

# SCIENTIFIC AMERICAN

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

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(NEW SERIES.)

NEW YORK, DECEMBER 9, 1876.

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## IMPROVED KNIFE-GRINDING MACHINE.

This machine is entirely different in construction and mode of operation from any other automatic apparatus heretofore made for similar purposes. On knife-sharpening machines where the grinding is done on the periphery of the wheel or stone, the beveled edge of the knife must necessarily be concave, and in shape exactly the reverse of a section of the periphery of the wheel of like width, and as the wheel becomes smaller by use, the knife edge is ground more and more concave until the wheel becomes too small, and a new one is necessary. After the substitution and at the first grinding, each knife is changed back to the shape it had when the former wheel was new, so that more is taken from the edge of the blade than is needed to sharpen it. This machine is claimed to overcome all the disadvantages described, and the wheel is in the form of a hollow cylinder or shell, and the grinding being done on its edge, it simply grows shorter as it wears away without decreasing in diameter. Another decided advantage possessed by this machine is that the wheel used is only nine inches in diameter, while the wheels grinding by the periphery are usually from twenty to thirty inches, and hence are more expensive. The following is a description of the machine and its mode of operation:

A is a cup-shaped emery wheel, across the projecting edges of which the knife passes during the process of grinding. B is a truck or way block on which the bed, C, carrying the knife holder, is reciprocated by means of a rack and reversing gear, similar to that of an iron planer. D is the knife holder, adjustable on bearing so as to give any degree of bevel required for the edge of the knife. E and F are respectively a slotted handle and stand connected by a bolt and hand nut, which admit of the knife holder being held in any required position and also serve as a gage for retreating it to the same position after it has been loosened for any purpose. At G are two hinged gages, one on each side, for setting the knife by its edge, bringing the edge exactly to the same position on the wheel. H is simply a shaft and

hand wheel, connecting the feed screw so that both ends of the knife holder are fed up simultaneously.

When it is desired to grind a perfectly flat bevel, the track is set so that the knife will strike both sides of the wheel. If it is desired to grind the edge concave, the track is placed so that the knife will strike but one side of the wheel. The more the track is set out of line, the more concave the knife will be ground. When once set, the machine will grind all knives to exactly the same shape until it is changed. Means are provided for setting the angle of the track so as to give a flat or concave bevel as may be desired.

For further particulars, address the Northampton Emery Wheel Company, Leeds, Mass.

## Bronze Statue of Daniel Webster.

On Saturday, November 25, the colossal statue of Daniel Webster was unveiled in Central Park, in this city. It is the gift of Gordon W. Burnham to the city, was modeled in Florence by Thomas Ball, and cast in bronze at Munich by Muller. Its height is fourteen feet, and its weight six tons. The pedestal is of Quincy granite, twenty feet in height and a hundred and nineteen tons in weight, and is of itself a symmetrical and handsome monument. The artist has produced a wonderful likeness of the deceased statesman, and has delineated very powerfully all that grace, dignity, and force which characterized the living Webster. Mr. Burnham has always maintained the greatest admiration for the genius of the great Webster, to whose memory this statue is dedicated. This last contribution is the second expensive bronze statue which, through the liberality of our wealthy citizen, G. W. Burnham, ornaments our beautiful park.

## New Alloys.

Mr. P. M. Parsons, of Blackheath, England, a well known inventor of alloys, has lately patented in that country a new series of compositions obtained by mingling spiegeleisen, or some other form of carburet of iron mixed with manganese, with bronze, brass, and yellow and Muntz metals.

The advantages claimed are greater homogeneity, hardness, strength, and closeness of texture.

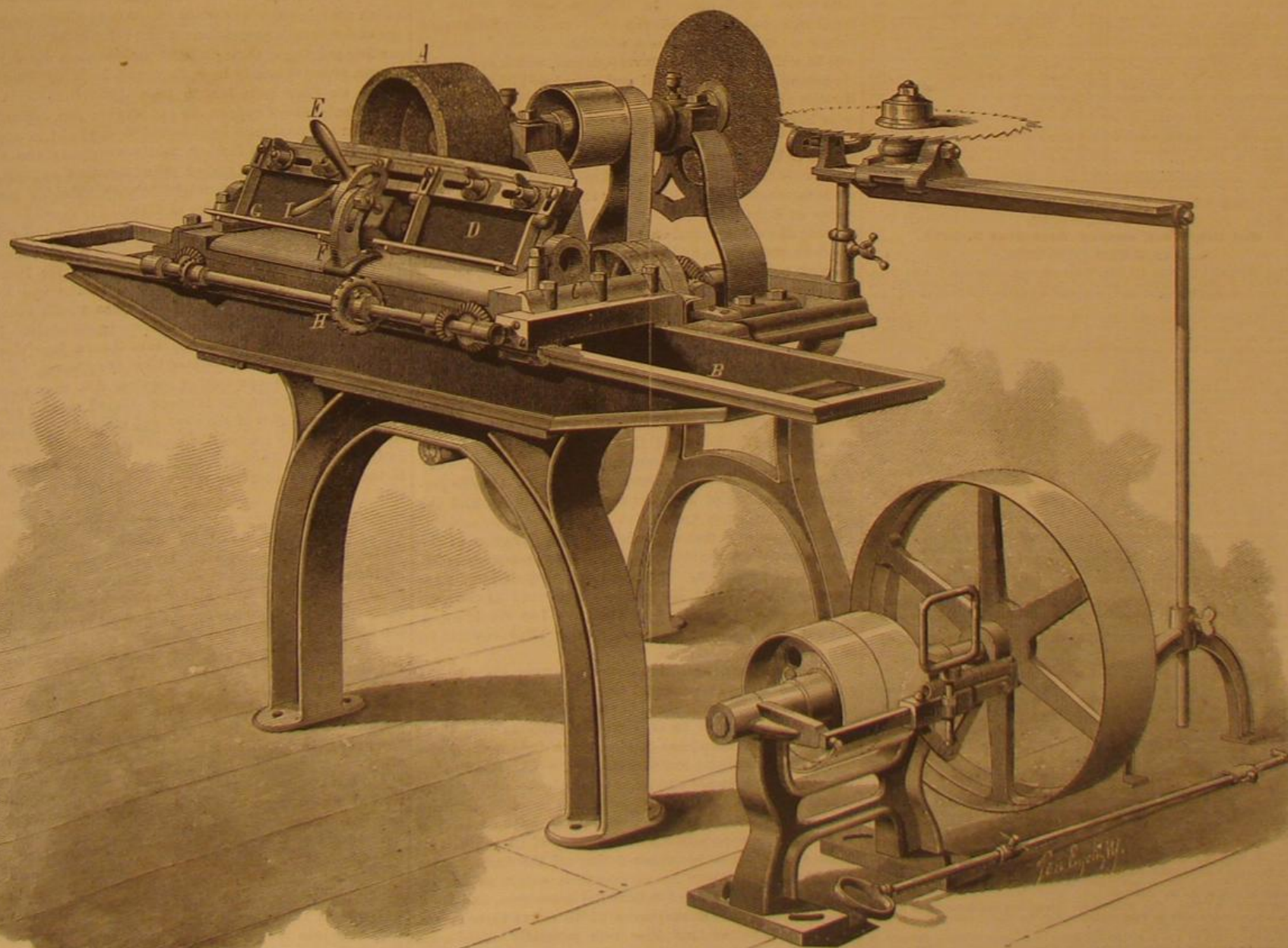
The ferromanganese, used to mix with gun metal, contains from 10 to 40 per cent of metallic manganese; with brass alloys, 5 to 20 per cent of same; and with bronze alloys, the proportion lies between the above according to the proportions of tin and zinc employed. To prepare ferromanganese containing a given amount of metallic manganese, the inventor melts rich ferromanganese, containing up to 70 per cent, in a crucible under powdered charcoal, and with a quantity of the purest wrought iron scrap. Thus, supposing it is desired to employ a ferromanganese to mix with any of the alloys containing 20 per cent of manganese, a ferromanganese containing 60 per cent of metallic manganese and, say, 1 per cent of silicon, is melted with wrought iron scrap, in the proportion of 100 of ferromanganese to 200 scrap. Then a ferromanganese containing 20 per cent of metallic manganese will be obtained, in which there is only one third of 1 per cent of silicon.

Dry sand or loam molds are recommended for casting. Metal molds render the alloy somewhat harder and closer in texture.

## To Detect Gas Pipe Leaks.

It is usual to detect gas escapes by applying a lighted taper or candle to the suspected place of leakage. This is dangerous, and many explosions have thus been occasioned. A safer mode is as follows: Mix dark soap and water in the proportion of 2 lbs. of the former to 5 or 7 pints of the latter. The sticky paste or liquid so obtained is ready to be applied by the brush to the gas pipe, when, if an escape is taking place, bubbles will readily be seen on the liquid; thus the positions of the gas escapes are indicated without any danger.

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EMERY WHEEL KNIFE-GRINDING MACHINE



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## Contents.

(Illustrated articles are marked with an asterisk.)

|                                     |     |
|-------------------------------------|-----|
| Academy of Sciences, New York.      | 369 |
| Achmea paniculata.                  | 370 |
| Air, purifying.                     | 371 |
| Albumen, paper, preparing (1).      | 372 |
| Alloys, new.                        | 373 |
| American climate and the voice.     | 374 |
| American progress.                  | 375 |
| Answers to correspondents.          | 376 |
| Army worm history.                  | 377 |
| Astronomical notes.                 | 378 |
| Blowpipe, a new.                    | 379 |
| Bolter safety apparatus.            | 380 |
| Bolter scale, remedy for.           | 381 |
| Bolters and engines (16).           | 382 |
| Black varnish for instruments (11). | 383 |
| Bricklayers, one-handed.            | 384 |
| Bricks, hollow.                     | 385 |
| Business and persons.               | 386 |
| Car, a two-story street.            | 387 |
| Carbollic acid (36).                | 388 |
| Cement for boilers (10).            | 389 |
| Cement for end wood (15).           | 390 |
| Cement for tin foil and tin (33).   | 391 |
| Centennial notes.                   | 392 |
| Chimney pipes.                      | 393 |
| Chuck, a handy form of.             | 394 |
| Cigars, coloring (30).              | 395 |
| Circle, diameter, etc., of a.       | 396 |
| Clock, a curious.                   | 397 |
| Coal oil, deodorizing (38).         | 398 |
| Color blindness and its remedy.     | 399 |
| Cryolite and its uses.              | 400 |
| Earth's motion, the.                | 401 |
| Electric light, new form of.        | 402 |
| Electrotyping flowers (39).         | 403 |
| Emery wheels, making (12).          | 404 |
| Enamels, French.                    | 405 |
| Engineering, French.                | 406 |
| Engine, the Nile's.                 | 407 |
| Explosive compounds, two new.       | 408 |
| Exposition, New South Wales.        | 409 |
| Eye, artificial.                    | 410 |
| Felt hats, cleaning (24).           | 411 |
| Fine workmanship, value of.         | 412 |
| Galvanized cooking pans, etc. (26). | 413 |
| Gas and air, explosive (14).        | 414 |
| Gas leaks, to detect.               | 415 |
| Girders.                            | 416 |
| Glass goblets, musical (28).        | 417 |
| Glass, scratches on plate (21).     | 418 |
| House building.                     | 419 |
| Indian manufactures.                | 420 |
| Ivory, substitute for.              | 421 |
| Lace, fine machine.                 | 422 |
| Laths, metallic.                    | 423 |
| Locomotive, a slipping (3).         | 424 |
| Magnetism and carbon.               | 425 |
| Masonry.                            | 426 |
| Matches, safety (34).               | 427 |
| Meat, American, in England.         | 428 |
| Motors, French.                     | 429 |
| Orto of roses, of (21) 373.         | 430 |
| Owl, the Cornish.                   | 431 |
| Paraffin, adulterated.              | 432 |
| Paste for box makers (5).           | 433 |
| Patents, American and Foreign.      | 434 |
| Plaster of Paris, hard (17).        | 435 |
| Practical mechanism—No. 16.         | 436 |
| Pump, a new steam.                  | 437 |
| Rust in soldering (4).              | 438 |
| Salt cellar, antique.               | 439 |
| Sawing granite.                     | 440 |
| Silicates, alkaline (35).           | 441 |
| Silver, chloride of (23).           | 442 |
| Smoke, ascending, etc. (25).        | 443 |
| Soap and candle machinery.          | 444 |
| Statue, model of (21) 373.          | 445 |
| Status of Dani-1 Webster.           | 446 |
| Stencil ink, etc. (18).             | 447 |
| Steel, good (9).                    | 448 |
| Stout people, advice to.            | 449 |
| Tallow, olein from (37).            | 450 |
| Tin and copper, mixing (2).         | 451 |
| Tobacco-curing apparatus.           | 452 |
| Trade marks in Great Britain.       | 453 |
| Vinegar, weighing (6).              | 454 |
| Wall paper and typhoid fever.       | 455 |
| Water, lime in cistern (31).        | 456 |
| Waterproofing paper boxes (21).     | 457 |
| Weapon of war, a new.               | 458 |
| Woodworking machinery, French.      | 459 |
| Worms in garden mold (19).          | 460 |
| Zinc in boilers (30).               | 461 |

## THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 50.

For the Week ending December 9, 1876.

## TABLE OF CONTENTS.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I. THE INTERNATIONAL EXHIBITION OF 1876. The New Corliss Gear-Cutting Engine, 12 figures, 4 pages of engravings, and full description.—Surgical Appliances at the Centennial.—English Exhibits at the Centennial.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| II. ENGINEERING AND MECHANICS.—Spring Motors, with 18 illustrations. Volute Spring Motor, by W. S. SHOEMAKER, 2 figures. FRANK & SCHAEFER'S Spring Motor, 4 figures. DOUGLASS'S Spring Motor, 4 figures. BACON'S Torsion Spring Motor, 3 figures. MOSKLEIN'S Spring Motor, 2 figures. HOWELL'S Spring Motor, 1 figure. LATIMER'S Spring Motor, 2 figures.—On the Construction of Ocean Steamers, by K. B. FORBES. An interesting paper.—Steam Riveted Boilers.—Twenty-four-inch Armor Plates.—Explosion of an Iron Furnace.—Substitutes for Horses on Street Cars.—Trial of Compressed Air Car.—On the Progress of Aeronautics, by F. W. BREAKEY, Secretary of the Aeronautical Society of London. A full and valuable paper, exhibiting the progress made up to the present time with air ships and aerial navigation. Requirements Necessary to the Solution of the Problem. Dimensions Necessary for Balloons. Examination of the Forces Involved in Flying. The Direction in which Improvements Lie. Facts, Figures, and Experiments touching the Lifting Power necessary for Aerial Navigation. May's Remarkable Steam Flying Locomotive, trials, dimensions, etc.—Details of a One Horse Power Steam Engine and Boiler, weighing only 13 lbs.—The Oil Pipe Lines of Pennsylvania. Names of the Various Companies, Length, Routes, and Dimensions of the Pipes.—The Remarkable Gas Wells, Pittsburgh, Pa. |
| III. TECHNOLOGY.—Description of the Method of Manufacture of Small Fire Arms in England.—Process of Making Steel Pens.—African Arrow Poison.—Fabrication of Nitro-Glycerin.—Copper Bronzes.—New Use for Refined Petroleum.—Oils of Peanuts and Olives.—Aluminium, Its Strength, Value, and Various Uses.—Ferns in the Parlor.—Carved Panel Ornaments, 3 figures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| IV. LESSONS IN MECHANICAL DRAWING, No. 30. By Professor C. W. MACKENZIE, With 13 illustrations. With Drawings in full size of the Best Forms of Curved Rulers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| V. CHEMISTRY AND METALLURGY.—Silver Salts in Photo-Plates.—Reactions of Gallium.—Palladium.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| VI. ELECTRICITY, LIGHT, ETC.—The Electric Kel.—Electricity in Agriculture.—Electric Discharges.—New Electric Lamp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VII. MEDICINE, HYGIENE, ETC.—Successful Treatment of Diphtheria with Hypophosphite of Soda, by Dr. E. CHESNEY, Boston, Mass.—Specific against Hydrophobia, by Dr. GEZYVALA.—Improved Treatment for Burps, by Dr. W. R. E. SMITH.—Causes and Removal of Catarrh, by R. W. RICHARDSON, M.D.—New Tape Worm Remedy, by Professor F. FREEMAN.—Diet Remedy for Gout.—Relief from Friction Heat.—New Treatment for Cancer.—Functions of Ophthalmic Thalmi.—Action of Hydrocyanic Acid on Insect Life.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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## COLOR BLINDNESS AND ITS REMEDY.

The name of color blindness has been given to an affection of the eye which renders it insensible to certain colors, whether they arise from the decomposition of the solar rays, or from artificial pigments, or from the action of natural bodies upon light. In 1855 Dr. George Wilson, of Edinburgh, published a short volume on this subject; and before considering the latest scientific views thereon, it will be well to sum up his investigations, which are probably among the most extended and complete hitherto made. He tells us that in England one person out of every 18 is color blind, basing his statement upon personal examination of over a thousand persons. Color blindness, he says, is moreover hereditary, and affects males more than females, and people of all habits alike. Three forms of the malady are recognized. 1. Inability to see any color but black and white or light and shadow, a highly colored picture appearing like a mezzotint engraving. 2. Inability to distinguish browns, grays, and neutral colors. 3. Inability to distinguish between red, blue, and yellow, and green, purple, orange, and brown. The first of these varieties is very rare. In the second variety, the mere shades of the more compound colors, such as browns, grays, and neutral tints, are alone mistaken. The third is the most common; and on an average 1 person in 55 confounds red with green, 1 in 60 brown with green, and 1 in 46 blue with green. Red and green are the two colors which the color blind are least able to appreciate; and it is one of the most ordinary occurrences in connection with the defect that a person seeing a scarlet verbenia in full blossom, cannot detect, at a little distance, any difference in color between leaves and flowers, nor can he perceive any contrast of color between ripe cherries and the foliage of the cherry tree.

Dr. Wilson says that no satisfactory explanation of the phenomena of color blindness has ever been propounded; but he wrote 21 years ago. The labors of Helmholtz, and more recently of Von Bezold, have since solved many of the most difficult optical problems. In Professor Von Bezold's new work on the "Theory of Color," color blindness and its causes are fully considered.

Physicists, even before the time of Newton, assumed the existence of three fundamental colors and attributed to them a physical significance: that is to say, the white light of the sun was supposed to be objectively resolvable into three such colors, an assumption which is now disproved. Later Young and Helmholtz renewed the idea, but ascribed to the fundamental colors not a physical but a physiological significance. They assume that the eye is accessible to three fundamental sensations, which we may perhaps conceive of as being made perceptible to us by means of three different kinds of nerves. It is supposed that all the various color sensations experienced by us owe their origin to the cooperation of these three fundamental sensations, and it becomes important to determine to which colors these correspond. Red, yellow, and blue were generally looked upon formerly as the fundamental triad, but later investigations lead to the substitution of green for yellow, and the select-

ing of a blue closely bordering upon violet; and this conclusion, that red, green, and deep blue are sensations of a simpler nature than those of any other color, is especially supported by the pathological phenomena of defective color vision, and thus we are led to an explanation of that ailment.

It is curious that not only are persons born color blind, but that they may be rendered artificially so. Violent injury to the head or overstraining of the eyes can induce a loss of the color sense; santonin derived from worm seed produces vertigo and headache, and causes the person afflicted to see all objects in two hues, yellow and violet.

When a person who confounds red and green regards the spectrum, he sees the red end shortened. The place in which the red is visible to the normal eye is to him black, hence red light does not affect his eye. He is red-blind. When intoxicated by santonin the violet end of the spectrum is wanting, on the contrary; and this condition may therefore be designated as violet blindness. The violet shadows seen under the influence of santonin are therefore simply the consequence of contrast, that is to say, a deception of the judgment.

In order therefore to explain these phenomena, Professor Von Bezold holds that it is only necessary to assume that color blind persons are devoid of one or the other of the three fundamental sensations. If we suppose that these sensations are brought to our perception by nerve fibers especially assigned to each, it is presumable that, in the case of a red-blind person, the fibers corresponding to the sensation of red are either paralyzed or that they are perhaps even wanting entirely; while in the case of a violet-blind person, the same would have to be true of the nerves set apart for the violet sensation.

We can arrive at an idea of the condition of a color-blind person approximately by looking through colored glass, or by noting our natural conditions when viewing objects by lamplight, when our vision is closely analogous to that of a violet-blind person. Hence the reason why dealers in paintings prefer to exhibit them for sale by gas light, when the violet rays being absent, the eye sees other colors under a rich glow of red and yellow, which adds greatly to the brilliancy of the pigments and softens and mellows tones which by daylight are crude and cold. Conversely, if a painting were executed by lamplight, it would look strange and faulty by daylight, and its incorrectness would increase with the number of cold colors intended to be employed in the picture. The same absence of blue and violet rays in lamplight explains why red and yellow dresses show nearly the same color under it, while blue stuffs can hardly be told from green, and violet becomes grayish or reddish. This is taken into consideration by ladies in buying dresses for evening wear, and by artists in decorating apartments especially intended to be used at night.

Now it follows that we have only to weaken the rays which are in excess, to cure the defects of either the normal eye under peculiar conditions or the color-blind eye. By regarding paintings through light yellow glass by daylight, we can perceive nearly how they will look by lamplight; and if we allow lamplight to pass through the blue solution of sulphate of copper, we can weaken the red and yellow rays and produce a light equal to daylight in composition. If we proceed further, and concentrate the altered light, we obtain a still nearer approximation to daylight in brilliancy, and one which might be very valuable for those who have to deal with colors at night.

To come back to people naturally color-blind, the consequence of the above is that colored glass offers a means of materially lessening the ocular defect. If for instance a solution of sulphate of copper renders the eye looking through it red-blind, then a colored glass which eliminates the blue green rays, interposed, restores equilibrium. In this way Professor Von Bezold suggests that a few pieces of glass of suitable color, mounted like eye glasses, for color-blind people whose profession requires that they should be able to tell the difference between colored signals (and the red and green lights of railways and ships are of the very colors most easily confounded), patterns, etc., or to study or design technical drawings, such as plans and charts, might be the means of affording very essential relief at a very low cost.

## OTTO OF ROSES.

The most delicious of all perfumed essences is obtained by the simple distillation of rose leaves. In our climate, roses are not sufficiently highly scented to produce the properly odoriferous essence or oil; and all that the druggists can produce from rose leaves is rose water, which in fact is water slightly impregnated with the essence or oil, which is, to a small degree, soluble in it. The most favorable country for the production of the most highly scented roses is the middle portion of European Turkey, at the base of the southern slope of the Balkan Mountains, where the roses are grown in localities where they are protected against all winds except those from the south; and the flowers thus attain a luxuriance in perfume and in growth, as well as in size, of which those who have not visited these regions can hardly form any idea.

The town of Késanlik, situated in the province of that name, is the center of the field of cultivation and distillation of the rose leaves. The leaves are gathered all over the province, which is 40 miles long, and is watered by the river Thungha and the many mountain streams which discharge into the same, furnishing the water necessary for the distillation. To give an idea of the extent which this industry has attained, we need only say that there are in that province 128 different villages, of which the inhabitants are all employed in the culture of the beautiful flow-



era. These all live in peace together, Turks and Christians; and they prosper, having become wise by experience, finding that it is better to work than to waste time in religious or political quarrels.

Almost all the country is occupied by rose plantations, and only a comparatively small portion is devoted to raising rye and barley, for the subsistence of the inhabitants and their cattle. The rose grows best on those parts of the slopes where the sun shines most, and which is the least northern in exposure. A light soil is best; and the planting is done during spring and autumn, in parallel ditches three inches deep and five feet apart. In these ditches shoots from old rose trees are laid; they must, however, not be cut from the tree, but torn off, so that each shoot has some portion of the root or bark of the root adherent. They are then covered with earth mixed with a little manure. If the land is horizontal, and a mountain stream can be diverted so as to inundate it, this is done, to hasten the growth; at the end of six months, shoots are seen coming up all along the furrows, and at the end of one year these shoots are 3 or 4 feet high, forming regular hedges. At the end of the second year, roses appear, but not in sufficient abundance for them to be gathered. The gathering is commenced in the third year, after which they produce largely, the hedges being, at the end of 5 years, 6 feet high. The bushes produce flowers until 15 years old, when the field is worn out, and must be plowed up. They do not prune the rose bushes at all, as we do; but they cut off, every year in the late fall or winter, the dead branches.

The great harvest commences about May 15, and lasts until June 5 or 10: the gathering is done daily in the morning before sunrise, and the distillation is finished before 12 noon, so as to have the benefit of all the freshness of the flowers, which is at once driven off by the heat of the day. In hot seasons, the roses open more rapidly, and the crop may last but for 10 days; but in wet, cooler seasons, the progress is slower, and the crop may last for 25 days: but then the daily harvest is smaller in proportion, so that the final result is about the same. However, cool, slow weather is preferred, as it eases the daily labor.

The stills used are of the roughest kind, and small; they hold from 200 to 240 pints of water, and are carried to the rose bushes to be filled. To 20 lbs. rose leaves, 160 pints of water are added; and the whole is distilled at a gentle heat until 20 pints of water are distilled off. This quantity contains nearly all the perfume of the leaves, which are then thrown away with the remaining water; and the still is again filled with 20 lbs. leaves and 160 pints water. This operation is repeated until all the leaves have been used. The water thus distilled off is a strong rose water; and the result of 8 or 10 distillations is put in a still and submitted to a second distillation, when a stronger rose water is obtained: so strong, indeed, that it is unable to contain the essence in solution, and the latter floats on the top of the water. Experience has shown that, for every ounce of otto of roses, 3,000 lbs. of rose leaves are required.

The total yearly production of eight districts, into which the 160 villages of the province of Kézanlik are divided, is on an average 3,500 lbs. of otto of roses, of which the district in which the capital is situated produces half. Some years ago, however, the bushes were exceptionally prolific. Thus, in 1866, 6,000 lbs. were produced; but in 1872 only 1,700 lbs. could be obtained. We ought to add that every rose farmer has his own stills for producing otto of roses immediately after picking the flowers; and thousands of industrious workers are thus occupied, earning in a single short period of 20 days the products of a year's labor in preparing the soil, planting, and taking care of the growing plants. When the distillation is over, the farmers come from all parts of the provinces to the capital to sell their products, those who have large quantities selling directly in the great commercial centers, such as Constantinople and Adrianople. At present, however, an enterprising firm in Kézanlik, considering the delay to which the trade with the last-named cities is subject, and the chances of adulteration, have established a depot in Paris, France, from which this delicate and expensive perfume is now distributed over Europe and all the world.

#### A VALUABLE DISCOVERY IN ELECTRIC ILLUMINATION.

M. Jablonskoff, a Russian physicist, has recently communicated to the French Academy of Sciences a new and apparently important device on which a single electric current can be divided among several burners of electric lamps, disposed apart at distances more or less great. At the same time the light is augmented, and the regulators, which are the most costly and most easily disarranged portion of electric lamps, are entirely done away with.

The ordinary electric lamp consists of the carbon pencils disposed perpendicularly one above the other. Between their extremities the current forms the luminous electric arc, provided, however, that these extremities are, as the material burns away, constantly maintained in the same relative position. To this end, delicate clockwork mechanism is used, which is both expensive and difficult to adjust. M. Jablonskoff's substitute for the latter apparatus leaves nothing to be desired on the score of simplicity. He places two pencils of carbon in a solid cylinder (of clay, powdered stone, or any other refractory material), so that the pencils form as it were a double wick to the novel candle. The pencils are adjusted to the proper distance apart, so that, when the candle is inverted, the current passes from the end of one to that of its neighbor. As the combustion progresses, the intense heat volatilizes the refractory material of the candle, and thus new portions of the pencils are constantly exposed, while the material itself, burning in the electric light,

adds to its power. The pencils of course always remain parallel, and hence at the distance apart to which they are primarily adjusted. One of these candles placed in a case, with reflector, etc., constitutes all that is necessary to connect with the battery to produce the light; and it is easy to see how a large number of them might be joined in circuit, and thus one current utilized to produce an extensive illumination.

#### THE VALUE OF FINE WORKMANSHIP.

"Whatever is worth doing is worth doing well" is, it is true, a platitude; but it has a peculiar value when applied to the machinist's art, for the difference in durability between an ordinary and a fine fit is so great that the latter is in the end the true economy. There is of course a large class of work in which the fit of the parts is of no practical moment, and in such cases the work may be put together as it leaves the machine tools; but for all general work, such as the connecting rods, link motions, guide rods, cross-heads, and valve motions of engines, either stationary or locomotive, it pays to finish the work everywhere to a fine fit. And it may safely be said that, while every piece of turned work should be finely turned, and each piece of boring carefully bored, every brass or journal box should be fitted with the smooth file and half round scraper to its place, red marking being used to show the fit; and if this is properly done while erecting the work, there will be no danger of hot journals, or of stiff working, which too often occurs when new engines or machines are first run. It is often advanced by machine builders that "the working parts will in a few days wear down to a bearing," and it is no doubt true; but in the process of that wearing down, infinite mischief is done. Suppose, for example, that a journal box is left to wear itself to a bearing instead of being fitted to one; then the whole strain placed on the bearing will be sustained by the reduced amount of journal area at first in contact, and as a consequence the wearing will not be smooth, the degree of roughness being proportionate to the area of metal in contact and the pressure upon the same. It is often found that the oil escaping from a newly run crosshead and slide, or from a new journal box, appears like liquid bronze, evincing that cutting is going on; and as that cutting will cease when the working parts have come down to a bearing, it is evident that, were the brasses fitted to a bearing, the cutting would not take place. Axle boxes are often left slack at first, and gradually tightened up as the engine or machine is run; and there would be no necessity for this if the parts are properly fitted, not only separately, but also when put together. If a journal box is properly fitted, the nuts may be screwed tightly home at once; and it will work smoothly and noiselessly without requiring any special attention. In lathe work, we find that, no matter how carefully it is turned, it is not true; and though outside work may be made sufficiently true for practical purposes, inside work, such as boring, will be greatly improved if fitted by hand, especially if it is put together in pieces. Eccentric straps and pillow block or connecting rod brasses are examples of this fact; for if we bore them to the correct size, we shall find that they close in across the joint during the process of boring, and we must, to make a good job of them, fit them to their places by hand work. But if once properly fitted, they will work a long time without causing any lost motion.

If we turn to flat surfaces, experience has demonstrated that, no matter how carefully they may be planed or milled, they are not finished true; and though for small work, such as sewing machine work, they may be true enough, they are not so for large work. Three cast iron surfaces, 11x8 inches, were recently carefully planed in a very superior planing machine; and yet it took two good hours' work with a 14 inch smooth file to file them sufficiently true to show a good bearing surface when tried together. Work may appear to be true and of a good fit when such is far from being the case, especially in the matter of flat surfaces. In fitting up connecting rods, for instance, it is no proof that, because the keys seem to have a very close fit to the keyways and the straps to the stub ends, the fitting is well done, because the vise hand or fitter knows that those are the points to which the examiner will look to judge of the fit; and hence he is very liable to keep those edges in contact, even though the interior surfaces are hollow, and therefore not in contact at all. But it must be remembered that the wearing surface is that which is in positive working contact; and the smaller its amount, the sooner will play, looseness, or lost motion occur; and after that has once begun, the wear is much more rapid and destructive.

In the matter of all flat surfaces, it is actually cheaper to make a good job than an indifferent one. Suppose, for example, we are filing out a keyway: we may use a keyway surface plate, and file it out level and out of twist; and then we know, when fitting the key, that the keyway being right, our attention need only be directed to the key. When the latter is planed, we may apply it to the surface plate and true it up and fit it to the keyway without having to drive it in and out to try the fit. If it binds in the middle or at the edges, we may, by applying the key to the surface plate, ascertain at once whether the key or the keyway requires to be eased, and thus ensure not only a close fit, but one fitting over the whole area.

It may in fact be said, without fear of contradiction, that no flat work can be either well or quickly done without the aid of a surface plate; nor can any work be really well done unless the parts are fitted together and the fit tried with marking. That work is often put together as it leaves the machine tool is too true, but its durability is comparatively short-lived; and it may safely be said that, whatever extra

cost is entailed, making work true and of a very fine fit is true economy. It is, *per contra*, frequently urged by engine builders that purchasers will not pay the increased cost; but the reply to this is that the cost is but little increased, because, in a majority of cases, the work may be performed actually more quickly by applying tests to ascertain its accuracy; and furthermore, the application of the tests shows where the defects are, and the machinist directs his attention to remedying them; and in fitting up the work, he knows just where to find them.

The standard of excellence to which work should be finished depends upon what, if any, means are to be taken to test the quality of the finished work, or whether it is to be subjected merely to a casual observation. We believe it costs much more to do good work without hand work than with it, and we are sure that good work cannot be done without actual testing, by trying the work together, and a careful application of marking, calipers, gages, etc.; and if any of our readers are not cognizant of this fact, let them test the flatness of the most carefully manipulated piece of work, and they will be speedily convinced. Even the extra finish upon work is labor well bestowed; for in using it, the operative is constantly reminded of its degree of superiority, and is just so much the more careful in using or working it. Another consideration is that the users of machinery are not slow to appreciate excellence of workmanship, and will be ready and willing enough to pay for that which time will inevitably prove to be commercially valuable. It very often occurs that a fine adjustment of fit is neglected because the parts are provided with a means of taking up any wear or lost motion. In many instances, however, the provision of such parts is more costly and not more desirable than omitting them and making the parts a good fit. The crossheads of stationary engines may be taken as a fair example of this. Solid crossheads have been known to work for years without any appreciable wear, while on the other hand it is not uncommon to find that the brass adjustable gibs and the surfaces of the guide bars are considerably worn after a few weeks' travel only. Locomotive guides and bars are much more subject to excessive duty than are those upon stationary engines; and yet it is not found desirable to provide them with any means for taking up lost motion. The link motion, etc., of a locomotive engine in England, that had run express trains for fifteen months, were taken apart, and it was found that the parts were so little worn as to be practically unimpaired; while another engine had oil on the guide bars, which was like a liquid bronze from the wear due to an improper adjustment of the gibs to the guide bars. It may also be noted that, while in many cases provision for taking up the wear is decidedly advantageous, in all such cases the wear is very likely to be excessive in consequence of an improper adjustment of the parts. In conclusion, it may justly be said that, in view of the similarity and excellence of design to which many of the more prominent builds of stationary engines have attained, the quality of the workmanship promises to receive more minute attention than has in former years been paid to it; while the employment of steel and the hardening or casehardening of the working parts promises to be much more general as their great advantages become universally known.

#### NEW YORK ACADEMY OF SCIENCES.

The chemical section of this society met at their rooms, 64 Madison avenue, on Monday evening, November 13, 1876. Some beautiful specimens of tourmaline from Brazil were shown, which exhibited the peculiarity of having a red center and green exterior, or were red at one end and green at the other. A very large black garnet also attracted a good deal of attention, as did a specimen of crystallized dolomite from Westchester county, N. Y.

Professor Winchell, Chancellor of the Syracuse University, made some remarks on cephalopods, more especially the endoceros, which he has been recently studying. His remarks were illustrated by blackboard drawings.

Dr. H. Carrington Bolton showed some experiments with Böttger's ozone mixture, namely, permanganate of potassium and sulphuric acid. Sulphuretted hydrogen gas is immediately inflamed by contact with this mixture, without the application of heat. When a jet of ammonia gas is directed against this mixture, it causes an appearance of flame, but the gas does not itself continue to burn. Dr. Bolton also referred to the fact that sulphuretted hydrogen gas may be ignited by means of concentrated nitric acid. Professor Falke spoke of the danger attending the use of this ozone mixture, and Professor Seeley described the use of chromic acid for producing heat and igniting substances.

Professor Charles A. Seeley read a paper on the friction of fluids. Including air and other gases under the name of fluid, he explained the ball puzzle at the Centennial, the formation of smoke rings, etc.

The next chemical meeting will be held on December 11, 1876.

THE shipment of American beef to England is becoming a large and growing business. Two Liverpool steamers took over four hundred dressed cattle a few days ago.

IN accordance with a long-established rule, all subscriptions terminating with this volume will be discontinued at that time. We trust that all our subscribers will not only renew, but that they may find it convenient to induce some of their neighbors to become subscribers. We shall in the future, as in the past, give our readers full measure and running over, in return for their money.



## THE NILES ENGINE.

When it is considered that the majority of steam users employ the cheaper classes of steam engines, it is hardly necessary to seek for further reasons why the engine with the single slide valve still finds abundant usage, despite the existence of the improved automatic cut-off machines, with all the advantages which they offer. To meet the demand for an efficient motor of the first mentioned type at low cost, the machine herewith illustrated in Fig. 1, modeled after the English Tangye engine, is offered. The design is quite novel and simple, the working parts are neatly proportioned and adjusted to compensate for wear, and access to them is rendered easy. The bed casting is cored out, and the metal disposed as nearly as possible in the line of strain; when bolted down on the foundation, the entire length is in contact with the masonry, thus insuring stability. The steam chest is on the side of the cylinder, and low enough to drain it of condensation. The connecting rod is a solid forging, without straps or stub ends. The mortises through each end are accurately broached for reception of the brasses, and a single cotter takes up the wear. The valve is driven directly by the eccentric rod.

The diagram, (Fig. 2) is taken from a 13x20 engine, and exemplifies the valve motion given to the engine. In this case the machine was carrying its maximum load, at rated speed, with exhaust connected to a feed water heater. The average back pressure, independent of cushion, is less than one half pound, the total counter pressure referred to the whole stroke being less than five per cent of the average direct pressure.

The engines are designed for use where the ordinary slide valve engine has hitherto been employed, and are built in sizes varying from 6 to 16 inches diameter of cylinders with 10 to 24 inches stroke.

Fig. 3 exhibits a complete stationary engine with vertical tubular boiler, conveniently arranged on a substantial cast iron base. This engine is also modeled after the Tangye, but possesses some novel features of its own. The bed, cylinder, in-board pillow block, slides, and seat of steam chest are all combined in a single casting. Around the cylinder is cast a thin shell forming an air space, into which the condensation from the cylinder is drawn. Ample provision is made to compensate for wear, and steel is freely used in the construction. The pump (not shown in the engraving) is driven by a small crank at the outboard end of the main shaft. The boiler is of the vertical tubular type. The smoke bonnet is made in two sections, the upper one of which is pivoted, allowing it to be swung entirely clear of the boiler, for cleaning the tubes.

The boiler is provided with compression gage cocks, spring pop safety valve, with hand lever to blow-off steam gage, check valve, blow-off, and drip tubes. The engine, boiler, governor, feed pump, and appurtenances are furnished in sizes from two to twelve horse power, complete, as shown in the engraving, all ready for the boiler to be charged with water, fired up, and run. The engine is warranted by the builders to develop the rated power at 60 lbs. boiler pressure.

For further information regarding either of the above engines, address the Niles Tool Works, Hamilton, Ohio.

## New South Wales International Exposition of 1877.

We would remind manufacturers, inventors, and all who have exhibited at the Centennial that an excellent disposition of their show articles would be to pack them and ship them to Sydney, New South Wales, for display at the International Exposition, there to be held in the months of April and May, 1877. Messrs. R. W. Cameron & Co., of 23 South William street, New York city, are representative commissioners here, and will despatch a ship direct from New York to Sydney on the 1st of December. Freight is fixed at \$10 per ton.

The exhibitions in Sydney, which are annual, are not so much attractive spectacles as places of business where people from all the Australasian colonies meet to buy and sell. The Australian public is wealthy but utilitarian: that is, it cares little for fine arts, but a great deal for useful and improved inventions which will aid in developing the resources of the country. What is especially wanted is labor saving machinery and in a recent letter the Executive Commissioner of New South Wales at the Centennial, Hon. Augustus Morris, offers some valuable suggestions as to the kinds of machines required. He says: "The greater portion of the best pastoral lands of Australia are wholly without surface water, and generally when wells are sunk they only reach salt water. Therefore, the great requirements are apparatus for sinking through the saline stratum to the fresh water, which probably lies below; and especially appliances for excavating tanks or reservoirs, into which the rainfall may be led from the plains. The most effective pumps for use on land or in ships are desirable objects of exhibition. So, also, are the best agricultural machinery

and implements, being strong and simple in construction. Timber-sawing machinery always finds a sale, and, if adapted to fell standing trees, and to cut them into lengths when on the ground, so much the better. This opportunity of bringing American railway appliances to the notice of the Australian Governments, which own nearly all the railroads,

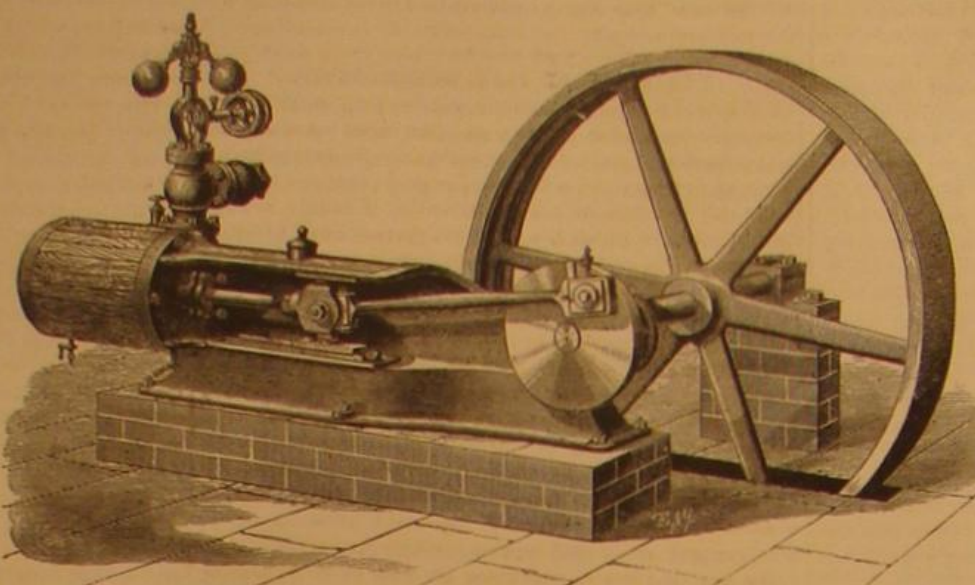


Fig. 1.—THE NILES ENGINE.

should not be neglected. Such a display would undoubtedly attract the principal civil engineers from all the colonies, and many prejudices would be removed. Although the Australian Commissioners have been very much impressed with the suitability of the American railway system to our colonies, and we have so reported, unfortunately none of us are civil engineers, and our opinions will certainly be taken with much allowance for error. I will, failing a more

which we are surprised to discover in an observer in other respects so acute. He objects to the award system on the ground that "the great builder and the great manufacturer who went to large expense in order to take part in the Exhibition are not distinguished from the smallest exhibitor, since they all alike receive bronze medals." Now, as the medals included in awards amount to nothing more than to attract attention to the report of merit, and as the reports offer a means of differentiating honors with a minuteness only limited by the adjectives and modes of expression comprised in the English language, it certainly follows that no one who reads the reports is liable to misunderstand why, and for what, awards were conferred. We cannot agree with M. Simonin in thinking the Corliss engine "the most remarkable thing in Machinery Hall and one of the greatest curiosities, perhaps the principal, in the Exhibition;" nor can we applaud the comparison of the spinning and weaving machines with similar collections in other Expositions "in number and noise." In his review of our industrial progress and possibilities we should expect to note the master hand of the writer, and the following significant paragraph certainly more than compensates for the minor errors into which he has strayed:

America can feed Europe with corn, wheat, preserved meats, and live stock, as it has supplied it with cotton; it has clothed Europe, and it can nourish Europe. It can get along without Europe as far as regards iron, steel, copper, machinery, and most of the manufactured products. It will not cease, however, to give Europe the gold and silver which is needed for all transactions, for the mines of the United States yield more than the mines of the whole world. As for coal, America will soon produce as much as England, that is, as much as all the rest of the world, and its carboniferous deposits are twenty times greater than those of England.

"America will learn more and more how to get along without Europe, but Europe will not be able to get along without her. It is truly a new England which is rising across the seas, and which already threatens the old England in all her markets. The commercial interests of France are also threatened; even American wines are competing with ours. The connoisseur alone demands the wines of France."

"But what is still graver is the fact that the Americans are getting hold of the processes, the sleight of hand of our workmen. Already in the manufacturing of jewelry, watches, bronzes, furniture, and artificial flowers, they produce an article which bears the real stamp of solidity and good taste. In these departments the American is more to be feared than the Englishman, because of his situation, which climate, a mixture of races, and an incessant contribution of European and Asiatic immigration render peculiarly favorable. Switzerland is already in a state of agitation over the success of American watches. In carriage making, cabinet work, glass work, and pottery, the United States is almost the peer of France and the other great nations. In other things they have got ahead of us; and all this in spite of the high price of labor. It may be said that we are their instructors and masters, as Italy was for us at the Renaissance, and that they are destined to surpass us some day, as we did the Italians. Venice, Milan, and Florence taught us formerly how to melt glass, to weave silk and velvet, and soon we got ahead of them. Will the same thing happen to us in respect to the United States?"

To determine whether beeswax is adulterated with paraffin, heat the suspected material to 329° Fah., with sulphuric acid. On cooling, the paraffin, if any be present, will rise to the surface.

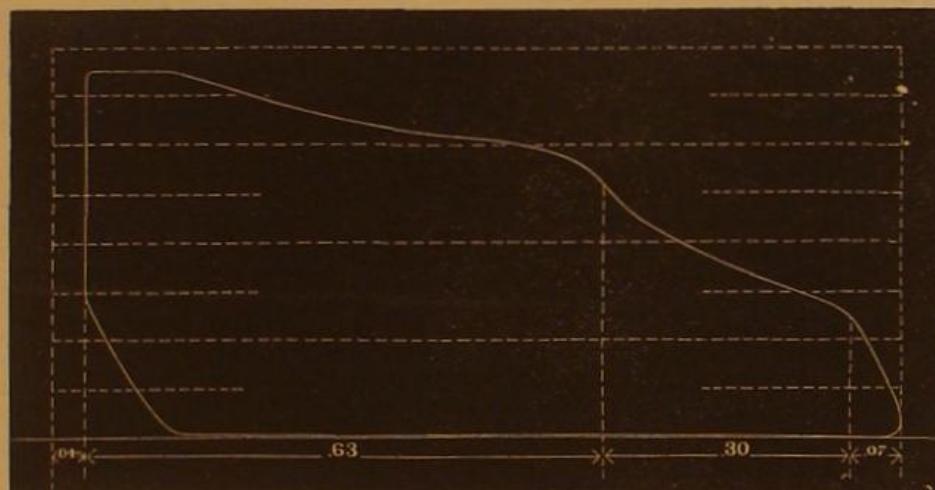


Fig. 2.—INDICATOR DIAGRAM OF A 13x20 NILES ENGINE.

suitable person, gladly take charge of any railway exhibits, and do my best to forward the interests of the exhibitors, if, on consultation, I can advise them to be sent. There are

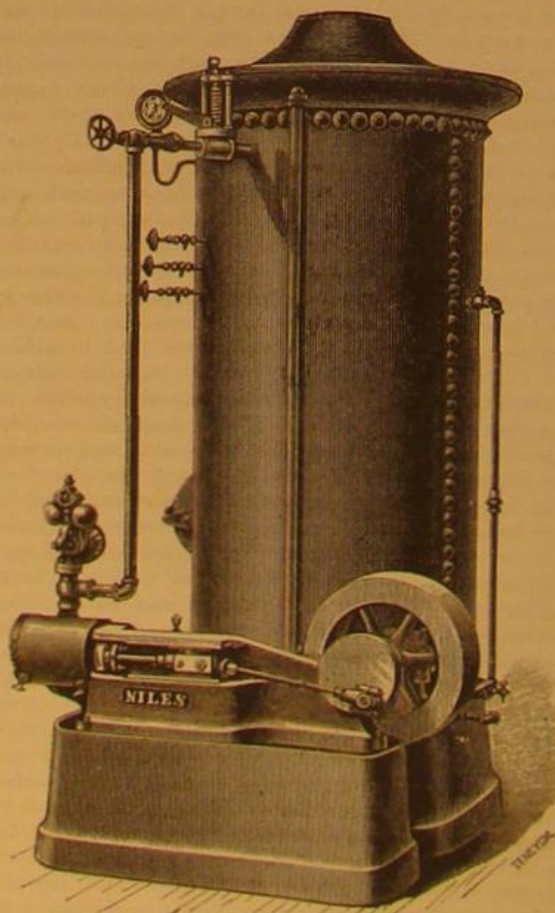


Fig. 3.—NILES SEMI-PORTABLE ENGINE.

very many articles in the Centennial buildings, which would, when known, be introduced into Australia advantageously to the makers. I will mention a few only: Brickmaking



## A CURIOUS CLOCK.

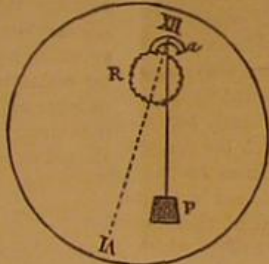
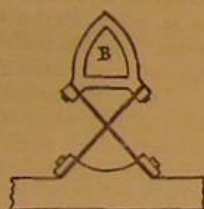
We take from *La Nature* the annexed engraving of a new clock lately devised by M. Guilmet. The odd feature about the timepiece is that the clock oscillates while the pendulum is stationary, thus reversing the usual order of things. The mechanism is contained in a circular case which is pivoted to the branches of the bracket, A B. The rear of the clock, with the escapement and small pendulum, P, is shown in Fig. 3. The ring, B, Fig. 2, is connected to the crosspiece, CC, Fig. 1, by means of three springs. Below the cross-

Fig. 1.



Fig. 2.

Fig. 3.



piece is attached a balance rod, which also acts as a pendulum. The ring is slipped over a hook, *a*, in the hand of the statue, and the clock is thus sustained, a slight swing being sufficient to start its oscillations. The effect obviously is the same as if the piece, *a*, Fig. 3, vibrated in the usual manner. The outline on the right of Fig. 1 indicates the swing of the main pendulum, the position of the bob of which governs the oscillation, and consequently regulates the movement of the clockwork. The weight of the small pendulum and the elasticity of the supporting springs unite to render the vibrations continuous.

## IMPROVED APPARATUS FOR CURING TOBACCO.

It is well known that a large portion of the tobacco grown never enters into that state of fermentation necessary to fully develop its burning quality, flavor, and dark color, so that it retains its wild rank elements and its green and yellow leaves, and is therefore unfit for cigar purposes.

The inventor claims that, by the process and apparatus

shown in the accompanying engravings, such tobacco can be forced to sweat and color, and its quality can be improved, thus reclaiming a large quantity of goods hitherto considered worthless. The case of tobacco to be operated upon is unpacked, and the tobacco, one or more hands at a time, is laid loosely in layers upon the rack bottom of the truck, D. As each layer rises a little above the horizontal bars of the side racks, one of the loose racks, E, is placed upon it, and so on until the whole case has been transferred to the truck, D. Each layer is then moistened with water. As the tobacco becomes soft it settles down, and the racks, E, rest upon the horizontal slats of the side racks of the truck, which prevents the tobacco from packing so closely as to prevent all its parts from being moistened evenly. The loaded truck is now run into the steam chest, A, the door, C, is closed steam-tight, and steam is admitted until it has attained a pressure of from 3 or 5 lbs., which pressure is maintained for 5 or 10 minutes. During this time any excess of moisture that may be contained in the leaves will be vaporized and distributed evenly through the entire mass, and the tobacco will have settled so that the hands press upon each other, and will be in suitable condition to sweat and color. The steam valve is now nearly closed, only enough steam being admitted to maintain a temperature of from 150° to 200° Fah., long enough to thoroughly sweat the tobacco and bring it to the depth of color desired. It is then ready for stripping.

This invention was patented through the Scientific American Patent Agency, September 26, 1876, by Mr. Charles S. Phillips, of Brooklyn, N. Y.

## A Two-Story Street Car.

The Sixth Avenue Railroad Company of this city have introduced a novel car on their road, which attracts considerable attention and will be found specially desirable for summer use. It is only the pioneer of others if the new design prove desirable. Its interior is of hard wood, handsomely finished, polished, and varnished. The braces, bolt heads, door handles, and even the match scraper, are nickel plated. The seats are of fine polished wood, perforated, the nail heads mounted and burnished. The body of the car is shortened to give space for the stairway on each platform. The two benches on the center of the roof are placed so that passengers will sit back to back. A canopy is spread on braces that are screwed to two strong uprights, and is high enough to allow a person six feet in stature to stand upright.

This car has one commendable improvement in the shape of a guard before the front wheels. It is a broad iron strap attached to the under edge of the car, extending to within an inch of the track, thus sheathing the wheel, and acting as a sweeper of the rail.

## The Cornell Owl.

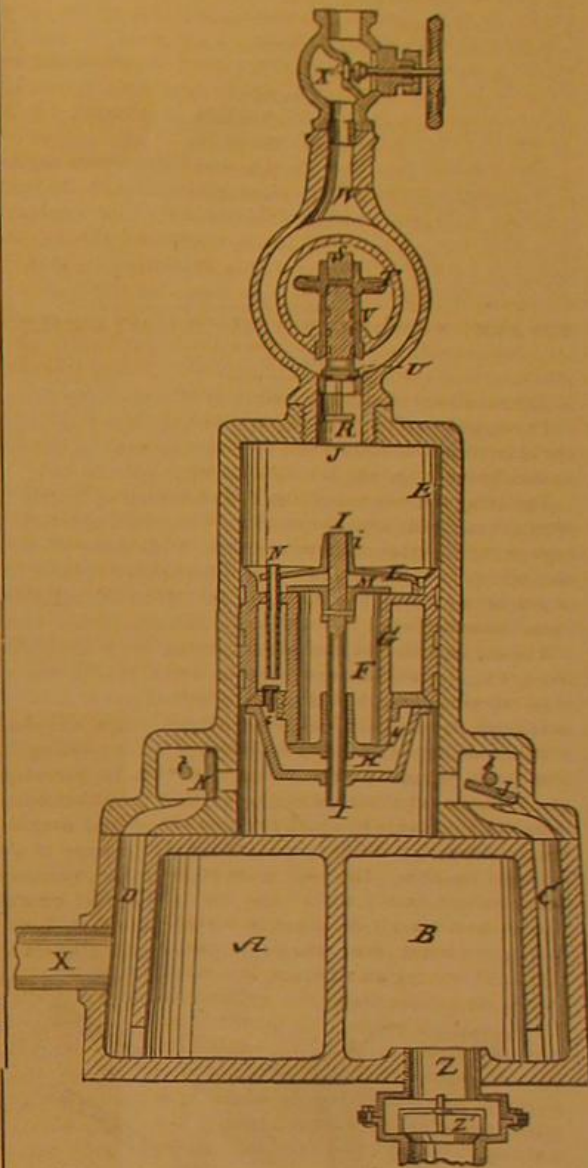
During the past week, a bittern, a duck, and four owls have been received at the laboratory. One of the owls is kept alive. He has disposed of parts of several fish, a chipmunk, and a live snake two feet long. The encounter with the snake was quite amusing. The owl, on spying him in a glass case, evinced a desire to form a closer acquaintance, and so the snake was placed on the floor of the laboratory. The owl with one fell swoop came down upon his snakeship, and, striking its claws into his back, raised his head to its mouth and instantly smashed it. Then commenced the process of deglutition. The owl proceeded to swallow the snake's head first, and proceeded badly enough, until, after a minute's struggle, all was swallowed but two inches of the tail. At this point the owl stopped to take breath, and stood with its eyes slowly blinking, while the two inches of tail, still visible, was wriggling vigorously. At last, summoning up courage, the owl gave a last struggle and the end of the tail disappeared, still wriggling, down his throat.—*Cornell Era*.

## Wall Papers and Typhoid Fever.

An Englishman, several members of whose family had been sick with typhoid fever, had a room repapered, and found that there were no less than twenty-five wall papers already on the wall. The presence of this mass of decomposing paste and paper sufficiently accounted for the disagreeable smell that was always noticeable, although drains and water closets were well trapped.

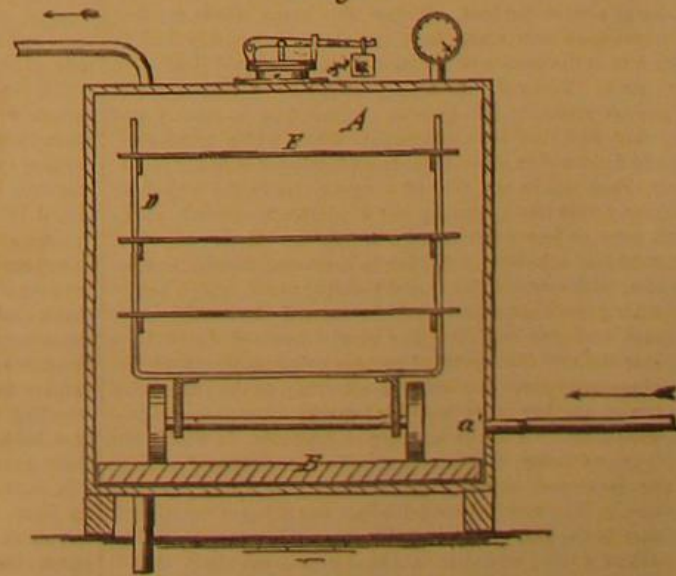
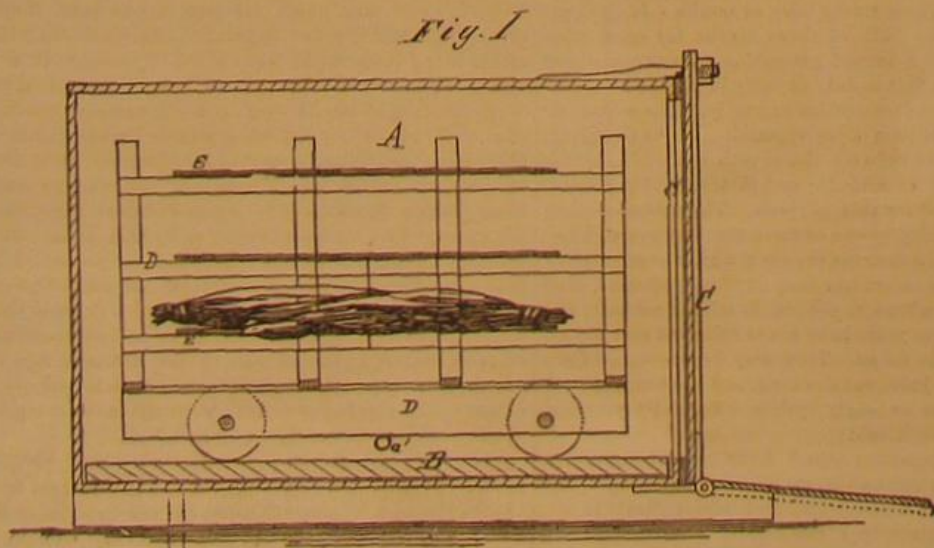
## A NEW STEAM PUMP.

We illustrate herewith a novel steam pump, operated by the condensation of steam, something after the pulsometer principle. To start the pump when first set up, it is only necessary to pour a small quantity of water into the cylinder, then open the globe valve, X', and raise the steam valve, U, by means of the milled nut, T, which allows the steam to flow into the cylinder, E, forcing the air therefrom through the port, K. The head, G, being at the bottom of the cylinder, the valve stem, I, projecting below, holds the valve, M, open, and allows the steam to come in contact with the water. Then, by closing the steam valve, U, a partial vacuum



is formed. The steam is then again admitted, and the same operation continued until the air is exhausted from the pump and pipes. This being accomplished, the pressure of the atmosphere forces the water up the suction pipe, Z, nearly filling the vacuum chamber, B, then up the passage, C, forcing the head, G, upward until the hub on the disk, L, comes in contact with the counterbalance, R, and, lifting the steam valve, U, admits steam into the cylinder, E. As the valve, M (the only means of escape for the steam), is closed, the head, G, is forced downward, forcing the water with it until the valve stem, I, is brought to bear on the bottom of the cylinder, when the head, G, leaves the valve, M, which is thereby opened and allows the steam to pass through the piston, past valve, H, and exhaust into the water below the piston, which condenses it instantly, thus forming nearly a perfect vacuum in the cylinder, E, the valve, U, being at that instant closed by the pressure of the atmosphere. When the vacuum is formed in cylinder, E, beneath the piston, the air instantly expands and forces the water out of the

Fig. 2



PHILIPS' APPARATUS FOR CURING TOBACCO



chamber, B, into the cylinder. At such time the foot valve, R', is held closed by reason of the pressure in the chamber, B, being superior to the atmospheric pressure without. But the instant the piston begins to descend again, so that the valve, J, closes, the water at once rushes past the foot valve and into the chamber, B, with great force, thus compressing the air as before. In this respect the action is similar to what takes place in a hydraulic ram. When water enters the cylinder, E, a jet is forced through tube, N, above the piston. The steam valve, U, is held open while steam is to be admitted by the pressure of steam under it, but is closed by atmospheric pressure as soon as it is allowed to descend by the forming of the vacuum under it, the action being gentle, so as to prevent hammering the seat by the valve. The arrangement of the cylinder, E, and head, G, with its valves or equivalent, effects separation of the steam and water until the time of exhaust, and secures at all times a hot steam cylinder, in which the water to be pumped has no access either to space or surface.

This machine may be used as a condensing steam engine, it being only necessary to connect a piston rod with the head, allowing it to take in only sufficient water for condensation purposes. The invention was patented through the Scientific American Patent Agency, September 19, 1876, by Mr. E. G. Shortt, of Carthage, N. Y.

#### THE ARMY WORM: ITS NATURAL HISTORY COMPLETE

BY PROFESSOR C. V. RILEY.

The substance of some experiments of mine made during the year, on the biology of the army worm, was laid before the American Association for the Advancement of Science at its late meeting, and is here repeated in popular form.

