once. The National Co., 23 Dey St., N.Y.

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H.A. Herfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 1. The same number also contains the rules and regulations for the formation of ice-boat clubs, the salling and management of ice-boats. Price 10 cents.



VALUABLE BOOKS.

Machinist, the Complete Practical.—By Joshua Rose. Embracing lathe work, vise-work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo, 439 pages, \$2.50

In one volume, 12mo, 439 pages, \$2.50
Engineer's Handy Book,—By Stephen Roper. The most comprehensive and best illustrated book ever published in this country on the steam engine; stationary, locomotive and marine, and the steam engine indicator. It contains nearly 300 main subjects; 1,316 paragraphs, 876 questions and answers, 52 suggestions and instructions, 105 rules, formulæ, and examples, 149 tables, 136 illustrations, 31 indicator diagrams, and 167 technical terms; over 5,000 different subjects, with the questions most likely to be asked when under examination, before being commissioned as an engineer in the U. S. Navy or Revenue Service, or licensed as an Engineer in the Mercantile Marine Service; \$5.50

Engineer in the Mercantile Marine Service; \$3.50 Engineer's Pocket-Book.—By Charles H. Haswell, civil, marine, and mechanical engineer. Giving tables, rules, and formulas pertaining to mechanics, mathematics, and physics, architecture, masonry, steam vessels, mills, limes, mortars, cements, etc. New matter, as marsonry, canals, dams, building materials, floor beams, optics, logarithms, etc., with 226 additional pages, making 922 pages. Forty-mith edition, pocket-book form, leather,

Locometive.—Cathechism of the locomotive, by W. N. Forney, mechanical engineer, with tables, 19 plates, and 227 wood engravings, crown 8vo, cleth, \$2,50 Steam Engineer's Guide in the destro, construction, and management of American stationary, portable and steam fire engines, steam pumps, boilers, injectors, governors, indicators, pistons, and rings, safety valves, and steam gauges. For the use of engineers, firemen and steam users. By Emory Edwards. Illustrated by 119 engravings. 420 pages, 12mo, \$2.50

Steam Engine.—A catechism of the steam engine in its various applications in the arts, to which is now added a chapter on Air and Gas Engines, and another devoted to useful rules, tables and memoranda. By John Bourne, C.E. New edition, much enlarged, and mostly rewrittan. Illustrated by 212 woodouts, for the most part new at this edition, 12mo, cloth, \$2.00 The above books sent by mail, postpaid, on receipt of the price.

Send for our complete Catalogue of books, free to ny address. MUNN & CO., Publishers of "Scientific American."

361 Broadway, New York.

ICE-HOUSE AND REFRIGERATOR.
Directions and Dimensions for construction, with one contained in SCIENTIFIC AMERICAN SUPPLEMENT, Sent Free of charge to any address.

MUNN & CO., 361 Broadway, N.Y.

ICE-HOUSE AND REFRIGERATOR.
Directions and Dimensions for construction, with one season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36° and the year at a temperature of from 34° to 36° at a temperature of 56° at a temperature of 56

HYDRAULIC FLANGED HEADS,

OF IRON OR STEEL, FOR BOILER AND TANK MAKERS.

Unequaled for Strength and Uniformity, THE DICKSON MANUFACTURING CO.

96 Lake Street, Chicago.

SCRANTON, PA. . 57 Oliver Street, Boston. 112 Liberty Street, New York.

BALL UNIPOLAR System of Electric Lighting is neapest and best for Arc or Incandescent. For information, guarantees, and estimates, address

NOVELTY ELECTRIC CO.,

5th & Locust Sts., Philadelphia.

TO THE STEEL MANUFACTURERS
OF THE
UNITED STATES OF AMERICA.
UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

Department in the way of armor-plates and heavy gun forrings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engageto produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bid sare hereby invited for supplying this Department with the under-mentioned material:

About 1,800cns of steel gun-forgings, of which about \$28\$ tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch.

8 " 5 "

10 " 9 "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 8 inch guns, within two years, and the remainder within 8 months.

For 8 inch guns, within two years, and the remainder within 8 months.

For 8 inch guns, within two years, and the remainder within 18 months.

For 8 inch guns, within two years, and the remainder within 8 months.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each evessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20

paterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows: 8 feet by 12 inches thick.

12 feet by 45 feet by 17 inches thick.

13 feet by 45 feet by 17 inches thick.

14 feet by 45 feet by 16 inches thick.

15 feet by 45 feet by 17 inches thick.

16 feet by 45 feet by 17 inches thick.

17 feet by 45 feet by 18 inches thick.

