

SCIENTIFIC AMERICAN

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

Vol. XXXIV. - No. 24.
(NEW SERIES.)

NEW YORK, JUNE 10, 1876.

\$3.20 per Annum.
(POSTAGE PREPAID.)

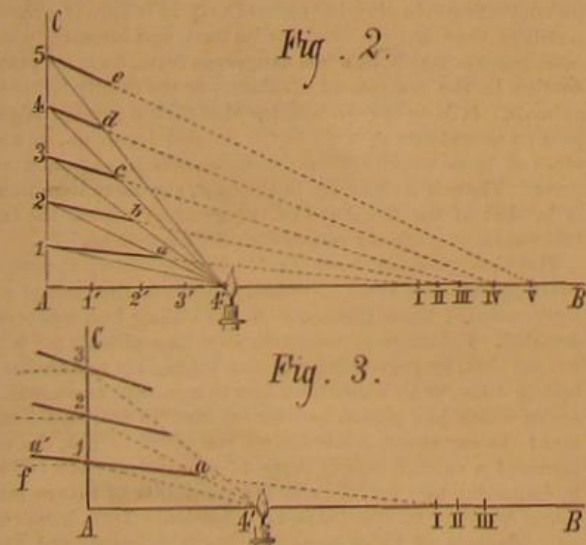
NEW SYSTEM OF ILLUMINATION BY REFLECTION.

In order to collect rays of radiant light or heat, two means are now used, based, the one on reflection by bright surfaces, the other on the refractive power of suitable lenses. Theoretically, reflection alone has an indefinite application, since recourse may be had to plane mirrors movable in all directions, the rays reflected from which may be converged on a determined point: or to concave mirrors. The practical employment of these last is however impeded by difficulties of fabrication.

In the case of refraction, such as takes place through the lenticular apparatus of lighthouses, for example, a variety of disadvantages exist. There is a large absorption of light by the glass, double refraction at the two surfaces of the refracting medium, dispersion due to *striae* and bubbles, and finally the double aberration of sphericity and refrangibility of the spherical glasses which form the principal part and often the entirety of the apparatus.

It will be seen, therefore, that, in order to obtain best results, a construction is needed which will combine all the advantages of the reflecting system, while eliminating the capital difficulties in fabrication, difficulties which are directly proportional to dimensions, and consequently diminish the useful effect of the reflector. Such is the problem which, it appears, has been successfully solved by Professor Balestrieri, of Naples, by the invention of the photo-thermic hollow sphere collector (*collecteur photo-thermique armillaire*), the principle of which we will now explain by the aid of the annexed diagrams.

A C and A B, in Fig. 2, are indefinite lines, placed at right angles, and divided from A into a certain number of equal



parts, 1, 2, 3, 1', 2', 3', etc. Take any point on the line, A B, for example 4', for the focus of the system, and draw therefrom the lines 4' 1, 4' 2, etc. These lines represent rays from focus 4'. From 4' on the line, A B, set off 4' I equal to 4' 1, 4' II equal to 4' 2, etc., and then join, by dotted lines, the points I, II, III, IV, V, with 1, 2, 3, 4, 5, on line, A C. Then

these lines, 1 I, 2 II, etc., when the line, A C, is revolved about A B as an axis, will describe surfaces of right cones; and the portions of said dotted lines comprised between the successive rays (made full lines in the engraving) will be superior profiles of segments of these cones on the base.

Suppose now that these profiles 1 a, 2 b, 3 c, etc., repre-

no image, no conjugate focus. In each segment there exists a circular section which reflects the rays from the luminous focus rigorously parallel. The other points of the segment reflect rays slightly divergent or convergent; each of the other points of the flame likewise gives some rays parallel, the rest not so; and the latter, after crossing, diverge in their turn. Thus innumerable parallel and diverging rays are produced, which combine to form a luminous cone, the base of which is projected in space. Thus the size of the flame is a first element of divergence, and the same is true of the segments: the larger they are, the greater is the divergence. Instead of arranging the segments on a plane, they may be disposed on a curve so as to collect the entire 180° of light of the anterior hemisphere.

No lens can have an opening, A B, Fig. 5 (page 375), greater than its radius of curvature, O C, on account of difficulties in fabrication and of the total angle of reflection of the glass. The angle, A C B, of this opening is but 60°. Now as the principal focus, F, of a plano-convex lens, is very nearly at the extremity of the diameter of the sphere, O F, it follows that the lens cannot collect more than 30° of light. In the construction of lighthouses, this large focal distance is a serious inconvenience, in addition to that due to the small collecting angle. In the case, for example, of a flash light, for lenses of 1

BALESTRIERI'S SYSTEM OF ILLUMINATION.