The army worm is one of the most destructive insects to North American agriculture. At irregular intervals it sweeps through the meadows and grain fields about the time that wheat is beginning to ripen, often rendering them unfit for the mower or harvest machine. It proves injurious from Maine to Texas, and from the Atlantic to the 100th meridian; and though the same species, or geographical races of it, occur in other parts of the world, it is not known to be anywhere else so injurious. It is the larva of *leucaria unipuncta*, Haw, a moth with buff-colored wings, and characterized chiefly by having a conspicuous white speck on the disk of the primaries. Up to the year 1861 its parentage was unknown; and it is a singular fact that, notwithstanding the great abundance in which the insect occurs all over the country indicated during certain years, the nature of the eggs, and the time, place, and mode of disposition, remained unknown up to the present year. Two trains of circumstances serve to explain this fact. The one is that, during great army worm years, when the species most attracts at-



Army worm moth. —a, male moth; b, abdomen of the male—natural size; c, eye; d, base of male antenna; e, base of female antenna—enlarged.

tention, the worms are so followed by parasitic and predaceous insects, and so persecuted and destroyed by other animals, man included, that comparatively few of them survive long enough to produce the moth. The other is that, in seasons when the insect does not abound, no one thinks of looking for the eggs.

The time and place of oviposition in this species is quite important from the economic standpoint. Structure is a reliable index to habit; and anatomical study of the structure of the ovipositor, made last winter, convinced me that there was a third and more important reason why the eggs remained undiscovered, namely, that they are secreted. With this clue, I have in the present year been able to solve the mystery, and to prove the correctness of the conclusions arrived at from structural study. The eggs are, indeed, thrust in between the sheath and stalk of well grown grasses, whether cut or standing, or occasionally in between the natural fold of the green leaf, or the unnatural curl at the sides of a withered leaf. On low blue grass, where my first observations were made, they are almost invariably laid in the fold at the base and junction of the terminal leaf with the stalk. The moth invariably endeavors to secrete them. They are generally laid in rows of from five to twenty and upward, and they are accompanied with a white, glistening, viscid fluid which glues them to each other and to the plant; and, when laid in the fold of a spear, draws the two sides securely over them, leaving but a glistening streak along the more or less perfectly closed edges. Each egg, when first laid, is spherical, 0.02 inch in diameter, smooth, opaque white, with a very delicate and yielding shell, which before hatching becomes faintly iridescent, and shows the more sordid embryo within. The newly hatched larva is a looper, the two front pairs of prolegs being so atrophied that it necessarily loops the body in crawling, as the full grown larva of another large family of moths—the *geometridae*—normally do. A large number of noctuids, in which the full grown larva have the normal complement of prolegs fully developed, exhibit this peculiarity in the early larval stages. The newly hatched army worm bears no resemblance to the full grown individual and is so small, and so much of a color with the pale base of a grass blade, that it would scarcely be noticed even where occurring in hundreds to the square foot. It develops very rapidly, going through

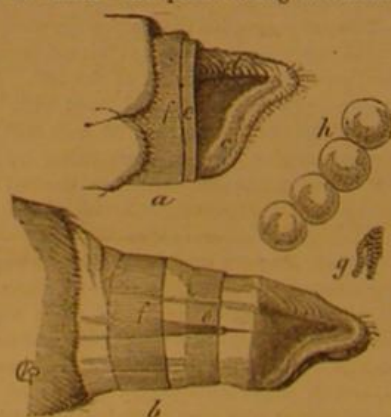
five molts, and attaining full growth in from two to three weeks.

There is one other mooted question in the natural history of the army worm which I have been able this summer to settle, namely, whether the species is single or double brooded. In a review of the matter in my eighth report, I came to the conclusion that, in the more Northern States

at least, or over the larger portion of the country in which it proves injurious, it is but single-brooded, and I am still of the opinion that such is the case. But I have proved that, like so many other species which are single brooded further north, it is frequently, if not always, double-brooded in the latitude of St. Louis. By carefully feeding the moths reared from my first larva with sweetened water, and supplying them with grass in spacious vivaria, I succeeded in obtaining eggs from them. These eggs in due time hatched, and the second brood of worms gave me the moths again early in August. The worms were generally paler than those of the first brood; and being the second generation, reared in confinement, they were less healthy. I obtained, in consequence, but five moths, all of them unfortunately females. One of these escaped, three died without showing any development of the ovaries, while the fifth died with the ovaries so well developed that the eggs, in a state of nature, would probably have been laid within a week. It is very clear, from the above recorded facts, that the eggs of this insect do not as a rule, if at all, pass the winter at the foot of grass stalks, as was heretofore surmised. Nevertheless, the burning over of meadows and grain stubble in winter will act as a preventive of army worm injuries, for the reasons that the moth lays very early in spring, that she prefers the full grown sheath and stalk, even when dry, to the young green spears, and that she cannot well lay her eggs, for want of support, where the grass is yet sparse and thin, as it is when first starting in a burnt meadow.

In my own experiments, the females, in secreting their eggs, showed a preference for old hay over fresh and growing grass. Finally, without entering into further details, I give the following as a revised summary of the natural history of the army worm:

The insect is with us every year. In ordinary seasons, when it is not excessively numerous, it is seldom noticed: 1, because the moths are low, swift flyers, and nocturnal in habit; 2, because the worms, when young, have protective coloring, and, when mature, hide during the day at the base of meadows. In years of great abundance the worms are generally unnoticed during early life, and attract attention only when, from crowding too much on each other, or from having exhausted the food supply in the fields in which they hatched, they are forced, from necessity, to migrate to fresh pastures in great bodies. The earliest attain full growth and commence to travel in armies, and to devastate our fields, and to attract attention, about the time that winter wheat is in the milk—this period being two months later in



Army worm moth: a, end of abdomen denuded and showing ovipositor at rest; b, same with ovipositor fully extended; c, f, retractile subjoinings; d, eggs—all enlarged; e, g, eggs, natural size.

Maine than in Southern Missouri; and they soon afterwards descend into the ground, and thus suddenly disappear, to issue again two or three weeks later as moths. In the latitude of St. Louis the bulk of these moths lay eggs, from which are produced a second generation of worms, which became moths again late in July or early in August. Further north there is but one generation annually. The moths hibernate and oviposit soon after vegetation starts in spring. The eggs are inserted between the sheath and stalk, or secreted in the folds of a blade; and mature and perennial grasses are preferred for this purpose. The worms abound in wet springs preceded by one or more very dry years. They are preyed upon by numerous enemies, which so effectually check their increase, whenever they unusually abound, that the second brood, where it occurs, is seldom noticed; and two great army worm years have never followed each other, and are not likely to do so. They may be prevented from invading a field by judicious ditching; and the burning over of a field, in winter or early spring, effectually prevents their hatching in such field.

It is thus that questions which have caused discussion for years, and given rise to various theories, are settled, and circumstances that seemed wonderful and difficult to account for are explained by a few careful observations and experiments.

St. Louis, Mo.

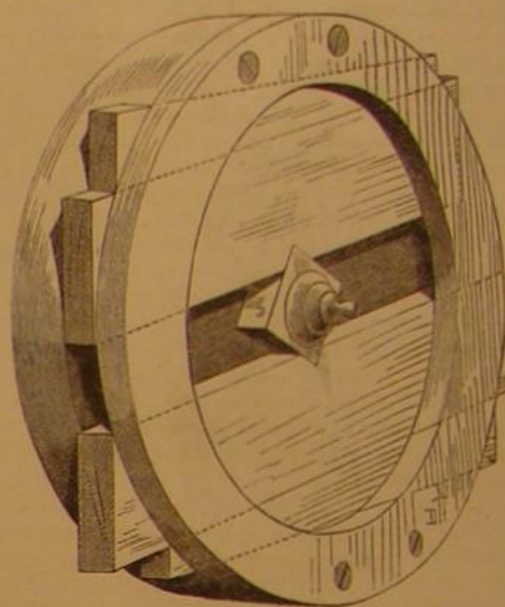
#### Correspondence.

##### A Handy Form of Chuck.

To the Editor of the Scientific American:

I want to thank you as well as Mr. Joshua Rose for the many useful hints to amateurs contained in his notes on tools and their uses, and particularly to the articles on lathes and lathe tools and I indebted much for useful information.

I send you a model of a chuck something in the style of the one described by Mr. Rose in your issue of August 5, 1876, in which, as your readers will see, by the use of a variety of parallel slips, many different sized pieces can be held for turning, by only two wedges; and any boy who can use a lathe can make it.



I would advise all amateurs to have a tap to match the screw on the mandrel; and also a small piece of hard, close-grained wood, tapped to fit, the hole being bored with the grain, and then screwed on to the mandrel, and there turned with slight taper from left to right. A small shoulder or flange should be turned on the left hand end, so that, when screwed on, it fits up close. Then turn a piece of good soft dry pine board, as large as will swing, 1½ to 2 inches thick, and turn a hole in the center to exactly fit the piece of hard wood in which you have cut the thread; put these together with good glue; when the glue is dry, turn the face and edge, and you have a chuck or face plate, which (being of soft wood) can be easily turned out so as to hold any block that is less in diameter. When this face plate is used up, it can easily be renewed on the same piece of hard wood in which the screw is cut. Dogwood is perhaps the best of the common woods in which to cut a thread; it is cheap, and to be found in almost any yard where firewood is sold. I have some of these wooden chucks, the threads being cut across the grain, which have been in use in my chuck for years; and they are as good as new. I prefer a wooden face plate, made as above described, to screwing a board on to an iron face plate, because the screws give in the wood, and they do not remain true.

AMATEUR.

Philadelphia, Pa.

##### The Ratio of the Diameter of a Circle to its Circumference.

To the Editor of the Scientific American:

It is not easy to realize the comparative minuteness of the difference between the figures 3.1416 and 3.14159, unless we reduce them to some familiar standard, say to some fraction of an inch. The former of these numbers is too large and the latter too small, the true figure being at some unknown point between them, but about three times as near the latter as the former. The difference between these numbers is 0.00001; and with regard to a 12 inch circle, it would represent 0.00012 of an inch. Every mechanic using a minutely divided steel scale is familiar with the appearance of  $\frac{1}{100}$  of an inch; and he may, by an effort, be able to imagine the minuteness of  $\frac{1}{1000}$  part of one of these one hundredths,  $\frac{1}{10}$  of which latter subdivisions constitutes the 0.00012 part of an inch. But this small fraction is the sum of the two errors contained by the numbers 3.1416 and 3.14159, said errors being respectively only about  $\frac{1}{100}$  and  $\frac{1}{1000}$  of a subdivision for those numbers. Now two lines over three feet long, differing in length only by 0.012 parts of a  $\frac{1}{100}$  of an inch, have practically the same length; and slight as is this difference, the circumference of a 12 inch circle, if straightened out, would be longer than one and shorter than the other, that is, it would differ from either one by less than the amount by which they differ from each other. If a microscope having a power of 200 diameters were brought to bear upon these minute portions of an inch, the former (0.3 inch etc.) would appear less than a  $\frac{1}{100}$  on the scale, while the latter ( $\frac{1}{1000}$ , etc.) would have an apparent breadth scarcely exceeding that of one of the division marks; and yet these microscopic amounts constitute respectively the extent of the errors developed by using the above ratios to obtain the circumference of a 12 inch circle.

For other sized circles, these errors increase or diminish in exact proportion to the diameters: for instance, in a circle the size of a locomotive turntable they would be respectively about  $\frac{1}{10}$  and  $\frac{1}{100}$  of a  $\frac{1}{100}$  of an inch. The mechanic realizing these facts is enabled to use the numbers 3.1416 and 3.14159 intelligently, as multipliers for the diameters



and with full confidence in their almost absolute truthfulness as applied to circles of moderate size.

Rochester, N. Y.

E. B. WHITMORE.

### The Earth's Motion.

To the Editor of the Scientific American:

In an article on the "Irregularity of the Earth's Motion," on page 331, current volume, it is mentioned that "smaller changes, some in one direction, others in the other, have taken place, generally lasting about four weeks at a time." Whatever may be the cause of the changes of long duration, there must, of necessity, be a change at every revolution of the moon, since it has long been a well established fact that the earth does not move in a regular orbit around the sun, but in epicycloidal curves, the center of gravity between the earth and moon making the real orbit in which both together revolve. And as this center is outside of the earth, the whole body of the earth must cross the orbit twice in every revolution of the moon, and thus must apparently be constantly varying in the velocity of its motion.

To represent the true path of the earth would require a section of over one hundred feet in length, of an arc of one hundred feet radius, in which the earth would be but one tenth of an inch in diameter. But the path of the moon, which is affected in a much greater degree, can be given on a much smaller scale. Thus, if we take a plain wheel of six inches diameter and insert a pin in the center and another at one tenth of an inch from the first, and roll this wheel around the edge of another wheel of seventy-six inches diameter, we will find that, while the center pin describes a circle of eighty inches, the other will describe a curved line like that of the moon. It will thus be seen that it is only the common center of gravity that has a regular motion, while the motion of both the earth and moon must be constantly varying.

Canton, Mass.

J. A. B.

### PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XVI.

#### PATTERN MAKING.

Our next example is what is called a T, a drawing for which is shown in Fig. 113. It is shown with flanges on the main body, and a hexagon on the branch. Sometimes a flange is employed instead of the hexagon, but this depends

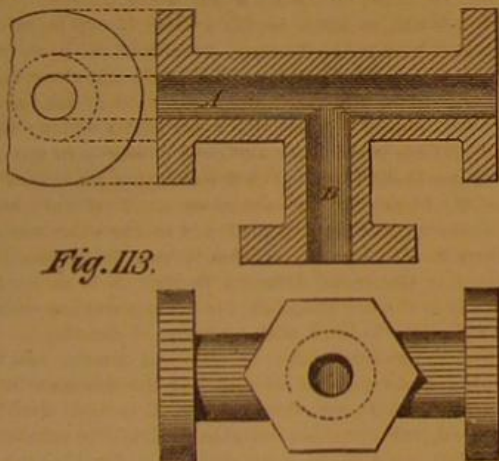
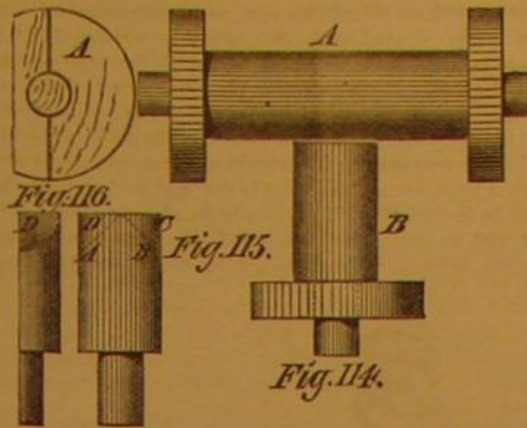


Fig. 113.

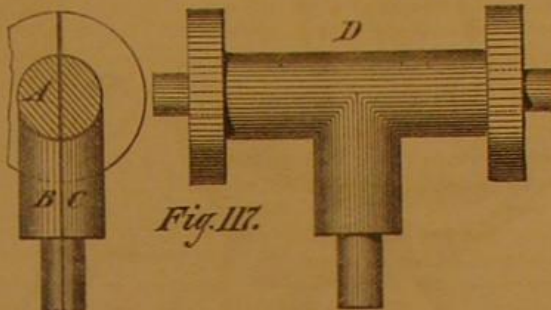
upon the connections to which it is to be attached. Patterns of this class are often made so that either round flanges or hexagonal connections may be put on at will; and it is in that style that we propose to make our example. It is apparent that the pattern will be the most easily molded with its body and branch both lying horizontally in the mold, so that, if we suppose the surface of this paper to represent the surface of the mold, the engraving shows just how the pattern will lie in it. It will be advisable, therefore, to make the pattern in halves.

We first prepare the body and flanges, in the same manner as described for the body of our gland, the only difference being that we have, in this case, to fit a flange on each end. The same method is pursued in making the branch, with the exception that we only require a core print on one end, the other end abutting against the body. The first question that arises is how long shall we make the branch; and this depends upon how far the branch follows the curvature of the body. In our example, the branch and body are of the same diameter, and therefore the branch will follow exactly half way around the body. We turn up the branch piece, then, to its requisite diameter, and make its length equal to the diameter to which it should stand out from the body, added to half the diameter of the body. The pieces we have made, then, are those shown in Fig. 114, in which A represents the piece for the body, and B the piece for the branch. Our next proceeding is to cut out the abutting end of the branch to fit to the curvature of the body, and this we perform as follows: We first set the bevel square to an angle of  $45^\circ$  by the process shown in Fig. 109, and then, taking the branch halves apart, and placing the bevel square with its back across the end face of the branch (the blade lying on the joint face of the half branch), we mark the two lines, A B, in Fig. 115, which must meet exactly in the center of the branch and at the extreme end, as shown in Fig. 116. We then pare off the angular piece, C D, down to the lines, A B. If, before we do the paring, however, we give our half branch a quarter turn around, it will appear as shown in Fig. 116; the curved formed by the intersection of the plane surface (just made) with the round surface of the piece is the true curve of the body of the T.

Turning to the other half of the branch, we perform upon it the same operation; and we may then cut away with the



gouge the intervening timber from between the curve lines. Our two halves will be of the proper curve at the end to fit exactly to the body of the T, as shown in Fig. 117, in which



A represents a sectional view of the body of the T, and B C are the two halves of the branch; while the view, D, shows the body of the T lying horizontally with the branch attached.

We have now to fasten the branch to the body of the T; and here we must pause to consider whether the pattern is required to serve simply for the production of a few castings, whether it is to be cast aside after the first casting, never to be used again (which is often the case), or whether it is intended for standard or continuous use. For a temporary purpose, a few screws will be sufficient; but for a permanent pattern, a much stronger joint may be made as follows: Brush with hot glue the ends of the branch piece, and let them stand until the glue has been absorbed into the pores of the wood. This is called sizing, and is always necessary in gluing end wood, as it is called, meaning the end grain of wood. The reason that sizing is, in that case, necessary is that the pores of the wood all meet the surface in the end grain, and the sizing is necessary to fill them. We then take a truly planed piece of board, and lay one half of the body down upon it, placing a piece of thin paper between the body and the board so that any glue that may run out may not touch the board; otherwise it may glue the work so fast to the board that, in parting them, some of the fibers of the wood may get torn out. Then we fasten temporarily the half body to the board, and lay one half of the branch with its flat surface on the same board, and glue it to its place, drawing it well up to the body piece with dogs or clamps, at the same time observing that it is close down to the board, and fixing it temporarily there, as shown in Fig. 118, and allowing it to remain until the glue is dry. In put-

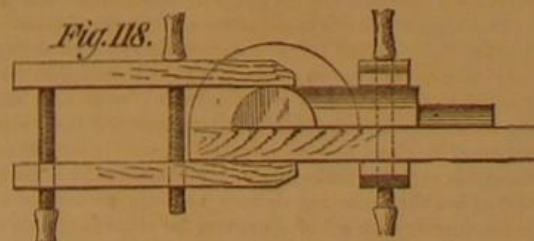


Fig. 118.

ting on the second half of the branch, the board need not be used, since the first half, already in position, will serve as a guide. A piece of paper must, however, be placed between the two halves of the branch to prevent them from adhering together. When all is dry, put a strong screw in the position denoted at A, in Fig. 119, cut out a recess on the flat face of each half, and let in a piece of hard wood, as shown by the dotted lines in the same figure.

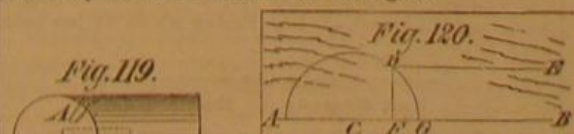


Fig. 119.

Let us now suppose that, in our example, the diameter of the branch had been smaller than that of the body of the T. In that case we must first ascertain its proper length by the process illustrated in Fig. 120, which represents a piece of board, upon which we strike the line, A B; and from the point, C, we mark the semicircle, D, which must be of the same radius as the body of the pattern. Then, parallel with the line, A B, we draw the line, D E, the distance between these two lines being equal to half the diameter of the branch of the pattern. Then from the junction of the line, D E, with the semicircle, D, we strike the line, D F, at a right angle to A D; and then from F to G, added to the distance which the branch requires to stand out from the edge of the body, is the length we require to make the branch.

To draw the curve on this branch so as to cut it out to fit

the body, we proceed as follows: Fig. 121 represents the application of a peculiar trammel designed for this and similar purposes. It enables the operator to strike a true circle upon a round or uneven surface. It is composed of the

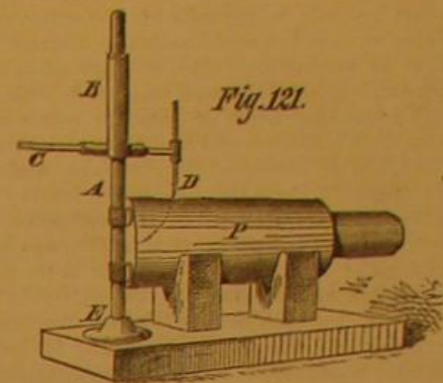


Fig. 121.

turned bar or rod of metal, A, of about half an inch diameter, and upon it slides the piece of brass tube, B, upon which is contrived a support for the sliding arm, C, as well as a set screw for fastening the arm, C, in any desired position. At the end of the arm, C, is placed an arrangement for fastening the scriber, D, so that we may set the scriber at any requisite distance from the rod, A, by adjusting and fastening the arm, C, and revolve it about while lifting or lowering it upon the rod, A. When properly made, this is a most useful tool; and if not in use, it may be taken apart in an instant, and it occupies but very little room in a tool box. If the stand, E, pierced with holes for screwing down, is provided, it will be a very useful addition, but it may be dispensed with; whereas the tool proper, or some improvised substitute for it, is absolutely necessary, for the curve must be struck somehow. If the pipe or branch is large, say even six inches in diameter, to attempt to fit it by guessing and trying is the work of a novice and not of a workman. To apply this tool to our branch, we proceed as follows: Taking a planed board, we gage a line upon it; and at a point on this line, we describe a circle upon it of the size of the foot of the instrument. We then make two V blocks, such as shown in Fig. 122, to carry the branch. We then place

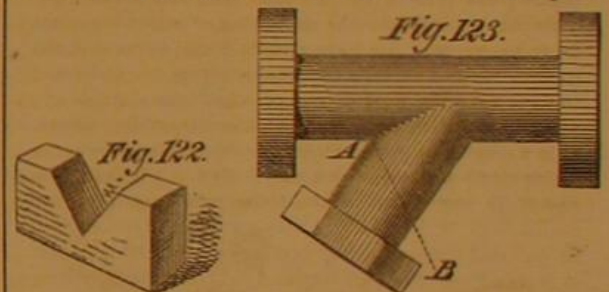


Fig. 122.

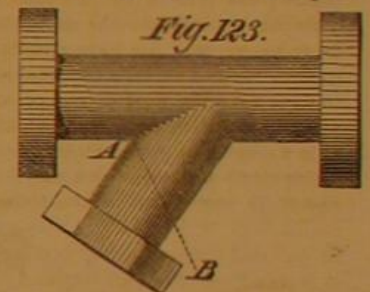


Fig. 123.

these V blocks with the apex of the V exactly over the gaged line, and place the branch in the Vs. We then set the point of the scriber at a distance from the rod of the trammel equal to the diameter of the branch, which may be readily done if the size of the rod be known. We next mark upon the top of the branch, as it lays in the Vs (with the joint of the two halves standing vertically), the distance it requires to be cut out to form the curve, which distance will correspond to the distance of F G, in Fig. 120. We then draw the branch forward until this mark falls exactly under the scriber, keeping the joint faces vertical; and this adjustment being made, we fix temporarily the branch to the piece of board whereon it and the Vs rest. Then we move the arm, C, in Fig. 121, a half circle; and letting the point of the scriber contact with the branch, we draw the necessary line. It will be found, however, that it is requisite to mark the lines while lifting the arm to prevent the scriber from digging into the wood. Thus one side of the branch will be marked, and we must then turn it upside down on the Vs, set the joint vertically again, adjust the mark to the scriber point, and proceed as before to mark the other side of the branch. We may then cut out the corners to the lines, which may be most rapidly performed by a band saw, sawing exactly to the line: the branch being held on a board, as it was when being marked. In fact, a piece of wood should be fitted underneath, where the saw cut will come, so as to prevent the fibers of the wood from being torn out at the edge, showing a ragged cut; as it is very apt to do, especially if the band saw is not in first class order.

Should the branch be required to stand obliquely to the body of the pattern, as shown in Fig. 123, it may be struck out in the same manner; but instead of being set square with the rod of the trammel, as in the former case, it must be set at the bevel at which it is to be fixed upon the body of the pattern. When marking one side, the branch must make an angle with the upright equal to the angle at A, in Fig. 123; while, when marking the other side, it must form an angle equal to that at B, in the same figure. It will pay, where two or three pattern makers are employed, to have this marking apparatus always standing ready for use upon a board, with the degrees of angles marked thereon; so that a workman could mark off his job in five minutes, and cut it out with a band saw. Cutting out with a gouge and trying to its place may take four or five hours. It must be borne in mind that too much care cannot be given to striking out the pieces accurately and to sawing them true to the lines. The saw must be sharp and of a width suitable to the curve, and not tremble, or "dither," as band sawyers say. By attending to these matters, a fit may be obtained with a minimum of labor to the workman; and this is desirable in itself and is an item of profit in the cost of the pattern.



## ANTIQUE GOLD AND SILVER WORK.

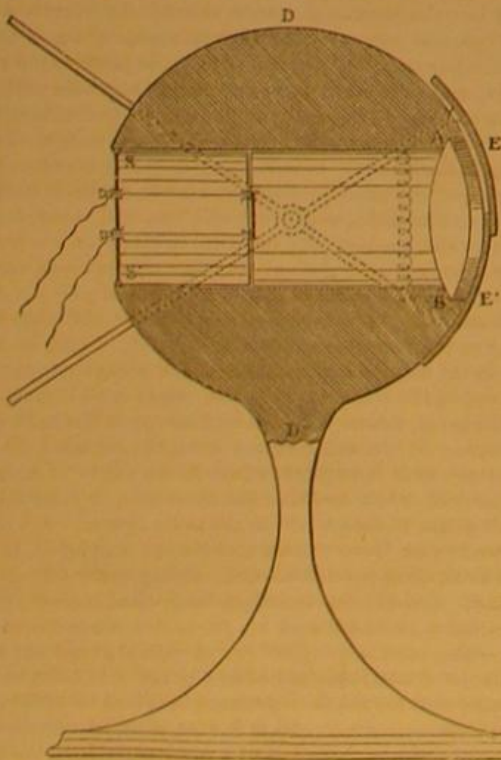
It was the custom among rich men in the middle ages to invest a considerable portion of their wealth in gold and silver wares: not only for the sake of possessing valuable and rare specimens of art workmanship, as a means of display, but as an investment. Men of large revenue must have been sorely puzzled to know what to do with money when stock companies, bonds of corporate bodies, and national debts were unknown; and even bankers, as known as such to-day, had no existence, the custom of banking not being introduced till about the seventeenth century. This consideration, probably, furnishes an explanation of the great wealth in gold and silver plate which was possessed by some of the European monarchs in the thirteenth and following centuries. As the goldsmiths became dealers in this form of property, and frequently received it for safe keeping or as security for loans, they gradually became bankers; and many of the oldest banks in London were originated in this way.

The practice called into existence some of the very greatest artists that the world has ever known. Benvenuto Cellini may justly be called the chief even of the most renowned workers in the precious metals; and the demand for his services spread to all the courts of Europe. His works are very numerous, and the smallest authentic specimen of his handiwork is sure to fetch an enormous price when offered for sale, and to be highly prized by its purchaser, and closely studied by the connoisseur, as well as by the aspirant for fame in the beautiful art of metal working. Cellini founded the *renaissance* school of design and ornamentation of the precious metals; and his contemporaries and followers extended the influence of the newly revived classical forms, till the goldsmith's art, as we now know it, was formed. The progress since made was studied by tens of thousands of people at the recent Centennial Exhibition; and the magnificent exhibits of Messrs. Elkington & Co., Tiffany & Co., and other firms have well shown the present condition of the craft.

The accompanying engraving delineates a very remarkable salt cellar, being part of a collection of antique plate formed by the late Lord Londesborough. This curious example (the engraving of which we select from the pages of the *Silversmith's Trade Journal*) of the quaint designs of the old metal workers is considered to have been the work of one of the famous Augsburg goldsmiths at the latter part of the sixteenth century. It is a combination of metals, jewels, and rare shells, in a singularly grotesque general design. The salt was placed in the large shell of the rare pecten of the South Seas, which is edged with a silver-gilt rim, chased in floriated ornament and further enriched by garnets; to it is affixed the half-length figure of a lady, whose bosom is formed of the larger orange-colored pecten, upon which is fixed a garnet, to represent a brooch; a crystal forms the caul of the head dress, another is placed below the waist. The large shell is supported by the tail of the whale on one side, and on the other by the serpent which twists around it; in this reptile's head a turquoise is set, the eyes are formed of garnets, and the tongue of red onyx. The whole is of silver-gilt, and within the mouth is a small figure of Jonah, whose adventure is thus strangely mixed with the general design. The sea is quaintly indicated by the circular base, chased with figures of sea monsters disporting in the waves. It would not be easy to select a more characteristic specimen of antique table plate.

## SIEMENS' SENSITIVE ARTIFICIAL EYE.

We have already alluded to Dr. William Siemens' curious device of an artificial eye sensitive to light, an invention



based upon the action of light upon the electric conductivity of selenium. The construction of the eye is shown in the annexed engraving.

A hollow sphere, suitably supported, is provided with two openings, in one of which is placed a converging lens, A, B,

and in the other a selenium plate, S S', the latter in communication with an electric current and a galvanometer. The lens being covered with two movable screens, E E', the whole is comparable to an eye, in which the screens represent the lids, and the selenium plate the retina. Whenever the screens are removed, the galvanometer is seen to deviate and the degree of deviation depends on the color of the light which converges upon the selenium. It is very slight if the light is blue, more if the light is red, and still more if white light be transmitted. The eye may be placed in communication with an electro-magnet, which may automatically operate the screens, in manner similar to lids. "Here," says



## AN ANTIQUE SALTCELLAR.

Dr. Siemens, "is an artificial eye, sensible to light and to differences in color, which gives signs of fatigue when it is submitted to the prolonged action of light, which regains its strength after resting with closed lids," and which, by an electro-magnet attachment, may be made to close itself, as does the human eye involuntarily, on the occurrence of a vivid flash.

## Trade Marks in Great Britain.

Hon. R. H. Duell, Commissioner of Patents, has received a communication from the Commissioner of Patents of Great Britain, informing him that by act of Parliament foreigners have been accorded the privilege of registering trade marks in that country on the same terms as British subjects. The United States Patent Office has recently declined to register trade marks for British subjects for the reason that no provision had been made by treaty or act of Parliament extending the reciprocal privilege to our citizens; but in view of the action of England now communicated, our Patent Office will hereafter register trade marks for them on the same terms and under the same regulations as those prescribed by it, in accordance with act of Congress for citizens of this country.

The letter from the London Patent Office calls especial attention to the fact that prior registration in the country of which a foreign trade mark owner is a subject is not necessary before registration in Great Britain; but in case a trade mark has been used before the date of enactment of the new law (which date is not, however, stated in this communication) it will be necessary in the application for registry that a description of the goods in respect of which it has been used, and the length of time during which it has been so used, be given.

## New Remedy for Boiler Scale.

Zinc has been shown to be an excellent anti-corrosive in those cases where decomposed grease or fatty acid is the destroying agent of boiler metal; but its usefulness is mainly confined to boilers in which sea water is not used. Filtering the feed is an excellent precaution and should be universally adopted. To prevent the corrosive action in marine boilers, of substances which no filtering can arrest, Mr. Rowan, in a paper recently read before the British Association, proposes forming on the interior surfaces of the boiler, an artificial coating of calcium sulphate and magnesium hydrate, in proportions varying with the pressure carried by the boiler. It is claimed that, when once hardened by heat, the artificial scale thus made with fresh water cannot be dissolved by fresh water, and is not likely to be affected by the small quantity of sea water which may leak in: that its thickness is quite under control, and that it is free from the trouble attending the keeping up of a salt scale.

## Sawing Granite.

Among the interesting things that were shown to the architects in Philadelphia, during their convention, was the patented process of Messrs. Struthers & Sons, for sawing granite. Hitherto it has been found impracticable to cut granite with a saw, since the ordinary sand process would cut only an inch and a half or two inches per day. The inventor of the Messrs. Struthers' process hit upon the idea of using chilled iron, finely divided, instead of sand. A jet of steam is directed upon a fine stream of melted iron, and blows it into spray, just as in the common atomizer a jet of air pulverizes, so to speak, the stream of liquid upon which it is turned. The iron, divided into fine globules of, say, a fortieth or a fiftieth of an inch in diameter, falls into cold water, and is chilled into excessive hardness. It is used under a saw of soft iron, and with a stream of water, as sand is used in sawing marble. Most persons would have supposed that the scratching of angular grains of sand would be more efficient than the rolling friction of globules of iron; but it would seem that the sand is speedily crushed into dust, while the tough iron, simply wearing down into smaller and smaller globules, crushes its way through the felspathic and other crystals of the granite (which with us is usually sienite, by the way, and not granite). The rolling of the globules is curiously shown by fine channelings or flutings, which score the under edge of the saw from end to end. By this device granite can be sawn at the rate of three or four inches per hour, and at small expense: the waste of the iron being about three pounds for every square foot of kerf, or two square feet of sawn surface. For small blocks, where a saw can be used that is short enough and therefore stiff enough to bear a heavy pressure without buckling, it is found possible to cut at the rate of twelve or fourteen inches per hour. The surface obtained by sawing is vastly better prepared for polishing than a hammered surface, not only because it is smoother, but because by hammering the surface of the stone is "stunned," as it is termed: that is, the crystals are so bruised and shattered below the surface that it is necessary, before the polishing can begin, to grind away an eighth of an inch or more, which is unnecessary with a sawn surface.—*American Architect and Building News.*

## A NEW BLOWPIPE.

We illustrate herewith a novel blowpipe, which consists of a fire chamber, connected with an air forcing apparatus, and provided with nozzles of various forms for directing one or more jets of heat and flame. The object is to provide a portable blowpipe, the flame of which will have sufficient power to heat objects of considerable size. The fire chamber consists of a cylinder, B, of iron, having conical ends. To one of these ends the blast pipe, C, is attached; and to the other a nozzle, D, is attached by screws, so that it may be removed and replaced by nozzles of different forms. E is an aperture in the top of the fire chamber, for the introduction of coal, etc. The chamber is lined with a coating of fire clay.

Fig. 2 represents a flat or elliptical nozzle, and Fig. 3 a double nozzle, capable of directing the flame on both sides of an object. In use, the chamber, A, is filled with burning charcoal, coke, or other suitable combustible substance, and the blast pipe, C, is connected by a flexible pipe with a blower or bellows. A blast being created, a jet of flame and heated gases issues from the nozzle, D, which is directed against the object to be operated on. The heat generated in this manner is said to be so intense that heavy irons, like the frame or braces of a locomotive or other large objects, may be heated in their places and bent. With a nozzle having several jets arranged in an arc, the tire of a locomotive wheel

Fig. 1.

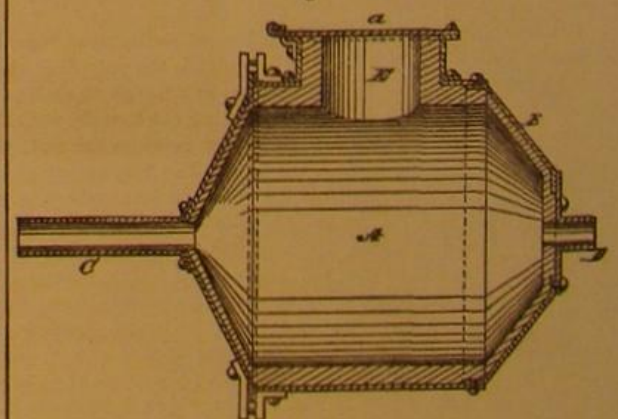


Fig. 2.]

Fig. 3.



may be heated and expanded, so that it may be easily removed.

The apparatus is the invention of Messrs. O. G. Dodge and William Gushurst, of Omaha, Neb., and was patented through the Scientific American Patent Agency, September 26, 1876.



## ACHMEA PANICULATA.

The *achmea paniculata*, represented in the fine engraving herewith (which we extract from *La Nature*), belongs to the *bromeliaceae*, a small family of endogenous plants, which includes the pineapple, and is quite nearly related to the canna, ginger, and banana families. The plants are usually stemless, scarcely woody, and nearly all tropical. They are mostly epiphytes in the forests of Central and South America, growing in trunks of trees (though they are by no means parasites) and in clefts in rocks. The leaves are dry or fleshy and channeled, sheathing at the base, and usually covered with scurf. The flowers are hermaphrodite and regular, and are crowded on the stalk, which grows to a height of two or three feet. Each flower consists of three outer divisions or calices, and three inner, much longer, with petal-like divisions all attached to the inferior three-celled ovary. Each flower is likewise placed in the axil of a bract, the upper bracts, which are without flowers, developing at the top of the stem as a group of small leaves, ending in a point or spur.

The six-cleft perianth is the distinguishing feature of the family to which the *achmea* belongs, and thus curiously enough allies to the wholly dissimilar appearing *Tillandsia* or long gray moss, so common in our Southern States.

## Knowledge Made Useful.

In a recent address to the students of the School of Pharmacy, London, by Mr. Barnard S. Proctor, he illustrated as follows the idea that not only must the mind have received an ample store of useful facts, but all those faculties must also have received a large development before one can be regarded as in any complete sense well educated and intelligent. "To make a carpenter you want wood and tools, and skill to use them. So to make a learned man you should have knowledge of facts and laws, and power to use them. Probably many of you are not aware how imperfectly you exercise these faculties upon facts or circumstances which are presented to you. I will take an illustration. Suppose I write down in a vertical column two series of units 0, 1, 2, 3, etc., up to 9, thus:

|   |   |
|---|---|
| 0 | 9 |
| 1 | 8 |
| 2 | 7 |
| 3 | 6 |
| 4 | 5 |
| 5 | 4 |
| 6 | 3 |
| 7 | 2 |
| 8 | 1 |
| 9 | 0 |

"Some would be noticed by all of you if you regarded the figures long enough, but you would not all observe them equally soon; it would depend upon the innate faculty and the degree of educational development of the individual. The first thing you would notice is that the double column represents the nine column in the multiplication table; next you might notice that, if we place a plus mark (+) between these two columns, and an equal mark after them, we should obtain a third column all nines, thus:  $0+9=9$ , and the same with all the others down to  $9+0=9$ . Next, if you draw diagonal lines from the 0 to the 8, and from the 9 to the 1, and so on, you will see that the products are all eights one way and all tens the other. In making these observations we should not say you had discovered a law, though we might say you had detected a rule applying to the arrangement, and you would naturally say: 'Where there's a rule there's a reason.' And in the search for the reason you exercise the higher faculties of the mind. You do not continue your observations upon these figures alone; you commence considering, speculating, and testing speculation with experiment. You may extend the column upwards and downwards, and find nine times nine tenths is 8.1, and nine times eight tenths is 7.2. So the remainder, the sum of the two figures continues to be nine. You may then carry your extension downwards, and find nine times eleven are ninety-nine, the sum of which two figures is not nine but eighteen. Then nine times twelve equal 108, in which case the sum of the three numbers gives us nine, as also is the case with the following numbers: 117 and 126, etc. You will observe the hitch at eleven times nine in the sum taken horizontally, and that there is no hitch in the sums taken by the right hand diagonal, and three hitches in the left hand diagonal. This will lead you to observe that in stepping from decimals into units the rate of progression is altered, and that it is not altered

in passing from units to tens, because we take in the teens between ten and twenty."

## Indian Manufactures.

According to the English papers, a great change is coming over India in the matter of manufactures. The old indigenous industries are in many places dying out, first through the competition of English looms, and latterly through the introduction of machinery into India itself. The delicate-handed natives, however, conform to the altered circumstances, and show a great readiness and aptitude for mechanical work. In jute, cotton, and sugar factories they find employment by thousands; but the traditional excellence of their work has not yet in all places succumbed to the invasion of steam, for in Orissa and in Patna the handloom still holds its own; and the muslin (the finest in the world, of which fabulous tales are related in connection

hard substance they are easily broken; further, it is frequently necessary to color the ball afresh, as any deep penetration of the color produced in the ivory would affect its quality, and give rise to more frequent fractures. The center of gravity of the ebonite ball lies exactly in the middle, as the material is perfectly homogeneous. The hardness of these balls is such that they may be thrown with all one's force against a granite plate without being injured, and they have also great elasticity, springing to a height of 60 or 90 feet. The price of the balls (notwithstanding their superior qualities) is about one third less than that of the ivory balls."

It might be worth while to test balls of glass, hardened by the Bostie process, as substitutes for ivory.

## Cryolite and Its Uses.

Cryolite was discovered toward the end of the last century in a bay in Arksut Fiord, West Greenland, where it constitutes a large bed or vein in the gneiss, of about 300 feet in length and 80 feet in thickness. The name is derived from two Greek words meaning "ice" and "stone," and is applied because of the fusibility of the mineral in the flame of a candle. It was supposed to be sulphate of barytes until examined by Abildgaard, who found it to contain fluoric acid. Subsequently Klaproth detected soda in its composition. It was not, however, until 1850, when Jules Thomson discovered that the mineral could be easily decomposed either by the dry or wet way with lime and the calcareous salts, that it came into industrial use. In appearance cryolite is snow white, partially transparent, of vitreous luster and brittle texture. Its hardness is 2.5, specific gravity 3; and it cleaves in three directions, two of which are rectangular.

From cryolite, aluminum, alum, caustic soda, and glass of a peculiar quality are obtained. About 6,000 tons of the mineral are yearly brought to this country for soda manufacture. The glass is produced in Philadelphia under the name of "hot cast porcelain," and, when made of pure cryolite, is milky white in hue and slightly transparent. Impure cryolite yields an opaque glass closely resembling marble. The mixture for milky glass consists of oxide of zinc 1 part, cryolite 4 parts, and sand 10 parts. This is melted in pipe clay pots, which are not attacked by the fluo-silicic acid disengaged. The glass is very hard, remarkably solid, and is not attacked by strong acids even when pulverized. These properties are doubtless due to the presence of undecomposed cryolite. With a small quantity of the mineral, the glass is brilliant and refracts light strongly; with a greater quantity it becomes opalescent, and finally, on more cryolite being added, the glass turns opaque and closely resembles porcelain.

## A New Weapon of War.

According to the San Francisco *Chronicle*, another terrible instrument of war has been invented, by a resident of that city.

The new gun, patented by Leonard and De Vry, and christened "Peace Conservator," was exhibited at the Pacific Iron Works. The prompt action of the instrument, delivering seventy shots in four seconds, and ten hundred and fifty shots in one minute, through a thick oak barricade, proves that it is one of the most terrible death-dealing inventions ever known. The machinery is simple and easily worked, requiring but few attendants, who are perfectly protected from their adversaries' bullets; and it can be transported with much greater ease than an ordinary six-pounder. The bullets from this terrible machine will, it is claimed, diverge 300 feet in 1,000 yards—the distance claimed at which it will effectually deliver shots—and the gun can be easily worked by one person in any direction, or made to shoot almost solid.

HALL's *Journal of Health* advises stout people not to seek to reduce flesh by drinking vinegar or smoking, but to maintain as perfect a digestion as possible and avoid fat-making foods, such as starch in the shape of potatoes, flour bread, and rice. Spirits, malt liquors, and sweets are to be abjured. The gluten of wheat is the best food. It will sustain life in full vigor, but it will not add an ounce of fat to the body.



ACHMEA PANICULATA.

with the most charming of princesses), though very costly, is even now to be obtained from the weavers of Dacca.

## A Substitute for Ivory Billiard Balls.

Probably the best known substitute for ivory billiard balls is the celluloid composition made by the Albany (N. Y.) Billiard Ball Company. There has been no material yet discovered that equals ivory for this purpose, but the latter is expensive; and the production of large tusks, which are required for full sized balls, is growing gradually less, so that increasing necessity exists for a substitute which possesses the requisite weight and elasticity. The celluloid balls cost about 25 per cent less than ivory at the present price, and are a fair substitute for the latter; but it would seem as if some of our ingenious inventors might discover a new material or improve on the present artificial substance. A billiard table manufacturer in this city writes to us "that if any man can invent a perfect substitute for ivory, his fortune is made." We have no doubt of the correctness of the last assertion, notwithstanding the absurd statement of some of the foreign journals that billiard balls are now made of ebonite, by a firm in Berlin, superior to ivory. We quote: "Ivory balls are objectionable, on the score that they are not of equal density throughout, and that by falling on a



## HOUSE BUILDING.

Bricks, girders, various types of masonry, metallic laths, and chimney-cowls, subjects all connected with house building, are illustrated in the accompanying engravings, which we select from Knight's "Mechanical Dictionary."

## HOLLOW BRICKS

are made for purposes of warming, ventilating, and removing moisture from walls. In some cases the hollows form flues or shafts, either for ventilation or for the discharge of dust from upper stories; in others the orifices form air chambers, the imprisoned air being a very poor conductor of heat. At *a*, Fig. 1, is represented a 9-inch wall of hollow brick

Fig. 1.

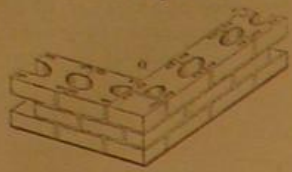
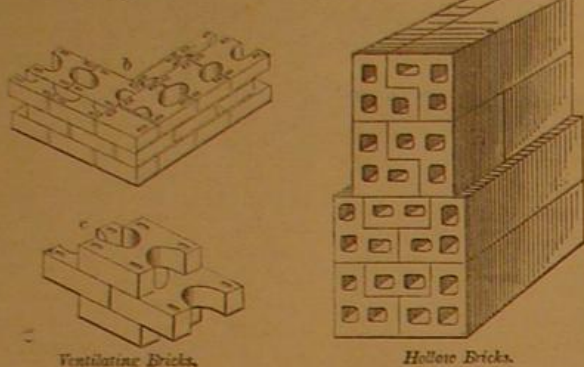


Fig. 2.

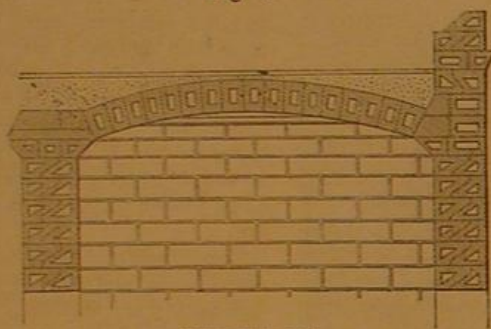


Ventilating Bricks.

Hollow Bricks.

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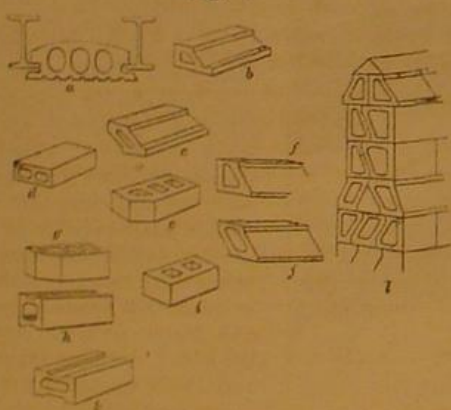
Fig. 3.



Hollow-Brick Arch.

finished with solid brick at the angle; *b* shows a 14-inch wall, a half ventilating brick being used alternately in the courses; *c* shows the relation to each other of the ventilating spaces, so as to render the openings continuous. Figs. 2 and 3 represent the construction adopted in Prince Albert's model houses. It is stated that there is an advantage of 20 per cent in favor of the hollow bricks over the ordinary bricks, in addition to a considerable diminution in the cost of carriage and transport, and a saving of 25 per cent in mortar and labor. In Fig. 4, *a* is a hollow brick for ceilings, hav-

Fig. 4.



Hollow Bricks

ing lips which rest on the lower flanges of the girders. The bricks indicated by letters, *b* to *k*, are external and internal, quoin, jamb, and splay bricks. Fig. 5 shows

## METALLIC LATHS

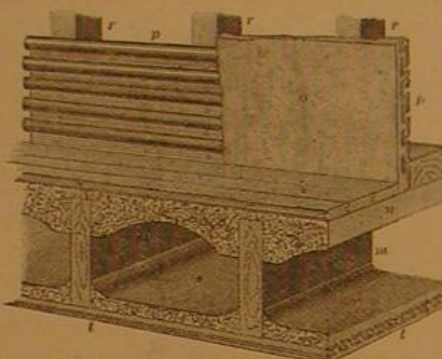
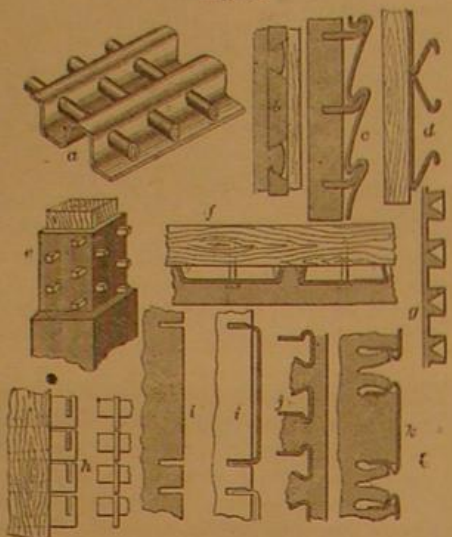
for wooden or iron partitions which are very much in use for fireproof and partially fireproof buildings. *a* has a corrugated plate and transverse rods; behind the latter the plaster makes its lock. *b* has plates with dovetail holes in which the plaster fastens. At *c* are corrugated plates which catch upon hooks on the studding. The plates at *d* have bent prongs; those at *e* are inverted frustums; those at *f* have flanged corrugated edges. At *g* there are sheets with projecting studs of frustal form; at *h*, iron slats, which are held by slotted iron plates driven into the studding. At *i* is shown a form in which the edges of bent slips enter slots in the studding; at *j*, bent strips occupy depressions in the same; *k* has means for pinching the edges of the lath. The lower figure represents a portion of a structure in which the wooden joists and studding are so isolated from each other and protected externally that the wood cannot be readily fired by exposure to flame. *m m* are the wooden joists, *n* protecting bodies of concrete, and *t* the corrugated lath. *o* is the wall plastering, which is spread upon similar metallic lathing on the studding, *r*.

## GIRDERS

are the principal beams of floors, spanning the distance from wall to wall, and affording a place of attachment for the

binders, to which the floor and ceiling joists are applied. In double framed floors the binding joists, *n*, Fig. 6, instead of resting on the walls, rest on the girders, *m*. The bridging

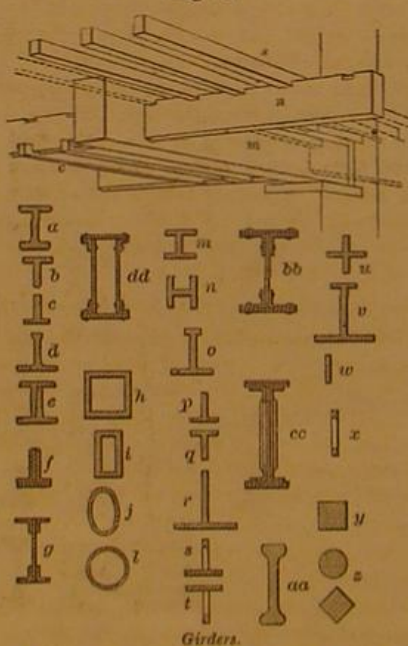
Fig. 5.



Metallic Lath.

joists, *s*, rest on the binding joists, and the ceiling joists are secured beneath the girders. *a* to *l* are forms of wrought iron, and *m* to *z* forms of cast iron, girders. *b b* is a compound I girder. *a a* is rolled in one piece, and *c c* is a com-

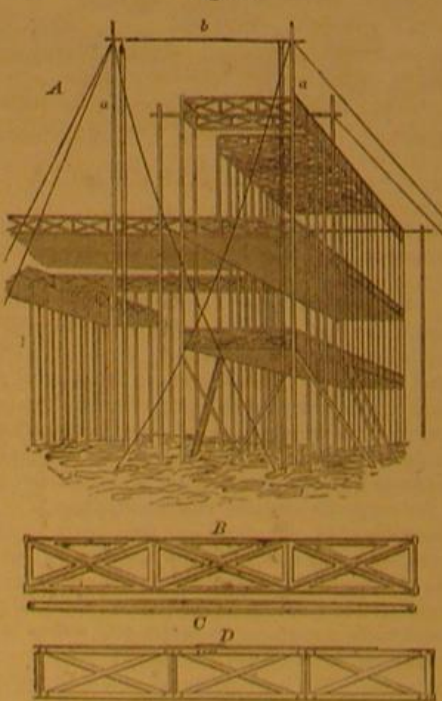
Fig. 6.



Girders.

pound beam built of several layers of plates riveted together and to angle irons. In Fig. 7, *A* represents a portion of

Fig. 7.



Paxton's Girders (Crystal Palace, London, 1851).

the framing of the London Crystal Palace, showing the means adopted for getting it into position. This was effected by upright poles, *a a*, connected by a crosspiece, *b*, and steadied

by guys. The supporting columns were, by means of tackles, attached to the crosspiece, hoisted into vertical position, and there bolted, after which the girders were raised and secured to the columns. *B* is an elevation, and *C* a plan, of one of the cast iron girders. They were 23 feet 3 1/2 inches long and

Fig. 8.

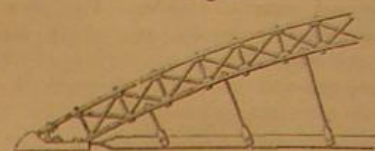
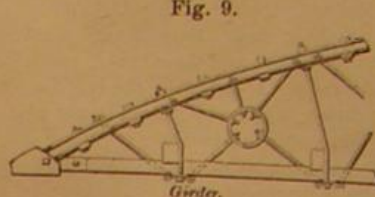


Fig. 9.



3 feet deep. Their great comparative strength enabled the columns to resist great lateral thrust, and imparted extreme stiffness to the structure. *D* is a form of wooden truss employed in the same building. Figs. 8 and 9 are arched girders for bridges.

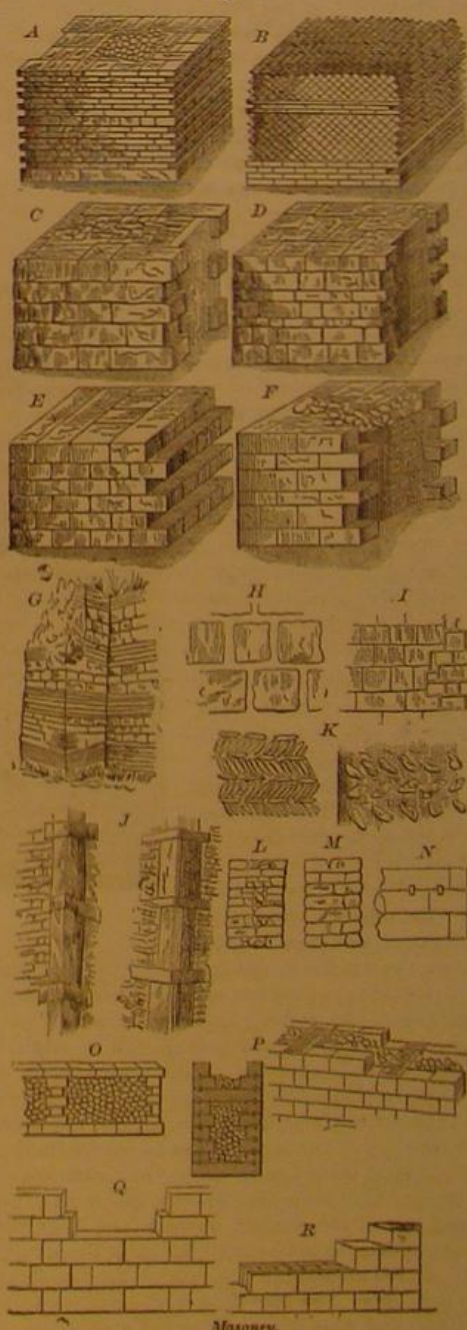
An interesting series of illustrations of ancient and modern

## MASONRY

is given in Fig. 10. The Greeks and Romans used several methods for walling, as the *opus incertum*, *A*, Fig. 10; *B*, *opus reticulatum*, formed of square stones laid diagonally; *C*, *isodomon*, in which the courses were of equal height, *D*, *pseudisodomon*, in which they were unequal; *E*, Greek *emplectum*; *F*, Roman *emplectum*, of coursed work on the outside, the interior being of rubble. In these the stones were small and laid in mortar. Where large stones were used, no mortar was employed. The Roman *emplectum* found in England has sometimes courses of tiles built in, as shown at *G*. *H* represents wide-jointed masonry, and *I* a combination of wide and close joints.

In a few of the earlier English buildings, considered by some to be Saxon, the quoins, the door and window jambs, and occasionally some other parts were formed of stones al-

Fig. 11.



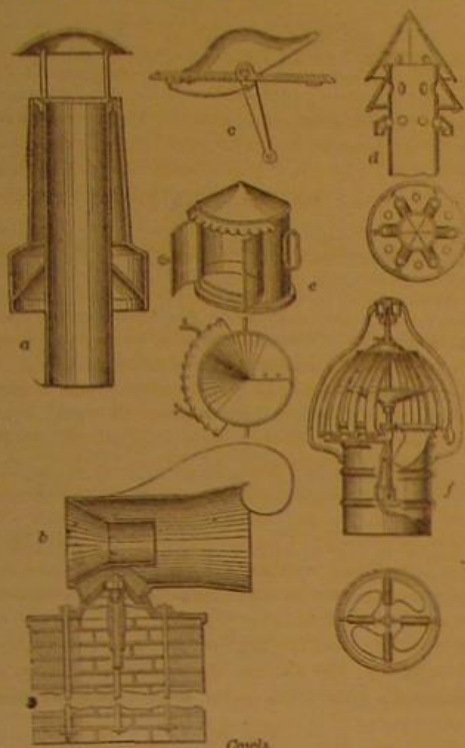
ternately laid flat and set up endwise; the latter were usually much longer than the others. This is termed long and short work, *J*. In the Norman period, herring-bone work, *K*, was frequently employed in rubble walls. The stones used during the Middle Ages were seldom larger than could be lifted by two or three men. The various kinds of masonry employed in modern practice may be divided into three principal classes: Rubble work, *L*, in which the stones are



not squared. Coursed work, M, in which the stones are squared more or less and set in courses. Ashlar, N, where each stone is squared and dressed to given dimensions. O is rubble with cut stone plinth, quoins, piers, and coping. P is ashlar facing filled in with rubble. In Q the stones are of equal thickness laid alternately header and stretcher. The length of each stone is double its width. R is a kind of masonry met with in Italy, composed of alternate courses of headers and stretchers.

Fig. 11 represents various forms of  
CHIMNEY COWLS.

As shown at a, the flue has enveloping side passages which assist the draft by induction. At b the spindle of the cowl is stepped in a socket, the collar revolving in flanges upon the upper side of the cap plate. c is a cowl for a car roof; its mouth may be adjusted in either direction. d has a cir-



cular series of openings to encourage upward draft, a deflecting frustum, and conical cap. e is a cover for a marine stovepipe. The side wings are held open by the top shield. In f the issuing current of air and smoke is deflected outward by the cone, and, impinging on the obliquely set plates of the fan cap, causes the latter to revolve.

#### CENTENNIAL NOTES.

The work of removing exhibits is still in progress, visitors are few, straw and packing boxes are everywhere, the screech of the locomotives and the noise of the cars have replaced the music of the chimes and of the band, the storms have beaten down vegetation and converted the neatly kept flower beds into puddles, the fall weather renders the buildings chilly and damp, and altogether there is an air of desolation and faded glory about the Centennial grounds, which, when contrasted with the magnificent scenes presented during September and October, leaves one with a well defined depression of spirit, and a tendency to moralize over the mutability of human undertakings. There is, and probably will be, a dearth of news regarding the future of the Centennial remains until after the sale of the buildings, now close at hand. Then will follow the speedy elimination of State edifices, annexes, etc., and only those structures which are in some wise connected with the projected permanent exposition of art and industry will be left.

Our still well filled note books remind us that the end of the great fair came upon us almost unawares; for we have much that is interesting yet to describe. To those who have seen the Exposition, our notes will serve as useful reminders; to those who have not, the details of the good things exhibited are always of timely interest.

#### THE FRENCH WOODWORKING MACHINERY

was an admirable display, principally from the works of M. F. Arbey, of Paris. Three machines, which won awards from the judges, are novel in construction. One of these is a planer with helical knives and a permanent sharpening apparatus. The spiral cutters present many advantages over the straight knives, always cutting equally and making the operation of cutting continuous. Very thin knife blades are used, so that but a short time is taken to sharpen them, and this is done with the utmost accuracy by an emery wheel, permanently attached to the machine, which has only to be set and then allowed to run, when it does the work automatically. A stave-cutting machine is exhibited, in which the revolving circular saw (which cuts the stave of any desired lateral curve and of any bevel) is brought up to the stave, instead of the stave being carried to the saw. It is constructed for the special purpose of economy in the use of wood. A lathe for copying sword handles and other small articles of irregular shape is also an ingenious machine. A feeder follows the original, as in a carving machine or pantograph, and reproduces it by the cutter, which is set in the same relative planes over the stock to be turned or carved. A lathe for turning the legs of tables, etc., also exhibited, does excellent work, and cuts a spiral groove down the body of the leg. All the exhibited machines are marked

by beauty of form and solidity, and, in ingenuity of combination, more nearly resemble American machinery (though different therefrom) than any others of foreign production.

#### THE FRENCH MOTORS.

The Gramme electric machine was used for driving an electric engine, which was exhibited pumping water, being connected with a pump by belting. It has no connection with other machinery, except the copper wire leading to the generator of electricity. As in this double conversion of power into electricity and electricity into power, less power is obtained than is expended, the machine is apparently of no practical value, but is interesting as showing the relations existing between power and electricity.

Mignon & Ronart, Paris, exhibit a domestic motor, which is a steam engine with vertical tubular boiler of novel construction. Steam is generated by a gas flame, automatically regulated according to the requirements of the engine.