18 feet by 45 feet by 18 inches thick.

19 feet by 18 feet by 18 inches thick.

19 feet by 18 feet by

covering both will be compared in two classes.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.
And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY.

Secretary of the Navy.

NOTICE.

WILLIAM

Secretary of the Navy.

NOTICE

NAVY DEPARTMENT.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun forgings and armor plates, viz. December 10, 1886, is extended to 12 o'clock noon, March 18, 1887, at which hour the opening of the bids will take place.

WILLIAM C. WHITNEY,

Secretary of the Navy.



Barnes' Foot-Power Machinery. Barnes' Foet-Fower Machinery,
Complete outfits for Actual Worksnop
Business. Read what a customer says:
"Considering its capacity and the accurateness of your No. 4 Lathe. I do
not see how it can be produced at such
low cost. The velocified foot-power
is simply elegant. I can turn steadily
for a whole day and at night feel as
little tired as if I had been walking
around." Descriptive Catalogue and
Price List Free. W. F. & John Barnes
Co. Address 1999 Main St., Rockford, Ill.





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



CURE FREDEAF

DEAFNESS its causes, and a new and successful CURE at your own twenty-eight years. Treated by most of the noted specialists without benefit. Cured himself in three months, and since then hundreds of others. Full particulars sent on application.

T. S. PAGE, No. 41 West 31st St., New York City.

CONSUMPTION CURED AND LUNG AFFECTIONS

Dr. W. F. G. Noetling & Co., Box East Hampton, Conn.



Advertisements.

Inside Page, each insertion - - - 75 cents a line Back Page, each insertion - - - 31.00 a line. The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

FOR SALE.

ate, County, and Territorial Rights in The Family nergency Medicine Chest; or will be given to reliable ms on Royalty. Canada for sale in a lump. See cut description in SCIENTIFIC AMERICAN, Nov. 20, 1886. Idress Dr. T. J. HUTTON,

College of Physicians and Surgeons,

CHICAGO, ILL.

AN OUTLINE HISTORY OF THE LOCO motive Engine in England.—A valuable and interesting paper by Theo. West, giving a chr. nological account the various inventors who have worked at the problem of steam traction upon railways, and a brief description of the motors devised by them. Contained in Scientific American Suppliement, No. 541. Price 10 cents. To be had at this office and from all newsdealers.



PATENT JACKET KETTLES.

Pain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists. HAND, BURR & CO., 614 and 616 Market St., Philadelphia. Pa.

COLD AS A CAUSE OF DEAFNESS.—A short but comprehensive paper by Dr. Theodore Griffin, answering the two important questions: How can the injurious effects of cold upon the ears be prevented? and secondly, How can they be cured after they have been developed? Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 265. Price 10 cents. To be had at this office and from all newsdealers.

Established 1837.

Machine Knives, L. & I. J. WHITE, BUFFALO, N. Y.

Planing, Moulding, Shingle and Stave, Hood and Veneer. Plated Stock and Blanks for Moulding Cutters. Cutters to Pattern. Moulding Cutters ca number from Universal Moulding Book.

PHOSPHATE MINES OF CANADA. By Beau Mont.—An interesting paper describing the various mines of apatite or "phosphate districts. How phosphate has been formed. The various mines and their products. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 537. Price 10 cents. To be had at this office and from all newsdealers.

Transmission of Power.
Suspension Bridges,
Tranways,
and other applications of

Iron Ce. Trenton WORK'S and OFFICE, TRENTON, N. J. New York Office—Cooper, Hewitt & Co., 17 Burling Sign Philadelphia Office—21 North Fourth Street. Chi-ago Office—146 Lake Street.

ASBESTOS Feit Works, 101 Maiden Lane, N. Y. Asbestos, and Hair Felt Boifer and Felt Boifer and Felt Boifer and Felt Boifer and all kinds manufactured and applied. Estimates given.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.



Mention this paper.

INTERNATIONAL INSTITUTE FOR Liquefied Carbonic Gas.

HOW TO GRAFT.—A VALUABLE PAper, giving complete directions for making various kinds of grafts in fruit trees.—Cleft grafting, slip grafting, bear's mouth grafting, wired grafting, side grafting, whip grafting, soudle grafting, tongue grafting, split grafting, sown grafting, Grafting, wax. Waxed cloth. With 11 figures. Contained in SCIENTETC AMERICAN SUPPLEMENT NO. 540. Price 10 cents. To be had at this office and from all newsdealers.