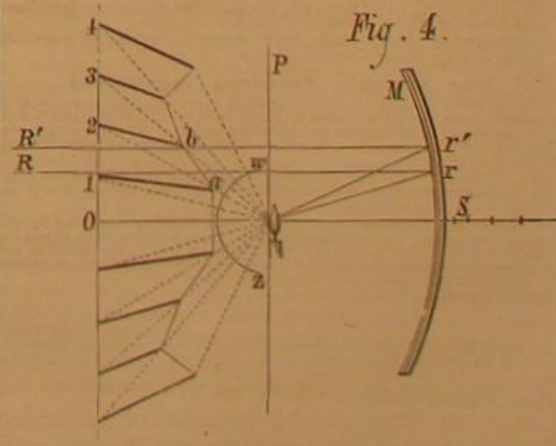
sent metallic segments with polished surfaces. The ray of light, 4 I, Fig. 3, impinges on the surface of annulet, 1a, at the point, 1, and will be reflected to f. Now as 4 I = 4 I' in the triangle 4 I I', the angle 4 I I' = 4 I I'. Moreover the angle of incidence, 4 I a = the angle of reflection, f 1 a'. Hence the reflected ray, f 1, is parallel to A B. Similarly it may be demonstrated that all the other reflected rays will be parallel to the same axis, and consequently the beam of reflected light will be composed of parallel rays.

Fig. 4 represents a section of an assemblage of these reflecting segments of cones, to which the inventor has given the name *armilles* (annulets), and which together compose a collector. The sphere of light emanating from the central source may be supposed to be divided into two hemispheres by the line, P. The rays of the anterior hemisphere are collected and reflected by the segments, 1 a, etc., and the quantity of collected rays is indicated by the arc, *u s*. It is equally possible to collect and utilize the rays of the posterior hemisphere, and to this end is arranged the concave mirror, M, the center of curvature of which is at O. The rays from the luminous source, impinging upon the mirror at r r', are projected on the lines, R r, R' r', through the spaces between the segments. Each part of said space through which the rays pass equals one half the distance, 1 2; consequently the reflector adds to the light collected by the segments one half of all that which falls upon its surface. If therefore the segments collect 150° of light, the mirror will collect 75°, and therefore the sum 225° will represent the portion of the luminous sphere utilized.

For lighthouses, at the present time the Fresnel lens is largely employed; but this is subject to the disadvantages already noted as peculiar to refractive apparatus. Moreover, with all lenses, no two rays are truly parallel, and the projection of the light at a distance causes a conjugate focus, which is in relation to the luminous object of which it is an enlarged image. With Professor Balestrieri's device, there is

meter, turning around a lamp, C (Fig. 5), O C + C F would be equal to 2 meters, and consequently the circumference about which the lens must travel would be 12.56 meters, or about 40 feet. As the flashes must be rapidly repeated, it follows that, in passing over so long a road, lenses must be multiplied, and therefore it happens that 10 or 12 of the latter are often found in a single lighthouse.

In Professor Balestrieri's apparatus the focal point is arbitrary, and the segments can be adjusted to suit it at any position, to give, say, a focal distance of 19½ inches or even less. The circular travel would be but 5 feet, and a single



set of segments, or at most two, would replace the dozen lenticular systems, besides affording a greater simplicity and much greater economy in construction.

The apparatus, we learn from *Les Mondes*, from which journal we condense the present article, has been subjected

(Continued on page 372.)

Scientific American.

ESTABLISHED 1846.

MUNN & CO., Editors and Proprietors.

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

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included.....2 70

The postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

Scientific American Supplement.

A distinct paper from the SCIENTIFIC AMERICAN, but of the same size, and published simultaneously with the regular edition.

TERMS.

One year by mail.....\$5 00
SCIENTIFIC AMERICAN and SUPPLEMENT, to one address.....7 00

Single Copies.....10

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

Address MUNN & Co., 37 Park Row, N. Y.
Subscriptions received and single copies of either paper sold by all the news agents.