Bischof's gas machine reminds one of the German gas machines, which attract considerable attention by their explosions of a mixture of gas and air. The explosion drives up a piston, the descent of which by gravity furnishes the motive power, and prepares the way for a new explosion. Bischof's machine appears to be made on the same principle, and is of 1½ horse power. These machines are made from 100 horse power to 1000 horse power. They are said to be noiseless, an advantage which cannot be claimed for the German engines.

Another interesting French exhibit was the novel

#### SOAP AND CANDLE MAKING MACHINERY.

The blocks of rough soap to be made into toilet soap are first cut into thin shavings in a planing machine, and the shavings are then ground with coloring matter, essential oils, and scents, until they form a homogeneous paste. The machine for grinding contains granite cylinders, which pass the paste automatically between them, and finally into the upper portion of the hopper, so that the services of only one attendant are required for several machines. After the paste has been ground, it passes to a machine called the *peloteuse*, or mixing mill, which stretches and draws it out and prepares it for being molded and stamped. The *peloteuse* does instantly what at one time required several weeks of scraping, washing, and drying. It is a mortar, in which the soap paste is packed until it is freed of air, and from which it is then forced by increase of pressure, passing through draw plates of any required cross section. A self-acting cutter divides the stream of soap into blocks of any desired size or weight, just as cutters on brick machines divide the continuous streams of clay into bricks. The blocks of soap are then taken to a press, which shapes or molds them, and impresses on them the name of the maker. In the candle-making process, a double hot press, with iron cylinder and forty hollow plates, produces from 150 to 165 pounds of stearin in twenty minutes—the time necessary for pressure to be applied. A double horizontal cold press contains 175 loaves, and may be loaded, operated, and unloaded in an hour and a half.

#### A NOVEL SAFETY APPARATUS FOR BOILERS

consists first of a combination of safety valve and of a float, which, under certain conditions of pressure or water level, acts upon the second part of the apparatus, which is a damper in the draft flue. When the limit of calculated pressure is reached, the clapper rises, the steam fills the apparatus, the whistle sounds, and the piston goes down, carrying with it the damper, which closes the flue. When the pressure has fallen, a counterpoise re-opens the damper. When the water falls below a determined level, the float raises the valve, and the same results follow.

#### THE FRENCH ENGINEERING EXHIBITS

offered abundant material for study. M. de Lesseps' proposed system of ascending Mont Blanc, by railway, was shown in a sectional drawing of the mountain side and the engineering works. The cars under this system would be run for a short distance on a level, then raised by hydraulic pressure to a new level, and run a short distance to a new station, from which they would be again lifted, and so on, until, ascending the mountain by forty-nine such lifts, they reached the top. The plan, in other words, proposes the building of a series of platforms or steps, up which the cars should be lifted by hydraulic pressure. With the display of patterns of steel rails, used on French railways, are given the details of experiments upon iron rails, which showed that those of the best quality did not resist the wear and tear of a traffic of twenty million of tons, while those of ordinary quality succumbed to a circulation of fourteen millions. With regard to steel rails, all the trials show that the flange wears in a uniform proportion of 0.039 inch of thickness for a traffic of twenty millions of tons; and as they are constructed for a wear of 0.39 inch, it may be calculated that the duration of the steel rails will correspond to a traffic of at least two hundred millions of tons, that is, that they will last ten times as long as the best rails in wrought iron. The weight of the rail, if of steel, can be reduced so as to bring the cost of steel rails to about that of wrought iron rails, and considerations like these have led to the general introduction of steel rails on the French railroads. Drawings of the elevating machines for the water supply of the canal from the Aisne to the Marne were also exhibited. This canal establishes water communication between the metal mines of Saint Dizier and the coal mines of the north of Belgium. It passes through a permeable stratum of white chalk formation, and there is no adequate supply of water at a convenient level. The water must, therefore, be raised from the Marne by the aid of powerful machinery. Five turbines placed in a line, and about 30 feet apart, are used

The three central ones work vertical double action pumps, and one system is connected with another by coupling gear joining the crank pins. The turbines at either end serve as a reinforcement, taking their share of the work only when the crank is put in gear with the adjacent system. The mechanical product in water raised, that is, the relation between the actual work done by the system and the gross power furnished by the fall, amounts to 0.67, and the cost of delivering 32,700 cubic feet of water at the summit level was calculated in 1871 at about 20 cents.

#### THE FRENCH ART ENAMELS

embody several wonderful copies of paintings by the ancient masters. The metals used to enamel on are gold, silver, and copper; and the enamels or vitrifiable paints, with which the metal is covered and decorated, are peculiar preparations of glass to which metallic oxides impart the required colors. In general, three parts of lead and three parts of tin are oxidized by continued heat and exposure to the air. To the mixed oxides thus obtained are added ten parts of powdered quartz or flint, and two parts of common salt. The whole is then melted in a crucible together, and produces white enamel and the basis of colored enamel, which latter is made by the addition to the white enamel of other metallic oxides. Yellow is produced by the addition of the oxide of lead; red by the oxides of gold and iron mixed together; green by the oxide of copper; blue by the oxide of iron; violet by the oxide of copper, and black by the combined oxides of copper, cobalt, and manganese. With his plate, or piece of gold or copper, prepared to receive the enamel, the workman sets about his work by breaking up and pulverizing his small cake of enamel. When this substance is thoroughly reduced to powder, it is made into a pasty form by the addition of water. The moistened mass is then laid smoothly on the metal with a spatula, and, when dried, is melted or fired under a muffle in a small furnace. This process is repeated if the enamel is desired of extra thickness; but for art purposes the first or surface enamel has seldom more than two coats. With his white or black surface, as the case may be, ready for his drawing or decoration, the artist transfers to it the outline and shading of his picture in chalk or charcoal. Guided by this, he adds enamel from time to time, with his spatula, to make the required shadings and lines, by piling it up in some places and thinning it down in others. When a certain figure or object is partially completed, it is fired and then again covered with enamel, until it is completed to the satisfaction of the artist. So with the whole picture, which undergoes sometimes as many as fifteen or twenty firings before it receives its last firing and polish.

#### THE FINE LACE MADE BY MACHINERY

was one of the most remarkable exhibits in the entire French Department. Hand made lace of almost cobweb texture is exceedingly expensive, and in the cases devoted to its display there was a large robe valued at \$800, a single handkerchief at \$200, lace flowers at \$400 per yard, and so on through a superb collection. Yet all this exquisite material could be found in another case, perfectly imitated by machinery. There was a complete dress in *point d'Alençon*, in which the famous stitch peculiar to that lace was accurately produced. It would have required a skilled connoisseur to detect the material from that made by hand labor, yet the latter would be worth probably \$5,000, while the price asked for the machine lace was but \$250.

#### ASTRONOMICAL NOTES.

##### OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

##### Positions of Planets for December, 1876.

###### Mercury.

Mercury cannot be seen until late in the month. On December 4, it is in what is called superior conjunction; its path is nearly that of the sun, and it is at the part of its orbit farthest from us. After the 27th, Mercury may be seen in the southwest, just after sunset, a little north of the sun's place. Mercury sets on the 31st at 5h. 43m. P. M.

###### Venus.

The planets Venus and Mars keep nearly the same diurnal path in the early part of December. They can both be seen in the morning. Venus rises on the 1st at 4 A. M., and sets at 2h. 44m. P. M. On the 31st, Venus rises at 5h. 9m. A. M., and sets at 2h. 33m. P. M.

The rapid motion of Venus carries it east, and on the 31st of December it is about 20° from Mars in that direction.

###### Mars.

On December 1, Mars rises at 3h. 55m. A. M., and sets at 2h. 34m. P. M. On the 31st, Mars rises at 3h. 38m. A. M., and sets at 1h. 28m. P. M.

Mars can easily be found on the 1st, by its nearness to Venus, being a little west of that planet. The star Spica can be seen, on nearly the same parallel, still farther west.

###### Jupiter.

Jupiter is very unfavorably situated. It rises at 7h. 23m. A. M. on the 1st, and sets at 4h. 36m. P. M. On the 31st, it rises at 5h. 57m. A. M., and sets at 3h. 3m. P. M. Its satellites cannot now be seen.

###### Saturn.

Saturn is the only planet which, through the whole month, can be seen in the evening. It is still moving very slowly among the small stars of *Aquarius*. On December 1, it rises at 1h. 19m. P. M., comes to the meridian at 5h.



34m., and sets at 10h. 49m. P. M. It can easily be found, as soon as twilight is over, at an altitude of about 36°, when it souths, and changes little in position during the month. If the motions of Saturn are watched for the whole month, it will be seen that it moves in an easterly direction, and toward the zenith. On the 31st, Saturn rises at 10h. 26m. A. M., and sets at 9h. 2m. P. M. A telescope of ordinary power will show the ring of Saturn, but it requires a good one in order to see its numerous satellites.

#### Uranus.

Uranus is coming into better position for observation. It rises on the 1st at 10h. 11m. P. M., and sets at 11h. 54m. the next morning. On the 31st, Uranus rises at 8h. 11m. P. M., and sets at 9h. 54m. the next morning. Uranus is a few degrees west of Regulus and farther north in declination. It moves very slowly among the stars toward the west.

#### Neptune.

Neptune rises at 2h. 41m. P. M. on the 1st, and sets at 3h. 59m. the next morning. On the 31st Neptune rises at 0h. 42m. A. M., and sets at 1h. 59m. P. M.

#### Sun Spots.

The report is from October 18 to November 18, inclusive. The photograph of October 18 shows a small spot coming on. On October 19 two small spots appeared following this, and around the group faculae were seen. From October 19 to October 30 photographing was interrupted by clouds. In the picture of this latter date, the disk appears to be free from spots. On November 18, when the next observation was made, a very small spot was seen on the eastern limb. The observations of November 16 and November 17 showed the small spot moving across the disk and a pair of large spots coming on. These large spots will, no doubt, be in sight until the 25th of November.

During the past month photographing and observations have been much interrupted by clouds.

#### The American Climate and the Voice.

Dr. Lenox-Browne, surgeon to Her Majesty's Italian Opera, in a paper recently read before the London Musical Association on "the Voice as a Musical Instrument," says that the notion that our American climate is destructive to fine voices is unfounded. People who never learned to sing properly may complain; but the well trained vocalists do not suffer. He also combats the idea that alcoholic stimulants or voice lozenges are beneficial to the singer. The latter are merely irritating, and the numerous pots of beer, which some celebrated operatic artists are reputed to indulge in, are useless to assist the voice. A glycerin lozenge, Mr. Sims Reeves states, is useful, and on very rare occasions a small quantity of claret and water may be necessary; but all alcoholic stimulants are detrimental.

#### Two New Explosive Compounds.

Lignose, invented by M. Falkenstein, is the name of a new blasting agent, and is made of woody fiber prepared with nitroglycerin. It is stated to have about three times the force of black blasting powder, but is very irregular in its action and is very sensitive to moisture. Pantopollet is produced at a dynamite manufactory at Opladen, on the Rhine, and consists of naphthalene dissolved in nitroglycerin. The blasting action is quite good, and the force equal to about three times that of ordinary blasting powder. It yielded, however, during the experiments a very unpleasant smoke and odor, and produced severe pains in the heads and chests of the workmen.

#### One-Handed Bricklayers.

The rule of the British Bricklayers' Association, by which the bricklayer is made to do his work with one hand in his pocket, is perhaps as efficacious a means of degrading work as has yet been devised. But, if we had the ear of the lawgivers of the union, we should be inclined to suggest the advantage of a rule requiring that all bricklayers in good standing should have the left hand amputated. This would make it easy to distinguish everywhere at a glance, with very little danger of mistake, between a unionist and a non-unionist. It would cheapen trousers by making the left hand pocket unnecessary, and so leave more money for beer and tobacco; and it would be the strongest possible guaranty against forgetfulness of the cardinal rule. It would not interfere with anything the bricklayer might want to do, for one hand is enough to fill a pipe or lift a beer mug. The loss of convenience in dressing and undressing would be a small matter, for, since this has to be done at home, the bricklayer's wife could be made to do it for him; and for disciplining a wife, one hand is probably almost as good as two, besides which the cherished privilege of kicking and stamping on her would be left unimpaired. Moreover, the sacrifice, or perhaps we should say the riddance, of the left hand would have the serious advantage of unfitting its owner for military service, while the resource of turning a hand organ would remain.—*American Architect and Building News.*

#### Magnetism and Carbon.

MM. Treves and Durassier have recently shown that the distribution of magnetism in a magnet is strongly influenced by the proportion of carbon in the steel. On comparing steels containing 1,  $\frac{1}{2}$ , and  $\frac{1}{4}$  per cent of carbon, it was noted that, the less the percentage, the more uniform the distribution. Carbonization tends to concentrate magnetism toward the poles.

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## Recent American and Foreign Patents.

### NEW AGRICULTURAL INVENTIONS.

#### IMPROVED PLOW.

John H. Newton, Rusk, Tex.—By suitable construction, by removing the scraper and the mold board, the plow can be used as a subsoiler. By removing the scraper, the plow can be used as a turning plow for breaking up land, throwing up beds, etc. By removing the mold board, the plow can be used as a scraper and cultivator. When all three parts are attached, the plow will scrape, cultivate, and hill the plants.

#### IMPROVED ROTARY CULTIVATOR.

Sevier Tadlock, Hope, Tex.—This is an improved machine for opening ditches to drain land and form fences, and to grade railroads, etc. Upon the rim of a large wheel, apart, are attached cross spades, and hinged right-angled spades, which form three sides of a series of rectangular boxes. A chute covers the open tops and sides of the boxes, and extends to below the wheel to cut the bottom and one side of the slice of soil while the spades cut its other side, thus dividing it into cubical blocks. As the machine is carried forward, the spades carry up the blocks of soil through the chute and discharge them into the trough. A carrier screw is operated by the advance of the machine, to move the soil deposited in the trough outward and drop it to the ground.

#### IMPROVED CULTIVATOR.

Garland A. Parsons, Dover, Ark.—This embodies a novel contrivance (consisting mainly of adjustable bars carrying the plows) for adjusting a gang cultivator to set the plows at various distances apart, for adapting them for different conditions of the plants, and other conditions.

#### IMPROVED PORTABLE FENCE.

George F. Stevens, Schuyler, Neb.—The panels of this fence are to be connected that the fence may be conveniently put up and taken down. The panels are secured by interlocking rods which enter the ground. Over the connecting portions of the rods, grooved blocks are fitted and detachably fastened.

#### IMPROVED PLOW.

George W. Parish, Savannah, Ga.—The object of this invention is to provide a plow separate and distinct from the beam, stock, and handles, as an article of manufacture, which shall be so constructed as to be quickly, easily, and substantially attached to the ordinary scooter stock now in common use. To this end, the invention consists in constructing the plow with a plate extending from the moldboard to the landside at an angle corresponding to the inclination of the stock, and slotting the said plate with an opening into which the bolt of the scooter stock passes, so as to engage with the plate and hold the plow securely to the stock.

#### IMPROVED RICE CULTIVATOR.

George W. Parish, Savannah, Ga.—The object of this invention is to provide a cultivator for rice, in the early stages of its growth, which will not sod the rice, and which may be readily adjusted to the width of the rows. To this end, it consists mainly in the construction of the cultivator teeth, and the combination of the same with a pivoted metallic frame, consisting of four loosely pivoted bars, forming a variable parallelogram, which may be adjusted to bring the teeth closer together in oblique lines, or farther apart.

### NEW HOUSEHOLD INVENTIONS.

#### IMPROVED CARPET SWEEPER.

Samuel F. Leach, Chelsea, Mass.—This invention consists in mounting the brush cylinder on a self-adjusting spring-pressed center or pivot and a fixed gudgeon, so that it will run without noise and permit of its removal from the top of the case or box without emptying the dust receptacles.

#### IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—This invention relates to certain improvement in folding chairs, and it consists in the peculiar arrangement of the back, seat, arms, and legs, whereby the chair may be adjusted for various positions in an easy and convenient manner, or be folded up into a small compass and made more readily portable. It also consists in the means for connecting the seat to the back so as to permit them to be upholstered and still successfully folded.

#### IMPROVED CLOTHES DRYER.

Finley H. McMartin, Big Grove, Iowa.—This is a novel combination of jointed end pieces and horizontal rods, forming a clothes rack that may be spread for drying clothes, or folded closely together when not in use. It also consists in a quilting frame of peculiar construction, to be used in connection with the clothes rack, which forms a support for one of its ends.

#### IMPROVED WASHING MACHINE.

Henry P. Lentz, Somerset, Ohio.—This invention relates to certain improvements in that class of washing machines called pounders, the same being adapted to pound the clothes in an open tub with a vertically reciprocating movement for the purpose of cleansing the same by an agitation of the water produced by the impact of the plunger and the production of air currents. The improvement consists in the peculiar construction of the plunger, whereby the clothes may be more readily and thoroughly cleaned, and the splashing of the water outside of the tub more effectually prevented.

#### IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—This invention relates to certain improvements in folding chairs designed to render the use of this class of chairs more reliable by imparting a greater degree of stiffness and rigidity to the same when disposed for use, while at the same time permitting the ready folding of the same into convenient dimensions for easy transportation. It consists mainly in constructing the arms with a limited toggle or knee joint adapted to fold upwardly when the chair is folded, or lie straightened out to form a brace when the chair is disposed for use, which automatically locks the back in proper position against its forward movement.

### NEW TEXTILE MACHINERY.

#### IMPROVED SPOOLER.

Samuel F. Cobb, Albion, Md.—This invention relates particularly to the form or construction of a slotted cam cylinder and the combination of the same with traversing bars carrying the thread guides and working horizontally in slots formed in the sides of the arches or frames, in which the spool spindles are journaled. A spur gear is attached to, or formed on, one end of the cam cylinder and meshes with a pinion on the driving shaft. The pinion is elongated to allow the cam cylinder to be adjusted lengthwise, to compensate for wear of the cam slot and other friction surfaces. The machine can be so changed as to increase or decrease the traverse simply by removing the gear, thereby enabling the operator to make as even and regular layers, when spooling number four yarn, as when spooling number fifteen—presenting, all the while the spool is being filled, a smooth even surface to the thread,

so that the spool must be finished as commenced. In other spooling machines, the traverse is generally worked without this provision, and changing them from fine to coarse numbers produces an uneven ridgy surface, and the difficulty increases as the spool increases in size.

### NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

#### IMPROVED WAGON BRAKE.

Josiah B. McAfee, Topeka, Kan.—This invention is an improvement in that class of wagon brakes in which two levers are employed, the same having a common fulcrum and being so connected by a dog or pawl that, when the levers are pressed together, said pawl is released from a curved ratchet bar. The improvement relates to the construction and arrangement of parts, whereby the brake lever may be held locked, and thus prevented from rattling when the brake is thrown back out of action.

### NEW MECHANICAL AND ENGINEERING INVENTIONS.

#### IMPROVED CAR BRAKE.

David H. Levy, New York city, assignor to himself and Edward W. Linzner, of same place.—This is an arrangement of clutches or wrenches attached to a sliding bar and capable of being instantly thrown forward by a spring to engage with a squared portion of the car axle, or to a square block bolted to the axle, the object being to stop a car in case of emergency in the shortest possible time.

#### IMPROVED CAR AXLE.

Ezra J. Bowen, Kent, O., assignor of one third his right to Orange E. Page, and one third to Thomas Egbert, of same place.—This is a car axle provided with grooves between the journal and its shell, together with inlets and outlets for the air, whereby it is claimed that much of the heat generated by friction in the shell will be carried off by a circulation of air.

#### IMPROVED VELOCIPEDE.

James Fishwick, Cincinnati, O.—This invention is designed to provide a simple, cheap, and substantial velocipede, more especially designed for the use of girls, but equally adapted for use by boys. It consists in an improved construction of the driving mechanism, the connection of the main axle to the reach, and the connection of the front guide wheel and lever to the reach.

#### IMPROVED DOUBLE-ACTING PUMP.

William B. Farrar, Greensborough, N.C.—This is a double-acting pump having but half the usual number of valves. It consists in two cylinders of different diameters, opening into each other and having a check valve at the bottom, combined with an upper piston fitting in the smaller cylinder, and a lower piston fitting in the larger one, and both connected by a pipe also provided with a valve. The two pistons are operated simultaneously and together by the piston rod, so that upon the upward stroke the water above the smaller piston is lifted out at the spout, and water is drawn beneath the lower large piston into the larger cylinder, while upon the downward stroke the water beneath the large piston is forced upwardly through the tubular opening into the upper cylinder, and by reason of the difference in the capacity of two cylinders is also forced out of the spout.

### NEW MISCELLANEOUS INVENTIONS.

#### IMPROVED FACING HAMMER.

Edgar F. Lemolne, Emmerton, Va.—This invention relates to certain improvements in facing hammers for dressing stone, and especially millstones. It consists in the particular construction and arrangement of the tool, in which the handle is constructed with a shoulder and a squared or rectangular stem screw, threaded at its end, upon which squared portion cutting blades with corresponding perforations are held by double inclined plates which are clamped between a screw nut upon the threaded end of the stem and the shoulder of the handle.

#### IMPROVED BEAM SCALES.

George W. Grove, Linnville, O.—When the tare is to be weighed, as, for instance, in retailing butter, the vessel is weighed first; a bar, which is graduated to correspond with the small beam, and which slides on an upper beam, is moved outward until its inner end corresponds with the pointer of the link of the counterpoise weight. The butter is then put in, and is balanced by adjusting the weight, and the net weight of the butter will be read from the bar opposite the pointer. If the gross weight is to be obtained first, the article and its package are weighed, and the sliding bar is moved inward until its outer end corresponds with the pointer. The article is then taken out of the package, the package is then weighed, and the net weight is read from the bar opposite the pointer, counting from the outer end or said bar. The bar will count up any number of pounds by adding or subtracting the extra weights, as is done in common scales.

#### IMPROVED STIRRUP.

Ransom Sabin, Shelby, Mich., assignor to himself and John Magee, same place.—This stirrup is made open at top and side, and provided with a bar and tongue, pivoted to the side flanges at the upper end to receive the supporting strap. This offers an easier rest to the foot, and prevents the same becoming entangled in the stirrup in case of accident.

#### IMPROVED POISON BOTTLE.

James W. Bowles, Louisville, Ky.—This is an improved bottle for storing and keeping poisons in such a manner that the peculiar shape of the bottle serves as a warning against the careless use of the contents; and the invention consists of a bottle made in the shape of a coffin resting on the head end as a base. The neck is applied to the upper or foot end.

#### IMPROVED CARTRIDGE BOX.

Solomon T. Satterwhite, Nashville, Tenn.—This consists of a circular case composed of two detachable parts, forming a central and an annular compartment. In the annular compartment fits and revolves a frame divided into two transverse chambers, in each of which is contained a cartridge, while the central compartment is intended for extra ammunition. The outer case is provided with an opening upon its periphery through which the cartridges drop, and it is also provided with a spring detent to determine the registration of the cartridge chambers with the opening in the outer case, and is slotted so as to permit the introduction of the finger to turn the ammunition frame.

IMPROVED DEVICE FOR TEACHING MUSICAL TRANSPOSITION.

Thomas J. Allison, Gladewater, Tex.—This consists of a key board with sliding instruments, which afford an easy and graphic means of explaining transpositions of musical scales.

#### IMPROVED EAR AND OTHER STUDS.

Anthony Hensels, New York city.—It has become fashionable of late to wear the diamond and other studs or drops in the ears without rings or other suspending parts that may be readily seen. In the present device a recessed shank of the stud is passed through the ear hole and locked to the ear by a fastening spring ring applied to the shank at the rear side of the ear.



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Send 25 cents to Milton Bradley & Co., Springfield, Mass., for New Mechanical Drawing Book, or address for a circular.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Safety Linen Hose for Factories, 1 to 3 inches, at reduced rates. Greene, Tweed & Co., 13 Park Place, N. Y.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 331.

See Boulton's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-55. Send for pamphlet and sample of work. B. C. Mach'ry Co., Battle Creek, Mich.

To Lease—The largest portion of the building corner Canal, Center, and Walker Sts., now occupied as a Billiard Manufactory and Sales Room. See advertisement in another column.

The Cabinet Machine—A Complete Wood Worker. M. R. Conway, 222 W. 34 St., Cincinnati, Ohio.

The Gatling Gun received the only medal and award given for machine guns at the Centennial Exhibition. For information regarding this gun, address Gatling Gun Co., Hartford, Conn., U. S. A.

For Sale—Shop Rights to every Tool Builder and manufacturer for Bean's Patent Friction Pulley Countershaft. D. Frisbie & Co., New Haven, Conn.

Superior Lace Leather, all Sizes, Cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

Magic Lanterns, Stereoscopes, for Parlor Entertainments and Public Exhibitions. Pays well on small capital. 74 Page Catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

Fire Hose, Rubber Lined Linen, also Cotton, finest quality. Eureka Fire Hose Co., 13 Barclay St., New York.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

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M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 239 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Mehy, Hall, Cent'l.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For durability and economy, use Blake's Belt Stds. to fasten Belts. Greene, Tweed & Co., 13 Park Place, New York.

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Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.



C. B. P. will find a description of a connection for a clock, to ring a bell, etc., at an appointment on p. 335, vol. 35.—W. F. will find a description of Portland cement on p. 199, vol. 31.—F. B. M. will find directions for soldering gold on

p. 251, vol. 28.—T. D. D. L. will find the dimensions of the sizes of wire on the British wire gauge on p. 263, vol. 28.—J. B. B. will find an answer to his query as to the weight of stone on p. 151, vol. 35.—A. S. will find a recipe for aquarum cement on p. 202, vol. 28.—J. B. will find directions for making spongy platinum on p. 330, vol. 25.—J. H. can fasten leather to rubber with rubber cement. See p. 203, vol. 30.—J. F. M. will find a recipe for shoe dressing on p. 283, vol. 51.—G. H. D. will find a stain to imitate rosewood on p. 154, vol. 30. This also answers P. McC.—W. N. H. will find a recipe for a liquid stove blacking on p. 219, vol. 31.—R. will find directions for washing flannels and other woollen goods on p. 267, vol. 30.—H. D. O. will find directions for making an electric engine on p. 91, vol. 26.—J. M. will find directions for frosting glass on p. 264, vol. 30.—F. S., C. A. S., J. D. H., J. C., S. J., J. W. M., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) E. L. asks: What is the best way of preparing sensitive albumen paper for printing, so that the paper will keep for at least two months in the dark without turning yellow? A. After the paper has been sensitized, hang it up until the silver ceases to drop, then float it for one minute (with the back down) on a mixture of 1 oz. hydrochloric acid in 40 oz. water. Dry thoroughly, and keep in a cool, dry place.

(2) C. H. W. H. says: I wish to fuse some tin with copper for a patent article. How can I do it? A. Fuse the copper first, allow to cool until it just begins to solidify, throw a handful of sal ammoniac on the surface of the fused metal, and immediately stir in the fragments of tin with a stick of wood. Heat again and run the alloy immediately into the mold. It is always necessary to add something more than the percentage of tin required in the alloy, as some of the tin is unavoidably lost by oxidation while in contact with the air at a high temperature. Stir well with a piece of wood and remove the scum of oxides from the surface before pouring out the metal.

(3) P. & E. R. R. asks: What is the cause of a locomotive slipping more on a curve than on a straight piece of road? A. Because of the extra friction on the parts, due to the bending of them, which increases the power necessary to move the engine and load.

(4) J. D. P. says: In soldering some work made of steel and iron wire, we find marks of rust after washing. Is there anything we can solder with that will not rust the wire? A. No. Cleaning the rust off afterwards is the only method.

(5) J. T. W. asks: 1. Please give me a recipe for paste, such as is used by paper box makers. A. Box maker's paste is simply flour paste containing a little alum to prevent molding. 2. Please tell me what cement can be used cold by paper box makers that will remain in solution, and that will stick as well as when hot? A. Use a strong solution of dextrin in water.

(6) E. H. R. says: I have a troy weight scale for weighing vinegar, but it requires too much time. Please give me a simple and correct way for weighing vinegar, to reckon by grains. A. The strength of vinegar is ordinarily determined by means of what is called the acetometer, an instrument closely resembling the common hydrometer. If the specific gravity of the vinegar be determined by means of an hydrometer, and the volume of the liquid determined by cubical measurement, a simple proportion of these and the standard weight of a gallon of pure water will be all that is necessary to determine the absolute weight of any quantity of vinegar. You can weigh vinegar in any good balance by weighing the vessel containing the vinegar and then deducting the weight of the vessel or first counterpoise the vessel and then weigh directly. In the troy and apothecary weights there are 480 grains in 1 oz.; in the avoirdupois scale the ounce contains 437.5 grains. In the decimal or French scale the gramme is equivalent to 15.434 grains.

(7) C. B. L. asks: Why is it, that in making centers for lathes, the dead center is drawn to a straw color, while the live is drawn to a blue? A. The dead center is made as hard as is consistent with strength. The running center is made soft enough to turn up. To distinguish, mark them.

(8) L. B. S. asks: Can I purify air by forcing it through a moistened sponge? Can you give me a convenient and inexpensive process for removing impurities from stagnant air, pregnant with human breath and tobacco smoke, before passing it through a small tube? A. Pass the air through the sponge seated in a small vessel of water, and then through a large pipe filled with coarsely pulverized boneblack or charcoal (well burnt) and caustic lime. This, we think, will thoroughly purify the air.

(9) A. G. asks: How can I tell good steel? A. By the closeness of the grain, evenness of fracture, and dulness of color at fracture.

(10) R. B. F. asks: 1. What is the effect of a cement composed of glycerin and litharge, applied on the inside of steam boilers for stopping leaky seams and rivets? A. The cement you mention is a very good boiler cement, having no properties deleterious to the iron. 2. How is the cement made? A. Mix the two ingredients to a thick paste. It should be allowed to stand till dry, the time depending on the temperature of the atmosphere.

(11) D. C. M. asks: How can I blacken, either with paint or varnish, a surveyor's instrument of which nearly all the black color has worn off? A. Use genuine asphalt (free from coal tar)

and spirits of wine. Give it several coatings of the varnish, thinned down well with the solvent, and dry each time in a moderately warm oven. The varnish should, after the addition of the alcohol, be allowed to stand several hours before using.

(12) W. H. G. asks: What can I use for coating a wheel with emery or sand, that will harden, and not get soft by the dampness of the atmosphere? A. Try glycerin and white lead, used as a glue.

(13) W. J. H. asks: Do you advise a counterbalance for a piston and connecting rod of the steam engine? A. No.

(14) J. T. H. asks: 1. What are the proportions of coal gas and air required to cause an explosion when ignited? A. Use 5 parts of air to 1 of coal gas. 2. What is the expansive force, and what are the products of the combustion? A. The explosive force of this mixture is very violent, but it depends much upon the conditions under which it takes place; the greater the pressure under which the mixture is ignited, the greater will be the effects of the explosion. If the mixture be in the proper proportions, the products will be only nitrogen, carbonic acid, and water. If pure oxygen be used, the explosive force is much enhanced. In this case the proportion of the gases should be as one to one, and products will be only carbonic acid gas and water. 3. Will a red hot wire ignite the compound instantly? A. It is necessary to raise the temperature of the wire to nearly white heat; the wire will then explode the mixture instantaneously.

(15) A. A. F. asks: Please give me a recipe for cement or glue for end wood, to work without sizing. Will white lead and glue together answer the purpose? A. Yes.

(16) T. A. R. says: I have an upright tubular boiler; it is called an 8 horse, and I have an upright engine called a 6 horse. The engine will do our work, but seems to have just enough to do; for when we throw our heavy machine on, it checks her for a moment or two. We propose to put in a larger engine of same make. Can we do so and get satisfactory results? A. If your boiler gives you a surplus of steam for your present engine with easy firing, you may try a larger cylinder as you propose.

(17) J. H. P. asks: What will harden plaster of Paris and make it set quickly? A. Try a strong alum solution.

(18) C. E. S. asks: Can you give me a recipe for a bright red paste for marking articles with a stencil plate? A. Try making a size with gelatin and striking the color with vermilion.

(19) E. W. C. says: I have a window garden, a large box filled with chip dirt, and full of flowers, which it will be impossible to empty and to change the earth from without injury to the flowers. Will angle worms injure the plants, and will carbolic acid destroy the worms? A. They would be beneficial, so far as improving the ground for cultivation was concerned. Carbolic acid would injure the plants. A small amount of Paris green mixed into the ground would be better.

(20) W. A. E. asks: Please inform me of some coloring fluid that would change the color of cigars from light to dark, if put on after they are made, without injury to the smoker. A. Try coloring the outside wrapping with a suitable vegetable dye, but be sure that your dyestuff has not been made with poisonous ingredients.

(21) C. H. W. asks: Is there anything that will remove scratches from heavy plate glass? The scratches were made with a block of iron pyrites. A. If the scratches are deep, grind down the surface with another block of plate glass, using at first fine emery and oil, and finishing with rouge to restore luster.

(22) H. N. S. says: E. H. L. asks if some sounds travel faster than others. I was formerly an organist. In listening to other player's performances across a large hall, I frequently noticed that the high tones came to my ear sooner than the low tones. I was always in doubt whether the manipulation preceded the pedipulation of the keys, and thus caused the want of unity, or whether the high sounds came faster than the low ones or not. Which was it, probably? A. M. Biot found, in his experiments on the conductivity of sound in tubes, that, when a well known air was played on a flute at one end of a tube 1,040 feet long, it was heard at the other end without alteration, from which he concluded that the velocity of different sounds is the same. For the same reason the tune played by a band is heard at a great distance without alteration, except in intensity, which could not be the case if some sounds traveled more rapidly than others. This cannot, however, be admitted as universally true. Earnshaw, by a profound mathematical investigation of the laws of the propagation of sound, has found that the velocity of the sound depends upon its strength, and accordingly that a violent sound ought to be propagated with greater velocity than a gentler one. This conclusion is confirmed by an observation made by Captain Parry on his arctic expedition. During artillery practice it was found, by persons stationed at considerable distances from the guns, that the report of the cannon was heard before the command to fire given by the officer. And more recently the experiments of Mallet and those undertaken at the explosion at Hell Gate go to prove the assumptions of Earnshaw.

(23) F. A. W. asks: Have quicksilver and chloride of silver any affinity for each other? A. No. The chloride of silver alone, when heated, melts and is converted into horn silver, except when reducing gases or carbonaceous matters are present, in which case it is converted into the metal.

(24) D. R. W. asks: What should be put into water which leaves an alkali coating on the flower pots and earth, to counteract its effect? A. Send some of the alkaline coating. The best remedy would depend upon its chemical nature, and would have to be determined by experiment.

(25) R. G. asks: Why does smoke ascend at one time and descend at another? A. Smoke (unconsumed carbon) is carried aloft by the rapid ascent of the heated air, which, on reaching a certain elevation and becoming chilled by radiation and contact with currents of colder air, seems to rise, and admits of the gradual deposition of the heavier carbon. If the air is damp and cold, and the barometric pressure has considerably decreased, the loss of heat is more rapid; and as the barometric pressure is less than usual, the particles of carbon are practically heavier than usual, and in consequence their descent is quicker.

(26) W. Z. B. asks: What, if any, deleterious effects would result from using galvanized iron, for evaporating pans in the process of boiling cider for jellies and other domestic purposes? A. Zinc and zinc oxides are soluble in certain vegetable acids, like acetic, and would in solution prove injurious.

(27) S. D. P. asks: What waterproof solution or liquid is cheap, tasteless, and inodorous, and can be practically applied or used to make fruit, berry, and grape straw board baskets waterproof? A. Try gelatin made insoluble by bichromate of potash.

(28) G. H. G. says: I have heard airs played upon goblets which were partially filled with water, for the purpose, as I was informed, of regulating the different tones. What is on the little sticks which are drawn on the edges of the goblets to produce these sounds? A. We have not seen sticks used as you describe; but something of a resinous nature, sufficient to produce a slight degree of equable friction, would answer the purpose.

(29) L. M. H. asks: Please give me a good recipe for cleaning felt hats? A. Try methylic alcohol.

(30) Y. W. W. says: Please explain the chemical action that zinc has upon hard limestone water, in a locomotive or stationary engine boiler to prevent incrustation, and if it will have any effect on the boiler iron at the seams? A. The acid, such as sulphuric, if present in solution, would combine with the zinc to form a soluble salt of zinc. This would not only diminish the amount of acid which would be left free to form insoluble compounds with the bases present, but the zinc would be oxidized and destroyed, instead of the other metal. Possibly, as has been claimed by some, the electro-chemical action and currents set up between the iron and zinc would likewise assist in the prevention of matters being thrown down on the iron, which would be the electro-positive element in the circuit.

(31) W. M. says: I have just completed a cistern; but during my absence a quantity of lime was mixed with the cement in plastering the inside, so that the water is now thoroughly impregnated with lime, and we cannot use it for any purpose. Is there any remedy besides emptying it all out? Could I neutralize the lime and use the water? A. Take a measured amount of the water, and see how much a solution of alum of a certain strength will, on mixing and allowing to stand, precipitate out the lime. This will give the measure for the whole quantity, if successful, and if after treatment with alum the water is not injured.

(32) C. W. C. asks: Can a hot white metal be soldered to a piece of steel wire by forcing the metal on hot, with sal ammoniac or muriatic acid and zinc? A. No. Use a suitable solder. See p. 251, vol. 28.

(33) W. B. says: Pitch or rosin, with gutta percha, half and half, can be made to stick tin foil or foil paper on to tin. It is difficult and expensive to use. Is there any cheap material you know of? A. Try rectified petroleum or coal tar oil. Ether and caoutchouc would be more expensive.

(34) S. M. asks: What is the ordinary composition on the safety match, and what the composition of the material on the box? A. The match contains chlorate of potash and wax (paraffin) and the material on the box is red (amorphous) phosphorus and gum.

(35) A. J. H. asks: How can I make a solution of alkaline silicates, and of alumina, as described on p. 88, vol. 34, under heading of "A New Mode of Hardening Sandstone?" A. Alkaline silicate is silicate of soda or soluble glass. The alumina or aluminate of soda is composed of alumina and soda, the commercial salt containing 48 parts of the former, 44 parts of the latter, together with 8 parts of chloride of sodium and sulphate of soda, which are present as impurities.

(36) G. H. A. asks: 1. What is carbolic acid? A. Carbolic acid is a body produced in the dry distillation of coal, and, in other ways, forming the chief constituent of coal tar oil. When pure it forms long colorless needles which melt at about blood heat and boil at 356°. It has a very penetrating smell, resembling creosote, which body indeed largely consists of carbolic acid, and has a burning taste. 2. Has it any preservative properties? A. Yes, it is a powerful preservative agent. 3. If so, what is it used to preserve? A. More especially meat and all kinds of animal substances liable to decay, putrefaction, or fermentation. 4. How is it used? A. It is largely used in the form of carbolate of lime; or in small quantities, or diluted, alone.

(37) G. W. R. asks: How can I separate the olein from the stearin of tallow? A. By treating with sulphuric acid. It is performed in



large wooden tubs lined with lead, and heated by steam discharged into them by a perforated pipe. The agitation is kept up for 15 to 30 minutes, and, after reposing for a similar length of time, the water is drawn off by a pipe at the bottom. The fat which has thus been washed is put into a vessel heated by means of a steam jacket, and the water is driven off by evaporation. The fat is then ready to be treated with strong sulphuric acid, which is done in a boiler of copper furnished with a steam jacket. In case the tallow is pure, the preliminary treatment may be omitted. About 10 to 13 lbs. of strong acid are required for every 100 lbs. tallow.

(38) R. J. C. asks: How can I take the smell away from coal oil? A. By careful treatment with acid, alkali, and washing. You cannot do it without suitable apparatus; and well prepared coal oil should be free from any smell except what is natural to it, and which it must have so long as it remains coal oil.

(39) W. B. W. asks: How can I electotype natural flowers? A. First, dry the flower or leaf as far as may be without causing it to shrivel, and then dip it immediately into a dilute solution of pure shellac in alcohol: allow to dry in a warm place, and repeat the operation several times until a uniform covering of the resin is obtained, then allow to stand for several hours until perfectly dry. This treatment will render the leaf and stem nearly waterproof and rigid. Carefully dip the flower or leaf into the gum water, so as to moisten every part; expose for a moment to the air, and then dust over it very finely ground black lead (pure graphite); be careful to cover every part, and remove any superfluity, as far as possible, with a fine camel's hair pencil. Make a saturated solution of neutral sulphate of copper in pure water, and suspend in this a plate of clean copper connected with the wire from the copper pole of the battery. Wrap the stem of the flower with the finest copper wire, so as to have perfect connection with the carbon covering, and connect, by means of this wire, with the wire from the zinc plate of the battery; then immerse the flower in the electrolyte, and join it so as to remove any bubbles of air that may adhere to its surfaces, but avoid shaking it so as to rupture the thin film of shellac. The current for the first few moments should be quite strong (from two or three good Daniell's cells), but after this the current from one small cell is all that is requisite. The battery should be a constant one, such as is used for local sounders on telegraph lines, and the deposition should be allowed to proceed undisturbed for about 24 hours, or for 48 hours if necessary. We have tried this method and obtained very good results from it; but it requires some patience and practice to obtain uniformly good results. The nitrate of silver method of electrotyping gives very accurate results, but the flowers must be covered first with a film of collodion, which will protect them from injury by the silver solution. We do not know of any conductive pigment or metallic salt that can be substituted for graphite or silver, as in the above recipes.

(40) P. E. S. says, in reply to E. H. H., who asked what is the cause of difference in the travel of the sound of a rifle bullet in striking a canvas target, and then a rock only 7 feet behind it: Sound is conveyed by vibrations of the atmosphere; the canvas being a thin body, the vibrations are put in motion immediately after the bullet strikes. The rock, being a heavier and more inert body, takes some little time in accumulating the blow of the bullet, and does not communicate its vibration to the atmosphere so quickly, hence the difference in the time of the sound. The same phenomenon is noticed on a clear morning by a carpenter driving a nail in a board; the sound seems to be double, the first is made by the hammer on the small head of the nail, and the other by the end of the nail on the larger plank.

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

E. C. C.—It is a piece of hornblende.—B. B. H.—It is mispickite, a double sulphuret of iron and arsenic.—E. C. R.—It is basalt, sandstone, and argillaceous rock, containing iron pyrites (sulphide of iron).—V.—It contains no platinum whatsoever.—E. G. D.—It is sulphuret of iron.—J. J. S.—It is iron pyrites, of no market value.—J. R. Z.—It contains no zinc.—A. E. G.—It is sand containing a little oxide of iron.—D. H. C.—It is a piece of greenstone with mica, quartz, and clay.—D. R. Y.—No. 1 is iron pyrites. No. 2 is flint.—T. L.—It is a very compact variety of bituminous coal.—C. J. C.—The specimens sent are oxide of iron containing a small amount of oxide of titanium.—G. L.—The specimens sent are certainly very soft and pliable.—A. M.—It is galena (sulphide of lead) a valuable ore of lead.—J. V.—It is a peaty or vegetable debris, yielding a small percentage of mineral ash.—Will H. J. M., of Rochester, Pa., please send full name and larger specimen for examination? The piece sent on October 28 was not sufficient for satisfactory analysis.

C. E. asks: How can I change 14 carat yellow gold into 12 carat red gold?—A. J. A. says: A friend of mine tried preserving natural flowers in paraffin, but they retained their color for only a few days, when they turned quite dark and colorless. Can you tell the cause? How are funeral wreaths prepared so as to remain perfectly white?

#### COMMUNICATIONS RECEIVED.

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

On Cutting Screws. By E. J.  
On Growing Cotton. By R. B.

On Writing Dates. By F. H. R.  
On Boiler Explosions. By F. G. F.  
On the Planet Vulcan. By J. H. T.  
On a Scale of Colors. By B. B.  
On Trisecting an Angle. By J. A. T.  
On Progressive Thought, etc. By P. F. P.  
On a New Electric Light. By G. Q. T.

Also inquiries and answers from the following:  
A. G. Jr.—S.—C. W. H.—A. S.—M. E. N.—M. W.—  
J. J. C.—R. F. B.—W. S. H.—G. E. S.—W. P. P.—  
L. W. P.—T. J. R.

#### HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who are the principal needle manufacturers in the United States? Who sells hand knitting machines? Who sells darning machines? Who sells sporting guns? Why do not telescope makers advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

Up to the hour of going to press, the list of patents issued during the week ending November 7, and bearing that date, had not arrived from Washington.

## VALUE OF PATENTS,

AND

### How to Obtain Them.

#### Practical Hints to Inventors.

**P**ROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the THIRTY years they have acted as solicitors and publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents CHEAPER than any other reliable agency.

## HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention, which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his right.

**How Can I Best Secure My Invention?**  
This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

#### Preliminary Examination.

In order to have such a search, make out a written description of the invention, in your own words, and a pencil, or pen and ink sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is

made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

#### To Make an Application for a Patent.

The applicant for a patent must furnish a model of his invention, if susceptible of one; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

#### Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 33,000,000; Prussia, 40,000,000; Russia, 70,000,000. Patents may be secured by American citizens in all these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements of each country. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

#### Canadian Patents.

In order to apply for a patent in Canada, the applicant must furnish a working model, showing the operation of the improved parts; the model need not exceed eighteen inches on the longest side. Send the model, with a description of its merits, by express or otherwise, to MUNN & Co., 37 Park Row. Also remit to their order by draft, check, or postal order, the money to pay expenses, which are as follows: For a five years' patent, \$50; for a ten years' patent, \$75; for a fifteen years' patent, \$100. The five and ten years' patents are granted with privilege of extension to fifteen years.

#### Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars, address MUNN & Co., 37 Park Row, New York.

#### Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in the market.

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#### Copies of Patents.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

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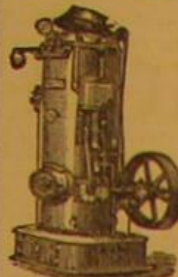
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## NEW ROTARY DIAMOND MILLSTONE DRESSER.

We illustrate in the annexed engraving a new application of the black diamond, or carbon, to the dressing of millstones. The device is the invention of M. A. Millot, of Zurich, Switzerland, and may be applied to millstones of any size and nature. The cutting is done by a rotary head to which the diamonds are attached.

The machine works entirely automatically, the mechanism being attached to a solid base, which is secured to the center of the stone. The rotating cutter moves forward and back; and when it has completed its travel in one direction, a ratchet wheel advances one tooth, and the machine operates so as to present a new surface of the stone to the action of the diamonds. The cutter head revolves at the rate of 12,000 turns per minute without the slightest vibration. The diamond points work in oil, and the adjustment is such that they always fall into the old series previously cut. But very little power is required, and a simple cord serves for its transmission. In less than an hour, it is stated, an ordinary stone is dressed with an accuracy never before attained. The edges are disposed to any desired eccentricity, in order that the increase may take place under the most favorable conditions, and so as to overcome the centrifugal force corresponding to the diameter of the stone.

M. Millot states that the automatic action of his machine is an advantage more than sufficient to compensate for its cutting only in radial direction. Waste of diamonds is prevented by completely imbedding the stones in the cutter head, so that these points never project beyond their metallic holder.

In one of the largest mills in Zurich there are eight pair of stones, four of which turn to the right and four to the left. No difference whatever is noted between the two sets in point of product obtained. In order to test the durability of stones cut by the machine with those dressed by hand, two pairs were prepared, one in each way, and worked for eight days. At the end of this time the hand-dressed millstone was considerably worn while that dressed by the machine was unaltered. It was also noted that the diamond-dressed stones remained more perfect at the circumference. One diamond cutter, it is further stated, will serve to dress several hundred stones.

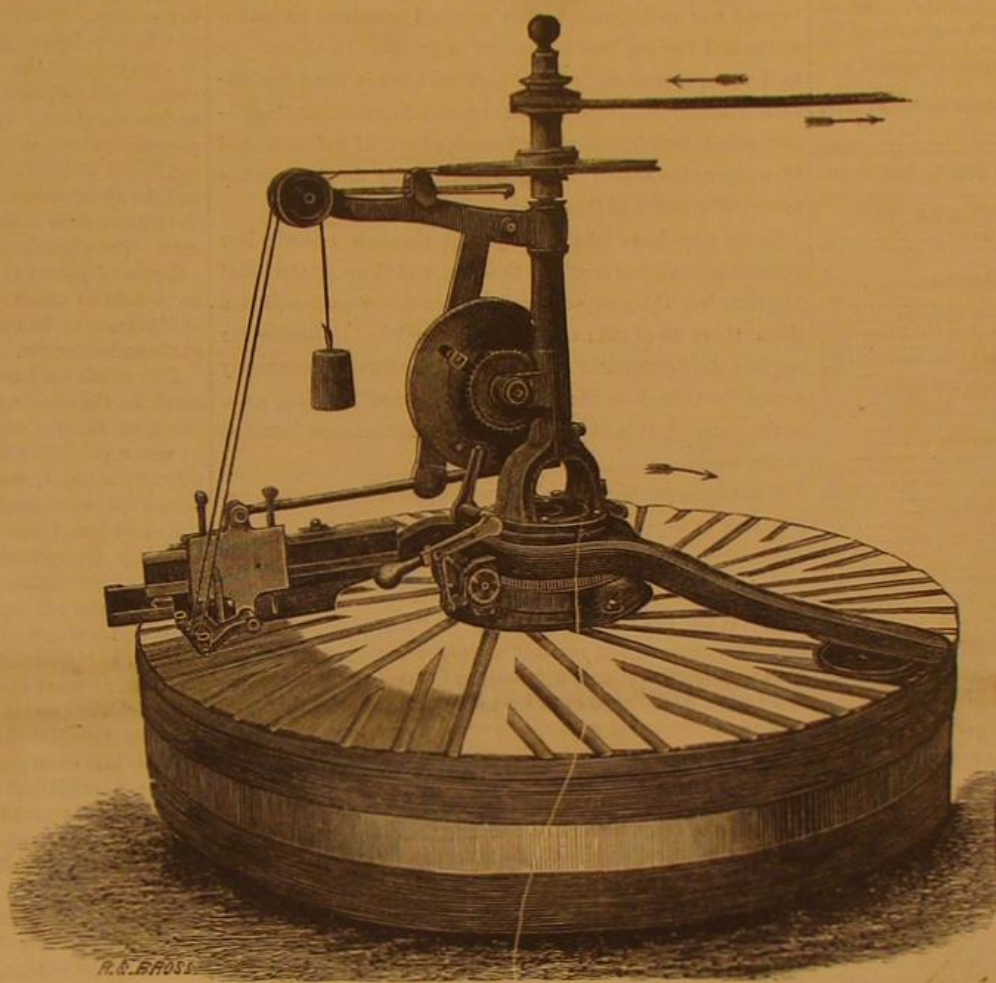
## PRICE'S IMPROVED HOSE COUPLING.

The annexed illustration represents a new hose coupling which offers the advantages of easy connection by simple automatic catch mechanism, and which embodies a novel way of securing the hose, so that the latter is held with great firmness. At the same time means are provided whereby the hose can be quickly released from the coupling. Fig. 1 is a sectional view, and Fig. 2 an end view, from which it will be understood that the two parts of the coupling are precisely alike, and are interchangeable: so that, if one portion should become injured, another may be readily substituted, and thus the failure of one part does not necessitate the removal of the entire union.

A is the main ring. In a recess on its front side is secured rubber packing, B. Pivoted in its upper portion is a catch, C, which bears against a bent rubber spring as shown. Cast on the corresponding lower part of ring, A, is a projection, D. As the opposite half of the union is made in similar manner, it will readily be seen that the projection, D, on one half enters under the hook of catch, C, on the other, and is engaged thereby, and vice versa. Hence it is only necessary to bring the faces of the parts together, when the catches become fastened; and the packing, B, being compressed, effectually closes the joint.

The principal difficulty encountered in devices of this description is the fastening of

the hose in the rings, so that it cannot be pulled out or forced out by heavy pressure. In the present invention, a flanged double-conical ring, E, is slipped on the hose, so that the edge of the latter is lapped by the flange while the conical portion passes inside. Over ring, E, the main coupling, as already described, is placed. Then a threaded ring, F, enters the threaded rear part of ring, A, takes against the hose, and jams it firmly against the tapered ring, as represented.



MILLOT'S ROTARY MILLSTONE DRESSER

Patented through the Scientific American Patent Agency, April 18, 1876. For further particulars, relative to sale of rights or of patent, address, before January 1 next, George W. Price, Smithtown Branch, Suffolk county, N. Y., or J. A. O'Brien, northwest corner of Front and Pine streets, Philadelphia, Pa.

## The Companion of Procyon.

It now seems probably that M. Struve was mistaken in his supposed discovery, made some time ago, of a companion star to Procyon. The astronomers at the Washington Ob-

servatory have been unable to detect any such star, even with the great telescope. M. Struve is repeating his observations; but as he has since noted companion stars to Regulus and Arcturus in the shape of fine spots of light, distant about 10 seconds, where it is certain that no heavenly bodies of the kind are in existence, it appears that the optical deficiencies of the astronomer himself have led him into error.

## Chinese Views on English Science.

If the election were not over, we should direct the attention of our political contemporaries, whose ingenuity is so fertile in devising campaign anecdotes not wholly complimentary to their opponents, to the author of a book called "Ki-king-lu," who seems to possess a special aptitude for that species of literary work. The volume is published in China; and the author, who has resided in England, returns home and accounts for British scientific progress by the fact that the English have undoubtedly robbed the Chinese of their learning. One method adopted by English scientists has been the making of an extract from the eyes of Chinese who have become Christians, and touching the eyes of foreigners with it, by which they have been enabled to understand astronomy and perceive the mineral wealth of the earth. This clearly accounts for Professor Proctor's remarkably rapid mastery of the science of the stars. Another valuable medicine for the promotion of intelligence has had, for one of its ingredients, the brains of a Chinese girl who had embraced Christianity. Other medicines have been mixed with the brains, and the compound made up into pills, which received their final touch in the shape of incantations instead of sugar coating.

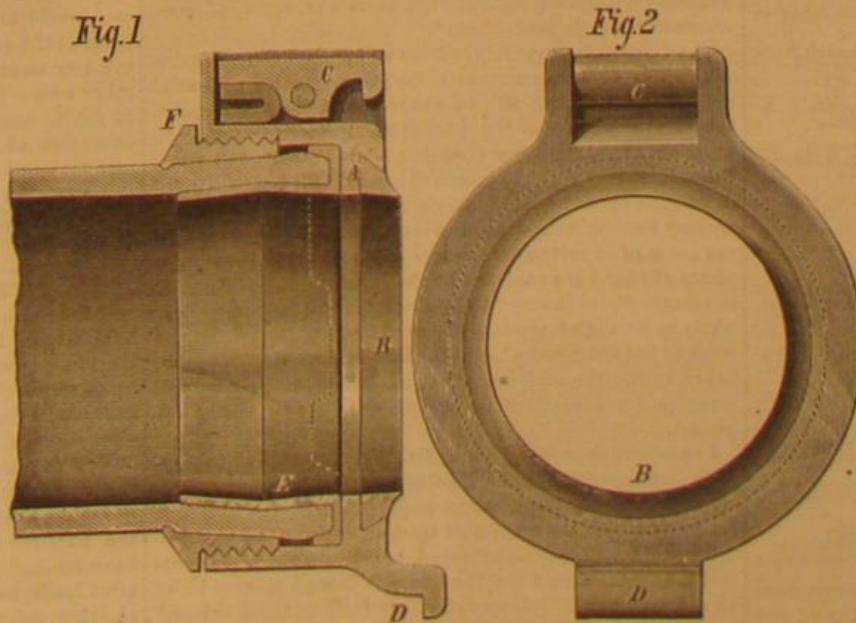
Our English readers will perhaps identify the author of this remarkable book from his statement that he lived three years in England, during which time he had three princesses given him to wife by Queen Victoria, and that he was only permitted to return to China upon giving a promise not to expose

th British improprieties which he had witnessed.

## A Curious Grain-Drying Process.

A correspondent of the Chicago *Inter-Ocean* describes a new process for drying grain, which he states is now in successful use in St. Louis and other cities, and by which grain, in any condition short of actual decay, can be restored to a merchantable grade and rendered safe to ship to any part of the world. The machinery consists of two conical-shaped revolving cylinders, the inner one being heated by confined steam, and the outer one fitted with appliances by which the grain is carried up and dropped through several feet of heated space upon the hot smaller cylinder. The cylinders being of conical shape, a draft is created, and the damp and impure vapor arising from the grain is carried off at the larger end of the curer in stifling clouds. Upon both cylinders electro-magnetic metals are attached in such manner as to generate a constant current of electricity, which is said to act upon the grain in some such manner as electricity acts upon the human skin. The grain becomes electrically excited. The result of the process upon grain is scarcely less than wonderful. Corn, wheat, and oats, in such wretched condition when they went into the machine that no one would ever think of doing anything with them but throw them away, came out entirely dry and thoroughly cleansed of mold.

[The foregoing may relate to some new process, but the description is evidently absurd. There are no "electro-magnetic metals," and we cannot perceive wherein "electricity" could, under the circumstances, exercise any effect, beneficial or otherwise, on the grain. Possibly some one can send us definite information regarding the process to which the writer refers.—Eps.]



PRICE'S HOSE COUPLING



If the disasters which have overtaken the unfortunate inhabitants of Bengal, India, had occurred in ancient times, we should now possess traditions of punishments inflicted by an offended deity, besides which the legends of the Flood, Sodom and Gomorrah, and the Egyptian plagues would be altogether inconsiderable. The population of the province is now as numerous as that of the United States. Through the failure of the rice crop in 1878, owing to protracted droughts, a famine occurred which killed off the people by the hundred thousand, and the deaths would undoubtedly have reached millions had not the British Government exerted itself to send immense quantities of food among the starving cultivators of the land. Now comes one of the most terrible hurricanes ever experienced in that land of typhoons and fierce storm; and official reports tell us that over 250,000 people have fallen victims to the three great



storm waves which have submerged the country for over 3,000 square miles.

The cyclone, which occurred on October 31 last, arose in the Bay of Bengal, and took a northward course, wrecking several large vessels which lay in its track. It just missed Calcutta, but struck Chittagong, which lies in the most northeasterly corner of the bay, stranding every vessel in the harbor and nearly destroying the town. Meanwhile the storm waves submerged the great islands of Hattiah, Sundep, and Dakhin, lying in one of the mouths of the Ganges, covered several smaller islands, and then flowed over the land for five or six miles toward the interior.

It appears that the immense waves were projected with astonishing velocity. Up to 11 o'clock on the night of October 31, Calcutta despatches reporting the storm said that no especial danger was anticipated, but before midnight the waters had overrun the land to a depth of 20 feet.

An examination of the map shows that the islands mentioned are situated near an estuary of the river Megna, and they owe their origin to the deposition of soil washed down by the Ganges. They constitute part of the Sunderbunds, as the low, marshy land thus produced is called, from its being covered with the "sunder" tree; and the district is not only the hottest but probably the most unhealthy portion of British India. Malaria reigns everywhere, and the forests and jungles abound with tigers and other ferocious beasts. The English Government for some time past has labored to reclaim the islands, and has offered strong inducements to settlers to cultivate the ground, which is rich and extremely fertile. These efforts have resulted in the clearing of a large portion of the territory, and the raising thereon of valuable crops of cotton, rice, sugar cane, mulberry trees for silkworm food, and timber: while the population of Dakhin, the largest island of about 800 miles in extent, has increased to 240,000, and those of Hattiah and Sundep together number some 100,000 inhabitants.

Of course the devastation in this district has been complete. The country is dead flat; and the people, when the wave burst upon them, had no place of safety but in the tree tops. And there such as were able found their way, sharing their refuges with the wild beasts, birds, and serpents. Houses by the thousand were utterly swept out of existence, and the only relics of human habitations afterwards found, were cast up on the Chittagong shore, ten miles distant.

The Calcutta Government Gazette says that, "wherever the storm wave passed, it is believed that not a third of the population survived. The islands have barely one fourth of their former inhabitants." All the cattle were destroyed, and the stench of the decomposing remains has already generated an outbreak of cholera which it is feared will prove general. The British Government is taking steps to relieve the distress which prevails.

#### AN INDIAN DUST STORM.

In his clever account of Bannu, a district in the Punjab, Thorburn describes a dust storm on the great plain of Marwat, a phenomenon of such imposing force and grandeur as to be well deserving of the important position lately accorded it, by American scholars, among the great geological agents.

Marwat, the bed of an ancient lake, is now a vast treeless plain of undulating, sandy down, bordered by a region of soft loamy clay, deeply furrowed by watercourses, and overlaid by a layer of gravel and smooth, rounded stones, called "hell stones" by the people, because of their black and scorched appearance, the effect, probably, of natural sand blast attrition. Seen in autumn or in a year of drought, it appears a bleak, howling wilderness, fit home for the whistling, heat laden dust storms that often sweep across its surface in the hot months; but in late spring, after a few timely showers, it presents an interminable sea of wheat, the vivid green of which gives place here and there to streaks and patches of darker shaded grain.

The approach of a dust storm over this place in the dry season, and witnessed from one of its boundary hills, is a grand and impressive sight. At first but a speck on the distant horizon, it rapidly elongates until it stretches from east to west, a mighty, threatening wall a thousand feet high and thirty miles in length. Nearer and nearer it comes, phantom-like, its rushing noise being inaudible to the spectator. Now one wing is pushed forward, now another, nearer still: and now the birds—kites, vultures, and a stray eagle or two—circling its front are visible, and one by one the villages at the foot of the hill are enveloped and hidden from the eye: a few minutes more and the summit of Shekhubudin, till then bathed in sunshine and sleeping in the sultry stillness of the June morning is shrouded in yellow, scudding clouds. Vanished is the grandeur of the scene in a moment, and nought remains but the stifling, begriming dust, flying and eddying about in all directions, penetrating everywhere. Outside nothing can be seen but a darkness which can be felt, and nothing is audible but the whistling of the wind and the flapping of bungalow chicks: but inside the lamps are lighted, and a quarter of an hour is idly passed, until the storm, which generally expends its fury on the hillsides, subsides or passes on.