Providence. R. I. (Park &t.) Sixminutes walk West from station.
Original and Only Builder of the
HARRIS-OQRLISS ENGINE With Harris' Patt Improvements, from 10 to 1,000 H. Send for copy Engineer's and Steam User Manual. By J.W. Hill, M.E. Price \$1.25.

THE COPYING PAD.—HOW TO MAKE THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

PATENTS

MESSRS. MUNN & CO., in connection with the publication of the Scientific American, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had farty one years' experience, and now have unequaled faculties for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn. & Co. assattend to the preparation of Caves, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Intringements of Patents. All business intrusted to them is done with special care and promptness, on very

We also send, free of charge, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,

261 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

H.*W. JOHNS' ASBESTOS

CORDED SHEAT HING.

A Fire-Proof Non-Conducting Covering for HEATER AND STEAM PIPES

IN CELLARS, ETC.

H. W. JOHNS' ASBESTOS

STOVE & FURNACE CEMENT.

A fire and acid proof material for comenting and repairing joints in Heaters, Furnaces, Stoves, Ranges, etc.

PREPARED READY FOR USE.

H. W. JOHNS MANUFACTURING COMPANY, * 87 MAIDEN LANE, NEW YORK.

• SOLE MANUFACTURERS OF

.H. W. Johns asbestos liquid paints, asbestos boofing, eteam pipe and boiler COVERINGS, STEAM PACKING FIRE & WATER PROOF SHEATHING. PLASTIC STOVE-LINING, ETC.

FAMPHLET ON "STEAM SAVING AND FIRE-PROOF, MATERIALS." FREE BY MAIL.



CLARK'S NOISELESS RUBBER WHEELS

No more Splintered Floors.

Pifferent Styles. Catalogue Free.

GEO. P. CLARK,

Box L. Wildsor Locks, Ct.

STAVE MACHINERY. Over 50 varieties manu factured by Tryss Hoop Driving. E. & B. Holmes, BUFFALO, N. Y.

BARREL, KEG,

Hogshead,

SOLID EMERY WHEELS.—BY T. D PART. D. LHIERY WHEELS.—BY T. D. Paret.—Early forms of emery wheels and their defects. Vulcanite wheels. The tanite wheels. Testing of tanite wheels at Stroudsburg. Best working speeds for emery wheels. Bursting of emery wheels. Tests for emery wheels. Comparative merits of American and English entery wheels. With 2 engravings. Contained in SCIENTIFIC AMELICAN SUPPLEMENT, No. 538. Price 10 cents. To be had at this office and from all newsdealers.

Telegraph and Electrical SUPPLIES

Models Batteries, Inventors' Models, Exerting Send for the press castings. Send for

mental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O. It is important to us that you mention this paper. TUNNEL FOR FOOT PASSENGERS IN

Stockholm.—Description of a difficult piece of tunneling, in which the freezing method was applied with success. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 542. Price 10 cents. To be had at this office and from all newsdealers.



VELOCITY OF ICE BOATS. A COLLEC-tion of interesting fetters to the editor of the SCIENTIFIC AMERICAN on the question of the srieed of ice boats, de-monstrating how and why it is that these craft sall faster than the wind which propels them. Illustrated with 10 explanato addagrams. Contained in SCIENTIFIC AMERICAN, SUPPLEMENT, NO. 214. Price 10 cents. To be had at this office and from all newsdealers.



FUNGI INDUCING DECAY IN TIMBER. By P. H. Dudley.—The dry rot of timber and thecause of it. List of fungi that aid in the decomposition of wood. Destruction of ties and bridge timbers. We trot. Fungi special to each kad of tree. Contained in SCIENTIFIO AMERICAN SUPPLEMENT, NO. 528. Price 16 cents. To be had at this office and from all newsdealers.

· VOLNEY W. MASON & CO. FRICTION PULLEYS CLUTCHES and ELEVATORS PROVIDENCE, R.J.

POLARIZED LIGHT. BY GEO. M. Hopkins.—An interesting paper upon one of the most difficult, least generally understood, and most theory, beset branches of the study of light. Illustrated with figures. Contained in SCIENTIFIC AMERICAN SUPPLIMENT, NO. 53E. Price IO cents. To be had at this office and from all newsdealers.



CLOUDS, THEIR FORMS AND Heights.—An interesting account of an important series of measurements and observations upon the heights and measurements of clouds made at Upsal by Ekholm and Hagsiran.—The forms of clouds. Apparatus for measuring the heights of clouds. Results of measurements. With 5 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT NO. 537. Price 10 cents. To be had at this office and from all newsdealers.



and is therefore far more economiand is therefore far more econdaria, costing less than one cent a cup. It is delicious, nourishing, strengthening, easily digested, and admirably adapted for invalida as well as for persons in health. Sold by Grocers everywhere.