VOLUME XXXIV., No. 24. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JUNE 10, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Air pump, improved.....	371
Alloy for small engines (42).....	370
Answers to correspondents.....	369
Astronomical notes.....	372
Battery for lighting gas (39).....	372
Bells, leather and rubber (16).....	372
Blood tester, a (38).....	372
Boilers, locomotive (12).....	372
Brass, tarnish on (25).....	372
Bridge, the East river.....	372
Building on clayey soils (2).....	372
Business and personal.....	372
Case-hardening steel plates (31).....	372
Cement, a resistant (1).....	372
Centennial exhibition, the*.....	372
Centennial judges, the.....	372
Centennial, the—The signal bureau.....	372
Centennial, the—The U. S. exhibit.....	372
Champagne, corks in (39).....	372
Connecting rod, the length of.....	372
Cow hair, uses of (27).....	372
Drawing instrument, new.....	372
Drawings, finishing crayon (26).....	372
Dyeing cotton blue.....	372
Electricity, atmospheric (18).....	372
Elevator, a handy (4).....	372
Exposition of 1878, the French.....	372
Fish, magnetic (28).....	372
Gas and oil chandelier.....	372
Glue, marine (41).....	372
Hair turning gray (29, 30).....	372
Hides, clarifying (43).....	372
Horses, drugging.....	372
Hotel sinking in the earth.....	372
Illumination, new system of.....	372
Induction coil sparks (19).....	372
Ink, making (32).....	372
Jet, imitation (30).....	371
Kalsomine, a good.....	371
Keely motor again, the.....	369
Light, concentrating (7, 8).....	372
Light, violet, action of.....	372
Light, white and red (36).....	372
Lighting rods (10, 11, 12).....	372
Master mechanics, suggestions for.....	369
Metal more fusible than tallow.....	371
Nickel with cobalt, detecting.....	372
Nutmegs, no more wooden.....	372
Ozone, powder for producing.....	372
Patents, American and foreign.....	372
Patents, official list of.....	372
Problem, an old.....	371
Racks, small, to make.....	369
Roll shafts, sprang (13).....	372
Roofs, leaky (3).....	372
Roofs, leaky iron (6).....	372
Sealing stars in the daytime (25).....	372
Silver, production of.....	372
Slide valve, balanced.....	372
Social peril, a.....	368
Spontaneous combustion.....	368
Springs, intermittent.....	372
Surgical operation, remarkable.....	372
Tea and tea culture.....	372
Telegraph details (21).....	372
Telegraph, multiple (22).....	372
Turbines.....	372
Turbine wheel, improved.....	372
Ventilating a schoolhouse (5).....	372
Watch dials, to clean silver.....	372
Water, purifying (34).....	372
Wax, what is bad, coating (44).....	372
Wax with plumbago, coating (44).....	372
Wood cutters, lathe (24).....	372
Writing, restoring faded.....	372

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 24.

For the Week ending June 10, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876. With 7 illustrations. —The United States Government Mechanism.—Manufacture of Cartridge Cases, 1 engraving.—How Breech-Loading Rifles are Made.—The Corliss Reel Gear Cutter, by J. Bock, 2 figures.—Belgian Corliss Engine.—Compound Horizontal Engines.—Band Saws.—The Pump Annex.—Machinery Hall Notes.—Locomotives at the Exhibition, 2 engravings, with Dimensions and Particulars.—The Art Gallery on the Day of Opening, 1 engraving.—The Main Building, Interesting Particulars, 1 engraving.—The Chimes of Bells.—Steam Engines at the Exhibition.—The Buckle Engines.—Air Compressors.—English Printing Machinery in Operation.	372
II. MECHANICS AND ENGINEERING. With 51 figures.—The Pneumatic Despatch System of Paris, 11 figures.—Raynor's Plan for Iron Submarine Tunnel, with 10 figures.—Iron and Steel from the Ore, 3 figures, by W. A. LITTLE.—Rigid Suspension Bridge, by T. CLAXTON FIDLER, 1 figure.—Windmills, Cost and Value.—Recent Austrian Ironclads, by E. J. REED, 2 figures.—How Blossom Rock, San Francisco, was Removed, by Colonel R. S. WILLIAMSON, with 21 figures.—Plan of the Rock.—Sinking of the Calson.—Excavation of the Interior.—Construction of the Pines, Arrangement of the Explosive Material in the Rock, Mode of Explosion.—Dredging Machinery after Explosion.—Our Foreign Iron Trade.—The Dhu Heartach Lighthouse, by D. A. STEVENSON.	372
III. LESSONS IN MECHANICAL DRAWING. By PROFESSOR W. A. MAC-CORD, with 5 figures.	372
IV. CHEMISTRY AND METALLURGY.—Decomposition of Nitrate of Ammonia.—Atmospheric Exchanges of Ammonia.—Vegetation of Plants.—Epsom Salts.—Tellurium, its History, Uses, Value, etc.—Daubrite, a New Mineral.	372
V. NATURAL HISTORY, ETC.—New York Academy of Sciences.—Glaciers of New Zealand.—French Academy of Sciences.—The Electric Rel.—Ancient Peru.—Artificial Prevention of Frost.—Fall of a Meteoric Stone.—Shower of Flies, Canada.	372
VI. ELECTRICITY, LIGHT, HEAT, ETC.—Action of Light on Selenium.—The Errors of Ocular Estimation, with 8 illustrations.	372
VII. MEDICINE, PHYSIOLOGY, ETC.—Small-pox Spread by Dogs.—Removal of Pork from Stomach.	372