#### LOW FLYING BALLOONS.

In his very excellent report, recently made, on the progress of aeronautics, to the British Aeronautical Society, of which he is secretary, Mr. Francis W. Brearey says:

"It is singular that no one has taken advantage of an ascertained fact to put the balloon to more pleasurable, because more prolonged, use than has hitherto been attempted." After instancing how a boat may be caused to travel with the current of a stream by simply using a pole

to push it clear of the banks, he adds: "There is every probability that, with a balloon so balanced, a push with a long pole would send it up spinning for fifty feet or more, and one might traverse a few hundred yards before it neared the earth and required another push."

Shortly before undertaking the ascension in which he lost his life, Mr. Donaldson, the well known aeronaut, described to us his experience in just such balloon sailing. He stated it as his belief that, if ever the time came when people would step into balloons as readily as they now do into railroad cars, the air ships would not sail above the clouds, but would skim close along the surface of the ground. He gave many reasons for this view—notably increased safety and economy, since balloons could be made much smaller, as they would not require a large amount of gas to keep them aloft, and there would be little difficulty in stopping to replenish the supply when exhausted. He had found no trouble in balancing a balloon at four feet above the ground, and at keeping it accurately at that height for hours. He told us, further, that he frequently traveled along country roads in this way during calm weather, using a pole to push himself along when there was no wind, or to guide himself when being wafted by a breeze. As an instance of how exactly a balloon can be balanced, he stated that, while thus sailing over a road, he carelessly dropped overboard about a quarter of a loaf of bread, whereupon the air ship sprang aloft a hundred feet or more. We asked him how he avoided wagons and similar obstacles in his path without discharging ballast, and so losing equilibrium? "Jump over them" was his answer. "A good strong push downwards on my guiding pole has sent me flying over many a tree in which I thought I was sure to be entangled." This flea-like mode of progression was a favorite mode he had of astonishing rustics.

Mr. Brearey's paper is published in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 50; and among other remarkable facts, it notes that a one horse power engine can be made to weigh only thirteen pounds. There are also descriptions of Moy's steam flying locomotives and others of the most nearly successful efforts toward solving the problem of aerial navigation.

#### THE RADIOMETER NOT A LIGHT MOTOR.

The immense quantity of evidence in the shape of experiments on the radiometer, which has been accumulated by the principal physicists of Europe, leaves no reasonable doubt but that the claim that the apparatus is driven by light is unfounded. It is maintained by our correspondent, M. Desaulx, that the radiometer is an electrical engine; a majority of observers pronounce it simply a machine driven by heat. So long as it is decided that the radiometer is actuated by forces which are intrinsically perfectly well understood, leaving the problem merely one of determining how the same are applied, the whole subject sinks at once to secondary importance. It was only because the apparatus appeared to demonstrate the ponderability of light, and hence was an apparent serious contradiction to the undulatory theory, that it has excited the close attention of the scientific world.

Dr. Frankland's recent experiments on the radiometer are among the most conclusive that have been made, as showing the true source of its motion. The disks of his instrument were of aluminum, polished on one side and blackened on the other. They were extraordinarily sensitive, and continued rotating often for twenty minutes after the sun had descended below the horizon. Placing this radiometer in a room where the conditions were such that it remained motionless, Dr. Frankland enclosed its globe in his hands so as to cut off light from the disks. Yet they at once began to rotate, polished side in advance. On withdrawing his hands, the motor, after the lapse of two or three minutes, stopped: then after another brief interval, it resumed in the opposite direction for a short time. There was rotation set up without the aid of light, and clearly due to the temperature of the investigator's hands.

The next experiment was exactly the converse, and involved testing the apparatus under light destitute of heat. It is well known that the moon, although reflecting the sun's rays, sends but a very small amount of heat to the earth. With a lens 3 feet in diameter, concentrating the lunar rays on a thermoscopic pile, Melloni proved that the deviation of the needle was from 0° 6' to 4° 8', according to the phase of the moon. This indicates so extremely small a heating power that it is practically inconsiderable, and is destitute of any known effects upon the earth. Dr. Frankland therefore exposed his radiometer to bright moonlight, but it did not stir. Then, with a powerful lens, he rendered the intensity of the rays 200 times greater, and directed the brilliant image of the moon, produced at the focus, directly upon one of the disks of the radiometer. Not the slightest movement was appreciable, although the light was kept unaltered for over a quarter of an hour.

Dr. Frankland's conclusions sum up the true facts regarding the radiometer in brief terms. He says: that light is not necessary to the motion of the instrument: that light does not contribute to its motion unless (by absorption) it be transformed into heat, which did not take place (or occurred in an unappreciable degree) for moonlight: that the movement of the disks is due to the unequal heating of the two faces of each disk, the cooler face always preceding the hotter one. When the globe is taken in the hands, the blackened face of each disk absorbs heat rapidly, while the bright side reflects it. Thus the surfaces of the black disks remain hotter than the metal situated below, but soon communicate their heat to said metal. If the hands be withdrawn, the thermal conditions are reversed: the black face, being a better absorbent and at the same time a better radi-

ator, cools much more quickly, and hence the opposite motion of the mill already described.

#### THE LIMITS TO PHYSICAL CULTURE.

We have frequently had occasion to dwell upon the fact that, while moderate physical culture is a great benefit, indeed a necessity, to ensure a proper balance of mental and bodily powers, and consequent health and longevity, physical overculture is a great evil, leading to results diametrically opposite to those sought to be attained. At one end of the series is a constitution weak and unfitted to resist disease or the effects of labor, on the other an organization strained to its utmost and ready to yield under the slightest addition to the stress. Obviously between these extremes there must be a mean up to which all culture is beneficial, and beyond which all is overculture. The question is, however, whether that mean is in the nature of a personal equation for every one, differing for each individual constitution, or whether it is possible to formulate general laws, true for all systems. The tendency of modern investigation, in all cases relating to the science of life and of living, is favorable to the latter view. Mr. Charles Darwin sends out his formulated questions the world over, and deduces results from the replies proportionally considered. Candolle does the same in his elaborate investigations into the antecedents of scientific men; the statistics relative to the recruits for our army we have shown, in recent articles, to admit of valuable deductions relative to our national characteristics; and we might add numerous examples, all showing that that which is proved true, on the average, for a large number of persons, may with reason be assumed to be true of an entire class, or even a race, when surrounded by generally similar conditions of life.

Now in the case of physical culture, the point specially to be determined by actual physiological investigation is to what extent the body may be benefited. This known, any one may easily discover for himself when the limit is reached, and will understand that to carry his training still further is a positive disadvantage and injury. Such an investigation has lately been made by Dr. Burcq of Paris, in the *Ecole de la Faisanderie*, a gymnasium where are drilled the soldiers who are destined to be the gymnastic instructors of the French army. No better set of men could be selected for examination, for the reason that each individual is virtually intended hereafter to serve as a model for others, and therefore his physical culture is brought to the best possible state. Dr. Burcq continued his investigations with the utmost care and minuteness, for six months, during which period the progress of over a thousand men was closely watched and criticized. As a general result, he tells us now that gymnastic exercises:

1. Increase the muscular forces up to 25 and even up to 38 per cent, at the same time tending to equilibrate them in the two halves of the body.

2. Increase the pulmonary capacity at least one sixth.

3. Increase the weight of men up to 15 per cent, while on the other hand diminishing the volume. This augmentation exclusively benefits the muscular system, as is demonstrated by its elevated dynamometric value.

And Dr. Burcq further observes that, during the first half of the six months' course at the school, the increase of force was most markedly noted.

To Dr. Burcq's admirable studies upon this body of trained gymnasts may be added those of M. Eugene Paz, who for a long period has been observing the results which methodical physical exercise produces in certain invalids and in a large number of people of various callings, notably artists, literary and business men, and others whose muscles are normally less voluminous than those of the picked soldiers at the *Faisanderie* School.

By means of a variety of ingenious mechanical apparatus, and by a course of investigation wholly different from that of Dr. Burcq, M. Paz reaches precisely the same results. He notes especially the increase in weight and decrease of volume of the body, above referred to, and also the augmentation of pulmonary capacity. Three operatic singers who were rigorously trained for a year attained a maximum lung power corresponding exactly to an increase of one sixth. It follows, therefore, that Dr. Burcq's results may be considered in the light of a general law, and likewise as a guide to what is correct physical culture. In this view, we commend them to the attention of college authorities and students.

#### English Views of our Silk Industry.

At a meeting of silk weavers at Macclesfield, England, the headquarters of British silk manufacture, considerable dissatisfaction was expressed that no steps had been taken to exhibit English silks at the Centennial, the speaker stating that, were the United States once made aware of the excellence of the goods, the 60 per cent duty on them, imposed by our laws, would probably soon be removed. The Centennial correspondent of the *Macclesfield Courier*, himself an expert in silk, denounces their expressions as "false and foolish." After mentioning that the reduction in cost of labor is fast removing the chief obstacle with which American manufacturers have to contend, he says to his countrymen: "We shall find that the ample labor saving appliances and greater intelligence of the work people will bring us face to face with a competition such as we have never yet dreamed of, and I venture to say that before long England, mother of free trade as she is, will find herself compelled to impose a duty on the importation of American silks, in order to protect her manufacturers from being beaten in their own markets."



## THE "JOHN BULL" LOCOMOTIVE AT THE CENTENNIAL.

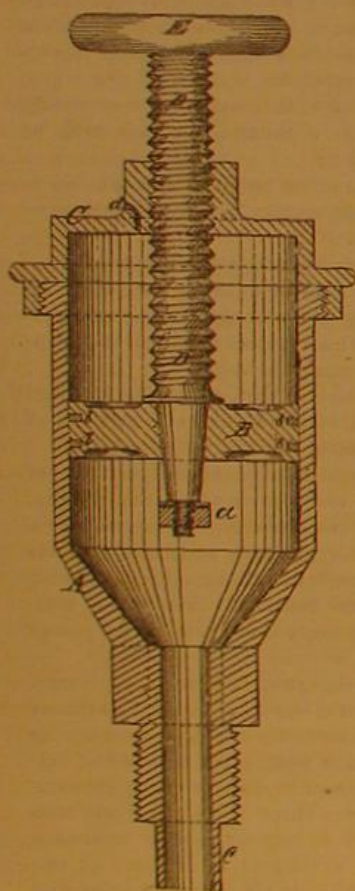
The annexed engraving represents a curious old relic of early railroading in this country, which attracted considerable attention during its exhibition at the Centennial. It is the locomotive "John Bull," built by George and Robert Stephenson, at Newcastle-on-Tyne, England, for the Camden and Amboy Transportation Company, and shipped to Philadelphia in 1831. From Philadelphia the machine was carried in a sloop to Bordentown, N. J., and, being packed in wagons, was hauled out to the only piece of permanent track of the Camden and Amboy company then completed, a line about  $\frac{1}{2}$  of a mile in length, and situated about 1 mile from Bordentown. The machinery was put together on the track, and a tender was constructed from a whisky hogshead placed on a small platform car which had been used by the contractor in building the road. The connection between the pump of the locomotive and the tank was made by means of leather hose fitted up by a Bordentown shoemaker.

Steam was first raised in the boiler on September 15, 1831, and after several trial trips the first public exhibition took place on November 12. R. L. Stevens acted as conductor and general director, and the entire New Jersey legislature were present as witnesses. The "John Bull" remained in Bordentown until 1833, and was occasionally used elsewhere until as late as 1865. The cylinders are 9 x 20 inches, and the driving wheels 4 feet 6 inches in diameter, with hubs of cast and tires of wrought iron. The entire weight of the locomotive is 10 tons.

With the old machine was exhibited a portion of the original track above mentioned. The rails were rolled in England, and were supported on stone blocks prepared at great expense, wooden ties not being deemed safe.

## IMPROVED LUBRICATOR.

Mr. George C. Johnson, of Portland, Me., has patented through the Scientific American Patent Agency, September 26, 1876, an improvement in lubricators, by means of which



a dense lubricating compound can be forced into journal boxes. A, in the annexed engraving, is a cylinder of brass, bored to receive the piston, B. A cap, C, is screwed to the top of the cylinder, A, and D a screw provided with the hand wheel, E, and fitting a screw thread cut in the center of the cap. The lower end of the screw is made conical, to fit a seat in the center of the piston.

The conical part of the screw is longer than the thickness of the piston, projects a short distance below, and is provided with a nut and washer, a, to prevent the piston from leaving it. Grooves, b, are cut in the piston to receive packing rings.

The lower end of the cylinder, A, is made conical or funnel-shaped, and is provided with a threaded tube, c, which screws into the journal box. An aperture, d, is

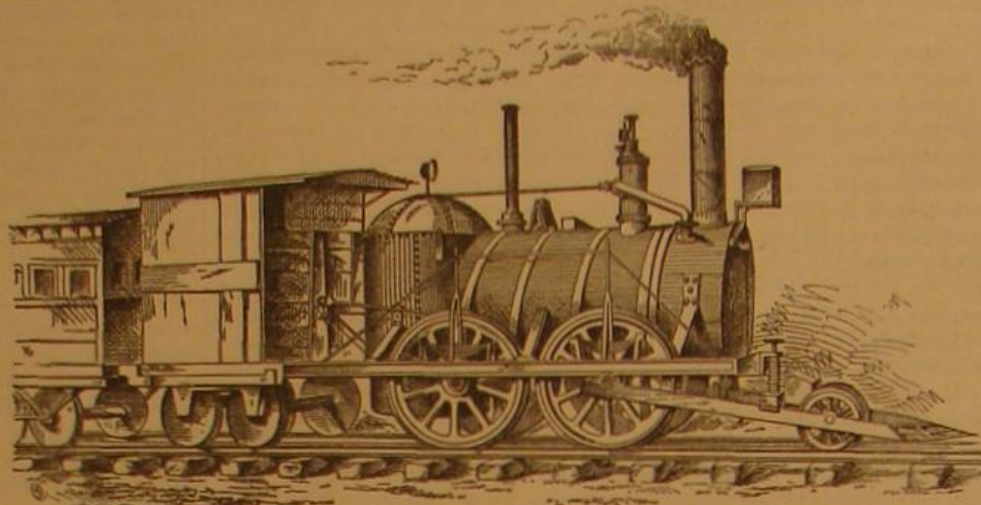
made in the cap for the admission of air. The cylinder, A, is filled by removing the cap and piston, and the lubricant is forced into the journal box, through the tube, c, by forcing down the piston, by means of the screw. Should the journal heat, the lubricator becomes warm, melting the lubricant, allowing the piston to drop to the nut, a, leaving a space between it and the conical part of the screw, through which air may pass.

## GALVANOMETER FOR TESTING LIGHTNING CONDUCTORS.

The preliminaries necessary to testing lightning conductors are often troublesome, the apparatus required for it being rarely obtainable in handy and convenient form, though, indeed, little apparatus is required: merely a galvanic element, a galvanometer, and a sufficient quantity of insulated copper wire. The firm of Mittelstrass Gebrüder, in Magdeburg, Germany, have recently combined the essential parts in a galvanometer chest, the arrangement of which (described in a recent number of Dinger's *Polytechnisches Journal*) is as follows: In front, the lid is fastened with two hooks. At the side are two binding screws for attachment of copper wires. On the top is a sensitive galvanometer, the needle of which can be arrested with a screw. In the interior of the chest stand two glasses (see engraving) with equal width of neck, so that the glass stopper in one may be readily transferred to the other, so as to close it. In

the one glass is a suitable solution of bichromate of potash; in the other is the carbon and zinc element, from which spirals of wire proceed to the binding screws as indicated. It is easy to lift the element out of the empty glass into the one filled with liquid, and so produce a current. In the third division of the chest is a roller with silk-covered copper wire, which can be easily wound off, and, with the aid of a small handle, wound on again. Lastly, a binding screw serves for connecting the line to the wire rope of the lightning conductor.

Where desirable, the arrangement is so completed that only one turn of the conducting wire round the galvanometer needle is inserted, or all the turns, which can be done



THE "JOHN BULL" LOCOMOTIVE.

in a moment by turning a binding eye on the upper side of the chest. Lastly, on the under side of the lid may be introduced two resistance coils of one to ten Siemens' units, which, again, may be similarly inserted or excluded.

In testing a lightning conductor, the process is as follows: 1. The wire is unwound from the roller, drawn up to the roof, and the end of it wound about the point of the conductor. 2. The chest is opened, the element lifted over into the salt solution, the chest closed again, and so placed that the needle is still; then the binding screw of the roller is connected with that of the chest with a piece of wire. 3. By means of the small binding screw in the bottom of the chest, a wire is connected with the lower part of the wire rope of the lightning conductor, and is brought to the second bind-



ing screw of the chest. If there be perfect electric connection between the upper point of the conductor and the lower parts, the needle will be deflected. Should the deflection not occur, the place of interruption is sought for by connecting the lower binding screw with the wire at successively higher points. 4. For investigation of the earth conduction, the point of the lightning conductor is excluded, by detaching the wire and connecting it with a neighboring gas chandelier, an iron spring, or an iron rod forced deep into the ground, and then the circuit is completed as before. The deflection of the needle will be greater, the more perfect the earth conductor. Important advantage is here derived from the above mentioned arrangements for insertion of the resistance coils, or only one or the whole of the galvanic windings. After use, the element is lifted back out of the solution into the empty glass, and the galvanometer needle again arrested.

## How Psycho is Worked.

It will be remembered that not long ago we illustrated Messrs. Maskelyne and Cooke's famous automaton Psycho, which has been exhibited in London, and which has puzzled every one who has attempted to explain its interior mechanism. The figure is seated, cross legged, on a cushion which is supported by a hollow clear glass cylinder, so as to show that no mechanical apparatus connects the automaton with the space beneath the stage or platform where a manipulator might be concealed. It has often been conjectured that the motive power was compressed air forced up through the cylinder, and this connection was strengthened when a prying Yankee, in one of Mr. Maskelyne's audiences, requested to be allowed to place a newspaper beneath the lower end of the tube, which request the exhibitor refused. Subsequently, however, the compressed air adherents were thrown into confusion by Maskelyne withdrawing his refusal and allowing the insertion of the newspaper. Now the London *Spiritualist* returns to the charge, with the same theory advanced in a new way. Psycho, its says, "is worked by varying the pressure of the air inside the glass cylinder on which the automaton stands; the compression of the air acts like a push, and the partial exhaustion of the air acts like a pull. The pushing and pulling action of this invisible rod—for committee men are not like provincial pigs, able to see the wind—the push and pull of this rod, we say,

starts and stops clockwork machinery at the proper moment inside the automaton. The air enters and leaves the glass cylinder through the green baize or other fabric on which the cylinder stands, portions of the air channel being concealed under the baize. There are two ways of working the figure. In the one case, the pedestal may be directly connected with the air pump apparatus by means of a pipe passing through the stage. In the other case, the figure may stand upon a pedestal connected with no pipe. Compressed air is then contained in a metallic vessel inside the pedestal, and its escape is permitted or stopped at will by means of an electro-magnetic valve. To work this valve, the feet of the pedestal are connected with fine wires running through the stage to the battery and the electrical commutator.

"Any committee men who wish to stop the working of Psycho can do so by placing a large folded newspaper over the top of the pedestal, so that air cannot be blown backwards and forwards into the bottom of the glass cylinder; but they must watch closely that Mr. Maskelyne does not punch a hole in their newspapers to let air through. Another way of stopping the working of Psycho is to mount the bottom of the glass cylinder upon three or four bungs, which anybody may take in his pocket to the Egyptian Hall. If the bottom of the cylinder is thus removed from the surface of the green baize, no blowing of air through the baize will much vary the pressure of that inside the cylinder."

The *Spiritualist* ought to be expert in matters of this kind, and therefore we look upon its opinion as semi-professional.

In any event it is the most plausible elucidation of the mechanism that has yet appeared.

## A NEW TACKLE.

We illustrate herewith a novel apparatus for setting up ships' rigging, which may also be applied to any purpose where heavy weights are to be moved over small distances. It was patented October 3, 1876, through the Scientific American Patent Agency, by Mr. Thomas F. Hall, of Omaha, Neb.

A are two guide rods, the upper ends of which are connected by bars, B, to and between which is pivoted a pulley, C. The lower ends of the rods, A, are connected by bars, D, to and between which is pivoted a pulley, E, the pulleys, C and E, being thus always kept at the same distance apart. F is a double chain pulley, the two parts of which are of different diameters. The double pulley, F, is arranged between the crossbars of the frame, G, at the ends of which are arranged the rods, A, which are capable of sliding up and down through the frame. Between the bars, H, are pivoted pulleys, I, at such distance from double pulley, F, that the chain, J, can pass between them freely. J is an endless chain which passes over the pulley, C, and the parts pass down upon the opposite sides of the double pulley, F, one part passing along the groove of the part of said pulley of greatest diameter, and the other part passing along the groove of the part of the pulley of smallest diameter. The parts of the chain, J, pass or cross each other between the pulleys, F and I, pass down upon the opposite sides of said pulleys, I, and around the pulley, E. The power is applied to the shaft of the double pulley, F. The crossbars or frame, B, is connected with the rigging or weight, and the end of the frame, H, is connected with the side of the vessel or support. As the pulley, F, is turned in one direction, it moves slowly up the chain, J, toward the pulley, C, drawing the frames, G H, toward the bars or frame, B, slowly, but with immense power, the pulleys, C E, keeping the chain, J, always taut, and the pulleys, I, holding the said chain in place upon the pulley, F.

## Smoky Stoves.

There is a very simple way of avoiding the disagreeable smoke and gas which always pours into the room when a fire is lit in a stove, heater, or fire place, on a damp day. Put in the wood and coal as usual; but before lighting them, ignite a handful of paper or shavings placed on the top of the coal. This produces a current of hot air in the chimney, which draws up the smoke and gas at once. Not one person out of fifty ever thinks of this easy expedient.

IRON is a dangerous ingredient in fire brick. When a brick containing iron is exposed, even at a low temperature, to gases containing carbon, part of the carbon is deposited near the iron. This has often not only caused the brick to lose its cohesion, but may even burst it so as to throw down the iron walls of furnaces and the linings of flues.



## IMPROVED TOOL HOLDERS AND CUTTERS.

The forms of tool holders and cutting tools shown in the annexed illustration are the subject of a patent to Messrs. New and Matthews, of Nottingham, England, and Mr. W. H. Berry, of the same place. They speak for themselves, says the *English Mechanic*, and require but little description. The tool holder is adapted for holding securely in a rectangular tapered slot a right hand or left hand cutting tool at suitable and fixed cutting angles (such tools being secured firmly by a serrated wedge and clamps held down by a swivel bolt and nut), also for holding in suitable tapered slots a straight tool and a cross tool cutting on either side at right angles. These tools are secured firmly by clamps held down by swivel bolt and nut. This holder is adapted for using the patentees' special sections or round or square steel. The invention further consists of three special sections of steel, and may be made to any size required. These sections of steel can be formed into uniform, angular, or round-nosed tools for right or left hand cutting. From these special sections a variety of tools suitable for various cutting purposes can be produced, which are particularly adapted for the rectangular tapered slot in the holder. From the same uniform bar of steel, tools can be cut in suitable lengths, and then, without being forged, ground to a proper cutting angle for the

several purposes required. Further, the novel shape of these special sections, when placed in the new holder, gives a positive and fixed angle for cutting.

Fig. 1 is a side elevation of tool holder in section (on line G H, 4). A is a rectangular tapered slot; B is a tapered slot at right angles to the lengthway of the holder; C is a tapered slot parallel with the lengthway of the holder; 2 is an elevation of the tool holder; 3 is an elevation in section (on line E F, 1), showing the tapered slot, C; 4 is a plan of tool holder, showing the rectangular tapered slot, A, and tapered slots, B and C; 5 is a front elevation of serrated wedge, and 6 is a side elevation of it; 7 is a front elevation of clamp, and 8 is a plan of it; 9 is a front elevation of swivel bolt and nut, and 10 is a side elevation of the same; 11, 12, and 13 are the special sections of steel particularly adapted for the tool holder to be held in the rectangular tapered slot, A; 14 is a side elevation of the right hand tool for cutting out corners, 15 is a front elevation, and 16 is a plan of it; 17 is a plan of a left hand tool for cutting out corners, and 18 is a front elevation of it; 19 is a plan of a right hand round-nosed tool; 20 is a plan of a left hand round-nosed tool; 21 is a side elevation of a straight tool, and 22 a plan of it; 23 is a side elevation of a cross tool; and 24 a plan of it. The tapered slots, B and C, in 1, are adapted for holding cutters severed from a bar of steel of uniform section, but thicker upon one edge than the other, as shown in section in 25. The patentees claim the constructions of the tool holder, as described and illustrated, and the three special sections of steel, particularly adapted for the rectangular tapered slot of the new tool holder. 11, 12, 13, and 25 are full size, as shown; the others are half size.

## PHARMACEUTICAL APPARATUS.

BY OCTAVIUS CORDER.

It has been frequently urged upon the Council of the Pharmaceutical Society of England to provide in their rooms a set of apparatus suitable for the use of retail estab-

lishments for the making of all such pharmaceutical preparations as may reasonably be expected by a chemist of the present day. Whether it is the duty of the Council to act the part of an educating body, either for students or mature pharmacists, I leave for the present (although I have a very decided opinion on the subject), my object on the present occasion being to assist those who may be in the same difficulty which I have felt. Having no set of apparatus to guide me, I should have been glad of information. I therefore send a short description of what I have found to answer my purpose, with a drawing of the apparatus.

A is a copper boiler holding about 12 gallons, fixed in a wrought iron jacket and heated by a ring gas burner. I used copper for the boiler, because, being made thinner than

is turned into the worm, H, about 4 gallons of water per hour are obtained. Two gallons of aromatic spirit of ammonia may be run over during the day, in conjunction with other preparations. I would add that it is well to cover the top of the boiler, and the sides of the pans and pipes, with felt, which effectually prevents a considerable loss of heat by radiation.

## In the Dock Warehouses of London.

A writer in the *British Trade Journal* has been exploring the vast warehouses of the East and West India Docks of London, where the cargoes of whole fleets of vessels are stored, pending the sale of the goods to wholesale merchants. One particular building examined was set apart for

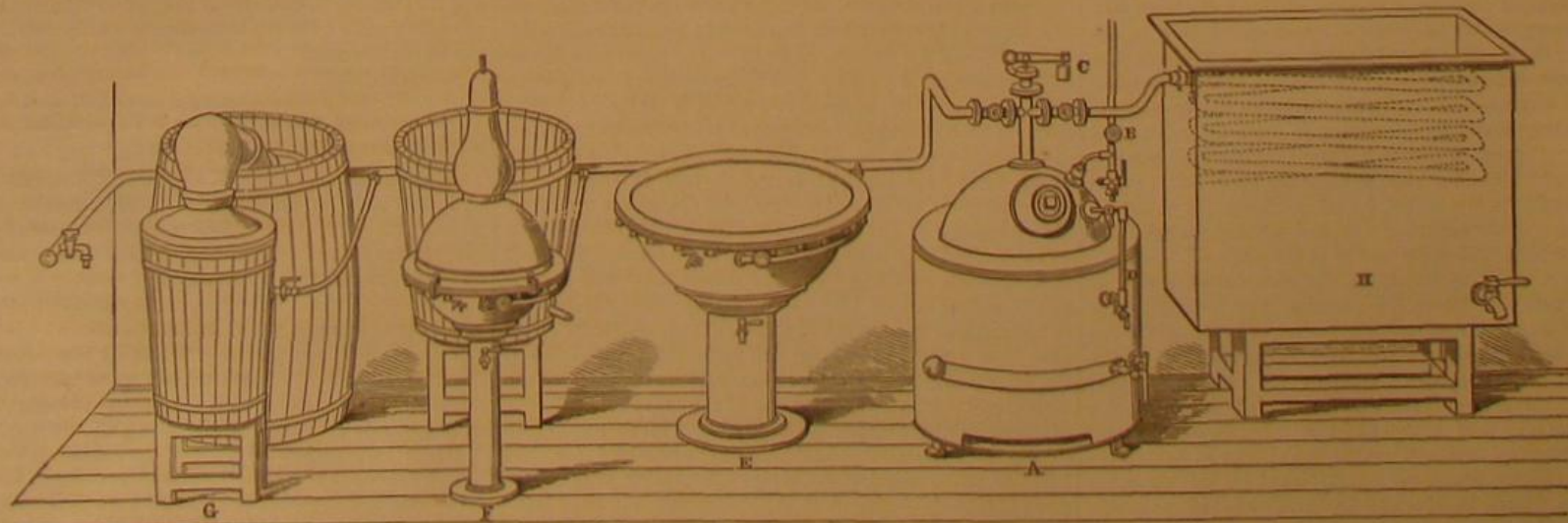
the most valuable articles of importation, such as drugs, ivory, feathers, etc., and about which a large variety of curious and interesting information was gathered.

In the drug department one sees such costly articles as vanilla, musk, ambergris, and the various kinds of essential oils undergoing manipulation. Each package of musk is carefully sorted, and every individual pod subjected to close scrutiny, for Ah Sing has a peculiar knack of deftly introducing different foreign substances into the pods and closing them up again. Some mysterious compound, known as Chinaman's earth, is a favorite

adulterant of this highly priced natural perfume. Ambergris, a peculiar secretion of the sperm whale and the base of many scents, was not a great number of years ago accounted worthless, but as much as five guineas an ounce has since been paid for it. Essential oils occupy an important place in the drug warehouse.

We noticed a large vat for the reception of cassia oil, capable of holding 200 gallons. This oil has to be turned out of its original packages and bulked, or mixed together, buyers being chary of investing in an article which exhibits very unequal quality. Proceeding from the drug warehouse, we ascend to the department devoted to ivory and tortoiseshell. The greater proportion of the former produce which reaches the London market finds its way to this warehouse. Every separate tusk is examined here at the hands of men whose long familiarity with the business enables them to detect the slightest imperfection. Each tooth bears on its surface a record of its own defects, which are expressed by certain cabalistic characters well understood by the trade. The dealer is able to place perfect reliance on these descriptive marks, and they, perhaps more than his own judgment, determine his biddings. Of the ivory of commerce, that hailing from the Gaboon is considered the best. It has a peculiar transparency, and, keeping its color well, is used for carving articles of a superior description. The largest tusks are those from Egypt and Zanzibar. One was pointed out to us from the latter place which weighed 128 lbs., this being, however, a tooth of quite exceptional size. Its defunct possessor would no doubt have proved an immense acquisition to a menagerie, for he must have been a very giant among giants. Every now and then a parcel of ante-diluvian ivory is forwarded from Siberia for sale. A passing glance at the tortoiseshell department reveals a good stock of that remarkable product. The cleats or pieces of shell which bind the plates together on the reptile's back were at one time valueless, but, strangely enough, now find a market in Japan as the material for the native jewelry.

Another floor of the warehouse introduces us to a rather



SIMPLE PHARMACEUTICAL APPARATUS.



novel show, that of birds, birdskins, and feathers. Here are cases upon cases and piles innumerable of feathered victims, from the magnificent Imperial pheasant off the Himalayas to the tiny humming bird of tropical America. The birds and birdskins are carefully sorted, and particulars taken for the transmission to the brokers, who are thus able to prepare their sale catalogues. One of the latter is before us, and although it is only a supplementary one the following are among the goods it specifies: 3,297 jays, 1,073 kingfishers, 1,047 ospreys, 649 red and orange tanagers, 394 parrots, 98 red ibis, 1,095 bee eaters, 653 bronze merles, 1,416 humming birds, and 2,023 various. Coming to the feathers, ostrich, of course, occupy the place of honor, both as regards quantity and relative value. Among other feathers are those of the osprey and the marabout or paddy bird of India. The latter are very pluffy and graceful in appearance, and in color are either a snow white or gray. The whole of the feather and bird business of London is concentrated in this warehouse, and the value of the peculiar merchandise here on show monthly is something about \$250,000.

The storage room, devoted to silk, is very considerable; and as far as possible, the different varieties, of which the principal are Bengal, China, and Japan, are kept distinct. Each skein has to pass muster, the inferior or damaged ones being thrown out; and the merchantable bulk of every bale is then enclosed in a hessian covering, which, when sewed up, constitutes a company's package. Bengal silk is in skeins, that from China in flattened bundles or books, and the Japanese skeins are tied up in grape-like bundles. The twine used by the Japanese silk packers is made of paper, but nevertheless wonderfully strong and of beautiful regularity. They are very liberal in the use of paper bands, which enclose the skeins in all directions; but as this paper is carefully preserved by the sorters and weighed off against the bale, the not over scrupulous "Japs" are defeated in their object, which is to get credit for paper as if it were silk. In the storerooms are between five and six thousand bales of silks. The facts of blinds being fitted to all the windows is calculated to puzzle the uninitiated, but this is a precautionary measure of some importance, it being found that the exposure of silk to light and warmth results in appreciable loss of weight.

The chief source of the indigo supply is India, but of late years the Central American States have been sending increasing quantities to this market. Bengal indigo, especially that classed by importers as Bengal blue, is most highly esteemed. Then follow Bengal violet and copper indigos, and after these rank Oude and Madras. The culture of the indigo plant is very precarious; and it thus happens that, although the consumption is tolerably uniform, the price is liable to violent fluctuations.

Inside the indigo warehouse there is but one universal color, and that is blue. The atmosphere is of a cerulean haziness, and the men, as they move about, give one the impression of having been in a dye bath. Certainly the blueness of Gainsborough's blue boy would have been doubly intensified by a brief sojourn in this region. The cases of indigo are weighed, tared, and samples drawn for display in the show rooms on the fifth floor. The skylights of these fine rooms are so arranged as to throw the light from the north on the samples of indigo arranged in long lines of trays below. Color is, of course, the chief guide to quality, lightness being also a characteristic of good indigo.

### Correspondence.

#### A Colossal Fortune Undeveloped.

To the Editor of the Scientific American:

For many years the subject of limiting the production of cotton, to bring the price to a more remunerative figure, has engaged the attention of many cotton planters in the South. If but a tithe of the mental labor which has been fruitlessly expended in this direction could be devoted to the invention of means by which the cost of production of cotton could be diminished 1 cent per lb., we might well look for most important results.

In the great Northwest, there has grown up within a few years a gigantic empire, teeming with its millions of thrifty farmers, who are able, by the aid of improved agricultural machinery, to produce the grain crops which feed a notable part of the civilized world. It is well known that this great result would not have been possible without the labor-saving machinery which has enabled them to compete in the markets of the world. But if we look at the cotton culture of the South, it is matter of great surprise that the production of so important a staple, involving so much constant manual labor, should have received so little assistance from inventors. There cannot be a more inviting field for mechanical ingenuity than this; and having given this subject much thought for ten years, I wish to direct the attention of mechanics to the nature of the demand and the probable means by which the supply can be achieved.

A given number of hands, in the rich cotton belt, can plant and cultivate double the quantity of cotton during the spring and summer that they can gather and prepare for the market in the fall and winter. Here, then, is a limit to the production of cotton which compels the culture of other crops in connection with cotton, crops which do not require labor in the season of cotton picking. Machinery for harvesting the cotton crop will enable the planter to double the quantity of cotton which can be produced by a given number of laborers. Here, then, is the first great want of the cotton grower.

I believe the man who successfully supplies this great want, by inventing machinery which will do for the cot-

ton crop what the improved reapers are doing for the wheat crop of the Northwest, will require a sewing machine to make his money bags. Then application of the buggy plow to the cultivation of the cotton plant will naturally follow, and still further diminish the cost of production.

Shortly after the late war, an ingenious Yankee exhibited in the South a device for picking cotton, which did the work, it is true; but it required to be brought to bear upon the cotton boll with something of the precision which points a gun at a bird. A southern negro would easily gather ten locks of cotton in the time required by the inventor to bring this cotton picker in contact with a single boll.

If I could be permitted to advise the would-be inventor of a cotton-picking machine, I would say: Take your first lesson in a cockle burr patch, as it is here called; pass through it, and note how tenaciously the numerous barbed points upon the burrs catch and hold your clothing. Thus you will find the first elementary principle of the cotton picker. Pass through the patch again upon a windy day, and note how your coat tail flies about in the wind, hunting, as it were, for the burrs that so readily seize it; and note also the increased number of burrs you bring away with you. Here you have a second lesson in the elements. Expand the cockle burr into a drum or cylinder covered with card clothing, such as is used in treating cotton or wool, but with teeth so fine as to exclude the limbs and leaves of the plant, seizing only the lint. Let there be two of these card cylinders, revolving in opposite directions, one upon either side of the row of plants; let them be placed nearly upright, leaning obliquely towards each other like the opposing rafters of a roof, so as to conform somewhat to the pyramidal form of the plant; let them be geared so that they can be raised or lowered by a lever to suit the height of the plant, and so that they can be approximated or separated to suit the breadth of the plant. Let each cylinder be provided with a comb or counter card, to remove the accumulated cotton from the card teeth, and drop it into a proper receptacle upon the machine. Let the whole be mounted upon broad-tired wheels and drawn by two horses, one upon each side of the row of plants. Let a suitable rotary fan be attached below, to send a strong draft of air up through the cotton plant to put the long, loose locks of lint in active agitation, so that they shall industriously search for the card teeth, and also to blow away sand and dust from the lint, and thus improve its quality. Do this, and you have the dry bones of a cotton picker, to be carefully studied, elaborated, and clothed in suitable habiliments, such as this writer has neither skill nor time to devise.

It is not necessary that the cotton picker shall do its work cleanly; if it can but garner two thirds or three fourths of the crop, manual labor will take care of the remainder. The customary price for picking cotton by hand is 75 cents per 100 lbs. of seed cotton, the average yield of which, in marketable lint, is 33 lbs. The cost of hand picking, therefore, is 2½ cents per lb., a very large item, which ought to be reduced, by appropriate machinery, by more than one half. A successful inventor who should exact as his royalty only ¼ of 1 cent per lb. upon the cotton crop of the United States might fairly figure his annual income at more than \$3,000,000, a sum worth striving for by any mechanic who has the gift of invention.

If these suggestions should drop a germinating seed into the fertile brain of the coming man who is destined to immortalize himself by the invention of a successful cotton-picking machine, I shall be most happily rewarded for my own part in the matter. ROBERT BATEY, M. D.  
Rome, Ga.

#### Boiler Explosions.—A Suggestion to Experts. To the Editor of the Scientific American:

The importance of the subject emboldens me, although not an engineer, to ask for a little space in your valuable journal, to allow me to rejoin to a communication from L. B. Davies, as to the cause of boiler explosions, which appears in your issue of November 18. I beg to be understood in advance that I have no intention of opening a controversy with an expert such as Mr. Davies seems to be, and that what I shall say is to be taken merely as a suggestion to practical engineers that, possibly, there may be a cause for such accidents which has been overlooked. The experiments as to the action of water under repeated heating, that I shall presently detail, were instituted three years ago in consequence of a series of investigations described, if I rightly remember, in the *Journal des Débats*, of Paris. The point was not directly raised by the article, but some collateral statements led me to question whether water, such as is ordinarily used for motive purposes, might not possibly acquire an explosive property by frequent heating. Although water is a protoxide of hydrogen, as a matter of fact, as found in its natural state in rivers and reservoirs, it contains a considerable percentage of nitrogenous admixture, partly in the form of animal and vegetable life containing nitrogen, and partly in compounds resulting from the decomposition of animal and vegetable tissues. The sedimentary coating it deposits in boilers, and the column of sediment that settles in a test tube after protracted boiling, are sufficient evidence as to the importance of the compounds held in solution to any careful and accurate investigation of the causes of explosion, in instances where inspection has failed to reveal any defects in the boiler itself. Again, under protracted jar, iron columns often acquire molecular properties that render them extremely brittle, and it is very possible that boiler iron under frequent heating and tension, saying nothing of inequality as respects both, may suffer molecular changes that cannot readily be detected even by an expert.

The experiments I have to detail were conducted in test tubes, with Croton water first, and afterwards with water obtained from the Hudson river. The degree of heat employed was uniform. The tubes used were two ounces, tightly corked with rubber stoppers, through each of which was passed longitudinally the refuse spout of a subcutaneous syringe, for the escape of steam. For the experiment I used seven tubes, each loaded with half an ounce of water. Six of the tubes were employed in this manner, namely, five of the six as a reservoir with which to replenish the sixth, thus eliminating one after another until only the sixth should remain: the seventh to be replenished with fresh water as often as the exhaust reduced its contents to one third of an ounce. That is to say, heating each in succession for five minutes: as often as the contents of any one of the first six was less than one third of an ounce, it was brought back to the original volume of water by replenishing from out its fellows, and so on until five of the six were empty; while, when the seventh had lost one third of its contents, the deficiency was supplied with fresh water from two and a half ounces reserved. The tubes were of average thickness. The interval allowed between boilings was one hour, during forty minutes of which the tubes were suspended in cold water to insure the necessary lowness of temperature. The thermometrical tests in each case were made with a very correct medical thermometer; and the external surface of each tube after cooling was carefully cleaned with a strong solution of caustic potash. The heating instrument was an alcohol lamp, filled after each series of heatings and carefully trimmed; and previous to each series I took the precaution to heat four ounces of fresh water in a tin cup for seven minutes, and then to test the heated water with the medical thermometer, in order to prevent any appreciable variation of temperature. Under these conditions, the test tubes being suspended by a wire loop always at the same distance from the tip of the wick, each time I found that there was a fixed diminution in the time required for perceptible boiling, after each experiment, and that the loss in volume by conversion into steam increased a trifle at each heating. The average first term with all the tubes was 3 minutes and 41 seconds. The last half ounce of the three ounces allotted to the six tubes replenished from each other boiled in 2 minutes and 47 seconds. The same quantity in the seventh tube, constantly replenished with fresh water, boiled in 3 minutes and 5 seconds, the diminution in time being 54 seconds in the one case, and only 36 in the other. Using three ounces of water from the Hudson river, in six tubes, under the same conditions, the average time of boiling at the first series of heatings was 3 minutes and 38 seconds, while the last half ounce boiled in 2 minutes and 27 seconds, a diminution of 71 seconds. Using three ounces of filtered Croton water, under the same conditions, the first term was 3 minutes and 49 seconds, and the second 3 minutes and 13 seconds, a difference of only 36 seconds.

I have carefully repeated these experiments a sufficient number of times to convince me that these phenomena are pretty constant; and, from the difference between filtered and unfiltered water in respect to them, it must be concluded, I think, that the presence of organic compounds has considerable influence in bringing them about. There is also a phenomenon, not readily described, but one readily appreciable by the eye—a manner of boiling, so to speak—which would enable an expert to guess pretty accurately whether a volume of water had been frequently heated, or was merely undergoing that process as virginal. It consists principally in the fact that water that has been persistently boiled and cooled breaks suddenly and violently into ebullition, as compared with fresh water under the same degree of heat. The experiments seem to indicate that nitrogenous compounds are responsible for this phenomenon, which in the last half ounce of a three ounce reduction pretty broadly suggests that the liquid under experiment has acquired an explosive property that, under such conditions of high heat as occur in using steam as a motive power, might prove very dangerous and destructive. I will not presume to say that experiments conducted on such a small scale are conclusive, save as establishing the fact that ordinary water acquires the property of yielding to heat the more readily in proportion to the number of times that it is heated, and that an increased rapidity of conversion into steam accompanies each increment of this change in molecular properties. I believe that nitrogenous compounds are responsible for this change and for the sudden violence of ebullition that accompanies it; but this point I have not been able to verify with the facilities at my command.

New York city.

F. G. F.

#### Suspended Animation as a Preserving Agent. To the Editor of the Scientific American:

On page 225 of volume XXXIII of the *SCIENTIFIC AMERICAN*, you have an article on the above named subject in which you give three different lines of investigation for future experiment. These are: 1. The power some animals have of rendering their natural prey utterly insensible for an indefinite period. 2. The peculiar effect of cold on some of the lower animals, which reduces them to a state not death, nor yet the ordinary torpidity caused by low temperature in other organisms. 3. Hibernation. In considering each in turn, you give as an instance of the first the complete torpor or anesthesia produced by the sting of the female of the "digger" wasp upon its prey; of the second, the well known torpor produced by cold in the case of serpents and certain fish, with subsequent return to activity on the application of heat; and lastly, hibernation is explained by the fact that "the muscular irritability of the left ventricle of the heart, highly increased, permits it to contract under the weak stimulus of



the non-oxygenated blood. It is this exaltation of a single vital property which preserves the animal life." One or two quotations from recent lectures of Dr. Brown-Séquard in your city will serve to indicate several other methods of investigation. The learned doctor gives an instance of a dead ox having been kept 56 days without putrefaction. M. Flourens considers that a spot in the *medulla oblongata* is the focus of vital force. There is, you know, a spot which is pierced by the matadores in Spain when they rush to kill a bull immediately. Death occurs instantly. \* \* It is interesting to know what becomes of the nervous force in these cases. It seems to have been altogether lost. I say it seems, for if we examine a little further we find that it is only dormant. The nervous centers have lost it almost altogether, but the nerves are quite rich in nerve force, so much so that I have kept one of those animals for nearly 65 days in my laboratory, without any trace of putrefaction, at a temperature which varied between 45° and 65°. The lack of putrefaction certainly depended on the long persistence of the nerve force after death."

Animals thus killed could no doubt be transported across the Atlantic from North or South America, in sailing vessels, without loss of weight and with little expense. It would be interesting to know if simple compression of the *medulla*, as by a ligature, for example, would not so suspend animation that it could be recalled at pleasure.

I quote further from the same author: "You know that they (the fakirs of India) may remain dead to all appearance for a number of days, and, it is even said, for months, without any change occurring in the body, without any change in the weight, without their receiving any food. They show neither circulation nor respiration, as their temperatures diminish very considerably, and altogether present a series of effects which are certainly very marvelous. But in the light of the fact that I had a dead animal in my laboratory lying for several months without any sign of decomposition, in a temperature varying from 40° to 60° during day and night, we can understand that these fakirs may remain able to live although they do not live—that is, they do not have actual and active life. But why, you will say, do they come out? Admit that there is in us a power which is quite distinct from our ordinary power of mind, which is quite distinct from that which we call consciousness, which during our sleep is awake and watches: with this admission and the facts I have mentioned above, we have all the elements, I think, for an explanation of what has been said about the fakirs."

Although I do not quite comprehend this explanation. I have thought it well to allude to it, as leading to a possible solution of the problem given toward the close of your article, namely that of having our own sensation and volition suspended at will, indefinitely.

Chatham, N. B., Canada. JOHN McCURDY, M. D.

#### The Supposed Planet Vulcan.

To the Editor of the Scientific American:

I felt much interest in the discussion on the planet Vulcan; and if all the observations are genuine, they are totally irreconcilable with any hypothesis as to the periodicity of the planet yet proposed. I think it was in the winter of 1872 that I gave you my observations, which you published, of a transit of the planet seen—as I have since determined—by me on September 15, 1859, in the forenoon. If I recollect rightly, I gave the diameter of the planet as apparently 2½ inches, taking the apparent diameter of the sun as 28 inches. This was about 8 o'clock, A. M., when the planet had just entered on the eastern limb of the sun, a little south of the sun's equator. The sun being near the horizon, it was enlarged by refraction. The planet was nearly, if not quite, two hours in making the transit, and I looked at it every five or ten minutes. We used only a smoked glass. In studying and comparing the phenomena I attributed to this planet, I found a regular recurrence of the phenomena at about the end of 23 days. By averaging the periodicity, I fixed it at 23.03 days. During over ten years I have minutely observed the recurring phenomena, with a view of verifying both the theory and the periodicity, and I have found but little if any variation in the periodicity. I do not claim that it is exact, but I am satisfied it is as near an approximation as can be arrived at until the planet's true position is determined.

I believe that the planet has an enormous size, at least equal to that of Uranus; and therefore the planet has never been seen by the observers who saw small black specks make transits of the sun. If any such speck has been seen, of which there can be no doubt, then it was a satellite and not the planet. I believe, however, that Mayer saw the planet make a transit on March 15, 1758, when he saw a spot one twentieth the diameter of the sun, which agrees in size with my observation in 1859.

It is to be regretted that M. Leverrier rejected all the observations where no forward movement of the speck was observed; for if it were a satellite, it might for a time be stationary, or have even a retrograde as well as a forward movement. The following calculations have recently been made:

From 1758, 74 days, when seen by Mayer at the descending node, to 1859, 258 days, when seen by Tice at the ascending node, is 101 years and 184 days = 37074.24 days ÷ R (23.02) = 1610½ revolutions + 0.55 days.

From 1758, 74 days (Mayer), to 1859, 85 days (Lescarbault), is 101 years 11 days = 36900.25 days ÷ R = 1603 revolutions + 0.19 days. Both these observations were at the descending node; therefore a whole number expressed the number of revolutions.

From 1758, 71 days, to 1876, 91 days (Wolf and Weber,

April 4, 1876), is 118 years and 20 days = 43119.50 ÷ R = 1873 R + 3.08, from which deduct 2 days for the time it will take the planet to move from node to inferior conjunction, leaving 1.08 days. My position for the planet was for April 3, 1876, at its inferior conjunction, or the day before the observation of the small speck.

From 1859, 85 days (Lescarbault), to 1859, 258 days (Tice), is 173 days = 7½ revolutions + 0.36 days. From which has to be deducted difference between time in Europe and America, which will leave a difference of between 2 and 3 hours.

Mayer's observation and the observation of October, 1802, gives 707 revolutions + 2.98 days, deducting 2 days for passage from node; this leaves 0.98 day; but one is an observation at the ascending node, and the other at the descending node, therefore there should be half a revolution. It is therefore half a revolution, say 11.50 days, short. But here a remarkable fact occurs, a series coming in as though there were two planets, half a circle, 180°, apart, and revolving around the sun in the same period, 23.02 days.

From October 10, 1802, to October 2, 1839, is 13,506 days = 591 revolutions + 1.58 days.

From 1839, October 2, to March 12, 1849, is 3,448 days = 148½ revolutions + 0.9 day.

From 1839 to either of the observations of 1859, there lacks half a revolution. The observations of 1802, 1839, 1849, lack half a revolution when compared with 1758, 1859, 1876. The observation of March 20, 1862, has no corresponding observation, differing with one series 7.56 days, and 14.08 with the other. The observations published in SCIENTIFIC AMERICAN for July 23 and October 24, 1876, belong to the series of 1802, 1839, and 1849. They are midway between the latter series and those of 1758, 1859, and 1876. From July 23 to October 24 is 92 days; four revolutions of 23.02 days are 92.08 days.

It will be seen that the component elements of the problem as far as known are irreconcilable, because some may not be authentic. The way out of the difficulty is to look for the planet, not the satellites, outside of the sun when at its greatest eastern or western elongation. Its immense size will render it visible twice for a day or so on each revolution, under proper conditions of the atmosphere. I did see it, and showed it to my family on the afternoon of June, 1876, in the exceptionally blue and serene atmosphere of that day. It was about five or six apparent solar diameters northwest of the sun.

It probably may make a transit of the sun on March 12, 1877, as it will be at its inferior conjunction on that day and very near the node. I expect it to make a transit on March 14 or 15, 1878, and on the 14 or 15 of September, 1882. It may be visible at the total eclipse of July 29, 1878, but it will be very near the sun, having passed its inferior conjunction a day or two before.

JOHN H. TICE.

St. Louis, Mo

#### A New Method of Cutting Screws.

To the Editor of the Scientific American:

Thinking a method for cutting screws would be of benefit to some of your readers, I send you the following, which is not generally known:

When the screw tool has cut the required length of screw, the quickest way of taking the saddle back is by hand; and to do that, the part of tailstock which comes in contact with the saddle must be set a certain distance from it; and to find that distance, it must be known which are the right places for putting the nut in and out of gear with the leading screw. But previous to setting the tailstock the required distance from the saddle, the screw tool must be set true and opposite the end of the work to be screw-cut—where in some cases a hole is drilled—likewise the nut in gear with the leading screw. The following rules for getting the above distance will be found to answer for any pitch of leading screw: First, when the number of threads per inch required to be cut can be divided by the number per inch of the leading screw without any remainder, the nut will be right when in gear with any part of the leading screw. And in all other cases, multiply the number of threads per inch that you wish to cut by some number of inches (which will depend upon the length of the screw to be cut) that will give an even number, which will be the proper distance to move the saddle.

I have used this mode for several years on both male and female screws of single, double, and triple threads, and have never known it to fail.

Smithville, N. J.

EDWIN JUDD.

#### Smiler's Health Lift.

Dr. Smiler, says Max Adeler, had a large tank placed on the top of his house from which to supply his bathroom, and so forth, with water. The water had to be pumped up about fifty feet from the cistern in the yard, and the doctor found it to be a pretty good-sized job, which would cause him constant expense. So after thinking the matter over very carefully, one day an idea struck him. He built a room over the cistern and put word "Sanitarium" over the door. Then he concealed the pump machinery beneath the floor, and he rigged up a kind of complicated apparatus with handles and hinges and a crank, so that a man by standing in the middle of the machine and pulling the handle up and down would operate that pump.

Then the doctor got out circulars and published advertisements about "Smiler's Patent Health Lift," and he secured testimonials from a thousand or so people who agreed that the health lift was the only hope for the physical salvation of the human race. Pretty soon people began to see about it, and Smiler would rush them out to the "Sanitarium" and set them to jerking the handles. And when a customer

had pumped up fifty gallons or so, Smiler would charge him a quarter, and tell him that three months of that kind of thing would give him muscles like a prizefighter.

The thing became so popular that he had to enlarge his tank and put in a smaller pump; and he not only got all his pumping done for nothing, but the people who did it paid him about \$1,500 a year for the privilege.

One day, however, Mr. Maginnis, who had been practicing at the health lift every day for months, broke the board upon which he was standing, and plunged into the cistern, and just as he was sinking for the third time Smiler fished him out with a crooked nail in the end of a clothes prop.

A few days later Maginnis came round with a lot of other patients, and cross-examined Smiler's servant girl, and learned about the truth, and then they went home mad. A consultation was held, at which they resolved to prosecute Smiler for damages and for obtaining money under false pretences. It is thought by good judges that, by the time the court get through with Smiler, it will be about the unhealthiest lift for him he was ever interested in.

#### Sawmill Machinery.

The building devoted to the sawmill exhibit, which is situated at the base of George's Hill, presents, says one of our contemporaries, a sight to the inquiring mind both interesting and instructive. In it may be seen, in operation, all the processes and machinery of a regular sawmill, all the leading manufacturers of this important branch of machinery being represented. The exhibit which attracts the most attention is that of the Stearns Manufacturing Company of Erie, Pa., who have some of the most beautiful pieces of mechanism at work that we have ever seen. To them was awarded a prize medal and diploma of merit for their machinery, on account of its manifest superiority of construction, in the many novel features and important improvements they have made (which are patented), and general excellence of workmanship. The Stearns Manufacturing Company have long been regarded as being at the head of this branch of business, and their productions may be found in sawmills all over the country. The central object of interest in the whole sawmill building, one which commands the attention of all the mill men, is a saw which cuts through a sixteen foot log in one and a half seconds of time, every revolution of the saw cutting in 10½ inches. This is the highest speed ever before attained, and shows conclusively to what a high degree of perfection they have brought their machinery. The work exhibited by them, in all its details, speaks emphatically for itself, and shows that the Stearns Manufacturing Company have no need to fear any rivals in their business, as their workmanship cannot be excelled. This is all the more true when we consider that those articles are taken from regular stock, and are not made specially for exhibition. A better idea, therefore, can be had of the general excellence.

#### Prompt Payment.

"Prompt pay is the key to all success in business. There are times in the history of every trader when he finds it inconvenient to meet his bills promptly, and in such case we find the man who knows his credit to be good becoming lukewarm, forgetting that his creditors are calculating upon him perhaps to meet some pressing obligation. The result is that he disappoints them, and thus, after one or two repetitions of the same, even the man whose credit is first class can soon impair it, and sometimes to a degree that makes it hard for him to recuperate. Now let us take the man of moderate (say fair) credit. He knows under such circumstances that his credit is scrupulously watched; and if his bills begin to lapse, he is at once notified of it, and informed that unless past bills are paid no more goods can be procured. With such a contingency facing him, he sees it is to his interest to meet his payments promptly, and is on the high road to success. Prompt pay does two important things—it inspires confidence in the seller, putting the buyer upon a first class basis, and it insures the prompt shipment of goods."

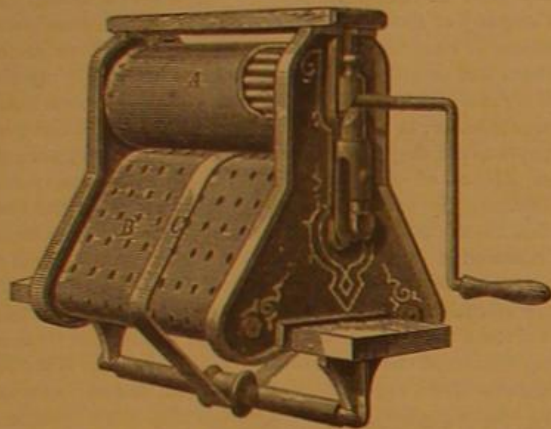
Our English contemporary, whence we extract the above sound advice, forgets to point out that there is a still greater advantage in seeking no credit at all, but in making payment at once. Persons who have not tried the cash system (and we mean not merely in ordinary business transactions, but everywhere, even in the small expenditures of the household) has any idea how much it simplifies the transaction and benefits both the buyer and seller. Moreover it is a saving to the purchaser of a very large percentage. We have found, by inquiry among many retail dealers in this city, that such houses as are in the habit of allowing credit to their customers, from six months to one year, add on an average of at least ten per cent to the cash price. And this must be so, because the dealer cannot afford to lose the interest on his money and take the risk of a failure of payment of a portion, which is inevitable. Another fact for debtors, more especially of wine merchants, tobacco sellers, and tailors, is worth remembering: and that is that, where one of these dealers gives credit, he calculates that a certain percentage of the debts will never be paid, and this percentage is necessarily added to the charges made to all customers, both time and cash. There are multitudes of other benefits, which will suggest themselves to any thoughtful person, all accruing by the prompt cash system.

THE American Institute Fair closed on November 25. Mr. F. D. Curtis delivered an oration, in which he stated that the entries at the exhibition numbered 1,333 and the visitors over 500,000. Awards were given in the usual wholesale manner.



## DENNEY'S IMPROVED WASHING MACHINE.

We illustrate herewith a new roller washing machine which is claimed to wash fabrics of any degree of fineness thoroughly and without injury. It is also adapted to the cleansing of garments, etc. The frame of the machine is made of cast iron, galvanized. The top roller, A, has longitudinal corrugations, and is covered with a sleeve of vulcanized rubber, which consists of a ply of cotton duck, having merely sufficient rubber on its under side to protect it from the action of the water, the requisite degree of elasticity being secured by the application of the greater thickness of rubber to the outer surface. The lower roller is provided with peculiarly shaped channels, differently spaced from the corrugations on the top roller. There is thus created an abrading action when the machine is working, while a pressure is exerted by the top roller, which is held down by detachable springs. The endless apron, B, passes over the lower roller and down around small carrying rollers, as shown. The rubber cloth of which it is made is prepared with the greater amount of rubber on the upper surface, which fits it for contact with the most tender articles to be cleaned. The band is perforated so that the air and water contained in the channels of the under roller are utilized by being driven through the clothing. The inclination given to the band causes the clothes to adhere to it, so that they can be run through past the top roll, and thereby cleansed out to their extreme ends. The apron acts as a conveyer, also to carry a larger quantity of water along with the clothing



to the rolls while the water may be used much hotter than usual. The rubber conforms to the uneven thicknesses of the clothing. The machine is designed to be used in an ordinary washtub.

In order to prevent the finer articles from sticking to the endless apron, a small narrow band, C, is passed around the apron, which band is carried down around a lower roller, so as to pull off the articles as they descend into the water.

Patented by S. L. Denney, June 1, 1875, and May 9, 1876. For further particulars address the inventor at Gap, Lancaster county, Pa.

## A Variety of Rare Chemicals for Twelve Cents.

A writer to one of our exchanges, who has been assiduously perusing our scientific dissection of a cigar, wants to know how, with such an array of rare chemicals as pyridine, lutidine, pyridine, etc. ("not to mention cabbage and burdockic acid"), any one can expect to buy a good cigar for less than ten cents. This is a financial view of the subject which had not occurred to us, but a moment's consideration shows that it conceals a specious sophistry. Let us reply, Yankee fashion, by another question.

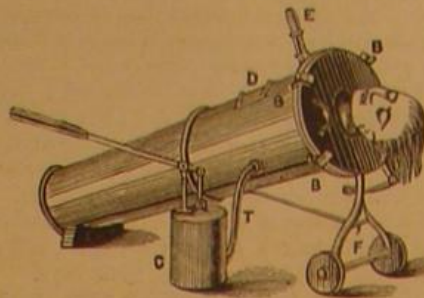
How can any one expect the cost of living to be further reduced when a pound of butyric acid, butyric acid, capric acid, caprylic acid, caproic acid, palmitic acid, myristic acid, vaccinic acid, stearic acid, oleic acid, oxide of lipyle, chlorine, sodium, potassium, phosphate of lime, phosphate of magnesia, casein, lactose, mucus, albumen, iron, glycerin, hircine, lacto-protein, lacto-albumen, besides bixin and orellin and hair (all of which, according to an actual assay of one of our metropolitan chemists, go to make the compound known as boarding house butter) is obtainable for 12 cents?

## THE SPIROPHORE.

This apparatus was recently described to the Paris Academy by M. Woillez. It is for restoring asphyxiated persons, especially such as have been in danger of drowning, and new born infants. We are indebted to the *Journal de Pharmacie et de Chimie* for the annexed engraving of the apparatus. It consists of a cylinder of sheet iron closed at one end and open at the other. The case is large enough to receive the body to be treated, which is let down into it as far as the head, which remains outside. A tightly fitting diaphragm closes the aperture about the neck. A strong air pump, C, containing more than four and a half gallons of air, is situated outside of the case, and communicates with it by a thick tube, T. It is worked by means of a lever, the descent of which produces aspiration of the air confined about the body. The raising of the lever again restores the abstracted air to the case. A transparent piece of glass, D, on the upper part of the cylinder enables one to see the chest and abdomen of the patient, and a movable rod, E, sliding in a vertical tube, is made to rest on the sternum.