W. BAKER & CO., Dorchester, Mass.

JAPANESE HOUSE BUILDING.—BY Prof. E. S. Morse. An interesting description of the Japanese method of building; the mode of constructing the foundations, of framing the sides, ends, and roof, of bracing the timbers, and of putting on the tilles. With 12 illustrations. Contained in Scientific American Supplement, No. 543. Price il cents. To be had at this office and from all newsdealers.

Use the JENKINS STANDARD PACKING in the worst joint you have, and if, after following dissections, it is not what we claim, WE WILL REFUND THE MONEY.

Or "Tride Mark" is stamped on every sheet. None genuine unless so stamped. To Send for Price List.

JENKINS SROS 71 John Street, N. Y. 79 Kilby Street, Boston. 13 Se. Fourth Street, Phila.



THE INVENTION OF MACHINES.

A paper by Prof. Hale Shaw, pointing out what is necessary for the foundation of a science of the invention machines, and showing what steps have already betaken in this direction. Contained in SCINTIF AMERICAN SUPPLEMENT, NO. 542. Price 10 cent to be had at this office and from all was general.



introduced. Made by SCHIEREN & CO. rrv St., New York; 416

ARGENTIC-BROMIDE EMULSIONS.—
A paper by H. London on an apparatus for preparing argentic bromide emulsions, and for coating and drying plates. With 15 engravings, illustrative of apparatus and manipulations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 341. Price 10 cents. To be and at this office and from all newsdealers.

POINTERS for Users of Care.

ARGENTIC-BROMIDE EMULSIONS.—
A paper by H. London on an apparatus for preparing argentic bromide emulsions, and for coating and drying plates. With 15 engravings, illustrative of apparatus and manipulations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 341. Price 10 cents. To be add at this office and from all newsdealers.

POINTERS for Users of Care.

PHONOGRAPH

Works for a care.

Pointers for Users of Steam Pumps, Van Duzen's Patent Steam Pump
Hot or Cold.
Can Pump (Sandy or Impure Emiliary)
Water or Liquids (Smicient. Has no moving parts, consequently no wear, no repairs no trouble. Purchasers assume no risks as we guarantee every Pump. Above comparison with Jet Pumps, Ejectors, etc., made of Iron. Demand this Pump of your dealer and take no heap substitute. We make Ten Sizes, Prices from \$7 to \$75. Capacities from 100 to 20,000 gallons per hour. State for whate purpose wanted and send for Catalogue of "Pumps."

YAN DUZEN & TIFT. Cincinnati, O.

reasonable terms. A pampflet sent free of charge, on application, containing full information about Patents and how to produce them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc. Tiffic American Supplication, Supplication, Containing full information about Patents and how to produce them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc. RUBBER GOODS,

MECHANICAL AND MANUFACTURING PURPOSES. The Largest and Most Extensive Manufacturers in America THE GUTTA PERCHA AND RUBBER MFG. CO., New York, Chicago, San Francisco, Toronto.

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

CAPILLARY TUBES, SPONTANEOUS MOTONIA TUBEN, SPUNTANEUUS Motion in.—A paper by C. Decharme upou the application of electricity to the study of the spontaneous ascensional motion of liquids in applibing twees—the question being studied from a dynamic standpoint. With 10 engravings of apparatus and details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 538. Price 10 cents. To be had at this office and from all newsdealers.

PULLEYS. Order from our "Special List." THE JOHN T. NOYE MFG. CO., BUFFALO, N. Y.



Scientific American

FOR 1887. . The Most Popular Scientific Paper in the World. Only \$3.00 a Year, including Postage. Weekly.

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

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

Terms of Subscription:—One copy of the SCIEN-TRICA MERICAN will be sent for one year. So numbers—

TIFIC 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 pub-

lishers; 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

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

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 SCHENTIFIC AMERICAN SURFLEMENT is published. THE SCIENTIFIC AMELICAN SURFLEMENT 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, Geclogy, Mineralogy, Natural History, Geography, Archeology, 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,

 MÜNN & 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 chemistry British colonies; to France, austria, Belgium, Germany, in SCIEN-ce 10 cents.

Russia, and all other European States; Japan, Brazii, 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.

${f PRINTING \cdot INKS.}$

THE "Scientific American" is printed with CHAS ENEU JOHNSON & CO. S INK. Tenth and Lom bard Sts., Phila., and 47 Rose St., pop. Duane St., N. Y.