The Scientific American Supplement

is a distinctive publication issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

COMBINED RATES.—The SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT will be sent together for one year, postage free to subscribers, on receipt of \$7.00.

TO SCIENTIFIC AMERICAN SUBSCRIBERS WHO WISH TO TAKE THE SUPPLEMENT.—A subscriber to the SCIENTIFIC AMERICAN may change at any time to the SUPPLEMENT, or may have both papers sent to him, by remitting to us the difference between the amount already paid for the SCIENTIFIC AMERICAN and the SUPPLEMENT prices above mentioned.

Remit by postal order.

MUNN & CO., PUBLISHERS,

37 Park Row, New York.

All the numbers of the SUPPLEMENT from its commencement, January 1, 1876, can be supplied; subscriptions date with No. 1 unless otherwise ordered.

Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 10 cents.

Imitation Silver on Stone and Plaster.

Take two sheets of mica, and render them perfectly white by boiling in hydrochloric acid, or by the action of fire. Wash and dry, and then bruise them to fine powder, which sift. Mix the powder with very light collodion; and with a soft camel's hair brush, put two or three layers on the object. This coating, as soon as dry, will assume and preserve the appearance of silver.

SPONTANEOUS COMBUSTION.

We noted, recently, a case of spontaneous combustion due to the saturation of sawdust and shavings by boiled linseed oil. The refuse had accumulated under the floor of a carpenter's shop, through cracks in which the oil had leaked, and the first intimation which the occupant of the premises had of his impending danger was a thin wreath of smoke oozing up between the boards. Instances of this kind are exceedingly common; so common, indeed, that it may be fairly believed that a very large proportion of the fires, the immediate causes of which frequently baffle all attempts at discovery, arise from the flame thus insidiously generated. A case lately happened within our own knowledge, where a gentleman, who had left his house for a brief period unoccupied, returned late at night to find the building filled with smoke and his kitchen woodwork in a light blaze. Prompt measures luckily resulted in extinguishment of the fire; and on investigation it was found that a servant had employed a closet shelf as a receptacle for old greasy dishcloths and oily rags used for cleaning furniture. The ignition of such materials, always favored by a slight warmth, was hastened by the temperature of the kitchen, and the rapid oxidation soon determined active combustion.

It has been determined by experiment that a handful of cotton waste soaked in boiled linseed oil, placed in a chamber at a temperature of 170° Fah., will take fire in less than two hours. If raw linseed oil be used, the time occupied is from four to five hours, and with rape oil about six hours. Gallipoli oil takes about the time last mentioned, under 132° Fah. Castor oil, under like circumstances, is very slow; and at the end of two days, waste saturated with it only became a mass of charred cotton. Lard oil produces rapid combustion in about four hours. Sperm oil, on the other hand, refuses even to cause a charring of the waste. Seal oil, of a strong fish odor not unlike sperm, has produced rapid ignition in one hundred minutes, temperatures being as last stated. The heavy oils from coal and shale, being chiefly the higher olefines, have a remarkable effect in preventing oxidation, through giving a certain protection from the air. Mixtures of these oils with 20 per cent of rape oil gave no indication of heat whatever at 170° Fah.; and even seal oil, with its own bulk of mineral oil added to it, did not at 135° reach a temperature sufficient to char cotton.

As a general rule, it may be laid down that spontaneous combustion of refuse, soaked with vegetable or animal oils, will occur whenever the conditions are such that a temperature of at least 175° continues for several hours. Cotton will burst into flame; wool, on the other hand, becomes a blackened mass. Equal weights of cotton and oil produce the most rapid inflammation. Combustion may be checked or stopped by the addition of mineral oil. Wherever vegetable or animal oil (other than sperm) is largely used, therefore, whether for lubricating machinery or oiling tissues, it would seem to be a safe precaution to add to it as large a proportion of mineral oil as possible, if such addition can be made without interfering with the use of the material.