M. Woillez states that he has made several experiments with the apparatus, the general results of which are as follows: When a human body is inclosed as described, and the lever quickly lowered, a vacuum is produced round the body, and immediately the external air penetrates into the

chest, the walls of which are seen to rise as in normal life. The ribs separate, the sternum is pushed up 0.393 inch at least (indicated by the movable rod which rests on it). Further, the epigastrium, and even the abdomen below, present an inspiratory projection, which shows that the enlargement of the chest is effected during this artificial inspiration not merely by the raising of the ribs and the sternum, but also



by the descent of the diaphragm. All returns to the former position when the lever is raised again. These complete respiratory movements may be repeated fifteen to eighteen times in a minute, as in a living man.

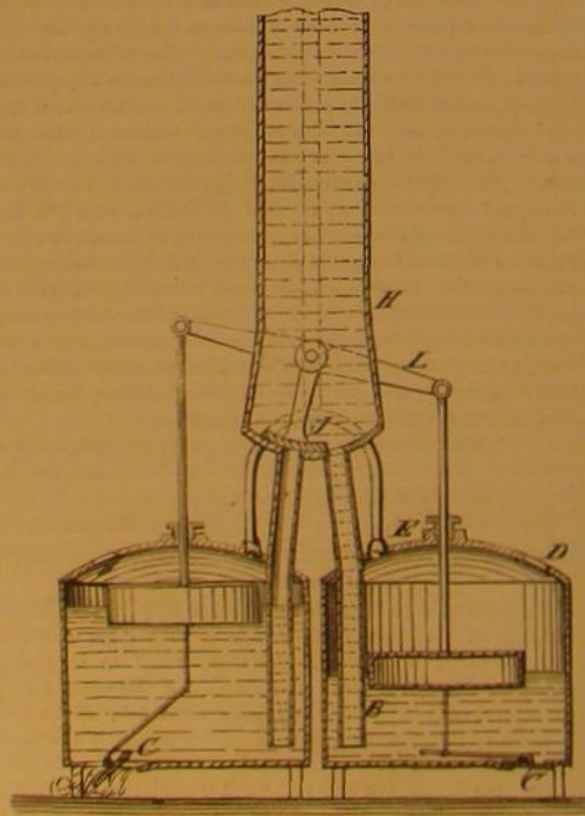
By means of a tube fixed into the windpipe of the body, and communicating with a graduated reservoir of air over a vessel of water, M. Woillez has measured the quantity of air which thus penetrates into the chest at each pressure of the lever. He finds that this is, on an average, 1½ pints; whereas the physiological average is only 1/10 pint. More than 22 gallons of air can be made to traverse the lungs of the asphyxiated person in ten minutes.

It is easy, then, to see the advantages presented by this apparatus for treatment of the asphyxiated, especially drowning persons and new born infants. In all cases of asphyxia by vitiated or insufficient air, or by certain poisonings, in paralysis of the respiratory muscles, in most dysphoric affections, in asphyxia by bronchial mucosities, and that due to inhalations of chloroform, and lastly, in determining some cases of apparent death, the spirophore may be used to produce an efficacious artificial respiration.

This respiration is without danger to the lungs, which are not liable to rupture, however strong the action of the lever. This innocuity is due to the fact that the force of penetration of the air into the lungs is never superior in this case (as also in the case of normal life) to the weight of the atmosphere.

## A NOVEL AIR COMPRESSOR.

The annexed engraving represents a new machine for compressing air by water pressure. Two cylinders, placed side by side, have an inlet pipe, B, and an outlet valve, C, for water; there is also an inlet, D, and outlet, E, for air, and each cylinder contains a float, F. The pipes for admitting water extend from near the bottom of the cylinders, to cut off the air, into the curved bottom of a penstock, H, in which is a rock valve, J, for alternately opening and closing the passages to the respective cylinders. The stem of this valve extends out through the penstock in a suitable stuffing box, and connects with a rocking beam, L, one end of which is connected to the float, F, of one of the cylinders by a rod, M, and the other is connected to the other float by a similar



rod. The valves, at C, are so connected to the floats that, when they are raised by the water to the required height, the floats open them to let the water escape and reverse the machine. By the filling of the cylinders with water the air is forced out through outlet, E, into the receiver; and by the escape of the water the cylinders fill with air again, to be again expelled into the receiver. This device was patented October 24, 1876, through the Scientific American Patent Agency, by Mr. Henry H. Sawtell, of Randolph, N. Y.

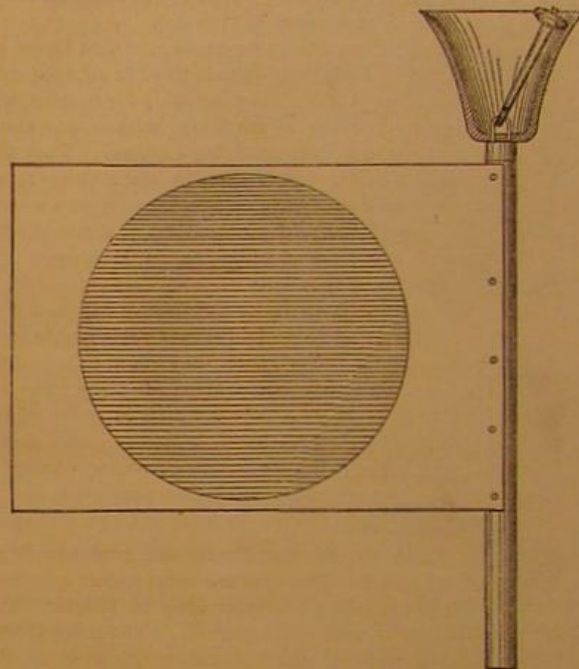
## Spontaneous Combustion of Sawdust.

Sawdust is a dangerous material wherewith to fill spittoons, nor is it a wholly safe substance to strew upon floors. Several cases have recently been noted where conflagrations have been caused by cigar stumps igniting the sawdust, which smoldered slowly in the receptacles, unperceived, and finally set fire to the adjoining woodwork. Sawdust, moreover, when slightly impregnated with oil or grease, is very prone to spontaneous combustion. We published, not very long since, an instance where the sawdust sifted down through cracks in the floor boards, and accumulated between the beams, where it absorbed spilled oil. It eventually burst into flames which nearly destroyed the entire edifice.

## A SOUNDING HAND SIGNAL FOR RAILROADS.

To the end of the handle, to which the ordinary signal flag is attached, a bell, C, a rattle, or other sounding device is fastened, so that it may sound when the flag is waved, and thus call to it the attention of those who may be looking the other way, and who might not observe the signal. Instead of a flag, a lantern or other light signal may be used, so as to give a sight and a sound signal at the same time.

This device might be useful in foggy weather, when locomotive engineers may not be able to discern the color of a



flag, or when the latter is altogether, at short distances, obscured by the fog.

Patented through the Scientific American Patent Agency, September 19, 1876, by Mr. S. Brown, of Philadelphia, Pa.

## Removing Nuts from Clips and Bolts.

The London (England) *Carriage Builders' Gazette*, in answer to a writer who asks as to the best means of getting off the nuts of bolts and clips, and of driving up bolts and clips, without destroying the screws, gives the following reply:

When the clips twist ever so slightly in trying to unscrew the nuts, cease to try until you have enlarged the nut by holding it for a minute or two with a pair of red hot tongs. If the clip has an extra point on it, file it round and oil it; then try. If still firm, cut the nut in halves with a chisel, having another long chisel or iron bar held against the opposite side of the nut to take the force of the blows of the hammer. Be sure to use a light bolt hammer, which is more effective than a heavy hammer—it is better to cut off twenty nuts than to break a clip. For driving up bolts so as not to bruise or burr up the screw, unscrew the nut one turn only, or enough to cover the point of the bolt; then drive the bolt back by striking the nut; if immovable, get somebody to hold a heavy hammer on the nut while you strike forcibly the iron on each side of the head; if set fast, apply the end of a hot iron bar to the side of the head of the bolt to expand the iron. If you cannot start the bolt for the want of room to strike a fair blow on the bolt point, get somebody to hold the edge of a long piece of heavy tire iron on the bolt point: then with a heavy hammer strike the bar as near the bearing as you can get at. Sometimes if the bolt is through a scroll iron, and where the spring is in the way of the hammer, a peculiar shaped drift pin has to be used—it is something like a tuning fork; the fork being put on the driving bar at right angles, the bar is struck to drive the drift pin up the bolt hole.

## The Supposed Planet Vulcan.

Astronomer Royal Airy gives M. Weber's observation—on which it will be remembered the recent predictions by Leverrier of a transit of the supposed planet were founded—its coup de grace by producing two photographs of the sun, taken on April 4, Weber's date, showing the imaginary planet to be a sun spot beyond question. It appears as a nucleus, without penumbra and surrounded by a small group of faculae.

In accordance with a long-established rule, all subscriptions terminating with this volume will be discontinued at that time. We trust that all our subscribers will not only renew, but that they may find it convenient to induce some of their neighbors to become subscribers. We shall in the future, as in the past, give our readers full measure and running over, in return for their money.



## NEW CHINESE DEER.

Towards the end of 1873, Michie, an English naturalist in China, discovered in the mountains, near Ningpo, a new species of deer, termed by the inhabitants the *shanyang*. The skin of the animal being sent to England, it was there carefully studied, and Mr. Swinhoe, a well known zoölogist, declared not only the species to be new, but that the animal belonged to a new generic type, different from any yet known. He applied to it the name *laphotragus Michianus*, the first word having reference to the peculiar tuft of hair on the animal's head, and the last referring to the name of the discoverer. A living deer has lately been placed in the Zoölogical Gardens, London, and the identity of the genus, with that of the *claphodus* discovered by Abbé David in the mountains of the principality of Moupin, has been determined.

The *laphotragus* is a deer of small size, resembling the *hydropotes* or Chinese aquatic deer. Its height is about 21 inches. On the summit of the head the hair forms a tuft about 1.5 inches in length, which is slightly inclined rearward between the ears, presenting a very singular aspect. By separating this tuft with the fingers, two bony protuberances may be recognized, starting from the skull; but no genuine horns can be found, nor have any appeared in the specimens examined. The upper jaw has two canine teeth, which extend past the lip and protrude from each side of the mouth. The eyes are large and expressive, the lachrymal fossæ being nearly an inch in length. The nostrils are confluent with the upper lip. The color of the skin is a blackish brown, which becomes very dark on the forehead, the tuft, the rear of the ears, the dorsal line, and on the outer sides of the legs, but which lightens considerably on the belly. Insides of the ears are white, covered by black bands. There are also two white bands near the mouth. Our engraving affords an excellent idea of the general characteristics of the animal.

## CURIOUS FISH AT THE NEW YORK AQUARIUM.

In the accompanying illustrations are represented three

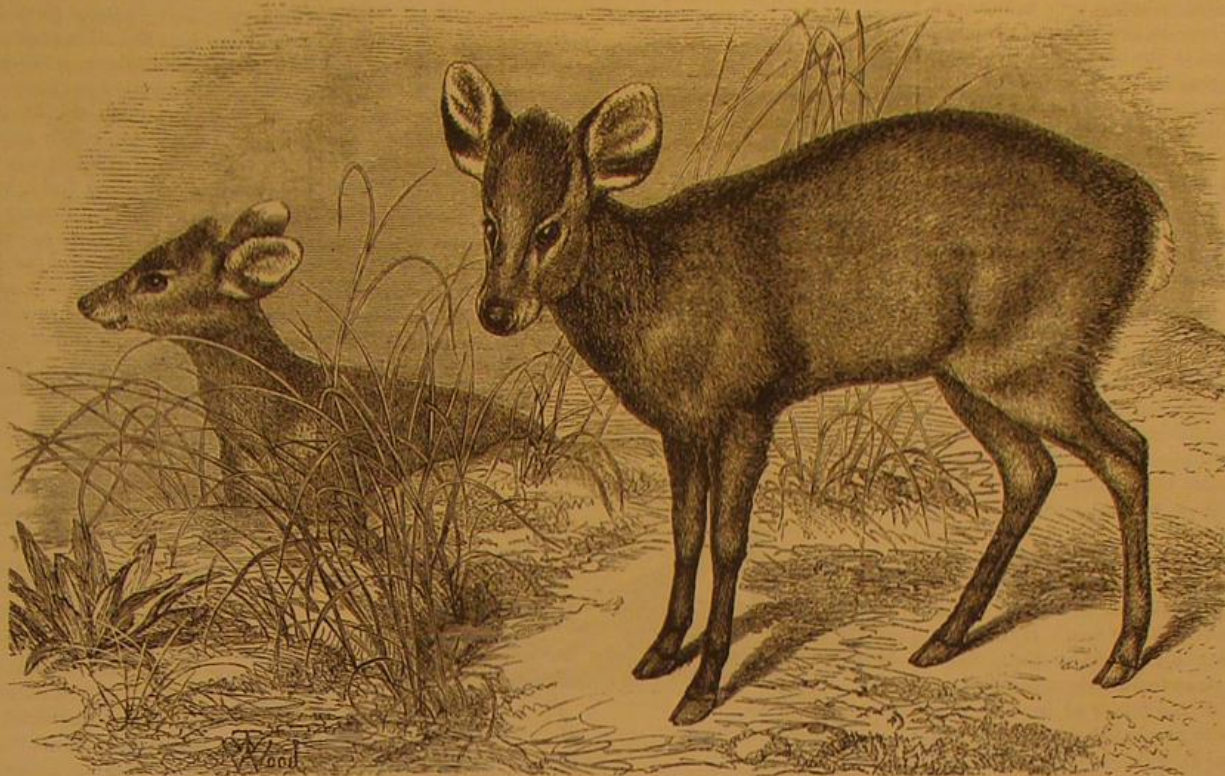


remarkable creatures which have recently been added to the New York Aquarium. The first is the

## JAPANESE KINGIYO,

a fish which, apart from its great beauty, possesses an exceptional interest in that it is one of the most curious results attained by the process of artificial selection carried on over a long period of time. The animal appears to belong to the carp species, and possesses the brilliant color of the gold fish. The body, however, is almost oval, and the belly is very protuberant. Forming an exquisite contrast with the deep golden red of the body are the fins and tail, which seem to be pure, pearly white, silky membranes, edged with a delicate fringe. The tail at rest is canopy-shaped; but as the fish moves, it floats into the most graceful undulations, reminding one of a filmy cloud or curling smoke wreath. It is hardly possible to divine by what series of steps this wonderful finny creation was produced. No naturalist would hesitate an instant in classing it under a new species, were it discovered in a wild state; but the fact that it is an artificial production, obtained from monstrosities or sports of well known types, now forbids such classification, and at the same time renders the animal living evidence in favor of the evolutionary hypothesis as advocated by Darwin. There are but very few kingiyos in this country at the present time. Eighty-eight constituted the first lot brought from Japan not

long since, but of these all but seven died during the voyage, or shortly after. The survivors were successfully carried to Baltimore, and during the last summer they spawned, the result being about fifty young fry, which exhibit all the peculiarities of the originals. It is the intention of the owner, when he has a sufficient stock, to donate them among persons who will take an interest in them and carefully raise them. Meanwhile Mr. W. S. Ward, the naturalist of the aquarium, has taken measures to apply and test the Oriental methods whereby this curious animal was produced;



## CHINESE DEER.

and the aid of the most improved piscicultural appliances will be invoked during a series of experiments intended to produce still more curious fish as the result of special culture. In our second engraving is represented the

## ALLEGHANY HELL-BENDER,

or *menopoma Alleghaniensis*, an exceedingly ugly half lizard, half fish, found in the Alleghany river and other tributaries of the Ohio. Mr. A. R. Grote records in the *American Journal of Science* the interesting fact that this animal sheds a transparent membrane, which he believes to be the exterior layer of the skin. While observing one in the aquarium of the Buffalo Society of Natural Sciences, an almost complete skin, all the feet and toes being readily perceived, was seen floating in the water; and later the creature was discovered in the act of swallowing his former covering, a practice which has also been observed in the toad. In a recent communication Mr. Grote describes this operation of shedding the skin, from which we learn that this thin and transparent membrane is first seen to loosen and separate from the entire surface of the body, appearing at this stage like an envelope or glove in which the animal is contained. By a number of wide gapings, during which the mouth is opened to the fullest extent, the skin is parted about the lips, and then commences to fold backward from the head. Convulsive and undulating movements with the body and fore legs are employed to extract these from the loose skin. The skin then readily falls backward, as the animal crawls forward and out of it, until the hind legs are reached, when the *menopoma* turns round upon itself, and, taking the skin in its mouth, pulls it over the legs and tail. The operation reminds one of taking off clothes. The cast-off skin is retained in the mouth and finally swallowed. The operation is quickly performed. The visitor who watches the *menopoma* will observe a swaying motion of the body; this action is not yet fully accounted for, though it is possible that



it is connected with the animal's desire to rid himself of his ugly skin.

A female hell-bender, opened on the 21st of August, con-

tained well developed eggs attached by a membrane to the ovary. These eggs are laid in a connected string, and are deposited along the muddy banks of the river. At this time there is a change in the external appearance of the creature. The tail broadens, and there is a plaited extension of the skin along the sides of the body.

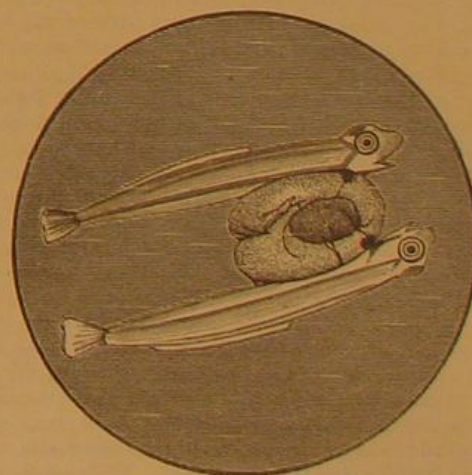
The *menopoma* furnishes a connecting link between the fish and lizards in the chain of evolution. On the fish side the *menopoma* is a higher development than the *lepidostiren* or legged fish, while it ranks lower in the scale than the amphibious *axolotl*.

THE TWIN SALMON, or "salmonese twins," as some witty individual has termed them, are represented in our third engraving. The two fish were hatched from a single egg; the two bodies are attached to one sac, but each fish is perfect in itself. The connecting vesicle is filled with oil globules, arteries, and veins; and it was expected that a microscopic examination would discover a diaphragm separating the circulation into distinct systems. The closest scrutiny, however, fails to discover this wall, and the circulatory systems appear so so intimately connected that the blood flows freely from one body to the other, impelled, however, by two hearts.

Mr. Mather is of the opinion that there is but little chance of their living after the absorption of the sac; for if they survive till that

time, the abdomens will still be joined by the membrane of the sac, and, being thus compelled to swim on their sides, great difficulty will be experienced in obtaining food. In this instance, however, a careful system of artificial feeding will be adopted in case the pair reach an age when they will need such nourishment. From the extended observations of Mr. Mather, it appears that these deformities are quite frequent in the salmon family, which includes the trout; and in hatching one hundred thousand eggs, there may be from three to five hundred abnormal specimens, comprising crooked backs and twisted heads and tails; and in some instances two or even three heads are attached to one body.

We are indebted to Mr. W. S. Ward and to the *New York Aquarium Journal*, an excellent little paper published at



the aquarium and devoted to popularizing scientific knowledge concerning the fish, for the engravings and facts presented.

## The First Sound Telegraph.

The project at present under consideration in England, of establishing a line of telegraph across the African continent from the Cape of Good Hope, reminds us of the curious fact, not generally known, we believe, that the earliest system of telegraphy for signaling over long distances originated among the African negroes. It is still more remarkable that the means used were telephonic, and the signals were read by sound, and not by the eye, as in the case of the semaphore or other early signaling devices. The "ellimbe," as the instrument used is termed, is still in existence, and has been in use from time immemorial in the Cameroons country, on the west coast of Africa. By the sounds produced on striking it, the natives carry on conversation with great rapidity and at several miles distance. The noises are made to produce a perfect and distinct language, as intelligible to the operator as that uttered by the human voice.

M. Gustave Delvigne, who died at Toulon, was the inventor of the explosive bullet and the rifled gun barrel bearing his name.



## LOCUST FLIGHTS EAST OF THE MISSISSIPPI.

BY PROFESSOR C. V. RILEY.

To the unscientific mind there are few things more difficult of apprehension than that species, whether of plants or animals, should be limited in geographical range to areas not separated from the rest of the country by any very marked barriers or by visible demarcations. Yet it is a fact well known to every naturalist: and the geographical distribution of species forms at once one of the most interesting and one of the most important studies in natural history. Some species have a very limited, others a very wide, range; and while in the course of time—in the lapse of centuries or ages—the limits have altered in the past and will alter in the future, they are, for all practical purposes, permanent in present time. These limits may in fact, for the purpose of illustration, be likened to those which separate different nations. Though frequently divided by purely imaginary lines, the nations of Europe, with their peculiar customs and languages, are well defined. Along the borders where two nations join, there is sometimes more or less commingling; at other times the line of demarcation is abrupt; and in no case could emigrants from the one long perpetuate their peculiarities unchanged in the midst of the other. Yet in the battle of nations the lines have changed, and the map of Europe has often been remodeled. So it is with species. On borders of the areas not abruptly defined, to which species are limited, there is more or less modification from the typical characters and habits; while in the struggle of species for supremacy, the limits may vary in the course of time. The difference is that the boundaries of nations result from human rather than natural agencies, while those of species result mostly from the latter, and are therefore more permanent. I found some difficulty, at the late conference of governors at Omaha to consider the locust problem, in satisfying those present that the Rocky Mountain locust could not permanently thrive south of the 44th parallel or east of the 100th meridian, and that there was no danger of its ever extending so as to do serious damage east of a line drawn a little west of the center of Iowa. They could not see what there was to prevent the pest from overrunning the whole country, and thought that Congress should



ROCKY MOUNTAIN LOCUST.

be appealed to, not alone on behalf of the country that has suffered from its ravages, but also of the whole country that is threatened therefrom. In my last two reports I have discussed the native home of the species, and the conditions which prevent its permanent settlement in the country to which it is not native. Briefly, the species is at home and can come to perfection only in the high and dry regions of the northwest, where the winters are long and cold, and the summers short; and whenever it migrates and oversweeps the country to the south or southeast, in which it is not indigenous, the changed conditions are such that the first generation hatched out in that, to it, unnatural climate either forsakes it on the wing, or perishes from debility, disease, and general deterioration. On the soundness of this conclusion depends the future welfare of most of the more fertile States between the Mississippi and the mountains; and Science, as well as past experience, shows it to be sound. Upon this hypothesis the people, of nearly the whole country so scourged during the year, and so threatened next spring, may console themselves that the evil is but temporary: they may have to fight their tiny foe most desperately next spring, but they have also the assurance that, even if he prove master of the field, he will vacate in time to allow of good crops of some of the staples, and that he may not return again for years. On the other hypothesis, for which there is only apparent and no real reason, ruin stares them inevitably in the face.

The causes which limit the eastward flight of the winged swarms that come from the northwest are, with the majority of people, still more difficult to appreciate, for most persons can see no reason why a swarm that overruns the western portions of Minnesota, Iowa, and Missouri should not extend to the eastern borders of the same States, or into Illinois, Indiana, Ohio, and eastward. Without discussing some of the more occult climatic influences that bear on the belief that they never will, the principal arguments rest in the facts, that: 1. The power of flight of any insect that has a limited winged existence must somewhere find a limit. 2. That all past experience has shown that *caloptenus spretus* has never extended in a general way beyond the limit indicated; and, 3, that, as long as the present average conditions of wind and climate prevail, it is reasonable to suppose it never will.

One of the principal difficulties in the way of a proper apprehension of these facts is found in the failure of the popular mind to properly discriminate between species. The ordinary newspaper writer talks of the grasshopper, or the locust, as though, all over the country and all over the world, there was but one and the same species. One of the governors present at the conference referred to was at first fully of the belief that our Rocky Mountain pest came all the way from Asia. In the case of this destructive species, even some entomologists have added to the difficulty by erroneously claiming that it is common all over the country, to the Atlantic.

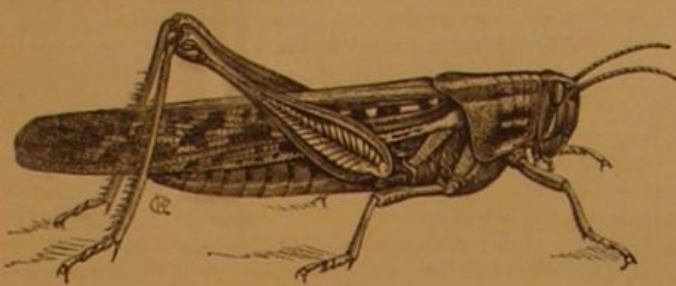
The above thoughts are suggested by the following reports that have just met my eye in the Cincinnati Gazette of October 24, from Dayton, Middleton, and Hamilton, respectively: "The advent of Kansas grasshoppers, over Sunday and until Monday evening, in great numbers throughout this city

is a most remarkable incident. They were found early on Sunday morning, and left, as suddenly as they came, on Monday evening."

"A shower of mammoth grasshoppers came down upon our town and vicinity on Saturday night. We have never seen such large ones before, and we understand from old citizens that they are entire strangers in this part of the country. We saw a boy have a string tied to two of them (which were as long as a man's finger) trying to drive them, and he succeeded pretty well."

"A flock of grasshoppers alighted in Hamilton about 11 o'clock on Saturday night, from the northwest. Those that were not drowned in the river, or killed by the heavy rain, were probably gobbled up before Sunday night by the chickens."

Such reports as these very naturally confirm the unscientific in their idea that the locust plague of the West, or so-called "Kansas grasshopper," has overstepped the limits entomology prescribes to it, and is upsetting the conclusions of Science. The same swarm passed over Oxford in the same State, in a southwesterly direction; and fortunately that veteran and well known apiarian, the Rev. L. L. Lantroth, who has not forgotten to be a close observer, had specimens sent to me. They prove to be the American acridium, *acridium Americanum*. As stated in my 8th report, it is our largest and most elegant locust, the prevailing color being dark brown, with a broad, pale yellowish line along the middle of the back when the wings are closed. The rest of the body is marked with deep brown, verging to black, with pale reddish brown, and with whitish, or greenish yellow: the front wings being prettily mottled, the hind wings very faintly greenish with brown veins, and the hind shanks generally coral red with black-tipped, white



AMERICAN ACRIDIUM.

spines. The species is quite variable in color, size, and marks, and several of the varieties have been described as distinct species by the species grinders. It has a wide range, hibernates in the winged condition, and differs not only in size and habit from the Rocky Mountain locust, but entomologically is as widely separated from it as is a sheep from a cow.

It is a species common over the country every year, and during exceptional years becomes excessively numerous, and acquires the migrating habit, its wings being long and well adapted to flying. It has been very abundant in the present year; and toward the end of July, while in the unfledged condition, did an immense amount of damage to the cotton and other crops of Georgia and South Carolina. The papers were full of graphic accounts of their destruction, and not only editors very generally took it for granted that they had to do with the western *spretus*, but Mr. T. P. Janes, Commissioner of Agriculture for Georgia, in his circular No. 27, supposed they were the same. Specimens which he subsequently sent me, however, revealed at once their true character.

In September, 1875, large swarms of locusts passed over Illinois, and those who were bent on the idea that there was no reason why that State should not be overrun with the Rocky Mountain locust found apparent justification for their views in the said swarms. Yet these proved to be composed of three species\*, indigenous to Illinois and every year common there; and after settling they did no harm, and nothing was heard of their progeny the following spring—all which would have been very different had it been a question of the western *spretus*.

The damage done by some of the more common locusts that occur over the country is sometimes very great, especially during hot dry years. In some of the New England States their ravages have, in restricted localities, fairly equaled those of the voracious *spretus* of the West. But while a few of them, under exceptional circumstances, develop the migratory habit, they none of them ever have compared, and in all probability never will compare, with *caloptenus spretus* in the vastness of its migrations and in its immense power for injury over extensive areas. In economic entomology, discrimination between species is very important, and the lack of it often leads to most erroneous conclusions. Whenever we hear of locust flights east of the Mississippi we may rest satisfied that they are not of our Rocky Mountain pest, and are, comparatively, harmless. Manhattan, Kan.

## Asbestos.—Its History and Uses.

Mr. C. E. Foster has compiled, for the *American Exchange and Review*, the following interesting history of the application of asbestos in the practical arts:

The daily increasing importance of asbestos in connection with packings, bearings for journals, coverings for boilers, and similar purposes, has directed attention to other applications and uses of this material, and to the patents under which exclusive rights to its employment are claimed. Being a natural substance, long known as a possible substitute for animal and vegetable fibers, and its refractory and

lubricating properties recognized for hundreds of years as its peculiar characteristics, it would seem improbable that any exclusive proprietorship, based on the utilization of these properties, could be claimed or acknowledged at this late day; yet it is by no means uncommon to find advertisements implying the right in some party to the sole use of asbestos for this or that purpose, or to find that capitalists have been induced to invest their money in the experimental manufacture of asbestos products, to be protected under the patent laws.

Asbestos, or amianthus, is a mineral of a white or greenish white color, found in dense heavy blocks. It is capable of being divided into fibers of greater or less fineness and length, resembling hair silk; it is smooth and unctuous to the touch, like plumbago; these qualities are available for lubricating or anti-friction purposes. The mineral is extensively distributed, but much of it is coarse, discolored, or in a disintegrated condition, which renders it unserviceable for any purposes to which asbestos has yet been applied. The finest beds are in Corsica and Italy, but a very fair article is found extensively in Canada, Pennsylvania, Maryland, Virginia, and other places. Efforts to utilize this mineral were early made in the historic period, and one of the first applications was in the manufacture of incombustible fabric. For this purpose vegetable filaments were combined with the mineral fiber, to give strength and consistence during manipulation, the vegetable fiber being burned away after the formation of the fabric. Notwithstanding this fact, the combination of asbestos and animal or vegetable fiber has constituted the basis of many patents, some of which are in existence while others have expired. An English patent, No. 145, for the year 1857, describes a lamp wick of silk and asbestos woven together. Prior patents describe wicks wholly of asbestos; and a latter patent, No. 2,647, for 1865, describes the plaiting of asbestos in a braiding machine, and also felting it or weaving it into ordinary fabric, to be used for lamp wicks. As a fabric, asbestos was once used in the manufacture of shrouds. One of the earliest applications was in the form of paper, and the efforts to render it available for this purpose have been most persevering and unremitted to the present time. An early description of the mode of making asbestos pulp for paper is contained in an English patent, No. 1413, for the year 1853, the process consisting of boiling the mineral,

dividing the fibers, and mixing alum therewith. Advantage was early taken of the non-conducting qualities of asbestos in the construction of safes—a reference to its use for this purpose being made in an English patent of 1834, No. 6,555; but it was not until 1870 that it was applied as a non-conductor in refrigerators, when F. Hyatt obtained a United States patent for a refrigerating car. Being flexible, non-combustible, and a natural lubricant, its employment as a packing for pistons and piston rods, joints, and pump plungers naturally resulted. Its adaptation for such purposes is fully set forth in a United States patent for steam engines, obtained by Israel Jennings in 1828. Notwithstanding this fact, several existing United States patents have claims for the use of asbestos for packings and joints, while others claim imparting to it a rope form, for packings, which is clearly described by Jennings. Other patents have been granted for the application of asbestos to journals or bearings, notwithstanding the existence of Jennings' patent, and also of an English patent, No. 2,048, of 1853, for a lubricating combination of asbestos, quicksilver, fats, and oils. A combination of asbestos, soapstone, and cotton is described in P. S. Devlan's patent of August 22, 1865. C. A. Steven's patent of March 29, 1870, claims the insertion of a cord in a rope packing of asbestos to strengthen it; and Morris Botticher's patent of October 4, 1864, refers to the use of the mineral for packing in a loose mass of fiber. A combination of asbestos with plumbago and iron filings is claimed in P. J. Kelly's patent of November 8, 1870; and a combination of asbestos and clay in Lanbureau's English patent, No. 213, for the year 1859, where the mixture is shown molded into bricks or forms for lining fire boxes. Combined with felt or pulp, and made into sheets, asbestos has been for some time applied for roofing, under H. W. Johns' patents of 1868; in 1866 it was applied to carbureters, as specified in J. A. Bassett's patent of September 18. William Beschke patented August 14, 1866, its use in lamps, to absorb the oil and prevent its distribution in case of fracture of the lamp; and the English patent, No. 362, for the year 1865, is based on the insulating property of asbestos, and its use as a non-conducting material in electrical apparatus.

## Railroad Accident.

Recently at North Concord, N. H., two ladies attempted to drive across a railroad track, after the train which had delayed their passage had gone by. They failed to notice a locomotive following closely in the rear of the cars, and consequently were run into and killed. This kind of accident, now becoming altogether too common, is chargeable directly to the negligence of railroad companies, and it will probably continue to occur until railroad crossings at grade are prohibited by law. Experience shows that gatekeepers and signal men, however vigilant, do not prevent people from suddenly driving or stepping upon the track. In England a crossing at grade is a rarity; and in this city, public outcry compelled the sinking of the tracks which pass through Fourth avenue.

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\*The differential locust (*caloptenus differentialis*) the Atlantic locust (*caloptenus atlantis*) and the red-legged locust (*caloptenus femur rubrum*).



## CENTENNIAL NOTES.

In the English department was exhibited a model of Whitwell's fire brick

## HOT BLAST STOVE

for raising the temperature in hot blast furnaces. The usual method of building these stoves has been to construct them of cast iron pipes, which, if the temperature were raised to 1,200° Fah., usually were burned out. In Whitwell's system, the heating surface is constructed entirely of fire brick, which are so laid up that the heated gases are forced through a series of flues, alternately from top to bottom of the stove, until the whole mass of brickwork is raised to a high degree of heat; the stoves will stand a temperature of 2,000° Fah., without damage. Three stoves are used with a furnace, two of which are being heated while the third is having the air forced through it into the furnace. The advantages claimed are that the greatest economy of fuel is secured, nearly the whole heat being utilized, several hundredweights of fuel per ton of iron being saved; that they last a long time with but trifling expense for repairs, and that they are easily cleaned. The estimate of saving in cost of producing iron is 33 per cent.

Among the

## ENGLISH CARPETS

we noted several magnificent patterns in Wilton and Axminster. The difference between these very costly kinds of floor covering is not generally understood. Wiltons are Brussels carpets with the loops cut before the wire is drawn out; they are generally closer woven, so the pile, or cut ends, may be packed closer together. The colors of these carpets go clear through to the back, but are only seen there in straight lines. The Axminster carpets, on the contrary, show not only the colors but the pattern on the back, though the pile is only on the right side. Nor is there any limit to the number of colors which may be used. They do not necessarily repeat themselves in any regular order, nor are the patterns repeated, either in regular order or at all, except at the will of the manufacturer. Each carpet has an individuality; but to accomplish these results there is less of machine work and more hand and labor required. The process is a slow one, but the result may be seen in carpets with a pile of five eighths of an inch high, and so close that it cannot be separated to show the warp. Such carpets endure a great deal of hard service, and when the pile has grown uneven it can be brightened up four or five times by shaving it with a machine made for that purpose.

What is called "patent" Axminster is woven in the loom, and the color does not appear on the back at all. On the surface it would be difficult to tell in what the difference consists. It can be made for a much less cost than the real Axminster, which requires each thread and color to be tied separately by hand to the warp. This is so great a labor that fully three months are required to make a carpet twenty feet square. So great is the difference that the best patent Axminsters can be furnished for much less than half the cheapest real Axminster; yet there seems to be no reason why the patent carpets should not wear as long as the real.

A new method of

## ARTISTIC POTTERY WORK

is called the *pâte sur pâte*, or paste upon paste process. The design is raised in white china clay upon a dark ground, the result being a most perfect imitation of a cameo in onyx or agate. White china clay is reduced to a liquid state; and with it this condition, the artist, with a thin brush, paints the design upon the plate, vase, or other object, putting on coat after coat of the liquid china until the desired thickness is obtained in each of the parts. Before burning, the china is opaque, but becomes translucent after burning. The artist, therefore, to properly distribute the light and shade, must put on the material thin or thick, and do this, too, without being able to judge of the effect by the eye; nor can any error of judgment be corrected by subsequent retouchings, as nothing can be done after the piece has been burned.

A model was exhibited by the Erie Railway Company of the famous

## WOODEN BRIDGE

that carried that line over the Genesee river at Portage: a structure so arranged that each piece of timber could be separately removed and replaced by a fresh piece without disturbing the strength of the work as a whole. The bridge was further distinguished by the fact that it was the highest wooden bridge in the world, the rails being 235 feet above the level of the water. It was opened to travel August 2, 1853, and was destroyed by fire on May 6, 1875. Hanging beside the model is a photograph of the iron bridge that has taken its place, an airy structure looking like a spider's web outlined against the sky. Not the least wonderful fact in connection with the new bridge was the rapidity with which it was erected, the line being reopened for travel on the 31st of the following July. But this was slow in comparison with what was accomplished (almost simultaneously) by the same company in rebuilding the bridge carrying their metals across the Delaware, three miles above Port Jervis. The bridge comprehended one deck span of 160 feet, three deck spans of 150 feet each, and a span over the Delaware and Hudson canal. The four deck spans were swept away by the ice on the night of March 17, 1875. On the 26th of the following April the new bridge, of iron, double track, was complete and put into service, having been built in just forty days. Another instance of quick work was in the case of the trestle of 780 feet long and 90 feet high, thrown across the Chattahoochee in four and a half days, in August, 1864, by the Construction Corps of the U. S. Military R. R., under the direction of Engineer W. W.

Wright. But in this case the piers were standing—the bridge had been burned by the rebels—and the structure was of a temporary character.

In the Tasmanian section a stuffed skin of that wonderful and incomprehensible creature known as the

## PLATYPUS OR ORNITHORHYNCHUS,

was displayed. The platypus is a fur-bearing animal, shaped much like a large duck; it has a duck bill and webbed feet, the web extending over the toes. The male has a spur like a rooster on his hind foot; back of the spur is a gland filled with poisonous matter, but the poison is not necessarily fatal. It has the fur and tail of a beaver; small black eyes like a mole; a pouch for carrying the young, like a kangaroo; its tongue is split and forked like a snake's. It lives on vegetable matter, and is amphibious, living, like the beaver, in or out of the water. In its anatomy, it has a wishbone, like a chicken, and in swimming the motions are the same as those of a bird in flying. Naturalists have been inclined to call it a bird, or at least oviparous, producing its young by eggs, but, unfortunately, the accounts of finding the eggs are too conflicting. Some men say they have seen the eggs, one man strengthening his assertion by saying he had eaten them for his breakfast. The young have been seen, evidently when but a few hours old; but no eggs have been found in the runs or holes near the water, which the platypus lives in, like a muskrat. Further than this, the natives say that this platypus does not lay eggs, and their habits of observation ought to make them good authorities on this point. A naturalist, who had dissected one of these animals, claims to have found mammary glands, which would strengthen the belief that the platypus is a beast, but sufficient evidence on this point has not yet been obtained.

In the French milling exhibits was a

## BURR STONE MILL

for bolting the flour as it is ground. This consists of a number of fine wire sieves, arranged like rays on the surface of the millstone, through which the flour falls as it is ground, its passage being facilitated by means of a revolving hammer, which jars each sieve. Some of this flour is very fine, but a large portion of it must be reground. What is called high grinding is adopted with this style of stone; that is, the millstones are more widely separated, the husks and fine flour are removed in the usual way, and a rather coarse middlings is left, which, while possessing the most nutritious qualities of the wheat, is too dark and coarse. This is afterwards run through another pair of stones, which grind it into fine flour.

## THE SALE OF THE BUILDINGS.

Twenty-four buildings belonging to the Centennial Board of Finance, besides a dozen structures of varying dimensions, the property of individuals, were sold at public auction on November 30. The Main Building, which cost about \$1,800,000, was sold to the Permanent Exhibition Company for \$250,000. The other structures brought even a less percentage of their original cost. The principal sums realized were as follows: Two Mineral Annexes, cost \$19,000, sold for \$1,000; Carriage Building, cost \$55,000, selling price \$4,100; Art Annex, cost \$110,000, selling price \$3,500; Photographic Hall, cost \$23,000, selling price \$1,000; Judges' Hall, cost \$30,000, selling price \$1,500; Shoe and Leather Building, cost \$30,750, selling price \$3,000; Agricultural Hall, cost \$275,000, selling price \$13,100. The remainder of the buildings sold at about similar rates, and the work of removing them will at once begin. The structures left are the Main Building, Machinery and Memorial Halls, German Pavilion, English dwellings, and Horticultural Hall. The Woman's Pavilion, which it was at first proposed to sell, is now to be reserved as a memorial. The Japanese Building will be sold, and the future disposition of the United States Building is not yet announced.

## THE OCCUPATIONS AND HEALTH OF THE MERCANTILE CLASSES.

Out of every thousand men engaged in mercantile employments, examined by the enrolment surgeons during the late war between the States, five hundred and twenty were fit for military service: forty more than were furnished per thousand of professional men, and forty-four less than were got from the same number of skilled mechanics. Rated according to the military capacity of their members, the different mercantile occupations stand in the following order: Tobacconists, furnishing 623 per thousand; clerks, 585; peddlers, 580; bar keepers, 500; liquor dealers, 471; grocers, 451; innkeepers, 430; agents, 416; merchants, 392; brokers, 329.

Bar keepers we have transferred from the list of unskilled workmen for comparison with liquor dealers and tobacconists. It is one of the most surprising results of this examination to find those engaged in handling tobacco and spirituous liquors so exceptionally healthy. They not only stand especially well among the mercantile classes, but much better than the members of the higher professions. And curiously, they would seem to be specially free from the disorders of the digestive system and the nervous system which certain popular theories would make inseparable from their employment.

The general health of tobacconists was even better than the foregoing figures would indicate, since 86 per thousand were rejected for conditions not necessarily connected with disease, chiefly for deficiencies in age and size, and 26 for local injuries and deformities, in which the selective action of a light occupation is apparent. In syphilis their record is bad: 16 per thousand, or twice as many as among the clergy, but only half as many as among bar keepers. Their chief diseases are of the digestive system, causing the rejection of

65 per thousand (almost wholly from loss of teeth and hernia); diseases of the circulatory system 43 (mainly heart disease); lung diseases 34; diseases of eye and ear 30, and of organs of locomotion 41. For diseases of the nervous system, they stand about with regular merchants and clerks. They are comparatively free from obesity, and but little troubled with chronic rheumatism.

Clerks were disabled chiefly by conditions not necessarily connected with disease, 76; local injuries 33; diseases of the digestive system (mainly hernia and loss of teeth) 106; diseases of the organs of locomotion 30; of the eye and ear 32; of the circulatory system 44; of the lungs 33. Peddlers rank next to clerks, and show for the most part disabilities not directly attributable to their work; for example, 50 per thousand rejected for conditions not necessarily associated with disease; 40 for loss of teeth; 51 for wounds, fractures, etc.; and 33 for diseases of eye and ear. For inguinal hernia, attributable in many instances no doubt to lifting heavy packs, 39 in the thousand were rejected; 17 for diseases of the joints, and 7 for spinal curvature, largely due, possibly, to the just mentioned cause. Consumption disabled 42 per thousand, and diseases of the circulatory system 48.

Bar keepers and liquor dealers stand near together in military efficiency, high compared with the professional classes, but low as compared with mechanics and laborers. Bar keepers suffer more than liquor dealers from diseases of the digestive system (133 to 40), but less from disorders of the circulatory system (52 to 129); in consumption and disorders of the nervous system their record is good, 21 to the thousand. Liquor dealers suffer more than any other mercantile class from chronic rheumatism, and from diseases of the eye and of the organs of locomotion. Grocers fall below the mean of the mercantile classes. Loss of teeth caused the rejection of 86 per thousand, and hernia, 69. For all disorders of the digestive system, the rejections were 190 per thousand. Disorders of the circulatory system come next, 67 per thousand. For disorders of the nervous system they stand among the worst, 21 per thousand being rejected for this reason; for consumption 35; diseases of the eye and ear 38; of the organs of locomotion 52; for conditions not necessarily associated with disease 27; for injuries, etc., 55.

Innkeepers are a grade lower than grocers in general health, and lead the van in obesity, for which ten per thousand were rejected: the same fault causing the rejection of five grocers and seven agents per thousand, all others of the mercantile class being nearly if not quite free from it. Innkeepers stand universally high also for loss of teeth, 93, and for hernia 48. For all diseases of the digestive system, 223 per thousand were rejected. For diseases of the nervous system, they stand higher than lawyers, and are exceeded only by agents, watchmen, ostlers, and unclassified "other occupations." For diseases of the eye and ear they stand third (44 per thousand), the ratio for brokers being 50, and for liquor dealers 57. They also stand next to brokers and above all others for disabilities arising from wounds, fractures, and malformations.

Agents suffer more than any other mercantile men from lung diseases, 53 per thousand, from diseases of the nervous system 29, and insanity 9; they are exceeded only by merchants in diseases of the digestive system, 189; and are afflicted more than the average by diseases of the circulatory system, 51. As regards syphilis they rank with clergymen, doctors, and public officers. For diseases of the eye and ear, 39 in the thousand were rejected; for diseases of the organs of locomotion 51; for conditions not necessarily associated with disease 49, and for local injuries and malformations 69.

Lowest in military capacity among mercantile men are merchants and brokers. Their disqualifying disabilities present some curious contrasts. For instance, more than twice as many brokers as merchants were rejected for wounds, fractures, malformations, and the like (120 to 56); and nearly fifty per cent more for conditions not necessarily associated with disease (76 to 56). On the other hand nearly three times as many merchants as brokers were rejected for diseases of the organs of locomotion (55 to 19). Evidently a larger proportion of men, unfit for severe labor because of injuries, malformations of hands and feet, and deficiencies in size and strength, adopt the broker's calling. More merchants are disqualified because of hernia and loss of teeth, fewer for disorders of the circulatory system (60 to 82); more for insanity and nervous derangement (13 to 9); and more for consumption (48 to 19). In general health and physical capacity, merchants and brokers rank with physicians, clergymen, and public officers, and were capable of furnishing for the army only about half as many men per thousand as the mass of unskilled laborers. In disorders of the digestive system, they exceeded all except innkeepers (brokers 177, merchants 218). In diseases of the circulatory system, the brokers came next to the liquor dealers (82), the merchants next to grocers (60). The brokers stood lowest in consumption, the merchants next the highest. In chronic rheumatism, the brokers stood second to liquor dealers, and the merchants come next, on a level with agents.

## Wanted, A Tiger Exterminator.

During the year 1872 a census was taken in India of the persons who had been killed by wild animals during the years 1868, 1869, and 1870. The total reached 38,218, of which it was found that 25,664 had died through the bites of venomous serpents, while the remaining 12,554 had nearly all been devoured by tigers. So that, for the years mentioned, Her Majesty's dusky subjects were eaten at the rate of about one every two hours. Plenty of such suggestive statistics are at hand. Official reports from Lower Bengal state that 13,400 persons in that section of the country were devoured in six years, and the destruction over the entire



peninsula is estimated at 10,000 people a year. In 1869 one tigress blockaded a road, stopped traffic thereon for several weeks, and slaughtered 127 victims. During two previous years she killed 108 people.

Nor do the feline damages end here. We have further statistics which show that for each person killed sixty head of cattle are destroyed, and this aggregates a money loss of about \$5,000,000 yearly. The terror produced by a tiger's ravages often desolates whole villages. At one time, in one of the Central Indian provinces, thirteen villages and a cultivated area of 250 square miles were simultaneously abandoned, owing to the visitation of a band of tigers.

These facts have been laid before the English House of Lords, and the government has been asked to take speedy measures to check the present rate of carnage. Since the Sepoy rebellion and the consequent disarmament of the natives, it is reported that the tigers have greatly increased in numbers. In localities where they abound, there are bands of hunters who receive a bounty from the government for every tiger killed; but these men never shoot a tiger unless the animal has acquired considerable celebrity by his exploits. They thus pocket a much higher reward, owing to the authorities setting a variable scale on the head of the beast, according to his age and voracity. Meanwhile the English papers are urging immediate action. The *Times* says that: "It is frightful to think that, in the middle of the nineteenth century, with all the improved engines which man has invented to destroy his kind, a considerable number of the subjects of Her Majesty are exposed, just as if it were a form of natural death, to be devoured on their very thresholds by savage beasts."

Here is a chance now for some enterprising person to undertake the extermination of the Indian tigers by contract. He might contrive an ironclad steam carriage, capable of propelling itself through jungles, and having apparatus for throwing jets of boiling water or hot steam into inaccessible places, to dislodge the animals, and a battery of Gatling guns wherewith to salute their appearance. Tigers are not invulnerable; but to engage them, even on elephant back, is a perilous undertaking. To destroy them from behind armor with Gatling guns and torpedoes is a much safer proceeding; and as the authorities frequently offer as high as \$150 for a single animal, it might prove a remunerative venture.

PROFESSOR HUXLEY says: "The general notion of an Englishman when he gets rich is to found an estate and benefit his family. The general notion of an American, when fortunate, is to do something for the good of the people and from which benefits shall continue to flow. The latter is the nobler ambition."

A distinguished French scientist has recently died. M. Charles St. Claire-Déville was a chemist and mineralogist of great ability. He discovered amorphous and insoluble sulphur, thus showing, for the first time, a simple body in two conditions, differing not only in physical characteristics, but in essential chemical properties.

## Recent American and Foreign Patents.

### NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

#### IMPROVED NECK YOKE.

Frank Hannig, Lockhart, Tex.—This consists in providing the neck yoke with a central enlargement, and connecting the tube which slips on the end of the carriage pole with the yoke by means of rings having perforated ears to receive the ends of a pivoted bar, to which the pole ring or tube is swiveled.

#### IMPROVED AXLE LUBRICATOR.

John J. Wetmore, Shabonier, Ill.—This consists in combining an oil chamber having a close-fitting plunger with a skein having an internal longitudinal groove and side apertures communicating with the surface of the bearing.

#### IMPROVED HAT-BOX-BOARD CUTTING MACHINE.

William Jenkins, Newark, N. J.—The invention consists of a reciprocating carrier that feeds the block against the adjustable cutting knife to cut off the thin boards. The board is pressed in one direction against the knife by a weighted roller, and lifted by vertically movable rollers and actuating mechanism operated by the carrier when sliding in opposite directions to clear the knife.

#### IMPROVED DOOR SHEAVE.

George Laauwe, New York city.—These sheaves for sliding doors are so constructed that they may be easily adjusted to regulate the door so that it may be plumb, and to enable the wear to be easily taken up. The sheaves are pivoted between the arms of a V strap, which is inserted in a case; through the top of the latter a screw passes, and is so secured to the sheave strap that the sheave may be raised and lowered to adjust the door.

### NEW AGRICULTURAL INVENTIONS.

#### IMPROVED CHURN.

Elisha A. Hewitt, Groton, Conn.—This consists of a churn with revolving bifurcated beaters and fixed side breakers, the air being admitted by a revolving fan with hollow shaft, operated by the driving mechanism.

#### IMPROVED CHECK ROWER.

Albert M. Black, Pawnee, Ill.—This check rower is used in connection with a planter, and is readily adjusted on the ground without necessitating the marking of the same. It consists of a cord with tags, applied at suitable distances, passing over guide pulleys and rollers at the ends of a cross bar of the planter. The dropper keeps his eye fixed on the end of the pointer, and gives a pull to the drop lever for depositing the required quantity of corn as each tag passes the end of the pointer. When the opposite side of the field is reached, the dropper takes a tension pin, with spring top hook, and drives it some distance back of the planter into the ground, passing the spring hook over the rope to retain the tension of the same. The stretching pin at the end is then taken up,

and the planter turned, the rope being again drawn through the pulleys and staked down at the opposite side of the planter, which is then ready to pass back over the field, dropping the corn in the same manner as before.

#### IMPROVED HORSE HAY RAKE.

Amos W. Coates, Alliance, O.—This invention relates to an improvement in clearers for horse hay rakes, and is more particularly an improvement in that class of clearers which consist of a transverse bar resting upon the rake teeth and connected to each of them by staples or equivalent devices. According to this improvement, the clearer bar is supported above the rake teeth by means of forks which bear upon but two of the latter, whereby certain advantages are secured in respect to wear and friction, ease of operation of the rake, and independent action of the wire teeth.

#### IMPROVED HARROW.

Adolphus W. Davis, Dwight, Ill.—This improves the construction of the harrow for which letters patent were granted to the same inventor, July 13, 1875. By pushing a lever forward and then raising its rear end, the forward end of a section will be raised from the ground, and then, as the upward movement of the lever is continued, the whole section will be raised from the ground. In the same way, by drawing the lever to the rearward, and then raising its rear end, the section will be raised rear end first. As either end is raised, the other end rests upon the ground to do its required work.

#### IMPROVED CORN PLANTER.

Ira Houghtling, Houghton, Mich.—This invention consists in providing a corn planter with a cam shaft, disk slide, spring, arm, and spouts; also, in connecting the feeding tube slide and spring by a link that may be shortened.

#### IMPROVED FARM GATE.

Joseph Jennings, Jr., Wilton, Iowa.—By raising the forward end of the gate the rear end of the braces are drawn forward, and a bolt drops into notches of the bottom bar and thus holds the forward end of the gate securely at the point to which it has been raised. Devices are provided for lowering the forward end of the gate to any desired point.

### NEW MECHANICAL AND ENGINEERING INVENTIONS.

#### IMPROVED PRINTING PRESS.

Willard W. W. Belknap, Brooklyn, N. Y.—The new feature consists of a swinging platen, in combination with a vertically movable bed, and an oscillating ink-distributing mechanism. The simplicity of this apparatus renders the press less expensive, and facilitates the rapid and effective working of the same.

#### DEVICE FOR MAKING FACE PLATES FOR DRAWBARS.

John Green, Sunbury, Pa.—This invention relates to an improvement in the manufacture of face plates for drawbars of railway cars, and it consists in a series of tools to be used for the common end of making the said plates, which tools are employed for the successive steps of cutting out the blanks, stamping the slot and rivet holes, and bending the stamped plate into curved form: each of the tools being provided with extended handles for their convenient manipulation beneath the hammer, whereby all of the said steps of the operation are conducted under the same heat employed for forging the blank plates.

#### IMPROVED ROTARY ENGINE.

George C. Hale, Kansas City, Mo.—The object of this invention is to effect an improvement in that class of rotary steam engines whose case or cylinder is made to revolve around a stationary circular head or disk to which the pistons are attached. To this end the pistons proper are hinged within a stationary disk having hollow trunnions, and the cylinder revolves around it. The induction ports are in the piston heads, and the cut-off is effected by the automatic movement of the pistons themselves. Thus the necessity of supplementary steam valves is avoided, the number of working parts reduced to a minimum, and the compactness of this class of engines considerably increased.

#### IMPROVED MILLSTONE DRESS.

Elias N. Roeder, Quakertown, Pa.—This invention consists in dressing both stones exactly alike, with a series of tapering, leading furrows, wider at the eye than at the skirt, deep on one side and tapering to a feather edge upon the other, which feather edge is arranged radially with the center of the stones, so as to have no draft in the leading furrows, the necessary draft being supplied by the quarter furrows, which open into the leading furrows and are formed with an inclined bottom, and of a tapering shape similarly to the leading furrows.

#### IMPROVED MILL PICK.

Edgar F. Lemoine, Emmerton, Va.—This improvement consists in the particular means for clamping the jaws, in which a screw-threaded stem of the shank enters a female thread of the upper jaw and holds the jaws together, while guide pins prevent the jaws from turning on each other. With this means of clamping the jaws the latter do not become loose, and the blades can never become accidentally detached, as when a key is used, which latter, from the impact of the blows, is readily displaced.

#### IMPROVED MIDDINGS SEPARATOR.

Edwin Slagle and John McClure Graham, Albany, Mo.—This relates to improvements in the flat, inclined, shaking flour bolt, having cloth arranged in wave-like form, for which a patent was granted to the same inventors, February 1, 1876. Seven new devices, mainly relating to improved mechanical construction, are embodied.

#### IMPROVED MILLSTONE DRESS.

Henry Grigg and William McElroy, Lockport, N. Y.—This invention consists in beveling the inner portion or bosom of a millstone, from a point about ten inches from the periphery down to the eye, making the space thus formed about one half inch deep at the eye. It also consists in cutting furrows from the eye outward, on a radial line from the center of the stone, to the line that defines the beveled portion, starting in a line at the eye, and increasing to the required depth at the outer edge of the beveled portion. The grooves, from this point, are tangential to a circle drawn outside of the eye, so that they have an inclination or draft of from five to eight inches. The object is to provide a millstone dress that will increase the quantity of middlings.

### NEW MISCELLANEOUS INVENTIONS.

#### IMPROVED GRINDING MILL.

James Madison Collier, Gadsden, Ala.—The driving belts are led to each end of the running stone, both from the countershaft, which is so located that the pull of the belts is directly against the crowding of the journals of the runner against the boxes by the grain.

#### IMPROVED OILER.

Nelson Holmes, Ypsilanti, Mich.—This consists of an annular spring-supported piston on the rear end of the nozzle, so that, when the latter is pushed back, oil is ejected through the spout.

#### IMPROVED COIN COUNTER.

Aron Bernstein, Berlin, Germany.—This furnishes a reliable means to instantly detect any false or light gold coin without showing the mode or mechanism by which the same is tested. This object is obtained by allowing the gold coin to fall through a narrow opening and guide channel on to a balance or tilter, from which it will, if genuine and of full weight, roll at once, by suitable deviating mechanism, into the cash box or receptacle; but if it is not genuine, or is of short weight, it is conducted into a separate open receptacle, so as to indicate directly the lack of genuineness or full weight.

#### IMPROVED LUBRICATING COMPOUND.

John W. Bartlett, Moline, Ill., assignor to himself and Mervin Witherell, same place.—This is a lubricating compound for car axles and other friction surfaces, which will not take fire from a hot journal. It is formed of pulverized blue stone, oil rock, carbonate of potash, chloride of lime, American soapstone, concentrated lye, golden machine oil, pure lard oil, salt, tartaric acid, and soft water.

#### IMPROVED CARTRIDGE-LOADING DEVICE.

Thomas P. Camp, Stoughton, Wis., assignor to himself and G. W. Wise, same place.—This is an improved device for loading the cartridge shells of breech-loading shot guns. It consists, mainly, in the arrangement of a single continuous slide, having two charging holes, which, by being moved back and forth in a race, receive the charge of powder and shot from respective powder and shot hoppers above, and deliver it to the cartridge shell below. There is a central plunger and inserting spout for the wads, and cut-off brushes in the hoppers, for brushing off and leveling the charge in the slide.

#### IMPROVED PESSARY.

Jonathan P. Barnett, Navasota, Tex.—This relates to an improvement upon the pessary described in patent No. 163,871, and consists mainly in the arrangement of the wings for supporting the pessary, the arms for adjusting said wings, whereby they are adapted to be folded inward, and the adjusting arms to be folded into slots formed in the tube, to which the wings are hinged.

#### IMPROVED BALE TIE.

James M. Pollard, New Orleans, La.—The central cross bar of the buckle is provided with a lug or projection on the under side, and the free end of the band is slotted and held up against the bar so that the lug projects into one of the slots, thereby forming the lock. The other or fast end of the band forms the spring by which the slotted end is thus held against the bar and engaged with the lug. The disengagement may therefore be readily effected by depressing the spring. The fast end of the band is so bent as to form a shoulder, which prevents the buckle being accidentally detached from the band; but the attachment and detachment of the buckle may be very easily effected when desired.

#### IMPROVED SCISSORS.

Amos W. Coates, Alliance, Ohio.—This is an improvement in scissors, designed particularly to adapt them to the use of little girls in cutting out their little quilt patches, doll papers, etc.; and it consists in constructing the two blades with two terminal bulbs or guards which, while permitting the perfect closing and free cutting action of the scissors, also form a guard, whether the scissors be open or shut, which prevents accidental injury to the child, and enables her to use the scissors with perfect safety to the eyes and body.

#### IMPROVED ANIMAL TRAP.

Cornelius Koons, York Road, Md.—This invention consists mainly in a drum-shaped two-compartment cage made of wire cloth, to the upper compartment of which access is had through a square tapering inlet formed by inwardly converging pointed wires, having suspended in the center a swinging gate composed of pointed wires which admit the access of the rats, or other animals, but prevent their escape; and it also consists in the particular construction and arrangement of the upper inlet and compartment with a lower compartment having a second inlet to receive and retain the rats caught by the first or upper compartment.

#### IMPROVED COMPOSITION FOR PRESERVING BOLTING CLOTH.

John Wayman, of Collinsville, Ill.—This is a compound formed of wormwood, oil of cedar, gall, and tallow, forming a paste which will keep insects away from the bolting cloth.

#### IMPROVED BELL TOY.

John T. Rich, Middle Haddam, Conn., assignor to J. C. Clark & Co., of same place.—This improves the construction of the toy bell for which letters patent were granted to J. C. Clark, November 2, 1875, in such a way that the vibrations of the bell may be less obstructed by the mounting. The bell, consisting of a spherical perforated shell, is now secured at one side only to the axle of the carriage on which it is supported.

### NEW HOUSEHOLD INVENTIONS.

#### IMPROVED WASHING MACHINE.

Benjamin F. Fowler, Eau Claire, Wis.—This improved machine does its work by alternately saturating the clothes and then pressing them, to force out the water and dirt, between an upper corrugated roller and a series of smaller rollers beneath.

#### IMPROVED WATER FILTER.

Samuel F. Simes and Charles Tate, Philadelphia, Pa.—This invention relates to a novel construction of filter for the purification of water or other liquids, which filter is especially designed for attachment to the nose of a hydrant, but applicable also for general use in any connection whatever. The invention consists mainly in a specially prepared purifying pad formed by embodying powdered charcoal, kaolin, or other purifying material, either singly or combined, with the fiber of felt, by blowing it in during the process of the manufacture of the felt. This pad is contained in a chamber formed by two detachable caps, and is held between gratings in the same by means of a cam joint which fastens the caps, which devices also form a part of the invention.

#### IMPROVED STEAM COOKING KETTLE.

William G. Flanders, West Lebanon, N. H.—This is a double-chambered culinary vessel, made in detachable parts, each provided with a perforated diaphragm. The upper part has a bottom provided with a slide for closing the apertures therein, so as to regulate the admission of steam to the articles to be cooked.