WHAT IS BAD WATER?

There has recently been some complaint in this city regarding the condition of the Croton water, which has appeared muddy in color, owing to its being slightly charged with organic and other substances. As the Croton is normally of exceptional purity and clearness, the presence of the foreign matter excites attention which would not be accorded if we were accustomed to drinking such water as is consumed from the Thames river in England, or from the Mississippi or Monongahela rivers in this country, where mudiness is rather the rule than the exception. In New York, however, we have the satisfaction of knowing that our water supply is undefiled. No town or factory refuse passes into it; and therefore it is reasonably certain that such impurities as may affect it are those due to natural causes, and not to the addition of extraneous matter which may be deleterious to health. But this is not the case everywhere; and in localities where the supply is taken from adjacent rivers and streams which pass through populous districts, any change in the water may bode its pollution to a degree which renders it unfit for human consumption; and indeed, the same result may happen without the water visibly indicating the fact, save by its effects. This trouble has been found seriously to exist in England; and for several years the subject of the river pollution, which is a necessary consequence of the closely settled country and its immense manufacturing districts, has been under examination by government commissions of scientific men.

Among other objects of the investigation has been that of determining what bad water is, or rather at what point, whether through mechanical or chemical impurities, pollution of the liquid may be considered as beginning. In a recent report, Professor Frankland answers the question of what a polluted liquid is as follows:

(1) Every liquid which has not been submitted to precipitation produced by a perfect repose in reservoirs of sufficient dimensions during a period of at least six hours; or which, having been submitted to precipitation, contains in suspension more than 1 part by weight of dry organic matter in 100,000 parts of liquid; or which, not having been submitted to precipitation, contains in suspension more than 3 parts by weight of dry mineral matter, or 1 part by weight of dry organic matter, in 100,000 parts of liquid. (2) Every liquid containing in solution more than 2 parts by weight of organic carbon or 3 parts of organic nitrogen in 100,000 parts of liquid. (3) Every liquid which, when placed in a white porcelain vessel to the depth of one inch, exhibits under daylight a distinct color. (4) Every liquid which contains in solution, in every 100,000 parts by

weight, more than 2 parts of any metal, except calcium, magnesium, potassium, and sodium. (5) Every liquid which in every 100,000 parts by weight, contains, in solution, suspension, chemical combination, or otherwise, more than 0.5 of metallic arsenic. (6) Every liquid which, after the addition of sulphuric acid, contains in every 100,000 parts by weight more than 1 part of free chlorine. (7) Every liquid which, in every 100,000 parts by weight, contains more than 1 part of sulphur, in the state of sulphuretted hydrogen or of a soluble sulphuret. (8) Every liquid having an acidity superior to that produced by adding 2 parts by weight of hydrochloric acid to 1,000 parts of distilled water. (9) Every liquid having an alkalinity greater than that produced by adding 1 part by weight of caustic soda to 1,000 parts of distilled water. (10) Every liquid exhibiting on its surface a film of petroleum or hydrocarbon, or containing in suspension, in 100,000 parts, more than 0.05 of such oils.

By the aid of the above, it is easy to determine what streams are polluted and what pure; and when the feeders to the source whence the water supply is obtained are found to be thus contaminated, it becomes a question for the authorities to determine as to the necessary restrictive measures to prevent the continuance of the evil. Of course, a stream cannot be regarded as polluting when, although containing deleterious ingredients in a greater degree than is above laid down it empties into a source of water supply which is even fouler: so that the question of whether a stream is a means of pollution, and hence a public nuisance, is one of a relative nature, depending on individual circumstances.

A SOCIAL PERIL.

The confession of the Boston belfry murderer, Piper, reveals an instance of a mental condition, the evil results of which seemingly defy any preventive measures that society can devise. It shows us that we have to face a new danger, more insidious and more terrible than are magazines of dangerous explosives located in our midst. We can recognize symptoms of lunacy and put the sufferer under restraint: if not before, at least immediately after he has slaughtered one fellow being; but what are we to do with those who exhibit no symptom of mental alienation, but who kill again and again for the love of killing? Unlike the lunatic who makes no effort to hide the crime, or the assassin who in his cooler moments betrays the work done in the heat of passion, these wretches are destitute even of a twinge of remorse, and their covering of the deed is performed with a coolness and thoroughness to which the murderer for greed or revenge is a stranger.

This man, Piper, confessed to have killed two victims, not because he was impelled to do so by any ungovernable impulse, but for a clear motive of self-gratification; he liked "to see them suffer." It appears that the very heinousness of the crimes has caused the idea that the perpetrator was in sane, and should not have suffered the death penalty, a notion we think unfounded and fraught with great mischief to society. There is the clearest possible distinction between the case of Piper and of a man who kills through morbid impulse. True morbid impulse, for example, impels a man to lie in wait for and to murder the person who his diseased delirious imagination supposes is about to do him some terrible injury. He is perfectly aware of his wrong-doing, but is so impelled to its perpetration that he cannot avoid it. Now, on the other hand, if while in a delirious state he should act according to his reason, no matter how perverted, and then strike down his victim, there is no morbid impulse; nor would there be any, should he commit suicide to avoid some imaginary impending calamity. Note the distinction which is here thus closely drawn: it lies simply in the fact that the murderer is irresistibly impelled to the deed. He does it not merely because he thinks it expedient for his safety, but because he *must* do it.

Now, in this Boston case, morbid impulse is obviously wanting, although it has been predicated on the apparent absence of motive to the crimes. Here is again an error; for there was a motive of the strongest possible description, namely, that of the love of killing; the same motive which induces a brute to slay its natural prey in infinitely greater numbers than are required for its food, and identically the same passion which, in a less dangerous form, finds its gratification in the combats of gladiators or the deadly fights of animals. It is as easy to imagine that such a passion might gain an ascendancy as well as the passion for drink, or any other of those which civilization endeavors to curb and repress. There is no insanity in the case, any more than there is in that of the drunkard or the gambler whom the law looks upon as perfectly responsible for his actions.

The vital question, however, is: How is society to protect itself against this evil? Necessity points to the prompt extermination of those affected with the killing lust wherever detected. Reformatory measures seem unavailing; for who can say that, by preventing a person killing his fellows for a certain time, or by submitting him to a certain treatment, a desire which has almost become an instinct will be obliterated? In any event, while society can afford to risk the relapses of a thief, it cannot those of a murderer; nor can it, by immuring him for life, risk the possibility of future misdeeds taken leniency in the shape of a pardon. This, however, only disposes of those persons actually detected, and prevents their subsequent crimes only. How to protect ourselves, against affected persons whose murderous disposition has not actually been manifested, is a problem which must be solved by eradicating such sources of moral contagion as we know to exist.

Despine, the celebrated French psychologist, records that, during the first empire, a soldier hanged himself in his sen-

try box; soon after, other soldiers did the same, and, until the curious expedient of destroying all the sentry boxes was thought of, the contagion remained active. The same observer points out the epidemic character, at one period, of duelling; and it is well known that, so frequent are suicides from particular high monuments, that especial means are there needed to prevent the crime. Despine considers this due to a moral influence. Bouchut, on the other hand, considers the mechanism of disturbance an external "miasmatic influence." Richardson, the most recent observer, thinks that the phenomena are connected with disturbance, that is, modified motion in the ethereal matter which, according to his theory, changes the living person's organism throughout its entire extent, and is the medium of communication between ourselves and the outer universe. "Through it different centers of the nervous organism can be excited by external forces as readily as they can be by direct organic injuries."

It remains, then, to discover accurately the causes of the particular disturbance which spreads the contagion of murder. In the Pomeroy case, the relation of the boy to his father's calling as a butcher and slaughterer gives us a possible clue to his murderous propensities; and at the same time, it may be suggested that the contagion spread by that boy's atrocities could easily have affected Piper, and perhaps others similarly disposed, and thus another argument is added to that in favor of the death penalty. From the Pomeroy case, the moral danger existing in habituating a person, and especially a child, to scenes of violent death is evident; and without further instance, it may be laid down as a duty of society to protect its members from the effect of such scenes. This would involve stringent laws, imposing more severe penalties than now exist for prizefighting, against wanton torture, killing and mutilation of brutes, and for mayhem, or like assaults of a peculiarly brutal character, on the person; also measures would be needed tending to the isolation of slaughterhouses and the prevention of public access thereto. It is, furthermore, obvious that the present publicity of the death penalty must in a measure defeat its object, since it is an open example of killing, fully susceptible of breeding moral contagion. Therefore, executions should be performed secretly, and the accounts now published to cater to a depraved taste rendered impossible. At the same time, such shows of murderers' and burglars' weapons as one which has recently disgraced a prominent thoroughfare in this city, together with that foul blot on modern journalism, the sensational sheet of criminal news, should be rigidly suppressed.