### NEW TEXTILE MACHINERY.

#### IMPROVED WARPING MACHINE.

John J. Ashworth and George Ashworth, Pendleton, England.—This invention places all the warp threads perfectly straight on the beam, prevents twisting, facilitates the weaving, simplifies the machinery, reduces labor, and economizes space in the mill. It embodies eight novel devices, all of which are of great ingenuity, but which are so combined that it is not possible to convey a clear idea of their working without the aid of drawings. There is a new registering apparatus which indicates the exact number of revolutions of the beam, while another device shows the tension of the yarn. By these the same length of yarn is wound in the same number of revolutions upon each of the succeeding sections of the beam as there is upon the first section.



## Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

**Agricultural Implements and Industrial Machinery for Export and Domestic Use.** H. H. Allen & Co., N. Y.

**Pattern Makers** can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

**Wanted**—A heavy first class Tenoning Machine. Address A. W. Gray's Sons, Middletown Springs, Vt.

The world-wide reputation of Asbestos Steam Pipe and Boiler Coverings, Roofing, Roof Paint, Cement for repairing roofs, etc., has induced unscrupulous persons to sell and apply worthless articles, representing them as being made of Asbestos. The use of Asbestos in these and other materials for structural and mechanical purposes is patented, and the genuine can be obtained only of H. W. Johns, 87 Maiden Lane, N. Y.

**Emery Grinders, Emery Wheels, best & cheapest.** Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

**Shingle, Heading and Stave Machine.** See advertisement of Trevor & Co., Lockport, N. Y.

**Chester Steel Castings Co.** make castings twice as strong as malleable iron castings at about the same price. See their advertisement, page 297.

**Patent Scroll and Band Saws, best & cheapest** in use. Corliesman, Esq. & Co., Cincinnati, Ohio.

**To Clean Boiler Tubes**—Use National Steel Tube Cleaner tempered and strong. Chalmers Spence Co., N. Y.

The best Sewing Machine in the world—Makes the Lock Stitch, the Chain Stitch, and Embroidery Stitch from two whole Spools. Agents wanted everywhere. G. L. De Lancy & Co., 74 Broadway, New York City.

**D. Frisbie & Co.** manufacture the Friction Pulley—Captains—best in the World. New Haven, Conn.

**Slide Rest for \$3** to fit any lathe. Goodnow & Wightman, 21 Cornhill, Boston, Mass.

**Lansdell's Pat. Steam Syphons**—Lansdell & Leng's Lever and Cam Valve. Leong & Ogden, 212 Pearl St., N. Y.

**Best Bolter for Sawing Handles, Furniture Stuff, Wagon Staff, Fence Boards, &c.** Send for Circulars. Richard W. Montross, Galien, Mich.

**Steel Stamps & Brass Stencils, for Marking Tools, Patterns, Boxes, &c.** E. H. Payne, Mfr., Burlington, Vt.

**For Specialties in Woolens, Seamless Roller Covers, Printers' Blankets, &c.,** address H. Waterbury & Co., Hensselaerville, Albany Co., N. Y.

**Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability,** are cheaper by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

**To Lease**—The largest portion of the building corner Canal, Center, and Walker Sts., now occupied as a Billiard Manufacturing and Sales Room. See advertisement in another column.

**Superior Lace Leather, all Sizes, Cheap.** Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Arny, 148 North 3d St., Philadelphia, Pa.

**Magie Lanterns, Stereoscopes, for Parlor Entertainments and Public Exhibitions.** Pays well on small capital. 74 Page Catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

**Fire Hose, Rubber Lined Linen, also Cotton, finest quality.** Kureka Fire Hose Co., 13 Barclay St., New York.

**The Scientific American Supplement**—Any desired back number can be had for 10 cents, at this office, or almost any news store.

**To stop leaks in boiler tubes, use Quinn's Patent Ferrules.** Address S. M. Co., 30, Newmarket, N. H.

**Water, Gas, and Steam Pipe, Wrought Iron.** Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

**For Solid Wrought-iron Beams, etc., see advertisement.** Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

**Solid Emery Vulcanite Wheels**—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 31 and 33 Park Row, New York.

**M. Shaw, Manufacturer of Insulated Wire** for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

**F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines,** have removed to 380 Water Street, New York.

**Power & Foot Presses & all Fruit-Can Tools.** Ferretate Wks., Bridgeton, N. J. & C. W. Mch. Hall, Cent'l.

**For Solid Emery Wheels and Machinery,** send to the Union Stone Co., Boston, Mass., for circular.

**For best Presses, Dies, and Fruit Can Tools, Blies & Williams,** cor. of Plymouth and Jay, Brooklyn, N. Y.

**Steel Castings, from one lb. to five thousand lbs.** Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

**Hydraulic Presses and Jacks, new and second hand.** Lathes and Machinery for Polishing and Bumping metals. E. Lyon, 4th Grand Street, New York.

**Diamond Tools**—J. Dickinson, 64 Nassau St., N. Y.

**Notes & Queries**  
J. N. P. will find directions for making friction matches on p. 75, vol. 29.—R. J. will find directions for nickel plating on p. 235, vol. 33.—J. N. will find the article on the friction of water in pipes on p. 48, vol. 29.—C. F. can remove moles from the skin by following the directions on p. 347, vol. 32.—C. R. S. will find on p. 120, vol. 33, directions for making muslin unflammable.—J. F., M. M., W. G. E., B. P., M. T. B., H. A., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. C. says: A asserts that water has been lifted 33 feet 6 inches with a common lift pump. B asserts that it never has been lifted higher than 32 feet. Which is right? A. Water was once raised 32 feet 11 inches by a lift pump at the Brooklyn navy yard. This is the greatest result of which we have heard.

(2) E. L. says: I have a small piece of sylvanite, said to yield \$40 gold to the lb. I suppose that it also contains tellurium and silver. I have used the blowpipe upon it and melted out a

large percentage of metal having a silvery appearance. How can I separate the gold from all other metals? A. Sylvanite contains 50 per cent of tellurium, 25 of gold, and 10 of silver. It frequently contains as well some antimony and lead. After complete roasting, dissolve in aqua regia; evaporate to dryness. Add a small amount of sulphuric acid, and dissolve as far as possible in water. From the concentrated solution, precipitate out the gold with a strong solution of green vitriol.

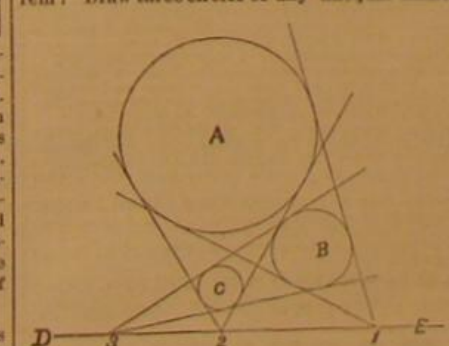
(3) A. O. W. says: I want to vulcanize rubber, and cannot get chloride of sulphur. Please give me the formula for it. A. Chloride of sulphur is obtained by passing dry chlorine gas slowly over molten sulphur, and collecting the product in a condenser. The sulphur should be heated until just at the point of volatilization, about 600° Fah. The impure chloride should be purified and freed from dissolved sulphur by redistillation. It is a reddish yellow fluid of a disagreeable odor, and boils at 280° Fah.

(4) A. C. G. asks: How can I make a composition of chalk or plaster of Paris for making molds that will not dissolve in water? And how can I take impressions or make molds in metal from natural objects? A. Molds of this character are not absolutely insoluble in water. Use 1 part of the finest chalk intimately mixed with 3 parts plaster of Paris. Place the object to be copied in a shallow tray, or other suitable vessel, cover every part of it with a thin film of olive oil, and then brush over it with a camel's hair pencil a thin cream of the finest plaster with water in order to exclude all air bubbles: when this is done, pour over it immediately, and at one motion, the proper quantity of plaster, of a somewhat thicker consistence than that first applied. Allow the plaster plenty of time to set, and, when perfectly hard, remove it carefully from the object, dry perfectly in an oven, and heat to nearly the fusing point of the metal (type metal), then pour the metal in immediately. Where the nature of the surface of the object will not allow of a direct cast being taken from the object in plaster, a thick solution of glue is sometimes employed; when cold, the glue is very elastic and flexible, and may be removed from almost any object without danger of breakage. These casts may be reversed in plaster, and the plaster, in turn, in metal.

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

N. V. W.—No. 1 is chlorite schist containing a small amount of carbonate of nickel. In large amounts it would be valuable. No. 2 is chlorite, a hydrous silicate of alumina and magnesia, containing a small percentage of oxide of iron and sometimes a small amount of oxide of chromium. No. 3 is chlorite schist.—S. D. S.—It is obsidian, or volcanic glass. The ancient inhabitants of Mexico, before their subjugation by Cortes, used it in making sacrificial knives. It is not employed at present.—A. N. T.—No. 1 is dolomite. No. 2 is calcite. No. 3 is coccolite. No. 4 is missing. No. 5 is a mixture of calcite with some siliceous rock—too indefinite to admit of separation. No. 6 is arenaceous limestone.—T. L.—The coal contains only a small percentage of sulphur, not enough to make it objectionable for the purpose you mention. It is a very compact variety of bituminous coal of excellent quality.—F. L. L.—The specimens you send us contain a considerable percentage of nickel, also chalcocopyrite and iron pyrites.—H. W. S.—It is trap rock containing small specks of iron pyrites.—E. A.—The mineral found near a lead mine is iron pyrites (sulphide of iron) in indurated clay. The other piece is shale.—E. W.—It is clay containing carboniferous matter of no particular value.—E. F. T.—The shell is made artificially of plaster of Paris moistened with a strong solution of alum together with the perfume, pressed into molds, and dried. The camphor cake contains pipe clay, chalk, magnesia, and a little starch besides the camphor.—J. N. C. (Fredericktown, O.), G. H. (Windsor Locks, Conn.), C. P. (Marysville, Tenn.), S. N. (Forest Station, Shenandoah county, Va.), send us letters of inquiry as to minerals, but no specimens which we are able to identify. If correspondents will not put their names on the boxes which they send (and several such boxes come through the mail at one time) it is very difficult and in some cases impossible to identify the senders.

D. M. asks: What preparation can be used on tenor drums, which will be waterproof and at the same time stand the beating?—J. B. C. asks: Is there any demonstration to the following theorem? Draw three circles of any unequal diam-



ters, as A, B, C. Produce the tangent lines, as shown, until they meet, from A through B, from A through C, and B through C. It will be found in all cases that the meeting points are in a straight line, as 1, 2, and 3 in the straight line, D E. The same result is obtained in whatever position the circles may be placed, or under any variations of their diameters, provided they are all unequal.

## COMMUNICATIONS RECEIVED.

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

- On the True Science of Religion. By T. D. McC.
- On Boiler Explosions. By T. J. R.
- On Cutting Tools. By J. R.
- On Ventilation. By G. W. W.
- On the United States Patent Association. By J. A. R.
- On the Expansion of Superheated Steam. By G. A. W.
- On Steel. By G. W. T.
- On Aeronautics. By C. E. D.
- On the Mississippi Jetties. By A. S.
- On Violins. By E. P. W.
- On Calipers. By E. R.

Also inquiries and answers from the following:  
J. M. McF., A. S., F. O. H., T. J. B., F. W. N., J. H. D., J. G., R. F. W., P. Q., N. O., A. W. K.

## HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells castings for small steam engines? Who sells malleable glass lamp chimneys? Who sells foot power band saws? Who sells the flexible shafting exhibited at the Centennial? Who is the best aneroid barometer?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

## [OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

November 7, 1876.

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

|                                                     |                 |
|-----------------------------------------------------|-----------------|
| Abdominal supporter, E. M. Holton.....              | 184,153         |
| Advertising clock, Spelman & Goetz.....             | 184,218         |
| Anthracene, making, S. Cabot, Jr.....               | 184,142         |
| Bale tie, A. Barabris (r).....                      | 7,388           |
| Bevel square, J. C. Rorick.....                     | 184,177         |
| Bill file, McLean & Redding.....                    | 184,045         |
| Book, C. F. McGill.....                             | 184,094         |
| Books, etc., backing, Crawley & Thomas.....         | 184,198         |
| Boot-crimping apparatus, H. Lampus.....             | 184,088         |
| Boot sole, E. Hanshaw.....                          | 184,077         |
| Breechloading fire arms, F. W. Freund.....          | 184,302         |
| Brick kiln, Mehauffey & Gear.....                   | 184,048         |
| Bridle bit, E. Wilder.....                          | 184,026         |
| Broom-winding machine, W. D. Jones.....             | 184,197         |
| Bucket ear, J. S. McMurray.....                     | 184,016         |
| Burglar alarm and fire arm, J. Dodson.....          | 184,037         |
| Button, A. M. Richmond.....                         | 184,179         |
| Car axle box, L. R. Bula.....                       | 184,140         |
| Car brakes, operating, J. J. Shafelt.....           | 184,179         |
| Car coupling, Greenleaf & Adams.....                | 184,149         |
| Car coupling, S. W. Kilbourne.....                  | 184,084         |
| Car coupling, G. R. Moore.....                      | 184,214         |
| Car coupling, Schmidt & Esche.....                  | 184,111         |
| Car fare register, J. Solter.....                   | 184,217         |
| Car starter, T. M. Brinshaw.....                    | 184,039         |
| Carbureter, C. A. T. de St. Aubin.....              | 184,223         |
| Carpet stretcher, Pirrung & Gronow.....             | 184,179         |
| Carpet stretcher, C. F. Bapp.....                   | 184,172         |
| Carriage coupling, J. L. H. Mosier.....             | 184,047         |
| Cast iron, etc., hardening, J. S. Robinson (r)..... | 7,390           |
| Casting printers' leads, H. J. Stone.....           | 184,115         |
| Chain pump bucket, B. W. F. Van Duzer.....          | 184,141         |
| Cigar box, C. Glund.....                            | 184,029         |
| Cigarette machine, A. H. Hook.....                  | 184,207         |
| Clothes dryer, D. Heffner.....                      | 184,306         |
| Clothes dryer, A. S. Parks.....                     | 184,189         |
| Corn planter, E. P. Williams.....                   | 184,195         |
| Cotton and hay press, W. M. Smith.....              | 184,113         |
| Cotton gin feeder and picker, W. T. Adams.....      | 184,065         |
| Coupling pin machine, etc., Blakeslee et al.....    | 184,125         |
| Cultivating harrow, R. Hamilton.....                | 184,130         |
| Cultivator, A. Hunt.....                            | 184,042         |
| Cupola furnace, E. C. Little.....                   | 184,141         |
| Cupboard, M. H. Hill.....                           | 184,037         |
| Curtain fixture, L. Powers.....                     | 184,022         |
| Damping paper, E. Walker.....                       | 184,025         |
| Derrick, G. W. Nickle.....                          | 184,168         |
| Desiccating eggs, W. O. Stoddard.....               | 184,186-187-188 |
| Desiccating eggs, Walz et al.....                   | 184,192         |
| Ditching machine, A. E. Johnson.....                | 184,156         |
| Door bolt, E. J. Steele.....                        | 184,184         |
| Door spring, W. H. Myers.....                       | 184,166         |
| Dredging apparatus, Van Hetschoten et al.....       | 184,121         |
| Dumping car, D. O'Brien.....                        | 184,048         |
| Ear muffler, B. Edgar.....                          | 184,006         |
| Earth auger, C. D. Pierce.....                      | 184,019         |
| Electric stop motion, H. A. Chapin.....             | 184,034         |
| Elevator, H. H. Blake.....                          | 184,120         |
| Explosive compound, J. P. E. Poch.....              | 184,020         |
| Extension table, J. L. Bronson.....                 | 184,139         |
| Feed trough, Grundy & Carter.....                   | 184,076         |
| Feed water heater, J. Q. Adams.....                 | 184,129         |
| Fence, S. Bobo.....                                 | 184,137         |
| Fence, F. Solter.....                               | 184,116         |
| Filtering liquids, R. Stewart.....                  | 184,024         |
| Fire arms, loading, C. W. Hovis.....                | 184,079         |
| Fire extinguishers, Dodd et al.....                 | 184,067         |
| Fire place grate, J. Old.....                       | 184,017         |
| Folding chair, W. H. Sternberg.....                 | 184,185         |
| Food cup for bird cages, G. Seyfang.....            | 184,179         |

|                                                      |         |
|------------------------------------------------------|---------|
| Freezing machine, etc., C. E. Kleinschmidt.....      | 184,072 |
| Fruit butter, producing, M. Ams.....                 | 184,027 |
| Furnace door, T. H. Butman.....                      | 184,061 |
| Fuse, continuous, W. A. Leonard.....                 | 184,043 |
| Gage cock, W. U. Fairbairn.....                      | 184,079 |
| Galvanic battery, H. P. Dechert.....                 | 184,055 |
| Gas meter, J. H. Alexander.....                      | 184,056 |
| Gas meter and carburetor, J. M. Cayce.....           | 184,033 |
| Gasifier, center sliding, S. H. B. Vance.....        | 184,130 |
| Gate, W. G. Hughes.....                              | 184,060 |
| Gate, J. G. Sherman.....                             | 184,181 |
| Gold separator, T. W. Irvin.....                     | 184,092 |
| Hammers, making, H. W. Kip.....                      | 184,138 |
| Harrow, W. W. Edgerton.....                          | 184,199 |
| Harrow, S. Kain.....                                 | 184,011 |
| Hay loader, J. Richter.....                          | 184,174 |
| Heat regulator, F. W. Ofeldt.....                    | 184,049 |
| Heater, greenhouse, J. T. Trench.....                | 184,301 |
| Hides, dehairing, T. Roberts.....                    | 184,175 |
| Hoe, E. W. Oakley.....                               | 184,100 |
| Horse collar, G. B. Griffin.....                     | 184,075 |
| Horses, handling, W. W. Winegar.....                 | 184,124 |
| Horsehoe machine, J. W. Cheuning, Jr.....            | 184,144 |
| Horsehoe nail plate, J. M. Laughlin.....             | 184,069 |
| Hotel range, G. W. Graves.....                       | 184,073 |
| Hydrant, T. Ahrens.....                              | 184,128 |
| Hydraulic propulsion, Leaman & Heckart.....          | 184,060 |
| Ice machine, D. Smith (r).....                       | 7,393   |
| Illuminating apparatus, G. B. Snider.....            | 184,103 |
| Ironing apparatus, S. S. Case.....                   | 184,003 |
| Ironing table, J. C. Hubinger.....                   | 184,041 |
| Knob roses to doors, J. Naylor.....                  | 184,167 |
| Lamp burner, W. H. Sanborn.....                      | 184,110 |
| Lamp-chimney holder, E. J. Blackham.....             | 184,184 |
| Lighting rod, D. Munson.....                         | 184,184 |
| Lining, refrigerator, J. M. Ayer.....                | 184,028 |
| Liquid filter, W. Maynard.....                       | 184,093 |
| Lithographic transfer, C. R. Biedermann.....         | 184,132 |
| Loom harness eye, W. F. Sherman.....                 | 184,112 |
| Lumber edging machine, G. W. Hobbs.....              | 184,067 |
| Mechanical movement, E. C. Hopping.....              | 184,208 |
| Mechanic's gage, W. S. How.....                      | 184,209 |
| Metal tubes, making, C. E. L. Holmes.....            | 184,152 |
| Milk can, D. S. Lewis.....                           | 184,091 |
| Milk pan, W. Cooley.....                             | 184,062 |
| Mill spindle, J. Payne.....                          | 184,105 |
| Motor for churns, etc., H. Odell.....                | 184,216 |
| Navigating torpedo boats, etc., H. J. Smith.....     | 184,192 |
| Nitrogenous fertilizers, H. P. O. Lissagaray.....    | 184,162 |
| Nut lock, C. Hall.....                               | 184,040 |
| Odorless closet, G. R. Moore.....                    | 184,099 |
| Oil and gas stove, O. Edwards.....                   | 184,148 |
| Oil stove, L. S. Enos.....                           | 184,100 |
| Ornamental chain link, J. A. Lieb.....               | 184,159 |
| Package band, Taylor & Patterson.....                | 184,118 |
| Padlock, A. O. Kruger.....                           | 184,047 |
| Paper bag machine, J. Arkell.....                    | 184,127 |
| Paper bag machine, T. W. Grinter.....                | 184,073 |
| Paper box, C. M. Arthur.....                         | 184,126 |
| Paper calendaring machine, N. H. Whitten.....        | 184,064 |
| Paper dish, J. W. Jarboe (r).....                    | 7,393   |
| Paper, perforating, L. A. Upson (r).....             | 7,395   |
| Paper pulp process, etc., J. Campbell.....           | 184,197 |
| Pattern for casting, A. F. Whiting.....              | 184,194 |
| Peanut beater, J. Esposito.....                      | 184,069 |
| Pencil sharpener, etc., A. Wilson.....               | 184,143 |
| Pencil with movable leads, O. Cleveland.....         | 184,035 |
| Petroleum stove, F. Hildebrandt.....                 | 184,079 |
| Planing and sawing machine, C. Bliven.....           | 184,136 |
| Plant support, A. Daul.....                          | 184,064 |
| Plug for drain pipes, etc., J. Chapman.....          | 184,143 |
| Polishing stone cylinders, C. C. Maurice.....        | 184,212 |
| Preserving meats, etc., J. C. Howard.....            | 184,154 |
| Preserving wood, process of, S. Cabot, Jr.....       | 184,141 |
| Printing press, W. P. Kidder.....                    | 184,083 |
| Pulverized fuel feeder, W. West.....                 | 184,122 |
| Pump valve, B. Kroecker.....                         | 184,044 |
| Radial drilling machine, A. Box.....                 | 184,060 |
| Railway signal, J. M. Peirce.....                    | 184,106 |
| Railway switch, J. M. Toucey.....                    | 184,119 |
| Railway ticket and stamp, W. F. Dwight.....          | 184,147 |
| Railway train reflector, H. A. Richards.....         | 184,050 |
| Refrigerating building, C. Stoll.....                | 184,189 |
| Refrigerator car, J. M. Ayer.....                    | 184,029 |
| Rein holder, E. Mears.....                           | 184,096 |
| Revolving churn, R. Murphy.....                      | 184,105 |
| Revolving fire arm, J. W. Cochran.....               | 184,145 |
| Ring holder, spinning, O. F. Garvey.....             | 184,205 |
| Rock drill, H. C. Sergeant (r).....                  | 7,391   |
| Roller skate, W. P. Gregg (r).....                   | 7,397   |
| Sash fastener, W. A. Davis.....                      | 184,086 |
| Sawmill carriage dog, S. B. Rittenhouse.....         | 184,109 |
| Scarf, J. G. Hitchcock.....                          | 184,131 |
| Screw propeller, F. Maynard.....                     | 184,132 |
| Screw propeller, horizontal, W. S. Myers.....        | 184,102 |
| Screw tap, J. W. Melville.....                       | 184,097 |
| Sewing machine, E. Townsend (r).....                 | 7,384   |
| Sewing machine cabinet, J. A. Liebert.....           | 184,160 |
| Sewing machine drawer, J. Mulcahey.....              | 184,100 |
| Shaft coupling, T. D. Powers.....                    | 184,021 |
| Shank stiffeners, cutting, W. N. Sprague.....        | 184,091 |
| Sheet metal cleaning, Davies & Lewis.....            | 184,146 |
| Sheet metal, die for, A. M. Kittredge.....           | 184,083 |
| Sheet metal, strengthening, Kittredge & Clark.....   | 184,086 |
| Shoe tip, D. K. Cross.....                           | 184,083 |
| Shoemaker's pinchers, T. B. Shelly.....              | 184,180 |
| Sliding gage, L. B. Ingold.....                      | 184,091 |
| Slate, trimming, D. Auld, Jr.....                    | 184,130 |
| Sliding rowlock, etc., W. N. Blakeman, Jr.....       | 184,091 |
| Snap hook, E. R. Jones.....                          | 184,211 |
| Sowing fertilizers, machine for, D. F. Hull.....     | 184,010 |
| Spinning ring, J. Booth.....                         | 184,136 |
| Spring bed bottom, A. W. Obermann.....               | 184,104 |
| Spring hinge, L. Bommer.....                         | 184,058 |
| Spring hoe for grain drills, C. E. Patrie.....       | 184,018 |
| Stair covering, M. Krick.....                        | 184,012 |
| Steam boiler blow-off, M. Rhoda.....                 | 184,105 |
| Steam trap, G. M. Davis.....                         | 184,094 |
| Step ladder, J. Dillon.....                          | 184,086 |
| Stone pavement, J. Murphy.....                       | 184,101 |
| Stove pipe shelf, J. F. Hinshaw.....                 | 184,023 |
| Street sweeper, J. Robinson.....                     | 184,170 |
| Subsoil plow, A. A. Porter.....                      | 184,177 |
| Sugar apparatus, etc., J. P. Cahill.....             | 184,025 |
| Swage for implements, J. W. Landon.....              | 184,011 |
| Swivel snap for harness, J. Fisk.....                | 184,035 |
| Table cutlery, R. N. Oakman, Jr.....                 | 184,215 |
| Tanning leather, M. J. Söderberg.....                | 184,111 |
| Telegraph cut-out, J. B. Stoner.....                 | 184,085 |
| Ticket punch, W. Hill.....                           | 184,093 |
| Tire upsetter, M. W. Griffiths.....                  | 184,077 |
| Tool holder, W. S. How.....                          | 184,216 |
| Transom lifter and sash center, J. F. Wollensak..... | 184,173 |
| Traveling bag frame, W. Simon.....                   | 184,028 |
| Tumbler washer, E. W. Russell (r).....               | 7,390   |
| Umbrella runner, H. S. Frost.....                    | 184,203 |
| Urn for growing plants, R. A. Van Court.....         | 184,118 |
| Wagon brake lever, D. McGuire.....                   | 184,098 |
| Wagon, excursion, E. Mills.....                      | 184,098 |
| Wagon bound and pole brace, F. Smith (r).....        | 7,396   |
| Wash tub, H. W. McClelland.....                      | 184,104 |
| Washing machine, S. J. Morey.....                    | 184,181 |



|                                               |         |
|-----------------------------------------------|---------|
| Washing machine, F. G. Tank.....              | 184,117 |
| Water filter, R. A. Bean.....                 | 184,131 |
| Water hook for harness, O. D. Aldrich.....    | 184,002 |
| Weather strip, J. C. Fleeter.....             | 184,071 |
| Weed turner for plows, U. Ballard.....        | 184,080 |
| Wheel cultivator, O. Hoffman.....             | 184,155 |
| Whip socket and rein holder, S. D. White..... | 184,193 |
| Whip tip, C. R. Shelton (r).....              | 7,382   |
| Windmill, C. B. Post.....                     | 184,107 |
| Windmill, M. M. Trimble.....                  | 184,093 |
| Window, M. McComb.....                        | 184,044 |
| Wire rope machine, M. M. Zellers.....         | 184,196 |
| Wood-boring machine, G. S. Derr.....          | 184,005 |

## DESIGNS PATENTED.

|                                                        |  |
|--------------------------------------------------------|--|
| 9,611.—TYPE.—J. M. Conner, Greenville, N. J.           |  |
| 9,612.—INKSTANDS.—J. B. Davids, New York city.         |  |
| 9,613.—INKSTANDS.—O. F. Fogelstrand, Kensington, Conn. |  |
| 9,614.—TYPES.—J. Herriot, New York city.               |  |
| 9,615.—PRINTING BORDER.—R. Smith, Philadelphia, Pa.    |  |

## FOR THE WEEK ENDING NOVEMBER 14, 1876.

|                                                    |         |
|----------------------------------------------------|---------|
| Animal trap, G. W. Kelly.....                      | 184,386 |
| Antifriction journal bearing, W. H. Haynes.....    | 184,242 |
| Apple parer, corer, etc., W. M. Griscom.....       | 184,371 |
| Apron for wet ore separators, W. Hooper.....       | 184,378 |
| Autographic telegraph, Sawyer & Smith.....         | 184,302 |
| Axes, manufacture of, H. W. Warner.....            | 184,311 |
| Axle lubricator, F. Corsa.....                     | 184,344 |
| Bale tie, J. W. Macomber.....                      | 184,37  |
| Bale tie, C. Van Derzee.....                       | 184,372 |
| Bale ties, making, C. Vanderzee.....               | 184,448 |
| Bath, portable, E. M. Bement.....                  | 184,321 |
| Boat-ditching apparatus, W. A. Brice.....          | 184,327 |
| Bobbin for spinning machines, J. Mawson.....       | 184,404 |
| Book binding, W. F. Eastman.....                   | 184,335 |
| Boot-nailing machine, H. Dunham.....               | 184,281 |
| Bottle case, etc., L. Mann.....                    | 184,339 |
| Brick kiln, H. B. Evans.....                       | 184,339 |
| Buggy top, G. F. Knight.....                       | 184,381 |
| Bungs, making, E. B. McIntosh.....                 | 184,407 |
| Burglar alarm, H. Holcroft.....                    | 184,243 |
| Button hole attachment, T. Hagerty.....            | 184,239 |
| Car axle box, W. M. Watson.....                    | 184,451 |
| Car coupling, J. Belshlag.....                     | 184,222 |
| Car coupling, W. A. Bushey.....                    | 184,332 |
| Car coupling, N. H. Dolson.....                    | 184,350 |
| Car coupling, G. F. Jackson.....                   | 184,383 |
| Car roof, J. M. Ayr (r).....                       | 7,391   |
| Car starter, J. H. Betteley.....                   | 184,357 |
| Car wheel, A. L. Blackman.....                     | 184,334 |
| Cartridges, crimping, M. B. Massey.....            | 184,403 |
| Chamber vessel, L. G. Woolley.....                 | 184,276 |
| Cheek rower, S. De Vaux.....                       | 184,231 |
| Churn, S. A. Gregg.....                            | 184,370 |
| Churn dasher, A. E. Queensberry.....               | 184,424 |
| Clothes dryer, etc., T. Haldeman.....              | 184,373 |
| Clocks, device for winding, J. N. Rice.....        | 184,264 |
| Coal chute, T. Kelsey.....                         | 184,387 |
| Combustion of fuel, W. Ennis.....                  | 184,335 |
| Compensating axle, etc., I. E. Palmer.....         | 184,421 |
| Compensation pendulum, I. C. Cowles.....           | 184,230 |
| Condensing pumping engine, Carr & Arthur.....      | 184,389 |
| Construction of wells, W. T. Kemple.....           | 184,388 |
| Corn marker, G. W. Graves.....                     | 184,369 |
| Corn planter, W. H. Dyke.....                      | 184,354 |
| Corn planter, Phelps & Dyer.....                   | 184,422 |
| Corset, R. Piepenbrung.....                        | 184,423 |
| Cotton and corn planter, A. W. Tufts.....          | 184,447 |
| Cotton chopper, J. R. McCormick.....               | 184,406 |
| Cotton cleaner, H. C. Cage.....                    | 184,233 |
| Coupling cars, Merryweather et al.....             | 184,409 |
| Cultivator, W. B. Sturges.....                     | 184,441 |
| Cultivator and marker, J. B. Mangett.....          | 184,398 |
| Dehydrating air, etc., R. H. Lucas.....            | 184,291 |
| Demijohn, J. C. Moore.....                         | 184,296 |
| Desk, O. Hansen.....                               | 184,375 |
| Detecting fires, etc., D. W. Howes.....            | 184,380 |
| Dining table, I. Y. Casiano.....                   | 184,340 |
| Dressing stone, J. D. Branton.....                 | 184,330 |
| Drill chock, C. N. & S. N. Trump.....              | 184,445 |
| Driving gear for horses, J. K. Poorman.....        | 184,296 |
| Dryer, A. G. Brodie.....                           | 184,229 |
| Dropsy, remedy for, D. W. Lawhon.....              | 184,399 |
| Druggist's shelf bottle, E. L. Witte.....          | 184,454 |
| Dumping car, S. D. King.....                       | 184,389 |
| Earth auger, A. W. Morgan.....                     | 184,257 |
| Electric signal, Lundberg et al.....               | 184,251 |
| Elevator, M. J. Coleman.....                       | 184,228 |
| Emery wheel holder, J. J. Steiger.....             | 184,306 |
| Engine valve gear, W. Winstanley.....              | 184,453 |
| Extension table, G. Hallbauer.....                 | 184,374 |
| Fare controller and indicator, L. Von Hoven.....   | 184,450 |
| Faucet, J. W. Chamberlain.....                     | 184,279 |
| Feeder for thrashing machines, W. Hutchins.....    | 184,244 |
| Feeding air to furnaces, G. W. Birch.....          | 184,224 |
| Fence, C. H. Wapler.....                           | 184,274 |
| Fence, portable, J. Bassett.....                   | 184,227 |
| Filter, D. W. Kiddle.....                          | 184,437 |
| Finger ring, N. A. Bellezza.....                   | 184,259 |
| Fire extinguisher, W. H. Laubach, (r).....         | 7,395   |
| Flue for glass ovens, H. Howard.....               | 184,379 |
| Flues, setting boiler, A. C. Ancona.....           | 184,314 |
| Fluid meter, J. C. Guerrant.....                   | 184,372 |
| Floating machine, C. F. Dudley.....                | 184,280 |
| Folding bed, G. Southard.....                      | 184,269 |
| Folding crib and cradle, T. C. Woodard.....        | 184,313 |
| Frying pan, Edgar & Bardell.....                   | 184,292 |
| Furnace for evaporators, Towers & Bowie.....       | 184,444 |
| Gag runner for harness, W. M. Blain.....           | 184,225 |
| Game card, J. W. Nicholson.....                    | 184,258 |
| Gang plow, J. B. Balston.....                      | 184,425 |
| Gate, automatic, W. Nairn.....                     | 184,416 |
| Grain drill, J. C. Buck.....                       | 184,331 |
| Grain drill, Smith & Thomas.....                   | 184,268 |
| Grasshopper catcher, F. E. Benson.....             | 184,223 |
| Hammock frame, J. B. Arel (r).....                 | 7,399   |
| Hand rest, Marshall & Colby.....                   | 184,402 |
| Handle for valves, etc., Lagowitz & Lieb.....      | 184,285 |
| Harness saddle, E. H. Cahoon.....                  | 184,333 |
| Harness trace, T. J. Mansfield.....                | 184,223 |
| Harvester, W. Gangwer.....                         | 184,265 |
| Harvester thrasher, M. L. Parrett.....             | 184,302 |
| Heater, W. H. Bush.....                            | 184,226 |
| Heater and condenser, R. Berryman.....             | 184,323 |
| Heating air, etc., for furnaces, J. Ferguson.....  | 184,361 |
| Heating chili molds, H. F. Eberts.....             | 184,356 |
| Heel blanks, sticking nails in, W. E. Forster..... | 184,393 |
| Hides, drying, J. N. Duffy.....                    | 184,352 |
| Hinges, constructing, C. Lanz.....                 | 184,349 |
| Hog-scraping apparatus, W. W. Kincaid.....         | 184,390 |
| Holder for crayons, etc., E. Lillenthal.....       | 184,290 |
| Hoop iron, rolling, J. T. Lowry.....               | 184,396 |
| Hoops, cutting, W. Steele.....                     | 184,398 |
| Horse power, J. W. Jackson.....                    | 184,382 |
| Horse rake, D. P. Sharp.....                       | 184,367 |
| Horseshoe, W. Lewis.....                           | 184,254 |
| Jadis rubber garment, O. W. Melter.....            | 184,409 |

|                                                     |         |
|-----------------------------------------------------|---------|
| Indicator for boilers, etc., S. Wheeler.....        | 184,275 |
| Inking apparatus, printing, A. Campbell.....        | 184,307 |
| Jelly jar, N. P. Todd.....                          | 184,442 |
| Joint for boat knees, J. W. Sanborn.....            | 184,263 |
| Jump seat carriage, E. S. Felch.....                | 184,236 |
| Kerosene lamp attachment, J. B. Searl.....          | 184,303 |
| Key turner, etc., gas, L. Stieringer.....           | 184,429 |
| Knife for pitting fruit, G. W. Tarleton.....        | 184,271 |
| Knob latch, M. C. Niles.....                        | 184,299 |
| Ladder, J. B. Lofland.....                          | 184,395 |
| Lamp, E. J. Murphy.....                             | 184,298 |
| Lamp, D. Sanford.....                               | 184,484 |
| Lamp burner, E. H. Jenkins.....                     | 184,245 |
| Lamp shade holder, W. Scarlett.....                 | 184,366 |
| Latch, reversible, M. Padden.....                   | 184,420 |
| Lifting jack, W. Saffer.....                        | 184,433 |
| Litaseed oil, treatment of, H. A. Clark.....        | 184,341 |
| Locomotive, J. Westcott.....                        | 184,452 |
| Log roller, T. Emery.....                           | 184,238 |
| Loom, J. Galt.....                                  | 184,364 |
| Lubricator, J. J. & J. V. Renchard.....             | 184,426 |
| Magazine fire arm, B. R. Hotchkiss.....             | 184,285 |
| Magnet for compass, E. S. Ritchie.....              | 184,300 |
| Magneto-electric machine, O. Heikel.....            | 184,377 |
| Mandrel for welding pipe, J. A. Kaylor.....         | 184,385 |
| Meal bin, Mangold & Summerville.....                | 184,400 |
| Mechanical movement, C. A. Deyrie.....              | 184,232 |
| Mechanical movement, W. O. Wakefield.....           | 184,273 |
| Medal, J. W. Lingg.....                             | 184,289 |
| Metal-shaping machine, G. A. Ohl.....               | 184,419 |
| Millstone staff, D. H. Rowe.....                    | 184,431 |
| Mustache guard, E. Avey.....                        | 184,317 |
| Mustache guard for cups, E. Avey.....               | 184,316 |
| Napkin holder, B. F. & V. A. Hardy.....             | 184,376 |
| Nut lock, J. A. Camp.....                           | 184,336 |
| Nut lock, D. Dull.....                              | 184,353 |
| Nails, machine for driving, B. S. Atwood.....       | 184,221 |
| Oil well wall cleaner, M. T. McCormick.....         | 184,254 |
| Ore concentrator, L. Stoner.....                    | 184,270 |
| Ornamental designs, producing, W. Boggett.....      | 184,326 |
| Oscillating churn, A. Snyder.....                   | 184,305 |
| Paper dish, J. W. Benham.....                       | 184,322 |
| Pipe fastener, W. Jacobus.....                      | 184,287 |
| Plane guide, W. H. & M. Harris.....                 | 184,241 |
| Planing machine, D. H. Rice.....                    | 184,299 |
| Plow, G. Moore.....                                 | 184,411 |
| Plow, reversible, Vickery & Prickett.....           | 184,449 |
| Pocket comb case, C. W. Walker.....                 | 184,310 |
| Polishing package, F. Wright.....                   | 184,455 |
| Primer for cartridges, B. B. Hotchkiss (r).....     | 7,394   |
| Projectile, B. B. Hotchkiss.....                    | 184,286 |
| Protecting threads on pipes, D. Calmus.....         | 184,335 |
| Puddling hearth bottom, L. Ryan.....                | 184,432 |
| Punching press, T. R. Morgan.....                   | 184,413 |
| Railroad switch, D. Rousseau.....                   | 184,430 |
| Rattan basket, etc., G. Gensch.....                 | 184,257 |
| Reclining chair, T. K. Siddham.....                 | 184,438 |
| Revolving show stand, A. Fischer.....               | 184,362 |
| Ricks and stacks, building, J. & H. Murdock.....    | 184,415 |
| Rocking chair frame, H. Oberg.....                  | 184,260 |
| Roofing and paving, G. Pulver.....                  | 184,263 |
| Rotary churn, C. & G. L. Farmer.....                | 184,235 |
| Rotary engine, D. D. Hardy.....                     | 184,284 |
| Running gear, G. Yetter.....                        | 184,277 |
| Sad iron, Evans & Kestler.....                      | 184,393 |
| Sad iron holder, C. B. Pettengill (r).....          | 7,392   |
| Sap spout, G. C. Shipper.....                       | 184,304 |
| Sash balance, B. M. Whiting.....                    | 184,312 |
| Sawing machine, E. & A. Landstrom.....              | 184,247 |
| Scale scraper, boiler, C. J. Cronin.....            | 184,345 |
| Seed drill, A. C. Evans.....                        | 184,234 |
| Seed-dropping plate, E. B. Null.....                | 184,418 |
| Self-generating gas lamp, R. W. Park.....           | 184,261 |
| Self support, stove, W. P. Abendroth.....           | 184,278 |
| Sewing machine, W. B. Cogger.....                   | 184,342 |
| Sewing machine needles, grooving, Dayton et al..... | 184,347 |
| Sewing machine needles, pointing, Dayton et al..... | 184,348 |
| Sewing machine shuttle, W. Gillett.....             | 184,266 |
| Sharpening machine, J. Markel.....                  | 184,401 |
| Shawl strap buckle, R. W. Owen.....                 | 184,296 |
| Shoe hanger, fanning, W. Coleman.....               | 184,343 |
| Side hill plow, W. Strait.....                      | 184,440 |
| Skate, J. M. Lamb.....                              | 184,392 |
| Skein-twisting machine, T. Stibbs.....              | 184,309 |
| Smoke pipe coupling, A. W. Decrow.....              | 184,349 |
| Soda-water apparatus, J. Matthews.....              | 184,292 |
| Spark arrester, S. Smith.....                       | 184,437 |
| Spark extinguisher, Donaldson & Miller.....         | 184,351 |
| Spring hoe, Kuhns & Kneale.....                     | 184,246 |
| Spring vehicle, S. W. Ludlow.....                   | 184,220 |
| Sprinkler, portable, D. R. Brownlow.....            | 184,225 |
| Steam cooker, G. M. Stephen.....                    | 184,307 |
| Steam hammers, T. R. Morgan.....                    | 184,412 |
| Steam stop valve, A. Orme.....                      | 184,294 |
| Stone-polishing machine, Risdon & Gale.....         | 184,428 |
| Stopper and dropper, bottle, J. A. Armstrong.....   | 184,315 |
| Stove leg, Mason & Baker.....                       | 184,255 |
| Stove pipe damper, H. A. Meers.....                 | 184,255 |
| Stove pipe thimble, T. E. Harris.....               | 184,340 |
| Strap hinges, forming, C. Lanz.....                 | 184,348 |
| Stump puller, J. B. Forbes.....                     | 184,288 |
| Tenement house, A. Nelson.....                      | 184,417 |
| Time lock, E. Grab.....                             | 184,398 |
| Time lock, W. L. Potter.....                        | 184,297 |
| Toypicture, J. Kayser.....                          | 184,384 |
| Umbrella drip cup, G. H. Ayres.....                 | 184,318 |
| Umbrella support, etc., W. Rounds.....              | 184,429 |
| Underground telegraph, D. Brooks.....               | 184,329 |
| Valve gear for steam engines, G. E. Tower.....      | 184,443 |
| Vat for filtering cider, H. Greenwood.....          | 184,398 |
| Vegetable cutter, P. Treibal.....                   | 184,446 |
| Vehicle axle box, G. Moore.....                     | 184,410 |
| Vehicle spring, J. C. Gould.....                    | 184,367 |
| Velocipede, F. G. Stemmer.....                      | 184,405 |
| Ventilating device, etc., D. K. Cartter.....        | 184,398 |
| Watch regulator, L. C. Cowles.....                  | 184,229 |
| Wheat steamer, J. W. Price.....                     | 184,298 |
| Windmill, H. S. & H. Croft, Jr.....                 | 184,245 |
| Window screen, W. McArthur.....                     | 184,405 |
| Wool-washing machine, C. G. & F. G. Sargent.....    | 184,301 |
| Wrench bars, heading, F. A. Smith.....              | 184,426 |
| Writing pen, L. B. Bertram.....                     | 184,319 |
| Zinc oxide furnace, S. T. Hughes.....               | 184,391 |

## DESIGNS PATENTED.

|                                                                  |  |
|------------------------------------------------------------------|--|
| 9,616.—BRACELETS.—H. Carlisle, Jr., Philadelphia, Pa.            |  |
| 9,617.—DRINKING FOUNTAIN.—J. W. Fluke, New York city.            |  |
| 9,618, 9,619.—MATCH-SAFES.—O. F. Fogelstrand, Kensington, Conn.  |  |
| 9,620.—CARPETS.—H. R. Campbell, Lowell, Mass.                    |  |
| 9,621 to 9,623.—CARPETS.—J. M. Christie, Kidderminster, England. |  |
| 9,623 to 9,625.—CARPETS.—J. Fisher, New York city.               |  |
| 9,625.—CARPETS.—A. L. Halliday, New York city.                   |  |
| 9,624.—CARPETS.—E. J. Ney, Lowell, Mass.                         |  |
| 9,625.—CARPETS.—F. F. Hicker, Lowell, Mass.                      |  |
| 9,626.—CARPETS.—T. J. Stearns, Boston, Mass.                     |  |
| 9,627 to 9,629.—CARPETS.—C. W. Swapp, Lowell, Mass.              |  |

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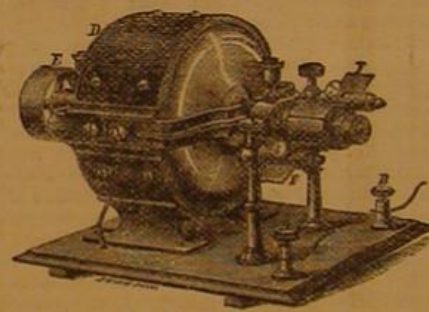
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(NEW SERIES.)

NEW YORK, DECEMBER 23 AND DECEMBER 30, 1876.

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## THE LUMBER TRADE IN PENNSYLVANIA.

The timber or lumber trade of Pennsylvania is exceedingly extensive, and is increasing in such proportion that it is reckoned—at the present rate of cutting—that most of the white pine of the State will be exhausted in four or five years. This will give some idea of the enormous demand for lumber, particularly the white pine and the hemlock logs. The central depôt of the trade in Pennsylvania is Williamsport, a handsome city on the Susquehanna. The timber is cut in the autumn and winter from the huge forests on the slopes bordering the river for two to three hundred miles above Williamsport. The logs are slid down into the stream, and then, being formed into mighty rafts, are floated down to the city by the spring freshets. At Williamsport they are caught by a boom, which will hold 300,000,000 feet of wood at one time. The voyage sometimes occupies several days, and is somewhat hazardous, as the rafts are frequently wrecked—a fact rendered manifestly evident to the visitor by the number of stranded logs left lying along the river shore when the floods subside.

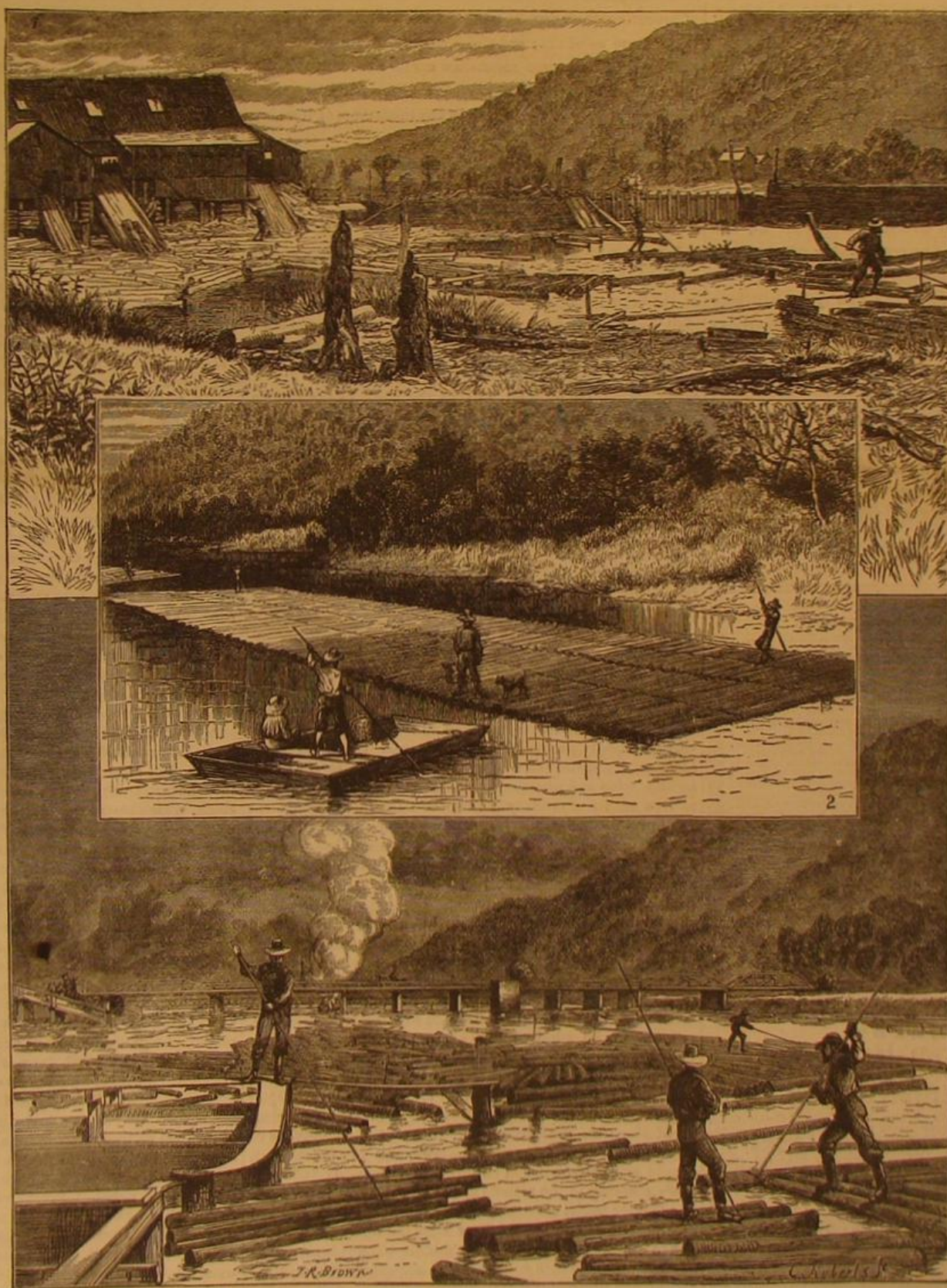
Arrived at Williamsport, the timber is stored in immense ponds until required for the sawmill, or until, once more formed into rafts, they are floated down the river to the mills many miles below the town. These sawmills form one of the chief features of Williamsport, where they number about thirty, and with an annual capacity for turning out 225,000,000 feet of lumber. The machinery in these mills is most ingenious, and quickly converts the huge trunks into logs, cutting them into lengths for building or other purposes. The enormous piles of lumber awaiting a market seem almost incredible to the European visitors, says the *London Graphic*, who are accustomed to look upon timber as a somewhat expensive commodity.

In the upper part of our engraving is shown the great dam at Williamsport above mentioned. In the middle is seen a raft of logs floating down stream and below is one of the lumber ponds, where the logs are stored till required for use or for other markets.

Williamsport is situated on the west branch of the Susquehanna, and is a thriving city, rapidly growing in population and manufactures. Its prosperity is mainly due to the lumber trade, for which the river and the West Branch canal, which flows through the city, afford great facilities. It is surrounded, as our illustrations show, by lofty, well wooded hills, the scenery of which is of the greatest beauty. Of the extent of the trade which is its chief support, much has been written; but its rapid development is still going on,

the timber sawn in this country in 1870 being nearly three times as much as that in 1860. The demand is on the increase, and there seems to be no possible check except the disforestation of the land adjacent to the lumber markets: an event which has long threatened us, and against which we have often warned our readers. When this comes to pass, prices of lumber will rise, and perhaps demand will fall off; and the planting of timber trees, now and for some years to come, is the obvious and only remedy for such a disaster.

of steam as a pump, or, by a simple modification, may be changed into a condensing steam engine. We learn that its manufacture will be at once begun by Messrs. Rumsey & Co., of Seneca Falls, N. Y., under the superintendence of the inventor, Mr. E. G. Shortt. The promptitude with which this recent invention is thus to be brought into practical use shows commendable enterprise on the part of the above firm, while the fact of their undertaking the work is excellent proof of the worth of the machine itself.



LUMBER OPERATIONS ON THE SUSQUEHANNA.

We have no doubt that steps will be taken to avert this threatened damage; but the necessity cannot be too frequently brought before public attention. It is not the present that has to be provided for; it is the future, and the destroying ax may proceed, in the next few years, to work greater havoc than ever in our forests.

## The Mystic Pump.

The above name has been given to the novel steam pumping engine which we illustrated on page 371 current volume, and which either operates through the condensation

the perfection required in bleaching.—Textile Manufacturer

## Bleaching Wool.

MM. Daudier and Son thus describe a new process for bleaching wool. It consists in plunging the wool or vegetable matters into a concentrated bath of chloride of calcium, and submitting them to prolonged boiling; to the bath may be added some hydrochloric acid, or compounds of that acid with metallic bases, such as aluminum, iron, zinc, copper, or tin, which will then act energetically on vegetable matters, while it will produce no alteration on wool.

## Bleaching Cotton.

Some of our readers may find it a great convenience to be able to bleach a few hanks or short pattern warps, in order to get samples round quickly; therefore, we give the following safe method:

Boil well your twist, having first put in the water 2 ozs. of soda ash to the gallon of water; wash off in cold water. Mix 1 lb. of fresh chloride of lime in 2 pints of water, crushing all the lumps, and then add 43 pints more water. After allowing time for the lime to settle, pour off the clear chloride liquor, and immerse the yarn for about seven hours, in a cool place. Care must be taken to keep the chloride solution and the yarn from contact with iron. Wring out and wash in cold water, and do not allow the yarn to remain in the air very long. Then immerse in a well mixed solution composed of 26 drachms of double oil of vitriol to 45 pints of water. Allow the yarn to remain in this acid solution ten hours, then wring out and wash off in cold water. In order to thoroughly remove the acid, work it well through a good white soap bath, and to this add a little marine blue to give the yarn any desired tint. Finally wash through warm water to clear away the soap. These proportions will do the least possible injury to the strength of the yarn. The solutions may be used stronger if it is desired to shorten the length of time of the processes. If soft mule yarn has to be bleached the solution may be used about one third weaker; but if doubled yarn, the strength of the solutions must be increased, according to



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DECEMBER 23 AND 30, 1876.

## THE END OF THE YEAR.

The present issue is the fifty-second and last number of the SCIENTIFIC AMERICAN for 1876.

Saturday is our usual dating day; and as there happen to be 53 Saturdays this year, we adjust them to the 52 weeks, by giving the double date of Saturday, December 23, and Saturday, December 30, to our present number, which finishes the year. No paper will therefore be issued next week.

Our next number, the first of the new year, will bear date Saturday, January 6, 1877. We hope that subscribers who have not already renewed will be prompt to send forward their subscriptions, and thus prevent loss or break in the continuity of their numbers.

We return our heartfelt thanks to the thousands of friends and patrons who have so generously encouraged our labors during the past. They are scattered far and wide throughout the world; but we hold them in the closest esteem. To one and all, we send the kindest greetings for the New Year, wishing them the largest measures of prosperity, health, and happiness.

## Contents.

(Illustrated articles are marked with an asterisk.)

|                                        |     |
|----------------------------------------|-----|
| Alcohol for varnish (2).....           | 409 |
| Animals, extinct, American.....        | 408 |
| Answers to correspondents.....         | 409 |
| Aquarium at Paris.....                 | 407 |
| Arctic expedition, the British.....    | 407 |
| Artist, the, vs. the artisan.....      | 400 |
| Belladonna as a brain stimulant.....   | 405 |
| Bleaching of carbon (8).....           | 409 |
| Bleaching cotton.....                  | 409 |
| Bleaching wool.....                    | 409 |
| Blood, the circulation of the.....     | 401 |
| Blood, transfusion of.....             | 401 |
| Business and personal.....             | 409 |
| Carbolic acid inhalations.....         | 405 |
| Cast iron, strengthening.....          | 405 |
| Cheese, English—its manufacture.....   | 405 |
| Clocks, remarkable.....                | 401 |
| Coal tar, preserving wood by.....      | 402 |
| Concrete blocks for building.....      | 406 |
| Cremation of Baron de Palm.....        | 402 |
| Crystalloid on collodion.....          | 406 |
| Dyeing saffron rose.....               | 406 |
| Electricity, nature of.....            | 405 |
| Electricity, nature of.....            | 405 |
| Fires in theaters, prevention of.....  | 401 |
| Glass, flint.....                      | 405 |
| Glass, coloring (6).....               | 409 |
| Gold and platinum, separating (1)..... | 409 |
| Gold plates, testing (7).....          | 409 |
| Hall, the, for the Centennial.....     | 401 |
| Horticultural notes.....               | 407 |
| How we lived: 1861 to 1866.....        | 404 |
| Ice, elasticity of.....                | 407 |
| Index to volume XXXV.....              | 410 |
| Iodoform (10).....                     | 409 |
| Iron, crystallized.....                | 407 |
| Lace making in England.....            | 407 |
| Laboratory apparatus.....              | 405 |
| Lightning rods (12).....               | 409 |
| Lumber operations, Susquehanna.....    | 409 |
| Mulling ink in cakes (3).....          | 409 |
| Mutilage for postage stamps (9).....   | 409 |
| Needle making.....                     | 403 |
| Nitro-glycerin.....                    | 407 |
| Paint for galvanized iron (13).....    | 409 |
| Patent decisions, recent.....          | 408 |
| Patents, American and foreign.....     | 408 |
| Photographic apparatus, solar.....     | 402 |
| Photographic baths (14).....           | 409 |
| Photography, underground.....          | 405 |
| Planing machine, hand and power.....   | 406 |
| Pump, the Mystic.....                  | 409 |
| Railroad, a single track.....          | 402 |
| Sail, the largest in the world.....    | 402 |
| Sand, musical.....                     | 402 |
| Semolina separator.....                | 402 |
| Silks breaking at the folds.....       | 405 |
| South, life in the: 1861 to 1866.....  | 404 |
| Steel.....                             | 404 |
| Swindle, a new rural.....              | 402 |
| Trellis, a tasteful flower.....        | 405 |
| Ventilation.....                       | 404 |
| Vinegar on millstones (5).....         | 409 |
| Wool, cleaning.....                    | 407 |
| Writing facsimile copies (4).....      | 402 |

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## THE ARTIST VS. THE ARTISAN.

An amusing objection was raised the other day by a literary paper, against Dr. Richardson's proposed City of Health. The sanitary promise of Hygeia was not questioned, nor the desirability of easier and healthier ways of living; yet the utter failure of every attempt to realize such a scheme was confidently predicted, on the ground that everything about such a residence would be so new and matter of fact, so utilitarian and unartistic, that nobody could be persuaded to live in it. Certainly no one of culture or refinement would be able to endure its brand new sanitary and labor-saving devices, or the absence of all those time-honored customs and domestic surroundings which make the average old mansion at once so picturesque and so hazardous to health.

No doubt the critic spoke from honest conviction. Much dwelling upon objects and opinions conventionally regarded as artistic has brought him and others like him to a frame of mind in which ugliness, if only ancient enough and sanctified by artistic associations, is positively cherished. Even squalor and wretchedness—in others—if picturesque, is more to be admired than any commonplace trimness, however wholesome. To minds of such artistic sensibility a laborer well fed and comfortably clad has no attractions; the same man picturesquely gaunt and ragged is an object to look upon with rapture, to draw, or to paint. So a cluster of shanties, perched on the rocks of Mackerellville or huddled in one of its muddy hollows, and swarming with ragged and half-famished children and goats, is infinitely more pleasing to the artistic eye than the finest row of garden-fronted model cottages ever occupied by a thrifty and comfortable community of New England operatives. It is one of the traditions of art to admire such things, and in admiring them artists and art critics are simply true to their calling and professional training.

But where there is one who can legitimately look at life from that point of view, there are scores who pretend to do so because they think it essential to high breeding, culture, and all that sort of thing. The artist delights in old things either from their intrinsic beauty or because from their age they have acquired artistic associations; therefore those who ape the artist think they too must declare "the old is better," and deplore the tendency of the age to depart from the ways of the fathers. Who ever saw a sewing machine in a Dutch interior by one of the old masters? or a stationary wash-tub? or any other of the modern utilitarian devices for the kitchen? How then can such things consist with true artistic feeling? Away with them!

A pretty illustration of this sentimental reaction against modern improvements, and the eagerness with which it is caught up by certain would-be aesthetic people, appears in—and in the circulation of an extract from—one of Clarence Cook's clever papers on furniture in *Scraper's*, just now going the rounds of the newspapers. We would be the last to deprecate the service which Mr. Cook is doing in these papers by directing the attention of furniture makers and buyers to simpler and at the same time more sensible and artistic styles of house furnishing and adornment than formerly prevailed, or to question the sincerity of his affection for the antique. Finding his models of excellence chiefly in old-time works of art, he has naturally come to look upon antiquity as almost in itself a certificate of merit. So when he finds in classic art representations of an abandoned arrangement for hand washing, he straightway falls in love with it and advocates its re-adoption.

The illustration he gives, from a woodcut by Albert Dürer—a trough attached to the wall and supplied with water from a metallic or earthen globe suspended above by a rod and chain, with an old style roller towel hanging beside it—is certainly ugly enough to delight any artist; but it does not strike us as at all a contrivance calculated to supplant anything now in use except it be the tin wash basin on a stool, still to be seen in some back country kitchens. Mr. Cook thinks such an exposed cistern ever so much more convenient and pretty than the secluded marble basin in common use in our cities: but then Mr. Cook professes "such a dislike, to the whole of what are called in housekeeping 'modern improvements,'" that his preference may be easily accounted for.

"I am well aware," he goes on to say in justification of this fancy, "that there is a sufficient reason for our American wholesale adoption of mechanical contrivances in the miserably inefficient character of our servants. In nine cases out of ten we use gas, furnaces, and plumbing, instead of lamps or candles, open fires, and movable washing apparatus, because it saves immensely in the labor and expense necessary to carry on a household. But now-a-days, when better servants are to be had, and 'service' is getting to be more and more a profession, we may reasonably plead for a more domestic and less hotel and steamboat way of living, knowing that in doing so we are pleading also for healthier ways of living, and not merely for picturesque-ness."