This much, and perhaps more which further consideration may suggest, society may do. But after all, the principal measures lie in the hands of parents and instructors. It is for them to repress the first manifestations of an abnormally destructive nature, for during early youth that nature is most clearly exhibited; and it is for them likewise to see to it that such sources of moral contagion as society tolerates shall not influence the plastic and receptive minds of those entrusted to their care.

SUGGESTIONS FOR YOUNG MASTER MECHANICS.

It is a great error for a young workman to suppose, because he has mastered enough of his trade to be considered a good hand, and now contemplates starting for himself, that all he has to do is to hang out a sign and people will thereupon rush to employ him. Every man has got to build up two things, first, his education, second, his business. There is no royal road to either. Because a workman has his trade education, it does not at all follow that he can command trade. True, he may have his reputation, and through it may obtain employment under others with ease; but in starting for himself, he should remember this distinction: that he becomes the servant not of one or of a dozen persons, but of the whole public; and for him to prove to the public, who knows nothing about him at first, that he is worthy of employment, takes time and patience. Now, it is usually the case that the young workman has no large amount of funds wherewith to maintain himself during that period of enforced idleness which must follow before sufficient business for his support is secured by him. To expend that amount in high rent, or in tools other than those absolutely necessary, or for costly fittings to the shop, is excessively fool-hardy and rash. He does not know how long he must wait before his period of independence will arrive, and it is therefore the commonest prudence to husband every resource, under the assumption that that period is a very long time in the future. The best policy, then, is to take a small room, just large enough for the purpose of the work to be done, and for the workman not to attempt anything "in all its branches." We never fancied that addition to a sign on a small shop; in ninety-nine cases out of a hundred, it is a misstatement of the capabilities of its owner. Better begin with the specialty that can be done best, and then, as business increases, add on the branches. Get a reputation established for doing one thing extraordinarily well, and it will go a long way toward extending a business to other affairs when the proper time arrives.

Never slight a job, no matter how small and trivial it may appear. People form estimates of ability from small things very frequently, arguing that a workman who attends to minutiae carefully will be likely to produce more important work complete in all its parts. Besides, the favorable impression conveyed by some little action has laid the foundation of many a man's subsequent future.

Be satisfied with small though just profits. Because you perhaps can do a job a shade better than any one in the vicinity, do not be exorbitant. We heard an unpublished story of the great drygoods merchant, Stewart, recently, which

is just to the point here. He said he never took advantage of the market but once, and then he had a large stock of a very superior fabric, not elsewhere found. The temptation was strong to run up the price, and he yielded. Despite the high figures, every yard was sold, and he realized two or three hundred thousand dollars. "I thought this a good bargain at the time," he said, "but I afterwards discovered that it cost me two or three millions. I found that people said: 'Stewart has first class goods, but you've got to pay good prices for them.' It took all my efforts to dispel that impression, and I believe it affected all my future business operations."

We would counsel young workmen to be saving, not only of money but of brains. It is a great deal easier to spend money than to get it, and it is easier to forget than to learn. We have great faith in savings' banks, when they can show a good surplus; and in this respect we would advise working men to avoid those institutions that offer remarkable inducements in the way of interest, and to deposit their funds in banks which pay less but which are firmly established. Thousands of New York workmen had their savings swept away recently by neglecting this precaution. Money at reasonable interest increases wonderfully fast, and nothing can make a man feel more independent of fortune than a neat sum, safely stored away, which can be drawn upon in times of emergency.

To paraphrase a well known axiom, "the price of knowledge is eternal study." The world moves. Because you mastered a subject ten years ago, it does not follow that you know all about it now. A person that expects to keep abreast with the times, and especially one engaged in a mechanical pursuit, in which improvements are constantly made, must read, or fall in the rear. Brains can be saved by reading, just as money can be by putting it in the bank. Study scientific and practical books and papers an hour a day; and the accumulation of money at interest will not be nearly so rapid as the growth of your knowledge. We believe more can be learned in half an hour's intelligent study, followed by a thorough thinking over of the subject, than in six hours' steady application. The study can be done out of working hours; the thinking you can do at the lathe or while performing any job which requires no special skill.