True enough: we do need healthier and more domestic ways of living; but it seems to us that we are not so likely to get them by increasing the number of our "domestics," or by a reaction against labor-saving contrivances, as by the increase and perfection of such household conveniences. The increasing intelligence of servants, so far from doing away with the need of mechanical helps, really adds immensely to their practicability and usefulness. As every housekeeper knows, the chief objections to most "modern conveniences" have arisen from the ignorance and stupidity of servants with a genius for converting labor-saving and sanitary inventions into trouble breeders and traps for disease. What seems to be really wanted, therefore, is not fewer improvements, but more and better ones—devices so well contrived that stupid servants cannot easily make them go wrong: or better still, so automatic in their action that the mediation of human intelligence or stupidity, in their sphere of action, is unnecessary.

A trusty servant to call one in the morning, one not likely to forget or mistake the hour, is undoubtedly a great convenience. But after all, the best of servants may oversleep, or in a thousand ways fail to do one's bidding as surely as a clock, which costs less, takes up less room, never intrudes upon one's privacy, and never forgets to perform its allotted task. So in every department of household service, there is much to do which mechanism can do more cheaply and satisfactorily than muscle, and ultimately mechanism will get the work to do. And we have no fear that in course of time the artistic mind will become reconciled to the new order of things. The most venerable of our domestic surroundings was once an innovation, and the most modern of modern improvements will acquire with age the associations which artists delight in. But whether they hold their own or are supplanted by something newer will depend, not on the plaudits or protests of sentimentalists, but on the inventive skill of those who seek for something better.

## TRANSFUSION OF BLOOD.

About half a century ago, a great discovery was heralded in medical science, namely, the transfusion of blood from one individual to another, by which process, it was claimed, the sick and weak were at once to be made well and strong, and even old people rejuvenated, by the transfer of youthful blood into their veins and arteries. At that time the medical papers reported the most astounding results and prophecies of still more astounding realizations, which were, however, soon proved futile; and the excitement gradually died away, and before long the whole subject was almost forgotten. But it was too important to be neglected by the medical profession, and it has been revived in Europe, notably in France and England. Recently at a clinic in one of the Manchester (England) hospitals, the attending surgeon came to the bed of a young patient who had lost so much blood by the amputation of a limb that he became moribund, his death being momentarily expected. The surgeon told his class that this was one of the rare cases in which the life of an individual could be saved by transfusion of blood, and at once a noble medical student offered himself for the experiment, and allowed over sixteen ounces of his blood to be transfused into the veins of the dying patient. The result was perfectly satisfactory;



the sufferer revived, in two hours afterwards he recognized people, and he was soon on the way to recovery. This incident, being published in the newspapers, has given occasion to the renewal of the discussion among semi scientific and quasi medical editors; and, as in the beginning of this century, when the subject was first agitated, all kinds of absurd ideas are being promulgated, such as that the old can be made young again by the influence of the transfused blood: the weak can be made strong, the sick healthy: and even bad tempered people can be made lamb-like by transfusion of sheep's blood, and cowards courageous by the infusion of the blood of a dozen or so of game roosters. The conditions in every case are the draining of as much defective blood as is to be replaced by the more perfect material. Of course such ideas are merely idle notions, and in no case can transfusion of blood do any good, except when a temporary relief is needed at a critical moment.

It should be remembered that old blood is always being consumed, and new blood is continually being manufactured in the system, from the chyle into which the food eaten is first transformed. In this strange manufacturing process, the whole digestive apparatus, with the mesentery and liver, spleen and lungs, continually takes part; and if these organs act inefficiently, the blood is defective, and transfusion can only effect a temporary correction, because, as soon as the transfused blood has been consumed by the continual wants of the system, it is again replaced by blood identical to that manufactured by the defective organs which produced the original defective fluid.

Blood is a constantly and absolutely necessary fluid in the economy of any animal with a circulation; but this does not mean that it has a constantly unchanged nature. On the contrary, it is the universal material which is to furnish to every organ all the materials needed to replace the continual waste, of muscular tissue or fleshy fiber to the muscles, nervous matter to the brain and nerves, phosphate of lime to the bones, etc. Blood is therefore continually in the torrent of its circulation to the most remote parts of the body, being deprived of the most important constituents which it carries; and without an equally continual supply of these constituents, it is soon unfit for further use in repairing the bodily waste. It is thus seen that the cause of poor or diseased blood is not to be looked for in the blood *per se*, but in the organs of which the function is blood making; and if these are defective, no transfusion can possibly be more than a transient benefit, and the attention of the rational physician should be directed to the defective organs in question and not to their result.

#### THE PREVENTION OF FIRES IN THEATERS.

The recent burning of a theater in Brooklyn, N. Y., was attended with a loss of life under circumstances which render the disaster one of the most horrible ever known. While the last act of the play under representation was in progress, a border—as the hanging piece of scenery used to represent sky, etc., is technically termed—was blown by a chance draft into a gas light. The men stationed in the vicinity saw the accident and quickly cut the burning portion away. They forgot, however, that over the stage below a canopy had been extended to represent the roof of a house, and therefore, instead of falling on the stage, where its burning would probably have done no harm, the ignited fragment fell on this light wooden and canvas framework, and in an instant set it in a blaze. The flames at once extended to the adjacent scenery; and before the audience had fairly become aware of the danger, the fire covered the whole stage.

There were at the time about 1,000 persons in the building, 400 of whom were in the highest gallery. Those who had seats on the lower floors, despite the terrible panic which arose, managed to gain the entrances; but the unfortunate persons above, crazed by fear, blocked the narrow passages, filled the stairways, and then the latter gave way under the weight. The entire crowd was precipitated down into the lobby, and through the burning timbers into the cellar. Meanwhile the fire raged furiously, and in a very short time the walls fell, leaving the theater in a heap of ruins. Although the fire department was promptly on hand, and dozens of persons were fighting the conflagration, no one discovered the frightful loss of life until the following morning, when access to the interior became possible. Then bodies were exhumed in literal masses, packed together tier upon tier like cord wood. Over three hundred, as we write, have been removed, and it is believed that, when all the rubbish can be cleared away, but few of the four hundred who filled the gallery will be found to have escaped.

The reasons that made this disaster possible are threefold: First, insufficient means of egress from the upper gallery; second, absence, it is alleged, of fire-extinguishing apparatus behind the scenes; and third, neglect to render the highly inflammable canvas, etc., fireproof.

It appears that for all ordinary purposes the stairways leading from the gallery were ample. But, as must be the case with all such means of exit under like circumstances, they were quickly blocked by a frantic and struggling crowd. It is scarcely possible to suggest any mode of access to lofty galleries which is not open to the same objection. The apparent remedy is to abolish high galleries altogether, and to allow but a single tier above the ground floor. While high galleries are in existence, however, it is clear that special fire escapes should be provided.

Regarding the second reason, nothing but the grossest negligence can suffice for its explanation. From all accounts a jet from a fire extinguisher, had one been handy, would have put out the incipient blaze. It seems to us that theaters would find a great safeguard in the system of per-

forated pipe fire extinguishers which we described some years ago. They consist simply in a series of pipes which may run parallel with the gas tubes, occupying but little space and being entirely out of the way. When the water is turned on, it escapes everywhere from the perforations made along the length of the pipes, and drenches the vicinity thoroughly. By this means, aided by some large tanks of water suitably disposed in the roof, a stage and all its appurtenances might rapidly be flooded.

Lastly, and with reference to the third reason, managers will find that they will consult their best interests if they adopt, or at least test, some of the suggestions which inventors have advanced for protection against fire. Canvas soaked in a solution of tungstate of soda will not burn even if held in a gaslight. We have saturated thin gauze with a solution of this salt and failed to make the fabric blaze. This wash might probably be applied to scenery with no more difficulty than the sizing with which every artist covers his canvas before painting thereon in distemper colors. A strong wash of alum might likewise prevent sudden ignition. For permanent hangings, such as are used about prosceniums, there is no reason why a canvas with which asbestos is interwoven should not be used. Asbestos ground fine and mixed with paint gives body to the pigment, and, while not wholly fireproofing the material to which it is applied, might prevent ignition by a chance spark. It would probably be difficult to make canvas covered with a wash of silicate of soda (water glass) catch fire quickly. A wash of green vitriol and alum, applied hot, and covered with a second coat of green vitriol and pipe clay, is said to render light wooden framework fireproof; or instead of wooden frames, light iron frames might be made, which would take up less space, and would be of course unflammable. Lastly, it is suggested that every theater should have a wire gauze drop curtain large enough to completely cut off the stage and its appurtenances from the auditorium. Such a curtain promptly lowered might effectually check the progress of flames toward the audience. In some theaters in this city, scenes are now painted on wire gauze when intended to be transparent. If plaster were used to fill up the perforations, the gauze might be a valuable fireproof substance to replace canvas, for flats and other scenes attached to frames.

It is a sad task to suggest means of prevention after such terrible damage has been accomplished: all the more so because such means might have been applied had ordinary forethought been exercised. It remains for the public to insist upon such safeguards so strongly that another such dreadful calamity will be effectually prevented. There is scarcely a theater in this city that is provided with sufficient means of egress from its gallery, and not one where just such a fire as lately took place might not occur behind the scenes.

Within the last ten years, nine theatres have been destroyed by fire in New York city alone. This puts the average at about one a year. Meantime, in the other cities of the country, twenty-eight theatres and concert halls were burned. These facts suggest how great are the risks which these structures run, and the need there is of better protection against fire.

#### REMARKABLE CLOCKS.

We gave, on page 371 of this volume, a description of a clock, which has the odd feature that it oscillates while the pendulum is stationary. The novelty of this clock (the invention of M. Guilmet) is in the form; the principle is old, and clocks may be seen, suspended in shop windows, which oscillate like pendulums, while the escape wheel works on an anchor on the top of a pendulum rod, which, however, in place of being movable, is fixed in the table under the clock, making it stationary; while the escape wheel, by the reaction of the pressure on its teeth upon the anchor, moves to the right and left, and communicates this movement to the whole clock. Usually the suspension rods of these clocks are of such a length as to make the whole clock a seconds pendulum; and these rods are composed of bars of steel and brass, to compensate properly for changes of their length by temperature. In this case, these clocks are, if well made, excellent time pieces; and they are often used by watchmakers as regulators.

Another remarkable kind of clock which recently has been imported, and put on exhibition in New York city, consists of a glass disk with the figures of the hours on it and hour and minute hands loosely slipped on a pivot in the center. The hands can be taken off, and no works whatever are visible, nor can any connection of the hands with anything be seen, notwithstanding that the hands point always to the right hour and minute; and even when turned round or even whirled by hand they will, after some revolutions and oscillations, come back to the right place. They are well called mysterious clocks, and spectators are assured that they are not moved by electricity. This is true; and the whole secret is in the counterpoise of the hands, each of which has a heavy arrow point at the long end, and at the short end a hollow round box. In this box are the works of a watch, which are so placed as to leave an annular space between them and the circumference of the box; and in this space is a counterpoise which is connected with the works so as to revolve once in 12 hours for the hour hand, and once in an hour for the minute hand; the revolution of the counterpoise inside the box shifts the center of gravity of the hand, so as to give the hand, successively, the necessary direction. Thus, when the counterpoise is the furthest from the axis, it brings the center of gravity opposite the arrow point, and the hand will point upward to 12; when, on the contrary, the counterpoise is between the

axis and the arrow point, the center of gravity will be there, and the arrow will point downward, to 6. In the intermediate sideward position of this revolving counterpoise, the center of gravity of the whole will be displaced sideways, and the hand point at 8, 9, 10, or 2, 3, 4, according to the shifting.

This clock was patented in this country on September 1, 1874, by Henry Robert, a clockmaker of Paris, France. Late-ly Mr. Robert has considerably improved on the plan, especially by using very light and very heavy metals in combination, so as to have a sufficient contrast in weight for obtaining the right effect. The hidden counterpoise, moving in the hollow box, is of platinum, so as to take up as little room as possible, and the hand with its arrow point is of aluminum, the lightest known metal.

#### THE CREMATION OF BARON DE PALM.

It is not exactly clear what the gentlemen who invited a number of physicians and scientific men to visit an out-of-the-way little Pennsylvania town, and there to witness the burning of an embalmed corpse, expected to prove by the operation. The deceased, an eccentric person named Baron de Palm expressed, before dying, a desire to be cremated. His equally eccentric executors felt morally bound to accede to his wishes; but instead of quietly and decorously burning the body, say in any gas retort or puddling furnace, they used a special apparatus constructed in the village aforesaid, after lavishly advertising the show and themselves for several weeks in advance. In the presence of a crowd, numbering very few scientists but very many newspaper reporters and morbid sight-seers, the withered corpse was placed in an iron basket, shoved into a retort heated to 2,300°, and in three hours it was reduced to ashes. Cost, ten dollars.

We venture to think that most people, even before this experiment took place, knew that a human body can be incinerated at the above high temperature in a brief space of time: and that it is no difficult matter to lead away evolved gases. Hence we fail to see wherein the much vaunted scientific interest of these crematory proceedings existed. So far as their effect upon the public mind is concerned, the sentiment left after the perusal of the published details of the burning and of the scenes attending it will savor strongly of disgust.

#### WHO DISCOVERED THE CIRCULATION OF THE BLOOD?

Strictly speaking, it was not one brilliant stroke of genius or good fortune, but a long series of investigations by different hands, which resulted in a true understanding of the circulation of the blood. And as with most epoch-making achievements in Science, so with this: while no one experimenter or thinker can certainly be credited with the first clear perception of the new truth, fame has given, and perhaps justly, the laurels to the man who was able to compel its acceptance by an unwilling world.

For two centuries that credit has been given to Harvey, for his masterly demonstration of the mechanism of the veins and arteries, and his not less masterly advocacy of the new doctrine. It is not as clear, however, that he was absolutely the first to detect and describe the true office and character of the circulatory system. It is certain that the nature of the pulmonary circulation was understood and taught by Italian and other physicians before Harvey's studies began; and more than a hundred years ago Moreri claimed that the honor of discovering and demonstrating, by experiment and reasoning, the nature of the greater or systemic circulation was really due to the Italian physician and naturalist Andrea Cæsalpin, commonly called Cæsalpinus, who published his "Exercitatio Anatomica de Cordis et Sanguinis Motu," in 1628.

Lately Professor Ceradini, of Genoa, has renewed the claim so successfully that a monument has been erected to his countryman's honor in Rome, and a tablet recording the discovery is to be fixed to the portals of the University of Pisa, where Cæsalpinus taught before he removed to the neighborhood of the Vatican, as physician to Pope Clement VIII. There is no proof, however, that Harvey knew anything about the work of his predecessor and rival, whose book does not appear to have received much attention even at home. And there is no question of the fact that the doctrine was first publicly discussed and combated as Harvey's, in Europe as well as in England. Within a century of the death of Harvey, it must be remembered, the father of modern physiology, Haller, revived the whole controversy, and gave a verdict in favor of the English physician. Holding that the true discoverer of any truth is he who draws it from its sources "at his own risk and by his own meditations, and establishes it by arguments so forcible that they convince those who are longing for the truth," Haller decided that "not to Cæsalpinus, on account of a few utterances of obscure meaning, but to Harvey, the laborious author of numerous experiments and the expounder of all the arguments which, in his time, could be advanced, belongs the immortal glory of the discovery of the circulation of the blood." As Haller was not a countryman of either claimant, there is no reason to suppose his decision other than impartial; and whatever Italian pride may lead to, it is altogether likely that the rest of the world will continue in the belief, so long entertained, that Harvey's fame was fairly won.

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## IMPROVED SOLAR PHOTOGRAPHIC APPARATUS.

In our recent articles on the supposed planet Vulcan, we noted the suggestion, made by the celebrated physical astronomer, M. Janssen, that at certain observatories a continuous photographic record of the sun's face should be kept, so that if by any possibility Vulcan should make a transit, the fact would be indelibly stamped on the record. For this purpose, the revolving photographic apparatus, formerly used during the transit of Venus, was proposed. This machine works automatically, and goes on taking dry plate photographs until it runs down.

The apparatus is represented in use in Fig. 1, and its detailed parts are shown in Figs. 2, 3, and 4. It is fixed at the extremity of a long wooden telescope which serves as a dark chamber. The telescope is mounted on a heliostat, which is moved by clockwork so as to follow the sun.

The construction is as follows: On a common axis are mounted: 1st. A copper disk, C, Figs. 2 and 4, fixed on a wheel engaging with the pinion of a clockwork train, M. 2d. A large wheel, R, carrying a plate of silvered copper, P, which receives the images. On the disk, C, are made twelve openings, F, Figs. 2 and 4, equally spaced. This disk makes its complete revolution in 18 seconds, while the wheel carrying the Daguerrean plate turns with one fourth the velocity—that is, once in 72 seconds.

In any photographic operation there are three processes: The opening of the light aperture, the posing, and the closing of the aperture. The disk, C, is the obturator, which opens and closes the aperture, while the plate, P, comes in place to receive the image. The three operations are accomplished in one second and a half.

The plate wheel, R, is governed by a Maltese cross wheel, which allows it to move over a certain part of its revolution, and then permits it to stop for a brief period. This stoppage occurs just as one of the openings, F, in the disk, C, comes in focus of the dark chamber. The other details of the instrument are as follows: O is a square for mounting the clock movement; F is the passage of the luminous ray and focus of the telescope; M, Fig. 2, is the connection of the clockwork wheels with those carrying the photographic plates and obturator; T and D are drums and plates for closing the photographic chamber exactly, and L is the tube of the telescope.

## A Single Track Railroad.

The San Francisco Examiner of November 25 says: "Yesterday the steamer Sonoma conveyed to Norfolk, on Sonoma Creek, a number of our prominent citizens, who assembled to witness the opening of the Prismoidal Railroad. The road commences at Norfolk, on Sonoma Creek, and extends three and a half miles towards Sonoma. The steamer arrived in good season at Norfolk, on Sonoma Creek, the terminus of the Sonoma Valley Prismoidal Railroad, where the party landed, and at once proceeded to inspect the line and the works generally. The Prismoidal Railroad is laid upon a prism of wood built of beveled boards, forming a continuous prism 27 inches wide at the base and 15 inches high, with the single rail laid on the top. The car which travels on the line is supported by two wheels, one at the front and one at the rear, with independent revolving flanges. On arrival, the first thing to be done was to test the road, and in a few minutes platform cars, with a prismoidal railway locomotive between them, were at the stations. The locomotive is the first of its kind constructed in this State, and was built under the superintendence of George W. Fogg, of the Pacific Iron Works. The party took their places on seats which were ranged on each side of the cars, the passengers being face to face. The first impression suggested was that which ordinarily fills the bosom of the novice who makes his maiden effort to ride the uncertain bicycle. A certain assurance that the whole thing would topple over at the first movement was the general belief of the uninitiated. But the engineer sounded his whistle, the passengers gave their tremulous cheers, and the train moved off smoothly, and soon the pace was considerably augmented. Wonderful to relate, the oscillation was scarcely perceptible, and the locomotive and cars rode the single rail as firmly as the trains on the broadest of English solidly constructed broad gages. The faster the train proceeded, the smaller in number and extent became the lateral oscillations, beautifully and practically exemplifying the great principles of

the whole prismoidal system, that the greater the speed, the less the liability to oscillate, a principle clearly demonstrated by the gyroscope and velocipede. To those making their first trip on the new railroad, the ease and comfort of this mode of traveling suggested itself most strikingly. The train was run out to the end of the completed line, where forty-five men were found continuing the building of the prism onward. The construction of the road has cost, for the present three miles and a half, including the cost of the road bed over the marsh, about \$4,500 a mile, one half of the cost of the narrow gage railroad, the most economical of

water, 39 lbs of caustic soda of 66° to 76° Baumé, and then adding 22 lbs. of white resin or colophony, boiled for half an hour. This must be done in an enameled metal or wooden vessel. The rest of the process is as usual, the wool being rinsed in water after cleansing. The quantities given above are about sufficient for 2 tons of wool, but this depends upon the quality of the latter.

## Musical Sand.

On page 154 of our current volume, we should have said that the microscopic examination of the sand was made by Professor Blake, and not Mr. Frink, as stated. In a recent communication to us, Mr. Frink says: "I do not coincide with him (Professor Blake) as to the cause of the sound. There are two ways in which the sound could be produced, which suggest themselves to me: 1. From the peculiar forms of the cavities in these coral sands, each and every cavity is sonorous like a hall, and multiplication of these unnumbered millions of voices produces the imitation of the rumbling of distant thunder. Or, 2, that the passage of air through the cavities causes the walls to vibrate like the reeds in musical instruments." Mr. Frink brought with him from the banks in Ranai, Sandwich Islands, two closely packed bags of the sand, each bag containing 90 lbs. In San Francisco, the sand was apparently as sonorous as when taken from its native banks; but after a railroad transit of two thousand miles, to Illinois or Iowa, it seems to have wholly lost this property. This is very probably due to the dampness of the elements. Mr. Frink continues: "As to the origin of the sand, none of it is sonorous except the coral, and that is from a pecu-

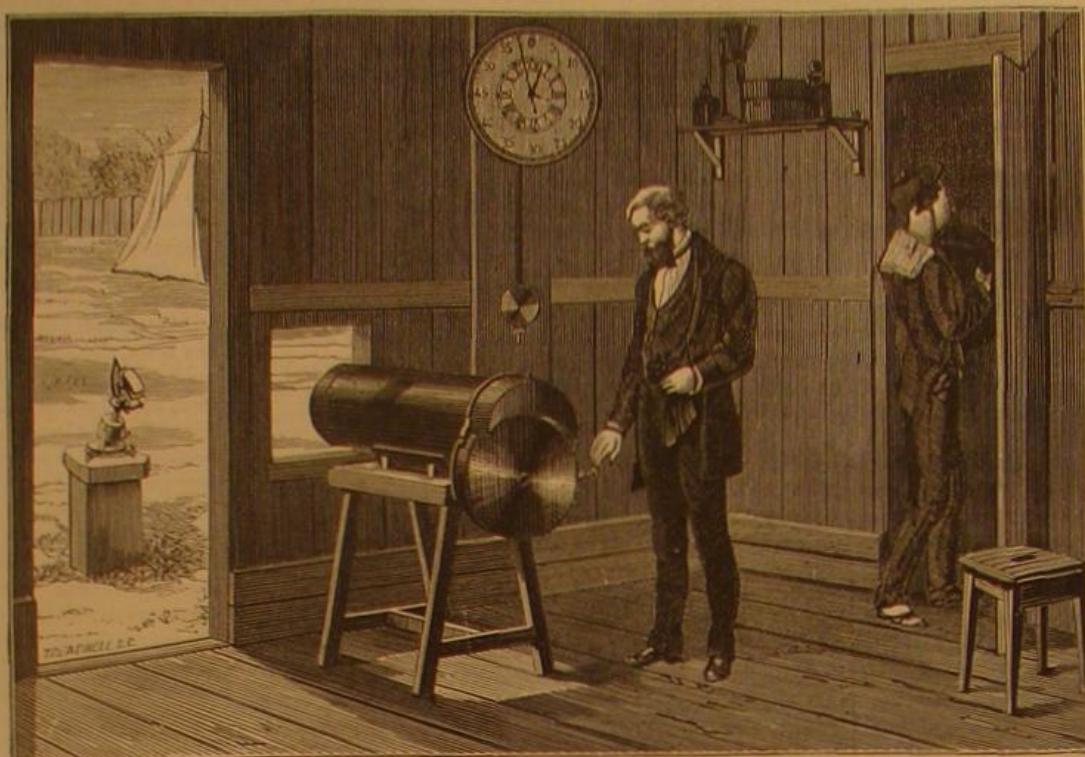
liar species. On the island of Nihau, twenty miles from Ranai, there is a similar bank. There is one bank near Kalou, on the island of Ranai, that is partially sonorous, but the sand is mixed with so much other coral that the sound is very weak. This bank is more than thirty miles from the others, but on the same island."

Mr. Frink kindly offers to supply any one, wishing to investigate the subject, with a suitable quantity of the sand. On the Pacific coast, as has been stated, if a pint bottle, half filled with the sand, or shaken rapidly up and down, so as to drive the contents quickly from one end to the other of the vessel, a distinct musical sound could be heard; but after transportation to the inland States, the sand failed to respond when similarly treated. Having received a portion of this sand, we subjected it to the following treatment: When shaken in a bottle, as described, we could not detect any marked difference between the noise produced by it and that of ordinary ocean sand, of the same sized grains, under the same conditions. Both kinds of sand were then dried in an evaporating dish at a temperature of 100° C. (212° Fah.), and

allowed to cool in desiccators over sulphuric acid. When the experiment was repeated with the dry sand, we had no difficulty in recognizing the coral sand by the peculiar sound produced. A large bottle, with a long body and narrow neck, was employed, the open mouth being connected, by means of a piece of flexible rubber tubing, with a small funnel, which was placed to the ear when the bottle was shaken. The same experiment was tried with a wooden vessel in place of the bottle. The sound is without doubt produced, at least in part, by the reverberations from the walls of the little caverns and the vibrations produced in the air itself, as in an organ pipe. The accumulation of all these little echoes and pipings would, we think, in the aggregate, amply suffice to produce the subdued roar, the statements of which, we are assured, have not been exaggerated.

The grains of the coral sand are somewhat larger than ordinary sea sand, their average dimensions being about one millimeter (0.039 inch). They consist principally of carbonate of lime, and of course dissolve almost completely in dilute acids. The little pebbles and variously colored shells form very interesting objects under a low power microscope.

COAL TAR A PRESERVATIVE OF WOOD.—We often notice that coal tar is named as a preservative of wood, and the comment is correct if those who advise would add that, in using, it must have the acid in it destroyed by mingling fresh quicklime with it. Half a bushel of lime, freshly dissolved and mingled with a barrel of tar, has kept posts, saturated with it and planted in clay ground, perfect over 20 years.—F. R. E., in the Cultivator and Country Gentleman



JANSSEN'S SOLAR PHOTOGRAPHIC APPARATUS.—Fig. 1.

the two rail system. The road was commenced on the 16th of August last by the building of the road bed.

## A New Rural Swindle.

The "granger" is now the object of a new swindling dodge, which deserves the palm for ingenuity. A substantial looking person, perhaps with a companion or two, drives up to the door and announces himself as a large butter dealer or agent of some large concern. He inspects the granger's dairy and stock of butter critically, and finally enters into a contract to buy all the butter the farm can produce at some exorbitant figure, say fifty cents a pound. The reason he gives is that butter is on the rise, supply is limited, demand never so heavy, he is willing to pay to insure a good stock, etc., etc. Then he departs, and the granger revels in dreams of affluence.

In about a week, along comes a herd of milch cows on their way to some other village. They stop to rest near the granger's house. He is especially interested in cows just at present, is of course anxious to add to his dairy facilities,

Fig. 2.

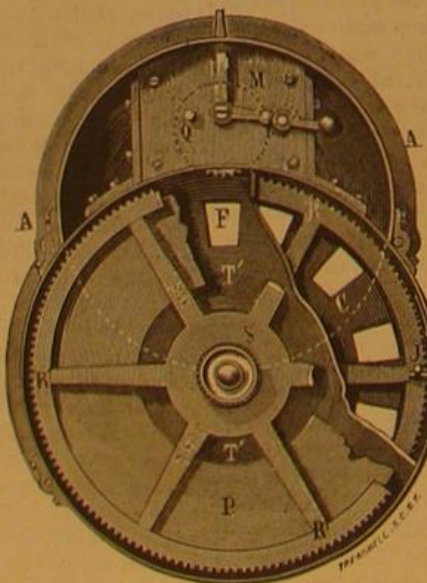


Fig. 3.

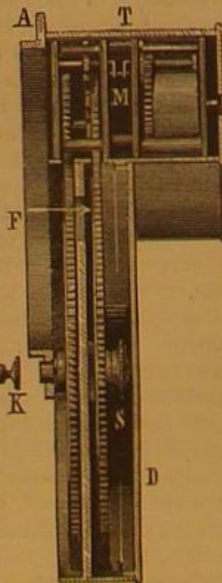
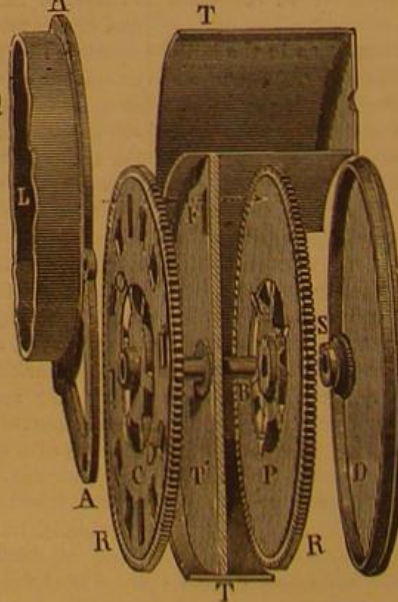


Fig. 4.



JANSSEN'S SOLAR PHOTOGRAPHIC APPARATUS.

and so he talks about purchasing to the drover. The latter don't want to sell—these animals are choice stock—can command fancy prices—all butter cows, etc. Granger bids high—higher, and finally, as a great favor, is permitted to buy a few animals at an exorbitant figure. Then the herd moves on. After a while the granger discovers that he has purchased some very indifferent beasts. He also learns that several of his neighbors have done likewise, under like motives. But neither he nor his neighbors ever hear of the butter dealer again.

## Cleansing Wool.

M. C. Hammelrath announces that he has succeeded in making the following improvement in the process of wool-cleaning, which consists in dissolving in 66 gallons of hot



## ENGLISH CHEESE—ITS MANUFACTURE.

Probably the best as well as the most famous English cheese is Cheddar, the excellence and sweetness of which depends as much upon the management of the processes of manufacture as upon the quality of the material used. It is made principally in Somersetshire, and is produced in the following manner: The evening's milk is placed in cooling vats so that it will be brought to a temperature of about 60° by the following morning, when the morning's milk is added, and the temperature raised to about 80°. The large vat which contains the milk is gently heated in the water bath; and when the milk reaches the last mentioned temperature, sufficient rennet is added to cause coagulation in about forty minutes. Some whey is added to hasten the development of lactic acid, and finally, when the curd has become sufficiently firm, it is cut with curd knives. It then contracts rapidly, expressing the whey; and in about twenty minutes it becomes quite firm, when it is broken into small pieces by a wire shovel breaker, and the temperature raised to 98°. The whey is now drawn off, and the curd left for about twenty minutes longer, when it becomes a coherent, partially solid mass.

When firm enough, it is removed, broken into thin flakes, and spread out to cool. After the lapse of another twenty minutes, it is turned over and left until it attains a peculiar mellow and flaky condition, well known to the experienced cheese maker. By this time the temperature has been reduced to about 70°. The curd is now put into a hoop and pressed gently for about fifteen minutes to drive out the whey, by which a too rapid fermentation is prevented. It is then taken out, cut into small bits by a curd mill, and then salted with 1 lb. of salt to 56 lbs. of curd.

The curd is now again placed in the hoops and kept under process for from 20 to 24 hours. It is then removed and the sharp edges pared off, after which it is turned, banded, and put in the press again for a day or two longer. The temperature at which it goes to press is a matter of great importance, because, if too high, fermentation with evolution of gas is liable to take place and make the cheese porous. Cheddar goes to press at about 65°. While in the curing room, which is kept at 70°, the cheese is rubbed with melted butter and turned over daily.

Cheese is usually classified into cream, whole milk, skim milk, and sour milk cheese. To the first class belong Stilton, cream Cheddar, and Cotham. Whole milk cheeses are Cheddar such as above described, Cheshire, best Gloucester and Wiltshire. Some Gloucester and Wiltshire cheeses are made of skim milk. Sour milk cheese is principally Dutch.

A great cheese fair was recently held in London, England, and of this we give several illustrations, for which we are indebted to the London Illustrated News. A large cheese vat is represented, capable of holding 500 gallons of milk. The men are engaged in what is technically termed cutting up the curd, an operation effected with a kind of rake. The steam required for heating the milk and other purposes connected with the manufacture was supplied by one of Burford & Co.'s steam generators. Another illustration shows the curd mill at work; after which we have what is called the filling-in of the vats: that is to say, of the molds from which the cheese takes its particular form. The cheese presses, also shown in our engraving, are the same that the Aylesbury Dairy Company use in their factory at Swindon.

In the cream and butter section of the Company's stall three fifty-gallon creaming tins, of a special pattern and each giving a skimming surface of twenty square feet, were exhibited. Churns, too, were seen at work as represented in the engraving, which also shows the system of making up the butter in pats. Upwards of 300 lbs. of this butter and more than half a ton of cheese were made at the Aylesbury

Dairy Company's stall, during the few days the show continued open, from the milk of the cows exhibited.

## Needle Making.

The *Journal of the Society of Arts*, London, gives the following account of the processes which every needle has to go through in its process of manufacture:

Redditch, in Worcestershire, England, and Aix-la-Chapelle, in Germany, it states, may be regarded as the seats of the needle trade of the whole world, comparatively few needles being made elsewhere; English needles are, however, more in request than those of any other country. As the needles undergo a considerable number of processes, from the rough steel wire to the highly polished hand instrument, which is not yet superseded by its machine competitor, perhaps some account of their manufacture may be found not uninteresting.

to rotate against the stone between the fingers and thumb of the operator; and the subtle dust from the stone and the needles was inhaled with the breath, and found its way into the lungs, causing the malady known as grinders' asthma, to which all grinders succumbed at an early age. All this is now changed, however. The needles are made to rotate between two india rubber bands traveling over the concave face of the grindstone, of special quality, obtained from Frankfurt; and the fine dust is carried off through a channel under the grinder's seat, by an exhausting fan, which does duty for all the stones.

The middle portions of the wires, now pointed at both ends, are next brought under a falling die, worked by the foot, which stamps the gutter for the eye, roughs out the heads, and marks the position of the eyes. The flattened portion has become hardened by the blow, and this hardness has to be removed in the annealing oven. The holes for the eyes are then punched out by a pair of small punches in a hand screw press; these punches require careful workmanship, both in making and adjusting, and employ special operatives, who work with magnifying glasses like those of watchmakers. A number of the pairs of needles, still united, are then threaded or spotted, as the term is, on a pair of fine wires; and the burr or fin, made in stamping the heads, is then removed by a file. After the lengths have been divided, by bending the wires backwards and forwards between the two spits, the rudely formed needles, now for the first time separate, have their heads rounded off by filing, especial care being taken to avoid weakening the eyes.

The needles are next heated in small iron trays, and then dropped separately into cold oil, which makes them very hard; they are then tempered by being heated on a hot plate, or in a charcoal stove, until a dark blue film forms over them. These two operations cause some amount of warping, to counteract which the needles are straightened by hand hammers on small anvils. To ascertain if they are straight, the needles are rolled by the finger on a smooth steel plate, and such as do not run smoothly are again straightened with the hammer.

The next operation is scouring, to remove the black coating, and give the needle that high polish which is necessary to enable it to pass readily through the fabric. Formerly, from seven to eight days were occupied in the case of best needles by this one process; but now the time is considerably shortened, owing to improvements in the appliances. The needles are weighed out into lots of from 400,000 to 500,000 each, according to size, and tied up with emery powder, oil, and soft soap, in a square piece of strong canvas, and securely bound with cord, thus forming rolls or bundles about two feet long and three inches in diameter. These bundles are rolled backwards and forwards in the scouring machine under a heavily weighted slab worked by cranks driven by the engine.

This process is repeated from seven to eight times, according to the quality of the needles, the needles being washed in soapsuds after each scouring. The final polishing is accomplished in the same manner, but with putty powder, and the needles are then dried in ash wood sawdust.

The needles are now highly polished and well tempered, but with the eyes not yet perfect. The heads are all arranged in the same direction by gradually bringing them up to the edge of a board, and letting the heavier heads fall over, so that they may be taken up and turned the other way; this is done by means of a couple of metal plates, as touching the needles by the hand would cause them to rust. For picking out defective needles, which must be done by hand, an operative of the gentler sex is chosen, whose hand is cold and dry. Before the eyes are drilled, they are softened or blued, by being made to pass through a gas flame by means of a revolving wheel, which picks them up by an ingenious



CHEESE AND BUTTER MAKING AT THE LONDON DAIRY SHOW.



arrangement. This seems to be the only process where any inconvenience is felt by the operatives, who complain of headache after remaining for any length of time in the room where several of these gas flames are burning. The withdrawal of the fumes from the gas by a hood and exhausting fan, like that used for the grindstones, would obviate this inconvenience. The eyes of the drilled eyed needles are smoothed by a fine countersunk drill of delicate workmanship, several drills being driven by one pulley. The eyes are polished by being again spitted on wires smeared with emery and oil, and hung in a frame made to travel backwards and forwards by the engine. As the wires are stretched in a direction oblique to the line of motion, the needles are shaken about in different directions so as to effectually round out the eye. Both heads and points are finished on small grindstones of very fine texture, a number of needles being rolled together between the finger and thumb, then polished in the same manner on emery buff rollers.

After passing through these multifarious operations the needles are at length quite finished, although some extra qualities now have their eyes gilt by the electrotype process; all that remains to be done is to put them up in packets, generally containing a quarter of a hundred, ready for sale. The better kinds are stuck through strips of cloth pasted on the paper; but even with the commoner kinds an improved wrapper has lately been devised, which enables one needle to be selected without the danger of all the rest falling out of the packet.

#### How We Lived: 1861-1865.

The following, under the above heading, in the *Semi-Tropical*—an excellent magazine, published at Jacksonville, Fla., devoted to the industrial resources of Florida—offers some striking exemplifications of the old saw: "Necessity is the mother of invention." It shows besides that, in point of ingenuity and fertility of resources, our Southern countrymen are not a whit behind their Yankee brethren. The period referred to is of course during the war, when the blockade had cut off supplies, and business in the Confederacy was practically at a standstill:

As time wore on (says the writer) and scarcity became absolute, people were forced to find substitutes in the articles produced here, for the then unobtainable things formerly used. But, with ingenuity and experiment, they succeeded so well that most were able to get along comfortably. For coffee, wheat, rye, barley, corn, sweet potatoes, roasted and ground, were substituted; for tea, sassafras, sage and the leaves of the yupon were decocted. The ashes of corn-cobs dissolved in water made a first-rate soda or "sea foam" for baking; peanuts were used for coffee and pressed for sweet oil. The barks of trees and shrubs, the roots of sarsaparilla, ginseng, and other medicinal plants indigenous there furnished medicine. Nutgalls and pomegranate skins made a good dye or ink; the china berries a polish for leather; agricultural implements, harness and household furniture became of primitive make; wood plows, rawhide harness, bear grass lines and ropes, corn husk or moss collars, wooden pins for nails, cypress knees and gourds for buckets and smaller vessels, and hide-seated chairs were soon the generally used articles; rude spinning wheels and looms were common and were to be seen in every house almost, where the family spun, knit, wove, and colored cotton and wool; many a new dress was woven from the threads raveled from an old silk dress laid aside in former years; palmetto was readily appropriated for thatching or even constructing houses, and women's ingenuity braided it for gentlemen's hats, as also for a *love of a bonnet*, trimmings and all; with dyes made from the forests and field, the ladies were able to fashion their wear usefully and with taste. Lightwood was the ordinary light; tallow candles a grade higher, and the berry of the wild myrtle furnished way tapers for bridal and religious celebrations. Ashes furnished the potash for soap, and the palmetto stalk was excellent for scrubbing and washing; the coonts and arrowroot served for food, starch, and in sickness. The ladies were most ingenious in making their own shoes; taking an old, worn-out pair which had been cast aside in former days, they would pick out the threads of sole and top, and, using the latter for patterns, make a genteel boot; and when flour got scarce, with meal ground fine they would make fruit cake with home-preserved citron, dried grapes, and cane sirup.

Nor were these improvised novel industries confined to the wants of the household. A very palatable beer was made from corn, from cane and roots; even liquor was distilled from hitherto unusual materials. Oranges, blackberries, plums, peaches, persimmons, sugar cane, were easily procured, and rude, simple stills constructed, sometimes on the smallest scale: the writer remembers on one occasion, travelling in Leon county, seeing a smoke on a small branch near the road; going to it, he found an old, one-eyed fellow, with his apparatus, consisting of a five-gallon pot with a wooden cap, which contained the mash of wild plums; three old musket barrels joined together conducted the vapor through a wooden trough filled with water, thus condensing it; from the end of the gun barrel slowly trickled the unrectified poison into a rude bucket—poison quite as destructive as the powder and ball which it originally carried. This crude liquor sold readily at one hundred dollars a quart; the daily product was some two quarts; the skimmings of boiling sirup were distilled into rum; the production of liquor, however, was very limited, the stuff mostly appropriated to the hospitals. Drinking intoxicating liquors almost entirely ceased, and the usual results of quarrels and disturbances were unknown.

The absence of the doctors in the army left the country without medical advice, and the scarcity of medicine afforded no opportunity for people to be dosed or to drug themselves, except with simples and herbs; and though it may have been exceptional and providential; there was no contagion or epidemic and very little sickness of any kind, and the mortality was less than ever before or since; plain food, temperance in eating and drinking, exercise and industry, no doubt assisted in causing general health.

Most of the newspapers were suspended: no news of the day, domestic or foreign, except occasionally when a return soldier or blockader brought papers. At first the want of salt was seriously felt, but soon salt works were established on the coast; mill boilers and sugar kettles being used to boil the sea water, and a supply afforded.

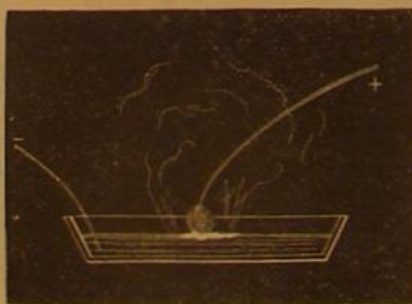
In looking back to those days, one is surprised at the latent resources developed by the people of the South. Up to that period there was scarcely an article, even the most common and simple, that was not brought from abroad: the christening robe, the shroud, and the coffin were of foreign make; agricultural and mechanical implements, from the ax helve to the cotton gin, came from the North; even the peculiar staples, grown only there, first went abroad, and were then repurchased and returned for consumption. In all Florida there were no manufactures, except the most simple and rude, on plantations. The largest towns seldom had even a blacksmith shop; tailors, shoemakers, harness makers, and wagon makers were unknown.

Jacksonville, before the war, with twenty first-class saw mills and an abundance of good clay, imported laths, planed lumber, and bricks for building purposes. War closing our ports and stopping our intercourse with the North and foreign countries, the Southerners, with true American spirit, went to work to put to use the hitherto dormant materials always present in the country; and if the war had been further protracted, they would have cultivated and manufactured, no doubt, all articles needful for the most advanced nation. Nor was the lesson or experience of the war times lost, for since 1861 manufactures have increased rapidly; agriculture has become diversified, and the South self-sustaining in provisions, and she will soon be independent in all manufactured articles.

#### M. PLANTE'S THEORY OF THE FORMATION OF HAIL.

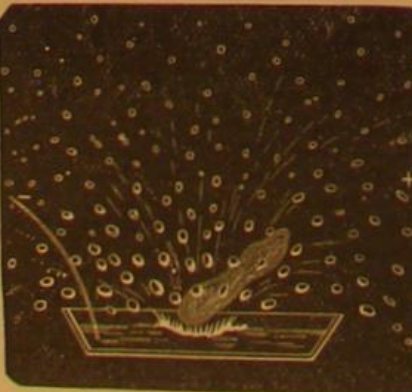
M. Planté considers that atmospheric electricity, in the state of a discharge or dynamic flux, produces a powerful calorific action capable of vaporizing water in clouds rapidly, and of projecting the vapor so formed into the cold regions of the atmosphere. In order to show the effect of the electricity in this phenomenon, it will suffice, he says, to mention the mechanical action which takes place on the passage of the electrical discharge through aqueous masses, and the projection into the air of liquid globules susceptible of becoming transformed into hailstones. With a source of intense voltaic electricity, the immersion of the positive wire into a conducting liquid, such as salted water, determines the aggregations of the aqueous molecules around the electrode, in the form of a luminous spheroid. This is due to the double simultaneous effect of scattering and aspiration which appears to be peculiar to the electric discharge. The appearance of the spheroid is clearly shown in Fig. 1.

Fig. 1.



If a more intense current be employed, coming from a battery of 400 secondary couples, instead of a single globule at the positive pole, a cluster of innumerable globules is obtained, which succeed each other with great rapidity, and which are projected for more than three feet from the vessel containing the water. The spark produced at the same time at the surface of the liquid appears as a corona or aureola of many points, from which the aqueous globules escape. This phenomenon is represented in Fig. 2.

Fig. 2.



To produce this effect the electrode need not be of metal. A piece of filtering paper, moistened with salt water, in communication with the positive pole causes a like result, and constitutes a humid mass analogous, in certain measure, to

that of a cloud whence an electric discharge escapes. If in place of meeting a deep layer of liquid, the current simply comes in contact with a damp surface, such as the sides or bottom of the vessel, the calorific effects predominate, the aureola is more brilliant, and the water is rapidly transformed into steam. This experiment is represented in Fig. 3.

Fig. 3.



It thus appears that the action of the current differs according to the resistance opposed to it, and thus here is found a new example of the reciprocal substitution of heat and mechanical work resulting from the electric shock. When the work represented by the violent projection of the liquid was visible, neither heat nor steam was developed; but when this does not take place, the powerful calorific effects at once are noticeable.

From these experiments M. Planté concludes:

1. That electric discharges produced in clouds may, according to the more or less great density of the moist conductors, determine their reduction into vapor or their instantaneous aggregation into globules of volume much larger than the cloud globules themselves; and that the liquid bombs thus formed may be projected to great heights, where a very low temperature prevails.
2. That the formation of hailstones, in cases where they do not present a series of opaque and transparent layers, but a radiating structure, is also explained by this mechanical action.
3. That the ovoidal or pyramidal form of the stones, as well as their protuberances, asperities, etc., are due to their electrical origin.
4. That the light sometimes emitted by hailstones is also due to electricity, the discharge producing them rendering them at the same time phosphorescent.

#### Correspondence.

##### Steel.

To the Editor of the Scientific American:

For years I have noted very many valuable hints and suggestions in your paper as to how to work the above problematical substance. Appreciating these, and having profited by them, I wish to tell my own experience in the hope that it may help some poor unlucky mechanic over a rough place. Twelve or fifteen years ago, when I wanted cast steel for any purpose, I went to the hardware merchant and purchased a piece that would serve my purpose best, with the very least forging, that is, I got the nearest size, to the one I wanted, which I could find. If too small I could "stove" it a little; if too large, it was drawn. But after a while I found that some steel would make springs for gun locks, knife blades, surgical instruments, etc., with but a few failures, probably one in one hundred; while with other pieces, I could not make one spring in a dozen stand. The first fact I was able to discover was that every piece of steel that gave me trouble was clean and new. For a year or two after, I avoided this clean pigeon-blue colored article; and I bought anything that was rusty, regardless of size. This naturally led me to suppose that my trouble was all located in an article lately put upon the market. But as time corrodes all things, all the pieces of steel kept by the dealers became more or less rusty, and I was no longer able to pick out the rusty steel that used to be good, or discard the clean and bright blue as bad: and so my rule, that had served me well, died a natural death. At last it occurred to me to examine the qualities of steel under a glass. This I did, and found the one that gave me trouble was coarse in grain, showing large crystals, with spaces between (like those in burnt steel); while that which gave no trouble was fine in grain and seemingly perfectly homogeneous throughout.

When I go to buy steel now, I carry my little glass in my vest pocket. I don't know the power of it, but I do know that it saves me a power of work and vexation.

Minneapolis, Minn.

G. W. TINSLEY.

##### Ventilation.

To the Editor of the Scientific American:

The want of ventilation in a superheated room is quickly noticed by those accustomed to the old-fashioned fireplace, and the accumulation of dust in such rooms is annoying. Having recently begun to use a stove, I made a sheet iron door, two feet wide and of the height of the arch, which can be opened so that the draft up the chimney can readily clear the room of dust, smoke, or vitiated air. An ordinary stove flue might be built so as to have a similar opening at the floor; it would serve as a ventilator, and as a means of withdrawing dust, etc.

G. W. W.

MR. EMIL BRUSH, Chief Centennial Commissioner from Egypt, and Secretary of the Board of Awards on hydraulic apparatus, has recently purchased one of the Valley Machine Co.'s bucket plunger steam pumps for his own use, in Egypt



**IMPROVED SEMOLINA SEPARATOR.**

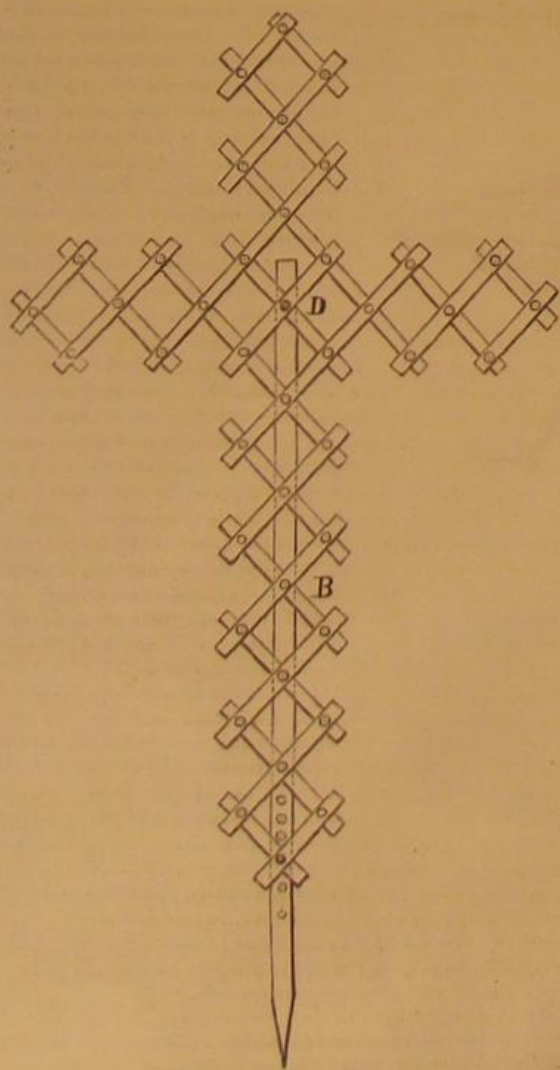
This machine is of somewhat peculiar construction, and its action will be readily understood by reference to the annexed engraving, extracted from the *English Miller*. The apparatus is represented without the sizing sleeves. The semolina enters the hopper, and falls upon the first inclined shelf. In its passage down, the semolina is acted on by a current of air, as indicated by the upper arrow; the light flocculent particles are carried up to the exhaust fan (see the large arrow), the intensity of the current being regulated by the adjustable slide. There are nine air inlets: the heaviest semolina will thus fall through no less than nine currents. The lighter and inferior semolina passes down to the next shelf, and is again subjected to a current of air, until the whole of the semolina passes down to the next shelf, and is again subjected to a current of air, until the whole of the semolina is separated and deposited in the respective apouts, according to its specific gravity; the dust and branny particles are drawn upwards by the fan, in the direction indicated by the points of the arrows. There are thus six separations made—two sorts of the heaviest and two of the lighter semolina, one of branny particles, and one of light dust. The apparatus shown in the engraving is 8 feet 3 inches in height, by 3 feet 3 inches wide, by 2 feet. The machine offers an interesting illustration of the adaptation of air to the automatic separation of such a delicate substance as semolina, so that every atom could be held in suspension, balanced, and finally deposited into the various divisions of the apparatus exactly in accordance with the respective specific gravities of the particles of semolina, etc., operated upon.

**Why Silks Break at the Folds.**

Formerly the silk manufacturers used ungummed silk both for warp and weft. The ungumming softens the silk, and removes from it a resinous matter, but there is a great loss of weight: in French silks 25 per cent, but in Chinese silks sometimes 40 per cent. The manufacturers have, for some time past, ungummed merely the silk for the warp, leaving that for the weft raw, as the threads of the warp are not seen. In this manner a great loss of weight is avoided; but the goods, as soon as wetted, become uneven. This happens especially where such tissues are dyed, when the weft is attacked by the color and the mordant, and becomes rough and broken. Like all other fibers, that of silk consists of a number of small particles linked together. These become prominent on ungumming; so that when a silk fabric, consisting entirely of ungummed silk, is moistened, no alteration appears. But in common silk goods this only happens with the warp. The moistening, finishing, etc., of these goods occasions a difference between the threads of the warp and of the weft. This explains the distortion of such goods, and their tendency to break in the folds.—*Moniteur de la Teinture*.

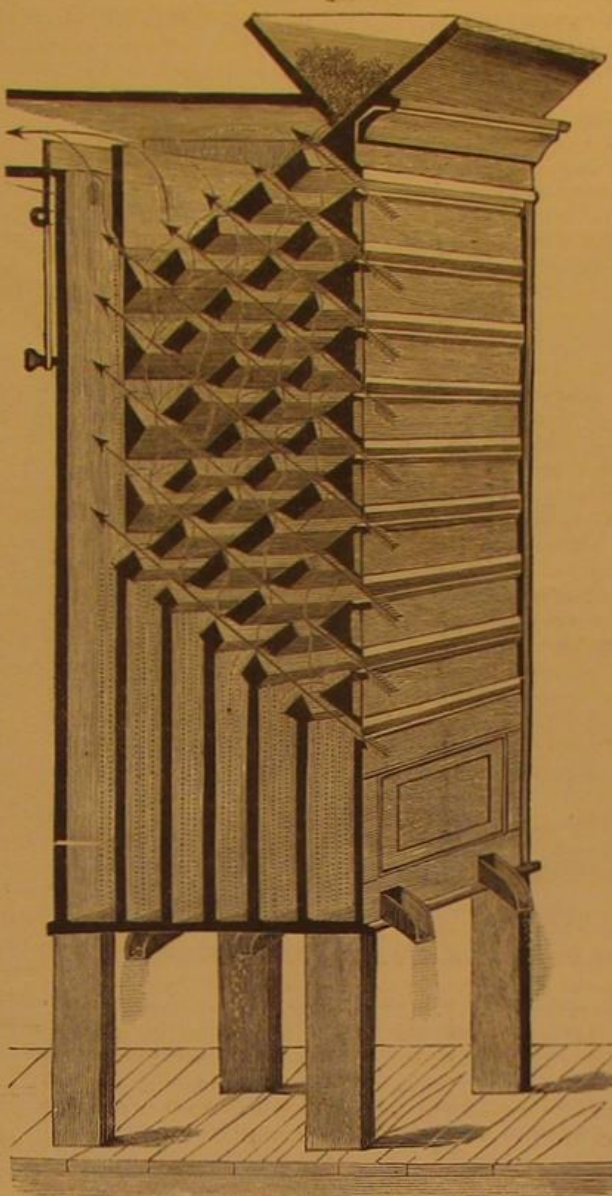
**A TASTEFUL FLOWER TRELLIS.**

The annexed engraving represents a tasteful form of trellis.



Its which may be used in gardens, or which, with ivy trailed over it, would form a pretty ornament indoors. It consists

simply of a framework of pivoted strips, arranged in the nature of lazy tongs, and pivoted to one or more supporting stakes. It swings on a pivot point, D, and is fastened at another point by a detachable pin, D'. This allows the folding up of the framework on the stake into smaller space, for more convenient shipment, and the ready opening and adjustment when desired for use.

**HOERDE'S SEMOLINA SEPARATOR.**

The frame may be spread to varying width and height on the supporting stake by providing a number of holes, into which the fastening pin may be placed.

This device was patented through the Scientific American Patent Agency, October 24, 1876, by Mr. Charles H. Westcott, of Seneca Falls, N. Y.

**Underground Photography.**

At the Bradford Colliery, England, recently, accurate pictures of some underground workings in the mine were obtained by the oxyhydrogen light in combination with magnesium ribbon in combustion. The process occupied for each picture from twenty-five minutes to half an hour while the sensitive plate was under the action of light. The possibility of introducing a powerful and steady light completely under control, which may be fed from the surface by means of flexible tubing, and which admits of an illumination rivaling that of day to be sent into dangerous places from a convenient and safe distance, appears to open a pathway to very important practical applications. In any aspect, the demonstration that perfect lens pictures can be obtained, altogether independent of the sun, deserves attention.

**Belladonna as a Cerebral Stimulant.**

Dr. Theodore H. Jewett, in a paper before the Maine Medical Association, maintains that belladonna is not a simple narcotic only, as has been generally supposed, but a brain stimulant and tonic of the first order. It is the special and appropriate remedy for congestion and inflammation of the brain, or for the debility of which they are the results. It is also the remedy for many affections, congestions, inflammations, and perverted action of many organs whose integrity is dependent upon a normal condition of the brain.

**Novel Mode of Strengthening Cast Iron.**

The President, Mr. R. M. Bancroft, and members of the Civil and Mechanical Engineers' Society, when visiting Kirkaldy's testing and experimental works the other day, were shown a cast iron bar which had been sent to him to test, as a sample that had been treated with mysterious chemical mixtures, which were said to increase its tensile strength over fifty per cent. But as Mr. Kirkaldy's rule is always to break the specimen, or else his machine, he found it contained, upon being fractured, a center core of wrought iron about two inches in diameter, and six small ones of the same metal spaced around it. He thus exposed the secret. *Mining and Scientific Press*.

**Bastie Glass.**

Mrs. Nassau Senior writes to the *London Times* on the curious behaviour of tempered glass. She furnished twelve gas burners with tempered glass globes purchased in London, and having the veritable label of M. de la Bastie affixed to each. On the night of October 6, after the gas had been extinguished for exactly an hour, one of the globes burst with a report and fell in pieces on the floor, leaving the bottom ring still on the burner. These pieces, which were, of course, perfectly cold, were some two or three inches long, and an inch or so wide. They continued for an hour or more splitting up and sub-dividing themselves into smaller and still smaller fragments, each split being accompanied by a slight report, until at length there was not a fragment larger than a hazel nut, and the greater part of the glass was in pieces of about the size of a pea, and of a crystalline form. In the morning it was found that the rim had fallen from the burner to the floor in atoms.

**Carbolic Acid Inhalations.**

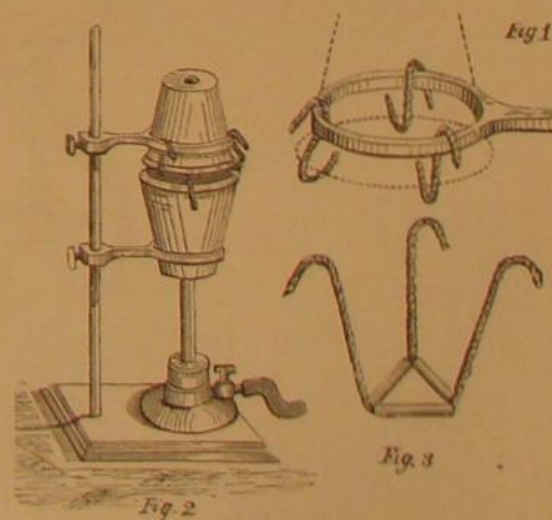
In a recent monograph of Dr. Lee, of the Hospital for Sick Children, London, the author states he has found marked benefit from the daily use of carbolic acid inhalations in whooping cough. The carbolic vapor ought to be diffused through the atmosphere of the room, in a certain proportion, and the patient must be confined to this atmosphere for several hours daily. Dr. Lee has had a vaporizing apparatus constructed on purpose, and he has exposed his patients (out-patients for the most part) to the vapor, in a little room adjoining his consulting room, for an hour or so once or twice a week. "Even under this limited use, there was undoubtedly an amelioration of the severe spasmodic cough."

**SIMPLE LABORATORY APPARATUS.**

The following short description of an extremely effective, cheap, and cleanly substitute for crucible jacks, etc., says Mr. E. T. Hardman in the *Chemical News*, may be useful, especially to those who have occasion to shift their quarters often.

The ordinary crucible jacket is made of sheet iron, and the small concentration of heat which it affords may be regarded as nearly nil, since radiation takes place very freely. Another drawback is that it soon becomes rusty or coated with scale. It is not only dirty to handle, therefore, but also presents the inconvenience of dropping some of its scale into the crucible if not carefully manipulated. Now an ordinary earthenware flower pot answers the purpose in every respect. It is of the proper shape, and being made of a non-conducting material it in a great measure prevents loss of heat from the burner. It is extremely cleanly to use, and it can be procured at the small cost of one cent or so. The bottom of the flower pot has a circular hole. This serves for the introduction of the Bunsen burner. As the supply of air would be insufficient otherwise, it will be necessary to enlarge the opening with a knife. The flower pot may be supported in the ring of a retort stand in the usual way. The chimney is a second flower pot inverted. To support it, the handiest way will be to make three S hooks of stout wire, and, having passed the narrow end of the pot upward through the ring, fix the rim within the hooks caught on the ring, as in Fig. 1.

It will be found convenient to devote a small retort stand permanently to the purpose. The whole arrangement is shown in Fig. 2, and is very handy, as the upper part can be raised to any desired height, regulating the heat and draft, and can be shifted from side to side.



The apparatus acts admirably as a small gas furnace for crucible operations, such as the fusion of silicates with carbonates of soda—as in the analyses of rocks.

The support for the crucible may be either a triangle of wire covered with pipe shank, the end of the wire being bent upwards and formed into hooks so as to hang on the edge of the flower pot, Fig. 3, or three pipe-covered wires suspended in the position of the ribs of a crucible jacket. The former is necessary for small crucibles.

The flower pot also makes an excellent lamp screen, for steadying and concentrating the flame under evaporating basins, etc.; of course a sufficient interval must be kept between the pot and the basin, or the light will go out.



# NEW COMBINATION HAND AND POWER FEED SURFACE PLANING MACHINE.

The accompanying engravings represent some new and attractive features in a machine intended for surfacing and smoothing, and for many of the operations usually performed upon a hand planing machine. It is one of a new series of machines recently brought out by the extensive wood tool builders J. A. Fay & Co., Cincinnati, Ohio, whose fine exhibit at the Centennial Exposition we recently illustrated. It combines facilities of adjustment for the processes of planing over the cylinder (Fig. 1) as in the ordinary hand planing machine, and for surfacing under the cylinder (Fig. 2) as in the power feed surfacing machine. Provision is also made for the easy removal of such parts as it may be necessary to displace to enable the operator to perform any especial work.

The frame of the machine is heavy, being made of continuous cast iron plate sides and ends. The tables forming the bed have horizontal and vertical adjustments, allowing them to be separated to let the cutter head pass between them as they are being raised or lowered. By means of the horizontal adjustment, the opening for the cutters is regulated, and by the vertical adjustment the thickness of cut is gaged, these adjustments governing the hand planing operations.

For surfacing, the tables are lowered until they are on a plane with the central portion of the bed. A continuous solid bed is thus formed, adjustable, for the different thicknesses of surfacing, by being raised and lowered by two screws, operated by a hand wheel and bevel gearing. The cylinder is stationary, being fixed in boxes cast solid to the sides, has steel journals, and is lipped with steel. It has three knives set on an angle to produce a drawing cut, reducing the tendency to split out in cross-grained lumber.

The feeding rolls are also set in bearings in the sides, the pressure being produced by volute steel springs and graduated by screws to such pressure as desired. The pressure bar, with the bonnet, is arranged to swing from the cutting edge of the cylinder and can be removed from the machine by detaching one bolt. When the bonnet is removed, the machine is ready to have the tables elevated, and thus a hand planing machine is obtained, suitable for the purpose of truing up, squaring, jointing, bevelling, chamfering, and many other operations common to furniture, car, sash, and door manufactories, etc.

The surfacing or thicknessing is accomplished by the driven feeding rollers, operated by gearing, with such difference in the speed of the feed as the character of the work may demand. The feed is started or stopped by a belt tightener moved by a lever, and is under perfect and ready control of the operator. As will be seen by the engravings, the hand wheels and levers are convenient to the operator, and can be easily and quickly adjusted.

The capacity of the machine is for 24 inch surfacing, and up to 6 inches in thickness, and hand planing to 24 inches in width in addition to the other hand operations mentioned above. The apparatus as a whole is well adapted for rapid and accurate work, producing a smooth surface on all kinds of hard and soft wood. An application for patent is now pending. For further particulars, address J. A. Fay & Co., Cincinnati, Ohio.

## Nature of Electricity.

A new hypothesis as to the nature of electricity (we learn from *Stummer's Ingenieur*) has been offered by Professor Rénard, of Nancy. He considers an electric current to be produced by longitudinal motion of the ether particles, which, at the same time, have a general forward motion. When the molecules of a body are surrounded by a greater ether atmosphere than the normal, the body is in the condition which we call positively electric; when the ether atmosphere about each molecule is less than the normal, the body is negatively electric. He has sought to explain various electrical phenomena thus: for example, the magnetization of steel needles by electrical discharges; regarding which, Savary has shown that, according to the position of the needle, it acts in one direction or the other.

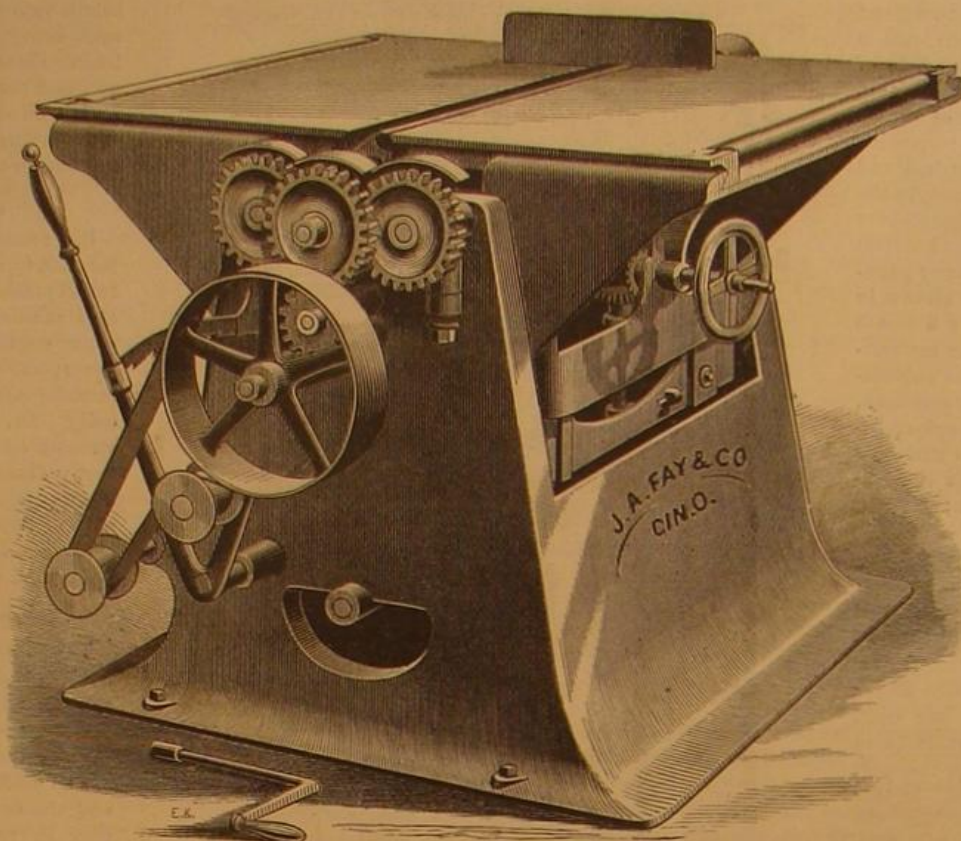
## The Largest Sail in the World.

A monster sail, said to be the largest in the world, may now be seen at Verdon's sail manufactory, Dublin. It measures in a rectangular form 180 feet by 60, and a cotemporary says of it: "The courses of a line of battle ship—the ta-

pered ninety feet jib—the great awnings of the Crystal Palace, are simply pocket handkerchiefs when contrasted with this doubly stitched, powerfully roped sheet of canvas." This sail has been produced to aid, by a new method, the raising of sunken vessels.

## Electrical Rubber.

A curious phenomenon has been described to the Belgian Academy by M. Spring. A sheet of thin vulcanized rubber, stretched to about six times its normal size, is rubbed with

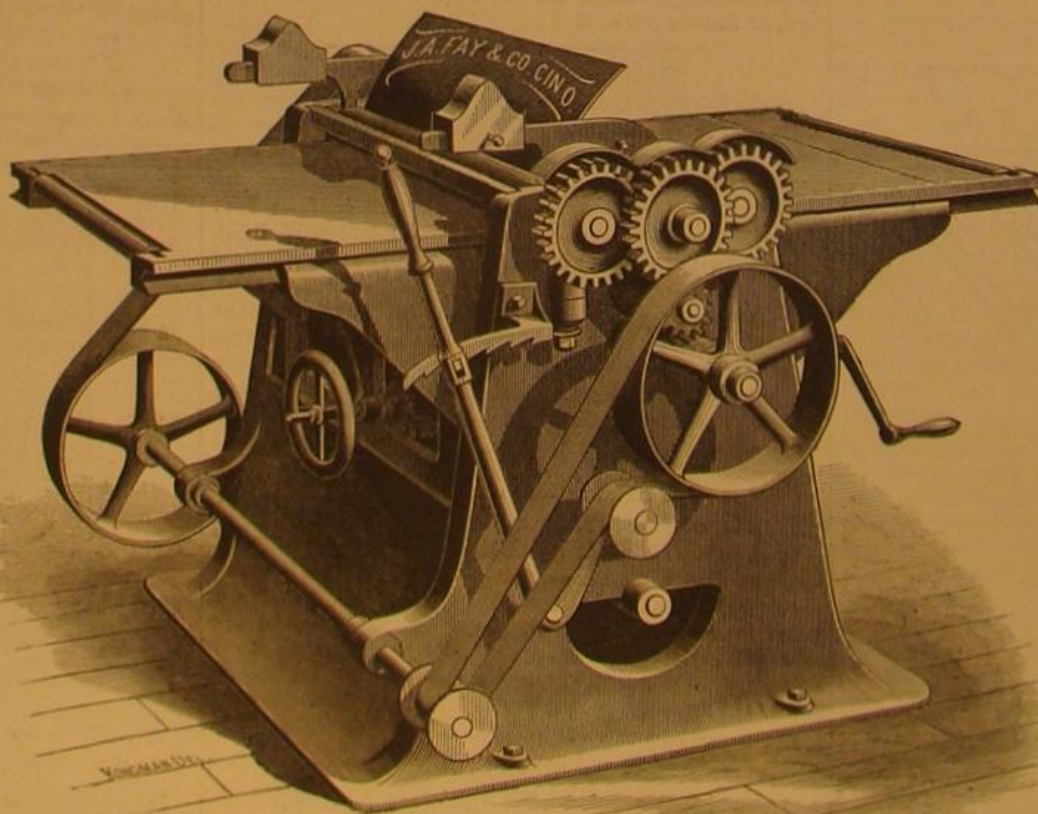


J. A. FAY & CO'S HAND AND POWER PLANER—Fig. 1.

a cloth until it will attract light bodies. If, now, it be allowed to contract, the electrical attraction will diminish as the sheet becomes smaller, until it entirely disappears when the rubber has resumed its ordinary size. That the electric state is dependent to a certain extent on the molecular arrangement of the rubber (or sulphur) would appear to be evident; but the phenomenon deserves the attention of physicists.

## Crystalloid on Colloid.

Dr. Guthrie lately described some experiments he had made to determine the effect of a crystalloid on a colloid, when in the presence of water. Two or three lumps of rock salt having been added to a jelly of size, and the whole hermetically sealed in a glass tube, the colloid parted with its



J. A. FAY & CO'S HAND AND POWER PLANER—Fig. 2.

water readily, a saturated solution of the salt was obtained, and the size became perfectly white and opaque, having undergone a structural change.

**DYEING SAFFRANIN ROSE ON SILK.**—The silk is prepared as for white, and, if it has a yellowish cast, stoved, rinsed, and washed twice in boiling soap lye. A fresh water at 122° Fah. is made up with the needful quantity of saffranin, and scoured with a fresh solution of tartaric acid.

## Hollow Concrete Blocks for Building.

A hollow concrete block for general building purposes has been introduced by Mr. James Woodhouse, of Lambeth. It resembles a block of stone molded in such a form that a vertical and horizontal groove or cavity is retained, so that really it possesses the advantages of a hollow brick. One of the single blocks is 2 feet long, 1 foot wide, and 9 inches high, in the center of which are apertures formed by grooving the block all round and perforating the center; but the material can be worked up into blocks of any size. Quoin

blocks are also made for working at the angles of buildings, and ornamental courses can be molded for cornices or string courses. When the blocks are put together, the apertures, both vertical and horizontal, are continuous, allowing a free circulation of air throughout the entire wall, ensuring ventilation and dryness. The blocks are proposed to be connected by cemented joggle holes or joints, by which they are joined together with great precision. The blocks can be moved and fixed by the lewis, and can be laid by the ordinary bricklayer. A bricklayer can lay about four hundred bricks per day, equal to 25 cubic feet; and, as the wages of the bricklayer and laborer are \$2.50 gold, in England, per day, the cost of brickwork for labor is about 9½ cents per cubic foot. It is stated that any bricklayer can lay 50 of these concrete blocks a day, equal to 75 cubic feet, thus showing a saving of over 200 per cent in labor. The advantages claimed are: Greater strength, damp-resisting qualities, resistance to fire, expedition in use, vermin expulsion, general applicability, sanitary qualities, cheapness, appearance, facilities of manufacture, etc. The author alludes to these advantages in order. Speaking of the strength of concrete, the author says concrete walls have withstood the most violent equinoctial hurricanes. The absorbency of brick and stone is well known. A common brick absorbs about a pint of water,

and a small house of one-brick walls, containing 12,000 bricks, is capable of holding 1,500 gallons, or 6½ tons of water. Absorbent bricks also retain dirt and gases, but the concrete block insures dryness in walls, so essential to health; it is, in fact, nearly non-absorbent. Of the fire-proof qualities of the concrete block, being composed of burnt clay, scoria, clinkers, shingle, etc., it is hardly necessary to dwell, as our readers know the refractory nature of these component materials. In gravel concrete, great heat would disintegrate the mass, and cause fractures; but with the burnt ballast, slags, etc., used in the patent block, the most intense heat would be powerless to destroy the mass.

Another advantage in favor of this block construction, from a sanitary point of view, is the absence of mortar joints, through which vermin and germs of animal life can pass. The author also considers the advantages of concrete block walls from another point of view. By molded forms cheaper ornamentation can be obtained, and it is thought this will conduce to the adornment of our humble dwellings. The cost of this kind of walling in gold is stated comparatively as follows: 1 foot cubic plain faced masonry, built complete, 66 cents; 1 foot plain-faced brickwork, 24 cents; 1 foot plain-faced patent block, 18 cents; 1 foot molded masonry, \$1 08; 1 foot molded brickwork, 30 cents; 1 foot molded patent block, 24 cents.

The author, in conclusion, believes the old-fashioned brick wall must give place to this kind of walling. At all events, one great inducement is facility of manufacture. The ingredients—pounded shingle, burnt clay, slag, etc., can be procured on any site, as most lands have gravel or clay, all that is required being the mold. We have long advocated concrete blocks for wall building; several kinds of blocks have been introduced at different times, and we believe Mr. Woodhouse's patent hollow concrete block is a simple and effectual mode of obtaining the combined advantages of concrete—durability, lightness of walling, and damp-proof qualities. Mr. James Lemon, C. E., the borough surveyor of Southampton, and some other authorities, speak highly of the invention.—*Building News*.

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We beg to inform our patrons that the Chicago concern has no connection with the SCIENTIFIC AMERICAN or the publishers of this paper.



## THE BRITISH ARCTIC EXPEDITION.

We have already published a detailed account of the British Polar Expedition, which lately returned after severe but fruitless endeavors to reach the North Pole. We now present two interesting engravings, the one showing the *Discovery* steaming through the ice, with her consort, the *Alert*, following in her wake, and the other representing one of the tents of the sledge exploring parties, together with the sledges and dogs, the latter being secured as shown during the stay of their masters in camp.

The two ships, in making their way through the ice, assisted each other in the necessary manœuvring or forcing a passage through the heavy floes. The *Discovery* was placed ahead because her bows were the sharpest. Describing the process of breaking through the floes, Captain Nares says: "It will be difficult ever to efface from my mind the determined manner in which (when the *Alert* had become embedded in the ice, which, by her impetus against it, had accumulated round and sunk under her bows, and a great quantity, by floating to the surface again on her wake, had helplessly enclosed her abaft) the *Discovery* was handled in her advancing to our rescue. Having backed some distance astern, for the double purpose of allowing the *débris* ice from a former blow to float away, and for the vessel to attain a distance sufficient for the accumulation of momentum with which to strike a second blow, coming ahead at her utmost speed she would force her way into the ice, burying her bows in it as far aft as the foremast: the commanding officer on the bowsprit, carefully conning the ship to an inch, for had the ice not been struck fairly it would have caused her to carom off it against ourselves, with much havoc to the two. From the moment of the first impact the overhanging stem necessarily caused the ship's bow to rise three or four feet as she advanced from twelve to twenty feet into the solid floe, and imbedded herself, before the force of the blow was expended; and as the ship's way was stopped, the overhanging weight, by settling down, crushed the ice down still further ahead. Frequently, on these occasions, her jibboom was within touching distance of the *Alert's* boats! But, after a little experience had been gained, such confidence had we in each other that there was not the slightest swerving in any one instance."

## Elasticity of Ice.

Professor Bianconi, of Bologna, Italy, has recently made a series of experiments with regard to the compressibility and plasticity of ice. Granite pebbles, placed on an ice surface, were pressed with constant and measured pressure for six, eight, or ten hours, at a surrounding temperature of 34° to 37° Fah. The impression was deep, but it was surrounded by a raised brim, and this again by a slight external cavity. M. Bianconi considers the central cavity to be the effect partly of strong compression, partly of fusion, produced by the heat proper of the pebble. The external cavity was probably due to initial calorific irradiation of the pebble; for, if the pebble had previously been placed in ice, this cavity became very small, or almost *null*. The raised brim is the swelling of the ice, produced by the pressure, the ice being expelled in virtue of its plasticity. This appears very clearly when the pressure of the pebble coming obliquely on a point of the ice surface, a certain protuberance is seen at an opposite point. Among other experiments, an iron plate, with a square hole in it, was strongly pressed on a plane surface of ice. After eight hours the ice had risen an inch or so through the hole, in the form of an unequal crest, and turned over on the plate, while the ice at the outer edges of the plate had similarly risen and turned over. Again, a bar of iron—plane below and convex above—was pressed for ten hours on a plane ice surface. The ice expelled below rose up on the sides, and became applied to the sloping surfaces. The experiments prove that ice has a manifest compressibility or plasticity, though slow and very limited.

## Crystallized Iron.

The well known phenomenon that iron, with long use in which it is subject to strains of the nature of shocks, assumes a coarsely granular structure has recently been illus-

trated by experiments made at the Friedens Hoffnung coal pit, near Waldenburg, on the hanging chain of the miner's cage, two years in use. A link of this chain broke, with the first blow of an 11 lbs. hand hammer, into four pieces, whose surfaces of fracture showed a crystalline texture. Another link of the same chain, after having been annealed at a red heat, only broke after 23 blows with the same hammer, and in such a way that the fracture on the one side of the ring went quite through, and on the other side only half through, and presented a fibrous structure. These facts in-



THE ALERT AND THE DISCOVERY IN THE ICE.

dicating the importance, in the arrangements for the lowering and raising of miners, of very careful observation of those changes of structure. They also appear to make desirable the introduction of spring boxes between the rope and the cage (so as to modify shocks), and the annealing, from time to time, of the connecting parts between the rope and the cage.

## Nitroglycerin.

The following method has been recommended by M. Böttger (in the Frankfurt Physical Society), for preparing nitroglycerin in small quantities, with a view to lecture experiments. It is stated to be quite free from danger. A few grammes of perfectly pure glycerin, free of water, is put into a test tube surrounded by a freezing mixture, and containing a mixture of 1 volume of the most concentrated nitric acid (1.52 specific gravity), and 2 volumes of the strongest sulphuric acid (1.83 specific gravity). Then, as quickly as possible, the whole is poured into a larger quantity of



ARCTIC SLEDGE-TRAVELING—THE ENCAMPMENT.

cold water. One now sees the nitroglycerin, that has formed like oil drops, sink to the bottom, being specifically the heavier liquid. You then soften it several times by decantation with fresh water, and, lastly, with a weak soda solution; remove the water with a few pieces of fused chloride of calcium, and you have then the nitroglycerin in such purity that it may, without danger, be kept any length of time, for lecture experiments.

ONE of the most attractive features of the Exposition of 1878 will be a large aquarium capable of containing four hundred thousand gallons of water, affording tank room for four million pounds of fish. The estimated cost is about two hundred thousand dollars. We shall shortly publish an engraving of the aquarium.

## Lace Making in England.

Honiton lace is, without doubt, the best ever made in England. Enormous prices were paid by the Honiton lace makers for Flemish thread, rising, it is said, to \$500 gold the lb. during the war with France. The workwomen were also well paid, their wages being calculated in this wise: the lace ground was spread out on the counter, and the worker herself desired to cover it with shillings; and as many coins as found place on her work she carried away as the fruit of her labor. Real Honiton ground went out of date with the invention of bobbin net, on which the sprigs were applied, until that form of lace went out of date altogether, being superseded by the modern guipure—the Honiton of to-day—which composed the bridal dresses of the Crown Princess of Prussia, the Princess Louis of Hesse, and the Princess of Wales.

A great deal of trouble has been experienced in persuading the lace workers of Devonshire to adopt newer and better designs. For a long while they insisted on sticking to their old patterns, but at last some impression has been made on them by the authorities of South Kensington, who have recently supplied them with a large number of beautiful designs.

One effect, of the gradual degradation of taste which led to the fineness of the *réseau* being ultimately considered of more importance than the beauty of the pattern, was one of those determinations of the human intellect in one direction, which rarely fail to achieve success in the end. After innumerable failures, bobbin net was at last made by Heathcote's machine, and the value of the clear ground was gone for ever. Bobbin net machines were not only set up in England, but in Brussels, for the purpose of making the double and triple twisted net upon which the pillow flowers are sewn, to produce the so-called *point appliqué*. This extra fine Brussels net has become deservedly celebrated, and it consumes a very large quantity of cotton thread annually. Soon after the triumph of England with bobbin net, the Jacquard system was tried at Lyons for making lace by machinery, and no sooner were the experiments successful than Nottingham began the manufacture of machine lace on a large scale. At the International Exhibition of 1863, Nottingham exhibited Spanish laces, most faithful copies of the costly pillow-made Barcelona, imitations of Mechlin (the *brode* and *picot* executed by hand) and Brussels needle-point, Caen blondes and Valenciennes, rivaling those of Calais, also the black laces of Chantilly and Mirecourt. Machine lace has had a curious effect. It has almost exterminated the inferior kinds of handmade lace, but it has not diminished the demand for the finer fabrics of the pillow and the needle. On the contrary, the finest work of Alençon and Brussels has been sought more eagerly than ever by the rich, since machinery has brought the wearing of lace within the reach of all classes.—*Textile Manufacturer*.

## Horticultural Hints.

The *Gardener's Monthly*, among other seasonable hints for horticulturists, points out that it is not so much severe frost that hurts vegetation as it is the severe thawings following the freezings. Everything, therefore, no matter how hardy, will be benefited by having something thrown over it. Hardy herbaceous plants can be protected by a little earth, and the same, if sandy, is good for seed beds.

An occasional change of soil is highly beneficial to flowers in pots. There is nothing better than surface soil from an old pasture, taken off about two inches deep, and thrown into a heap with about one sixth part old hot bed dung to partially decay. In addition to this staple item, smaller quantities of different matters should be gathered together for peculiar cases or particular plants. Peat, for instance, will be found very useful for many kinds of plants. This is not, as is often supposed, mere black sand, but a spongy, fibrous substance from the surface of bogs and boggy wastes. Sand should be collected sharp and clean; the washings from turnpike ditches are as good as anything. Leaf mold is best got already well decayed from the woods. That one makes for himself from rotten leaves is seldom good for anything; it is always sour, and seems indigestible to vegetation. A load or so of well decayed cow manure is a good thing for the gardener to have by him, as those plants that want cool soil prefer it to any other manure.



### The Extinct Animals of North America.

At a recent meeting of the Leeds Philosophical and Literary Society, an interesting lecture on this subject was delivered by Professor W. H. Flower, F.R.S., who was introduced by the President (Rev. J. H. McCheane). The lecturer described some discoveries lately made in certain districts of North America, which threw a great deal of new light upon past living inhabitants of this world. When naturalists attempted to reconstruct a history of extinct animals, they had to gather evidence from fossils in rocks or stones, and from deeply buried remains of the harder and more imperishable parts of these animals, such as their bones, teeth, shells, etc. Most wonderful deposits of this kind had lately been found in the western part of North America, especially between the river Mississippi and the Pacific—a wide region, which had only of late been opened up for scientific exploration. Although only three or four scientific men had yet been laboring there, they had already discovered during the last five or six years almost as many strange kinds of fossil animals as all those put together which had previously been found in every other part of the world. The discoveries thus made included some which dated so far back as the eocene epoch of the tertiary period. At one place the deposits were found fully a mile in depth, upon what must have been in some remote age the bottom of a great fresh water lake. Common as we thought the horse, donkey, or zebra, this species was remarkably specialized—unlike all other animals now existing, and wonderfully adapted for its own particular functions. Amongst these North American remains, there were found traces of an animal which had in the course of ages apparently developed into the horse of our own day. The earliest remains seem to represent an animal not much larger than a fox, and possessing the principal anatomical characteristics of the horse, but with some differences in teeth and hoofs. The later remains of succeeding epochs appeared to show the same animal becoming larger, first growing to the size of a sheep, and then as large as a donkey, whilst at the same time the minor distinctions which differentiated it from the horse of our own period gradually disappeared. The same explorations had shown that once upon a time there were in North America many curious kinds of rhinoceros, as well as in the southern parts of Africa and Asia, where alone these animals are now found.

There had also been found there the remains of some creatures, apparently intermediate in their character between the sheep and the pig—different as these two classes now appeared to us. The elephant was an extremely specialized animal, which seemed to have no relations now amongst existing creatures. These investigations into past life disclosed, however, that the elephant was not so isolated as we supposed, in illustration of which Professor Flower described the singular resemblances discovered in the now extinct *untatherium*. Generally, there was scarcely any group of animals now existing of which some representatives had not been found in these North American excavations, whilst there were likewise found many which we could not classify with any existing order. Of all birds at present existing, none were known to have teeth; but there had now been found, amongst the remains in the chalk formation, distinct traces of two or three kinds of large water birds which had long rows of true teeth. There had also been found, in the same productive field, an enormous and interesting fossil vegetation, opening up to the botanist as well as the naturalist something like a new world of past life.

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### DECISIONS OF THE COURTS.

#### Supreme Court of the United States.

FREDERICK BIRDALL AND GEORGE F. LANGTRY, PLAINTIFFS IN ERROR, vs. C. C. COOLIDGE.

In error to the Circuit Court of the United States for the District of Nevada.—Decided October term, 1876.

In an action at law for the infringement of a patent, the jury is required to find the actual damages sustained by the plaintiff. The court has power in such case to enter judgment for any sum above the amount of the verdict, not exceeding three times the amount of the same, together with costs.

Damages are given as a compensation, recompense, or satisfaction to the plaintiff for any injury actually received by him from the defendant.

Compensatory damages and actual damages mean the same thing.

Prior to the act of July 8, 1870, a patentee might proceed against an infringer either in equity or at law.

In equity the infringer would be regarded as trustee of the owner of the patent as respects the gains and profits which he had made by the unlawful use of the invention.

At law he could recover actual damages, the measure thereof being not what he defendants had gained, but what the plaintiff had lost.

The remedy at law remains unchanged, but in equity, where the gains and profits are clearly not sufficient to compensate the complainant for the injury sustained by the infringement, damages of a compensatory character may also be allowed.

Evidence of an established royalty will furnish the true measure of damages in an action at law, where the unlawful acts consist in making and selling the patented improvement, or in the extensive and protracted use of the same, without payment, or excuse; but when the use is a limited one, and for a brief period, it is error to apply that rule arbitrarily and without any qualification.

### United States Circuit Court—Northern District of Ohio.

HENRY F. MANN vs. EDWIN BAYLISS.—HARVESTER PATENT.

[In Chancery.—Before Emmons, C. J.—April term, 1876.]

[An incomplete report of this case was published in the *Official Gazette*, July 2, 1876, p. 113. The following is a more extended report, as published in the *Chicago Legal Times*, October 7, 1876.]

In this complainant's bill recites that he is owner of letters patent of the United States, dated February 25, 1871, being a reissue and extension of letters patent No. 15,044, dated June 3, 1836, said reissued letters patent being numbered 4,281, for an improvement in harvesters, complainant having been one of the original patentees, and having acquired the interest of his co-patentee, Jacob J. Mann, by an assignment from said Jacob's administrator.

The improvement consists, in brief terms, in having an elevated side delivery of the cut grain in the straw, by means of an endless apron, whereby the grain is discharged into a stationary receiver, of concave form, from whence, by means of a revolving rake, the teeth of which describe a circle nearly coincident with the circle of which the concave receiver forms a segment, the grain is gathered into gables of suitable size for binding into sheaves or bundles, and discharged upon the ground. The bill prays answer, account of profits and damages, and injunction in the usual form.

The answer denies originality and novelty of the invention, as also infringement. In that, whereas by complainant's device the grain is discharged into a receiver which is concave in form, the machines constructed by defendant discharge their grain by a slightly inclined chute from the elevating apron on to a receiver which is flat and horizontal, from which it is taken by the binder without the use of the revolving rake.

On the hearing, the question turned mainly upon the fourth claim of complainant's patent, which is in these words:

4. The stationary concave receiver, 1, having a continuous surface, arranged as described at the side of a harvesting machine, having an elevating and discharging apron, and a revolving rake, the teeth of which describe a circle nearly coincident with the circle of which the concave receiver forms a segment, and collect the same into gables preparatory to their being discharged from the machine.

His Honor expressed a strong sympathy with those canons of construction which so interpret a claim as to protect what a meritorious invention has created. He was just as much entitled to his right of property as a farmer to his wheat, or to the fat which he put upon his animals. If the invention be original, and the defendant be wronged by the defendant's use of it, the law should be applied to the defendant, and a less liberal construction of claims should be indulged in, and a less liberal application of the doctrine of mechanical equivalents should be extended.

The fourth claim is alone in controversy here, and its interpretation the only question necessarily to be decided. The answer insists that when properly interpreted the defendant does not infringe, and that if construed so as to include defendant's device, it is antedated by similar receivers before existing.

"We hold the fourth claim to include the conditions in which this curved metallic receiver could alone be used in the originally patented device. To construe it otherwise, and make it include, as plaintiff's counsel contend, every kind of barrier between the apparatus of an elevated delivery and the binding table upon a harvesting machine, save a perpendicular one, would, upon principles too familiar to be argued at length, render it void substantially. It would include all modes which, in the patent law, is impossible. No man of ordinary intelligence, desiring to annex a table to a harvester, would fail to insert some obstruction between the one and the other, to prevent the grain being carried by the wind into the moving machinery. It would be an equal lack of intelligence to make it perpendicular; and this is patent of Mann's was by no means necessary to instruct him to make it oblique, and carry it so far forward as to bring the tables as to bring the grain within the reach of the binders. The defendant, in annexing their new and useful binding table to an old familiar device, have adopted the only possible mode of conducting the grain from one to the other. Learned counsel were repeatedly asked to conceive of any other. They were unable to state any. To construe this fourth claim so as to include what defendant has actually done would impute to the patent law the folly of granting to one citizen the right to divorce, during fourteen years, this useful addition to the machine. It was intended to improve, and where their union required no device or contrivance which an ordinary citizen, without any mechanical knowledge whatever, would not readily adopt. This consequence is demonstrative that the Patent Office could not have intended it. It patented the receiver with the rake and accompanying conditions. We read this fourth claim so as to include them. Thus construed, the defendant's device is conceded not to infringe it."

"We also note the fact that, as often as learned counsel for the complainant were asked to state the leading features of this device and what distinguished it from what preceded it, they invariably pointed to the accompanying conditions which the court include in this fourth claim, and none of which are employed by this defendant."

[George H. Christy and William Bakerell, for complainant. S. A. Goodwin, for defendant.]

### Recent American and Foreign Patents.

#### NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

##### IMPROVED COMBINED SASH LOCK AND HOLDER.

Sylvester J. Tucker and Massena E. Gary, Richmond, Va.—The object of this invention is to provide an improved form of combined sash lock and sash holder which shall automatically maintain the sash in any elevated position, holding the same at any desired height without danger of falling, and which shall also be so arranged as to lock the sash when lowered, so as to prevent access to the building from the outside of the window. To this end the improvement consists in combining a rubber-faced cam-headed lever for supporting the sash by frictional contact, a spring for pressing the cam against the window frame, and a pivoted bar which, in one position, forms a bearing for the thumb or finger to rest upon while lifting the end of the cam-headed lever when raising the sash, or which may be thrown over on its pivot to engage with a notch in the window frame when the sash is down, to lock the same against all efforts to raise it from the outside.

##### IMPROVED WOOD GRINDER FOR PAPER PULP.

Joseph O. Gregg, Elkhart, Ind.—The wood to be reduced to pulp is placed in guide boxes. Weighted followers force the wood against a grindstone having a beveled and grooved periphery, and as the stone is revolved the fiber is separated, and washed away by a jet of water.

##### IMPROVED DESK.

Olaus Hansen, Cedar Vale, Kan.—This is a vertical desk, ward robe, or other analogous article of household furniture, having the end recesses, corner posts, and folding doors connected with the latter by flat hinges, whereby the said doors are adapted to swing around the posts and lie concealed in the recesses behind them. The doors are thereby not in the way, occupy no space, and may be readily closed again after use.

##### IMPROVED STAIR BUILDERS' TOOL.

Theodore Simonson, Hillsborough, Ohio.—This invention relates to the class of tools used by stair builders in getting the pitch, bevels, and length of wreaths or twists in hand rails. It consists of two bars of wood hinged together, having at their free ends adjustable slotted pieces which are held in place by thumb screws. The instrument avoids the complication of geometric lines, usually resorted to, and accomplishes the desired result with two simple lines.

#### NEW MISCELLANEOUS INVENTIONS.

##### IMPROVED BALE BAND STRETCHER.

Charles M. Pearce, Galveston, Tex.—The object of the invention is to provide a convenient and easily handled bale band stretcher, to be used in baling cotton, hay, etc., for the purpose of taking out the slack of the band that cannot be taken out by hand while the bale is under the press. To this end the improvement consists in a bar carrying at its end a gripping device for one end of the band, and a guide socket, in combination with an elbow lever pivoted at its end to a slide bar moving through said guide socket and carrying also a gripping device for the other end of the band, which two gripping devices are adapted to be brought together by bringing the handles of the elbow lever and bar together, and tilting the elbow lever upon its angle, at which point it is attached to the bar by a keeper, and slides over an inclined portion of the same upon rollers.

##### IMPROVED BALE TIE.

Joseph C. DuBois, Tuscaloosa, Ala.—The invention relates to that class of bale ties which are made of hoop iron, and applied to form a tie without bending either end. It consists of a band whose one end is slotted while the other is perforated, the two secured together by a wire. Its construction is such that the cost of manufacture is very trifling, while it possesses efficiency and durability.

#### IMPROVED ARGAND GAS BURNER.

Samuel B. H. Vance, New York city, assignor to Mitchell, Vance, & Co., of same place.—This is so constructed as to prevent the hissing noise of the gas, and to enable the flow of gas, and, consequently, the amount of light, to be regulated as desired. There is a new valve which may be adjusted to admit of the passage of any desired amount of gas.

#### IMPROVED REIN-SUPPORTING ATTACHMENT FOR NECK YOKES.

Charles R. Hicks, Mount Sterling, Ill.—This invention consists in attaching to the upper part of the neck yoke a supporting plate with raised center part, having screw holes with different inclination, into which an arm with pivoted end link and swiveled ring is secured, to secure the lines at their point of crossing. This prevents the lines from becoming entangled beneath the tongue.

#### IMPROVED CURRY COMB.

Giles H. Hawrigan, North Hero, Vt.—This implement is formed of a straight blade, convexo-convex in cross section, and provided on one side with beveled teeth having their points adjusted in line. This construction adapts the comb to be used equally well upon those parts of the body of the horse or other animal which are sinuous or angular as upon those which are smooth or gently rounded.

#### IMPROVED RULER.

Charles M. Hayes, Silver City, Idaho Terr.—The invention relates to parallel rulers, and consists in making a slot longitudinally—in the wood, metal, gutta percha or other material of which it may be made—in order to enable the user to sit at a table or desk, and without rising, stooping, or changing his position, to see the figures under which a balancing line is to be drawn, the same being thus readily accomplished without the least danger of a blot.

#### IMPROVED LAMP.

David Sanford, Ashton, Ill.—The burning apparatus here consists of an ordinary wick which passes through a long tube, and is tightly packed therein with cotton. At the summit is a piece of incombustible material, such as porous stone, which absorbs the oil drawn up by the wick, and so supports the flame. The advantages claimed for this arrangement are that, when a flame of the proper shape has been obtained, it will always remain the same; so that the flame can be arranged at such a distance above the oil reservoir that the oil cannot be heated; that burning vapor will now pass down to the oil; and that the light may be regulated as desired.

#### NEW MECHANICAL AND ENGINEERING INVENTIONS.

##### IMPROVED JIGGER.

Anthony Rowse, Nesquehoning, Pa.—This invention consists in causing the scraper of an ore separator to move down into the jig as the latter moves up, and the reverse, so as completely to separate the ore at a single operation. When used for separating coal from slate, the slate, being the heaviest, passes through the bottom of the shaking screen, while the coal is scraped off into the pit; but in separating iron ore, the ore, being the heaviest, passes the screen, while the refuse matters are scraped off into the pit.

##### IMPROVED MACHINE FOR FINISHING BUTTONS.

Marcus M. Rhodes, Taunton, Mass., assignor to M. M. Rhodes & Son, of same place.—This includes a variety of novel machinery for finishing buttons, including a combination of a feeding and holding device with a revolving mandrel carrying a cutter or finisher. The whole is arranged so that buttons that are placed in bulk in a receptacle in the machine are automatically placed in a holding device to be operated on by the rotating cutter or finishing tool. The object is to rapidly finish the edges of buttons. The machine is more particularly adapted to finishing *papier maché* shoe buttons.

##### IMPROVED SEWING MACHINE SHUTTLE.

William Gillett, Madison, Wis.—This consists in a support for the bobbin, which also carries the tension and thread slide, that can be readily attached to or removed from the shuttle. The object is to provide a reliable support for the bobbin, and an even and smooth tension on the thread, while all the parts are retained firmly in their places.

##### IMPROVED PAPER-FEEDING MACHINE.

Socrates Schofield, Providence, R. I., and Charles E. Baker, Montclair, N. J., assignors to themselves and Charles E. Johnson, Philadelphia, Pa.—This consists in arranging a pin in a paper feeder, so that it will make a hole on the backward movement, preparatory to entering the same on the forward movement. The object is to cause the penetrating instrument more surely to penetrate the top sheet and not affect the sheet below.

#### NEW HOUSEHOLD INVENTIONS.

##### IMPROVED JELLY JAR.

Nicholas P. Todd, Shamong, N. J.—This jelly jar is designed to form the jelly directly into molded shape when filling the jars for sale, so that it may be taken out and served in neat and convenient manner, being specially adapted for hotel, restaurant, and family use. The jar has a number of interior compartments of suitable shape, and a rim that extends to a suitable height above the compartments, for the purpose of containing a portion of jelly additional to that required to fill the compartments, and which will form the base of the molded jelly when the same is inverted. The jars may be made of larger size and arranged with suitable ornamentation in the molding compartments and on the top parts, so that the jelly presents, on being taken out, an elegant and attractive appearance.

#### NEW AGRICULTURAL INVENTIONS.

##### IMPROVED FLOW FENDER.

Andrew C. McLeary, Humboldt, Tenn., assignor of one half his right to James H. Hamon and Samuel McLeary, of same place.—This is an improved fender attachment, by which the plowing of young corn, cotton, etc., may be accomplished without stopping to uncover and take off clods from the young plants. The clods and irregular lumps of earth are carried back into the furrow. The fender piece is secured by curved rods and braces to the plow stock, and a swinging and adjustable barrow is applied to the fender piece.

##### IMPROVED SEED PLANTER.

Lycurgus J. Bosworth, Monmouth, Ill.—This machine has expansion spoke wheels, the spokes of which may be made to project more or less to cause the wheels to measure off more or less ground at each revolution, and plant the hills at a greater or less distance apart, as may be desired. The spoke wheels may also be turned to bring them into position to drop the seed in line with the hills previously planted.

##### IMPROVED SEED-DROPPING PLATE FOR GRAIN DRILLS.

Ephraim B. Null, Oxford, Ohio.—This consists in a seed-dropping plate, in which the holes are notched around their periphery, or are made star-shaped, to adapt them to receive large or small kernels. It is thus adapted to drop but one grain at a time, regardless of the size of the kernels.



## Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

**Agricultural Implements and Industrial Machinery for Export and Domestic Use.** H. H. Allen & Co., N. Y.

Directories for 1876 & '7, of all the leading Cities in the United States, will be sold at less than half price. Address P. O. Box 713, New York City.

**Power & Foot Presses, Ferracuto, Bridgeton, N. J.**

An experienced Sup't of Machine Work, a thorough practical mechanic and business man, desires employment. Best references. Address A. G. E., 271 Marshall St., Philadelphia, Pa.

The most economical and reliable articles for repainting and preserving Roofs are the Asbestos Roof Paint and Cement, H. W. Johns, 87 Maiden Lane, N. Y., patentee and sole manufacturer of Asbestos Materials.

A first class Machinist and Superintendent Wanted. Address P. O. Box 1317, New York, stating References, Experience, and Salary.

Makers of Jars and Cans for Fruit and Preserves, also Fruit Can Tools, please send wholesale price lists to Mann & Co., this office. Desired by a foreign correspondent who expects to give orders.

Wanted—Novel and practical invention, by a reliable house, for manufacturing. Address, Post Office Box 25, Chillicothe, Ohio.

**Split-Pulleys and Split-Collars** of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 413.

See **Boul's Paneling, Moulding, and Dovetailing Machine** at Centennial, B. 8-35. Send for pamphlet and sample of work. B. C. Maeb'y Co., Battle Creek, Mich.

**Hand Fire Engines, Lift and Force Pumps** for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

**Shingle, Heading and Stave Machine.** See advertisement of Trevor & Co., Lockport, N. Y.

The best Sewing Machine in the world—Makes the Lock Stitch, the Chain Stitch, and Embroidery Stitch from two whole Spools. Agents wanted everywhere. G. L. Du Laney & Co., 714 Broadway, New York City.

**Steel Stamps and Brass Stencils, for Marking Tools, Patents, Boxes, &c.** E. H. Payn, M'F'r, Burlington, Vt.

**Hyatt & Co.'s Varnishes and Japans**, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

To Lease—The largest portion of the building corner Canal, Center, and Walker Sts., now occupied as a Billiard Manufacturing and Sales Room. See advertisement in another column.

**Superior Lace Leather, all Sizes, Cheap.** Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Arny, 148 North 3d St., Philadelphia, Pa.

**Magic Lanterns, Stereopticons, for Parlor Entertainments and Public Exhibitions.** Pays well on small capital. 74 Page Catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

**Fire Hose, Rubber Lined Linen, also Cotton, finest quality.** Eureka Fire Hose Co., 13 Barclay St., New York.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

**Water, Gas, and Steam Pipe, Wrought Iron.** Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

**Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior.** Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

**Steel Castings, from one lb. to five thousand lbs.** Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

**Hydraulic Presses and Jacks, new and second hand.** Lathes and Machinery for Polishing and Boring metals. E. Lyon, 470 Grand Street, New York.

**Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.**

## Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Enquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present.

The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to enclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to enclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

R. J. will find a description of the physiological and pathological properties of alcohol on p. 91, vol. 31.—F. D. will find a recipe for blacking for patterns on p. 409, vol. 31.—F. N. T. will find a prescription for boils on p. 379, vol. 24.—H. J. will find on p. 337, vol. 31, directions for staining white wood in imitation of black walnut.—H. G. M., T. W., G. H. C., H. E. K., W. W. O., J. G. M., D. A. S., E. P. N., W. W. Y., C. E. G., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) T. S. asks: How can I separate gold and platinum filings? A. Dissolve the filings in strong aqua regia (3 parts hydrochloric acid to 1 of nitric acid), dilute with water, and filter. Evaporate the filtrate to dryness over a water bath, dissolve in hot water, rinse the evaporating dish with a little chlorine water or aqua regia (as small a quantity as possible) and add the rinsings to the main solution. Add to the solution chloride of ammonium until no further precipitate forms; allow to stand in a warm place for several hours, with occasional stirring. Remove the precipitate, which consists of the double chloride of platinum and ammonium, by filtration, and to the filtrate (the liquid) add a strong solution of protosulphate of iron; heat nearly to the boiling point, and allow to stand in a warm place for several hours, and filter. This last precipitate contains the gold; dry it on the filter paper, mix it with a little carbonate of soda (anhydrous) and a small fragment of rosin, place it in a small black lead crucible and heat strongly in a furnace or blacksmith's forge. If the amount of gold is small, it may be reduced on a piece of charcoal by means of a blowpipe and a good spirit lamp. If it is desired to reduce the platinum salt to the metallic form, it will be necessary to use the compound (oxyhydrogen) blowpipe and a small lime crucible: the substance should be mixed thoroughly with carbonate of soda, and the flame be made to impinge directly upon the substance, till it is fused to a clear button. The platinum salt may, however, be readily disposed of to any large dealer in fine chemicals or to manufacturers of platinum utensils.

(2) A. P. says: I notice that in several instances you recommend 70 per cent alcohol for making shellac varnish. Is it better than 95 per cent, and why? A. The chief recommendations are that it is much cheaper and does not evaporate quite as rapidly as stronger alcohol. The proportions of ingredients in the varnish depend altogether upon the character of the work upon which it is to be employed.

(3) J. C. K. asks: How is marking ink in cakes made? A. It consists essentially of bone-black, lampblack, gum arabic, molasses, and vinegar. The quantities of the two latter ingredients are quite small.

(4) F. B. H. asks: 1. How can I tan or treat bladders so that they will remain soft, pliant? A. We know of no such tanning process, and have not seen bladders treated so as to retain these properties.

Is there a machine by which a penman can produce one or more facsimile copies of a letter or instrument upon writing paper by the same operation that produces the original? A. The Edison electric writing pen allows any number of duplicates of a writing to be rapidly made. But this does not make the impression at the same time as the original. The manifold writer, consisting of alternate sheets of colored paper (see p. 378, vol. 28) and prepared tissue paper, the whole being written upon with a blunt point, comes the nearest to your description.

(5) A. G. S. asks: Is it a good plan to wash millstones with vinegar? A. If the millstones are of good material, the vinegar should not hurt them, and would help to wash off insoluble earthy matters. Other very dilute acids would probably answer equally well.

(6) W. asks: Has the lost art of coloring glass ever been rediscovered? Last June I resolved to make a preparation of paint to put on a tin roof. I used yellow ochre and oil mixed. I put on one coat. Not content with that, I went to work, put two other ingredients into a pot, heated them to boiling, put them into the paint pot, and gave the roof another coat of these four ingredients. It was very early in the morning, and the sun rose directly opposite the window, causing a very hot vapor to rise and settle on the second story window over the roof of the bay window. The rays of the sun were so powerful on these four panes of glass over the roof of the bay window that a perfect coloring of the glass took place. Any one, standing on the ground and looking up, can see 4 lights of glass over the said roof containing the most beautiful colors that eye ever beheld, arranged as complementaries, in ever graceful style than any artist could do it. The colors cannot be rubbed nor washed off, and they cannot be seen from the inside of the room, the glass being quite clear and transparent. A. The

art of staining glass has never been lost. Some of the ancient pigments cannot now be made. When the color is given to glass by a thin coating of colored glass, it is said to be flashed glass. When the coloring matter is spread through the entire material, it is said to be ruby, or green, or canary glass, according as it is stained with the oxides of copper, or oxide of uranium, etc. There is no difficulty in doing it. The appearances you mention are known in optics as the "interference colors of thin films," and are produced by a transparent film on the glass.

(7) P. L. G. asks: How may a dentist determine the fineness of a gold plate brought to him for repair, so that he may know what fineness of solder to use? A. Try it upon a touchstone and compare the streak with the streak of gold of a known degree of fineness.

(8) W. S. asks: 1. What are the relative volumes of 1 cubic inch of bisulphide of carbon, and 1 inch of its vapor at a tension of 15 lbs. per square inch? What is the weight of 1 cubic inch of bisulphide of carbon? A. The density of bisulphide of carbon at 60° is 1.27; a cubic inch would therefore weigh 232.5 x 1.27 = 295.26 grains. The density of the vapor of bisulphide of carbon is 2.67; a cubic inch would therefore weigh 232.5 x 2.67 = 620.66 grains. A cubic inch of bisulphide of carbon converted into vapor at 60° and 15 lbs. pressure would therefore occupy 265 cubic inches. 2. In what proportion must the vapor of a hydrocarbon, like benzene, be mixed with atmospheric air for perfect combustion? A. No general proportion can be given, the amount depending upon the relative proportion of the carbon and hydrogen in the compound. In the case of benzene, C<sub>6</sub>H<sub>6</sub>, about 7½ times its volume, in the state of vapor, of oxygen will be required for complete combustion. 3. Can such a mixture be lighted by a platinum wire heated by an electric current, the same as carburized hydrogen gas? A. Yes.

What paint or composition for iron will withstand great heat without burning or scaling off soon? It is intended for boiler fronts and furnace doors. A. There is none.

(9) W. H. W. asks: How can I make a mucilage such as is used on postage stamps? A. Use a strong aqueous solution of dextrin.

(10) D. W. S. asks: 1. Has iodoform ever been successfully used as a medicine? A. Iodoform was first employed as a remedy by Bouchardet of Paris in 1836. He recommended it as an alternative in serofulous affections, etc. It soon fell into disuse. In 1848 it was again brought forward. At present it is not much employed as an internal remedy. 2. What is its effect on the human system? A. It has been recommended for use in serofula, goitre, rickets, syphilis, consumption, and some diseases of the skin. Iodine is also used in the same conditions, and many believe that the good effects which have been obtained from the use of iodoform result from the iodine which it contains, and which is set free when it is decomposed in the human body. It is usually given in doses of ¼ to 1½ grains, in pill form. Iodoform is used as an external application to a considerable extent in cancer of the womb and breast, and as a dressing to certain forms of ulceration. Excellent effects are obtained from it when used in this way. It is applied either in powders, as an ointment, or in ethereal solution. Sometimes it is used as a suppository in the rectum or vagina. 3. Is it poisonous in any degree? A. When taken internally in moderate quantities, it does not usually produce any irritating effects. In overdoses it occasions intoxication, great nervous excitement, acceleration of the pulse, staggering gait, and convulsions resembling those produced by strychnin. The breath gives off the characteristic odor of iodoform. The quantity which will produce these effects and occasion death in the human being is not stated. In one experiment, upon a large dog, fifty grains proved fatal. One of the chief effects of iodoform is its anesthetic power. This is very marked when it is used upon sores (not inflamed), and when applied to the mucous membrane. In the throat and nasal passages, the rectum and vagina, this is often very decided.

What is meant by standard copies of the ohm, in speaking of electrical measurements? A. For a description of the ohm, which is a measure of electrical resistance, see p. 117, vol. 30.

(11) B. says: I have thousands of tons of sea kelp, not available for agricultural purposes. Can one suggest a method of utilizing it? A. Sea weed (*Fucus palmatus* and *saccharinus*) is chiefly employed as a source of iodine. The process for extracting the iodine is very long and tedious, and it requires considerable chemical skill to carry on the business successfully. There is no work of this kind in this country.

(12) E. S. T. says: I claim that, the larger the surface of a lightning rod is, the heavier is the charge it could conduct. A friend averred that it is the solid contents that must be considered and not the amount of surface presented. I find on reading your journal that I am wrong. Can you state what proof there is that shows that the surface area does not add to the conductivity? The facts on which I based my arguments I find in Silliman's "Philosophy," edition 1859, p. 923: "Electricity resides only on the outer surfaces," etc. A. The question of conductivity may be regarded in two lights, the results of which are very different. For instance, we know experimentally that a wide and very thin foil of metal is capable of transmitting the charge from a large plate electrical machine, giving a flash of perhaps several inches in length, while the same foil would be deflagrated by the current from one or two cells of battery. This apparent anomaly is not so difficult of explanation as might at first appear. In the former case, the electricity has what is called high potential or tension, and is deficient in quantity; in the latter, the quantity, on which the heating effects depend, is very great.

Again all conductors take what is called a charge, the magnitude of which depends upon several circumstances, and a certain time is consumed in the charging. Now, as regards comparatively short conductors at least, little or no heating effect is produced until the latter becomes charged throughout, in other words, until the current becomes uniform in the different sections of the conductor. If, then, but a fractional part of the time required to charge a conductor is occupied in communicating electricity to it, the latter is not affected, notwithstanding the fact that it would be melted were a current of equal strength maintained through it for even a few seconds. We would conclude from the above, then, when the discharge is all but instantaneous, that conductors possessing considerable surface are most desirable; but when it is remembered that lightning flashes, besides combining great quantity with high potential, sometimes succeed each other so as to produce a veritable current, that, and a marginal allowance for safety, suggest the employment of rods so constructed as to unite, with large mass of metal, considerable development of surface. The item from Silliman's "Philosophy" refers to the static charge; that alone resides on the surface, whereas, on the other hand, the whole mass of the conductor is concerned in transmitting a current after the charge has been once effected.

(13) J. H. B. asks: What kind of paint is best for painting galvanized iron exposed to the weather? The zinc appears to oxidize between the paint and the iron, and then peels off, when lead or common paint is used. A. One of the best paints we know of for this purpose, where a dark color is not objectionable, is common asphalt dissolved in turpentine or benzene. It is extremely tenacious, dries soon, and becomes very hard and insoluble by the action of sunlight. It is flexible and very durable. Do not mistake it for coal tar.

(14) E. L. W. says: I have a solution of nitrate of silver precipitated with cyanide of potassium, also a gold solution done in the same way. What cheap chemical could I add to let the work, in coming from the bath, need no burnishing? The bath is: 1 oz. silver, cut in 8 oz. nitric acid and 2 oz. water; and I add that to 5 oz. cyanide of potassium in 32 oz. water. A. There is nothing.

1. Is there a soft soldering fluid that will not rust? I now use muriate of zinc, with sal ammoniac added, but it rusts my tools. A. Try oleic acid (crude). 2. There is a solution sold named anti-oxidizer, which is clear as water, tastes similar to borax, and is used to preserve the color of gold and silver while being heated. The fluid is undoubtedly water and some chemical dissolved in it. I tried borax, but it does not seem to be that. It does not answer the purpose. Have you any idea what it is? A. It is probably chloride of ammonium (sal ammoniac).

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

N. F. R.—It is beautifully crystallized sulphide of iron in gneiss rock. The outer shell is composed of sesquioxide of iron from the decomposition of the sulphide.—Two specimens in a needle box, with no name on it, have been received. No. 1 is chalcopryite—sulphide of copper—and carbonate of copper. No. 2 is clay discolored by oxide of iron.—S. N.—No. 1 is a silicate containing iron, alumina, soda, lime, and magnesia. The nodular piece of stone is marcasite. No. 2 is sulphide of iron with clay. No. 3 is a piece of shale with crystals of carbonate of lime in the crevices. J. N. C.—It is a variety of infusorial earth. See p. 240, vol. 33.—G. W. S.—It is micaceous sand from decomposed and disintegrated granitic rock. It does not contain any precious metal. Other than the attraction of gravitation, which acts alike between all bodies, there exists no attractive influence whatever between the metals and peach tree limbs (or limbs of other trees). The divining rod is not a scientific instrument; and aside from its employment in sensational tales, its wonderful attributes, like those of the philosopher's stone, are merely delusive fancies.

### COMMUNICATIONS RECEIVED.

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

On the Mississippi Jetties. By A. S.  
On Binocular Vision. By J. H. H.  
On Car Wheels on a Curve. By S. T.

Also inquiries and answers from the following:

F. O. H.—C. A. C.—J. A. McN.—J. L. R.—C. W. J.—A. J. B.—E. B.—H. R. S.—W. C. F.—E. G.—J. T. S.

### HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells a tricycle propelled by steam? Whose is the best form of steam engine? Who sells electric telegraph wire? Whose are the best headlights for locomotives?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.



Up to the hour of going to press, the list of patents issued during the week ending November 21, and bearing that date, had not arrived from Washington.

## VALUE OF PATENTS,

AND

How to Obtain Them.

Practical Hints to Inventors.

**P**ROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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## HOW TO OBTAIN PATENTS.

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|                                                                   |          |                                             |         |                                             |     |                                       |     |                                                  |          |                                                   |          |
|-------------------------------------------------------------------|----------|---------------------------------------------|---------|---------------------------------------------|-----|---------------------------------------|-----|--------------------------------------------------|----------|---------------------------------------------------|----------|
| Electric light on a steamer.....                                  | 61       | Health lift, Smiler's.....                  | 389     | Lizards, flying, of America.....            | 185 | Gage cock.....                        | 58  | Salmon, twin.....                                | 345, 391 | Telescope lenses, hazy.....                       | (7) 139  |
| Electric locomotive wheels.....                                   | 378      | Heated terms, their causes and dangers..... | 64      | Locomotive building in England.....         | 185 | Harvester.....                        | 233 | Salt brine of Nevada, the.....                   | 337      | Telescope lenses, smoky.....                      | (1) 107  |
| Electric machine, the Holtz.....                                  | 313      | Heater, deposit in feed water.....          | (2) 171 | Locomotive, ice.....                        | 40  | Ice, stretching.....                  | 318 | Salt brine, antique.....                         | 374      | Temperature, low.....                             | (19) 29  |
| Electric valve, Ganguly's.....                                    | 184      | Heater, feed water.....                     | 102     | Locomotives and railways.....               | 181 | Iron bronze.....                      | 342 | Sample weighing scale.....                       | 275      | Test color, a new.....                            | 97       |
| Electric waves, velocity of.....                                  | 278      | Heating air for furnaces.....               | 107     | Locomotives for steep grades.....           | 189 | Oil well tubing.....                  | 73  | Sand, musical.....                               | 154, 402 | Test colors.....                                  | 164      |
| Electrical dust figures.....                                      | 151      | Heating and ventilating school houses.....  | (1) 107 | Locomotives, incendiary.....                | 113 | Patent damages.....                   | 408 | Sand, in anybody.....                            | 145      | Test for alcohol.....                             | 289      |
| Electrical experiments, new.....                                  | 154      | Heating by radiation.....                   | (2) 239 | Locomotives, those collided.....            | 213 | Patents, annulling.....               | 58  | Sap spout.....                                   | 235      | Test plates, microscopic ruled.....               | 154      |
| Electrical rubber.....                                            | 408      | Heliometer, Alleghany.....                  | 213     | Locust flights east of the Mississippi..... | 202 | Patents, extended.....                | 58  | Saw, filing a.....                               | 231      | Testing dyes.....                                 | (1) 156  |
| Electricity as a transmitter of power.....                        | 27       | Heliometer, the.....                        | 213     | Locust pest, the.....                       | 9   | Patents, foreign.....                 | 313 | Saw, model scroll.....                           | 261      | Testing iron and steel.....                       | 57       |
| Electricity, nature of.....                                       | 406      | Heliometer, the.....                        | 213     | Locusts, a few more words about.....        | 84  | Patents, for.....                     | 313 | Saw, steel rail.....                             | 134      | Testimonial, a misplaced.....                     | 3        |
| Electricity, passage of, through gases.....                       | 211      | Heliometer, the.....                        | 213     | Loggers live, how.....                      | 20  | Patents, for.....                     | 313 | Saw, teeth, inserted.....                        | 294      | Thistle, Canada.....                              | (4) 44   |
| Electro-chemical discoveries, Hertholtz's.....                    | 112      | Heliometer, the.....                        | 213     | Look out for him.....                       | 261 | Patent law reform in England.....     | 294 | Saw, velocity of.....                            | 71       | Thistle, the, or the simplest.....                | 66       |
| Electro-magnetic engine, Camacho's.....                           | 310      | Heliometer, the.....                        | 213     | Lubricator.....                             | 261 | Patent machine, selling.....          | 274 | Saw, spontaneous combustion of.....              | 390      | Tiger extirminator wanted.....                    | 363      |
| Electro-plating.....                                              | 248      | Heliometer, the.....                        | 213     | Lubricators.....                            | 261 | Patent system, the British.....       | 279 | Sawing granite.....                              | 274      | Timber, measuring.....                            | (22) 238 |
| Electroplating leaves, insects, etc.....                          | 340      | Heliometer, the.....                        | 213     | Lumber operation on the Suquia.....         | 261 | Patent system, the British.....       | 279 | Sawing steel bars.....                           | (6) 11   | Timber, well seasoned, for c-r time building..... | 197      |
| Electrotyping, who originated.....                                | 340      | Heliometer, the.....                        | 213     | Lung tester, a new.....                     | 242 | Patent system, the British.....       | 279 | School houses, panics in.....                    | 321      | Time intervals measured by electricity.....       | 128      |
| Electrotyping insects, etc.....                                   | 340      | Heliometer, the.....                        | 213     | Machine for making cab drivers.....         | 290 | Patents, cheap advantages of.....     | 256 | Science Association, American.....               | 185      | Times, better, at hand.....                       | 145      |
| Elements, volatile.....                                           | (12) 313 | Heliometer, the.....                        | 213     | Machinery, care of, no mystery.....         | 290 | Patents for seeders and planters..... | 134 | Science Association, Social, American.....       | 197      | Time, crystal surface on.....                     | 23       |
| Emery, coating wood with.....                                     | 379      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents in Great Britain.....         | 253 | Science in America.....                          | 269      | Tobacco, artificial.....                          | 13       |
| Emery grinder, car box.....                                       | 34       | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Science, summer.....                             | 128      | Tobacco-curing apparatus.....                     | 311      |
| Emery wheel, knife grinder.....                                   | 34       | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tobacco, detoxicated.....                         | 361      |
| Employment, honorable.....                                        | 354      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tobacco-straining machine.....                    | 271      |
| Enamelled cooking vessels.....                                    | 338      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tobacco, waste.....                               | 361      |
| Encyclopaedia, Appleton's.....                                    | 343      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tonate leaves, singular properties of.....        | 185      |
| Engine parts, etc.....                                            | (1) 27   | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tool, combination.....                            | 115      |
| Engine, rotary, Gallahue's.....                                   | 1        | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tool handles, staining.....                       | (1) 269  |
| Engine, steam, new.....                                           | 251      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tool, inners and cutters.....                     | 347      |
| Engine, the Collins.....                                          | 268      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Toothicks, a for time.....                        | 356      |
| Engine, the Harris-Corliss.....                                   | 30       | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Trade marks in Great Britain.....                 | 127      |
| Engine, the Niles.....                                            | 320      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Trade the value of a.....                         | 39       |
| Engine, water, a.....                                             | 250      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Engines, American and English.....                                | 250      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree plantations in Massachusetts.....            | 273      |
| Engineer's convention, the civil.....                             | 291      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| England's dilemma.....                                            | 134      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Engraving, steel plate.....                                       | 185      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Have one machine.....                                             | 281      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Etching on glass.....                                             | 199      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Eucalyptus globulus, the.....                                     | 121      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Evaporation, fuel for.....                                        | 121      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Evolution, thoughts on.....                                       | 361      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Exhibition, the French.....                                       | 361      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Explosion, the Thunderer.....                                     | 161      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Explosive, new safety.....                                        | 274      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Explosive compounds, new.....                                     | 374      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Explosion, African International Exposition, New South Wales..... | 374      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Eye, artificial.....                                              | 374      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Eye ball, drainage of the.....                                    | 31       | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |
| Eye, defects in the human.....                                    | 210      | Heliometer, the.....                        | 213     | Madder orange.....                          | 183 | Patents, official list of.....        | 253 | Scientific American, no connection with the..... | 406      | Tree, a useful.....                               | 164      |







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