Honor your calling, and it will honor you. It is a thousand times better to be a successful mender of pots and pans than an unsuccessful mender of peoples' bodies; better to be able to draw a straight forging than a bad brief; better to be able to compose good mortar than a poor sermon. There are plenty of examples of good workmen becoming great lawyers, and inventors, and senators, and presidents; but very few of poor doctors, or attorneys, or clergymen transforming themselves into anything useful at all. It is a pretty safe rule to believe that, in this world, sooner or later, every man finds his proper level; it is only a question of starting low and working slowly upwards, or starting too high and coming quickly down. The one is usually graceful, the other disgraceful; and there is no human task half so hard as regaining a lost position, nor one in which honest work more often fails to commend success.

DRUGGING HORSES.

We have in a previous article called attention to the barbarous practice of drugging horses in order to put them into apparently good condition. The present is the time of year when this most commonly done, both by those having the animals under their care, or by dealers who find that the effects of spring weather have rendered their horses less sleek and plump, and consequently less salable. It therefore is advisable for those who own horses to see that their stable men do not administer condition powders of their own concoction, however desirable it may be that a tonic of some kind in the spring time be administered; and in buying new stock, it would be as well to let bargains pend for a fortnight or so, in order to afford time for observation whenever the animals show suspicious signs.

There are very excellent veterinary surgeons in this and other cities; but the profession is ridiculously small in numerical strength, as compared to the live stock in the country. The last census states that the total number of surgeons is about 1,100, and there are over 8,000,000 horses and mules. There is 1 skilled cattle doctor to every 7,500 horses; or if we take into consideration other live stock, excluding sheep and swine, the average is as 1 to every 21,655 animals. We adduce these figures simply to show the lack of educated veterinarians, which exists throughout the country, a lack which, as every one knows, is made up by amateur doctoring *ad libitum*. There is nothing so utterly pernicious and unreliable as the work of amateur dabblers at professions; and in this very fact exists the short-sightedness of those who entrust the doctoring of valuable animals to men who are absolutely ignorant of the nature and cause of disease and of the proper scientific treatment to be adopted, and even of the anatomy of the animal. If the carriage breaks down, it is sent to a skilled workman for repairs. No one would listen to the idea of a groom attempting to replace the neat forgings. But when the horses break down, then, in nine cases out of ten, the groom's supposititious knowledge is deemed ample security against his working harm by administering drenches and boluses of fearful and wonderful ingredients. An English agricultural contemporary publishes a letter from a country druggist, which sheds some light on this ignorant system of dosing. One man demanded "condition powders" containing 4 ozs. of tartar emetic. Cream of tartar was meant, and the dispenser gave that harmless substance, otherwise the condition powders would have infallibly killed the patient. Another prescription

called for 1 oz. of Spanish flies, a frightfully irritating poison. "Again," adds the writer, "the men somehow obtain enormous quantities of sulphate of zinc (white copperas) and sugar of lead, which they afterwards dissolve in water to use as lotions. The substances lie scattered about the stable shelves, and are carelessly mixed with chopped food or mashes, in mistake for condition powders. When we hear complaints of actual horse poisoning, we wonder how it has been done. There need be no wonder. The local druggist could in most instances throw light upon the case."

It is bad enough to dose sick horses by the rule of thumb; but for the drugging of well animals, there is positively no excuse; and if our societies for the prevention of cruelty to animals would open a vigorous crusade against the system, we probably should hear less of it than we now do. It certainly is just as cruel to cause the animal suffering by doses of cantharides or arsenic as it is to drive it when its neck is galled; and as the officers of societies are empowered by law to prohibit the one, they doubtless are equally empowered to check the other. Meanwhile we suggest to those who possess horses that the present is an excellent time to inspect stables, and to destroy all the bottles of stuff and papers of powder sure to be found on out-of-the-way shelves, and of the uses and nature of which a satisfactory explanation cannot be given.

THE KEELY MOTOR DECEPTION AGAIN.

"When it is considered that machines driven by steam rarely or never create a pressure of over 200 pounds to the square inch, the enormous force of the Keely motor, and its immense capacity for propulsion, can be realized. The power will be generated by a vaporizing of water mechanically, and without the agency of heat. The expense of fuel will thus be saved. Those interested claim to have been misunderstood in saying that a pint of water only would be needed for the propulsion of a train of cars between this city and Philadelphia and back. They meant that if five gallons were used for an engine of 100 horse, a pint only might be lost by vaporization through the pores of the metal. None at all might be lost. The water, after being vaporized, and passing through the various tubes and chambers, does its allotted work upon the engine, is recondensed into its former state, and, again becoming vaporized, starts again upon its mission of mighty pressure."

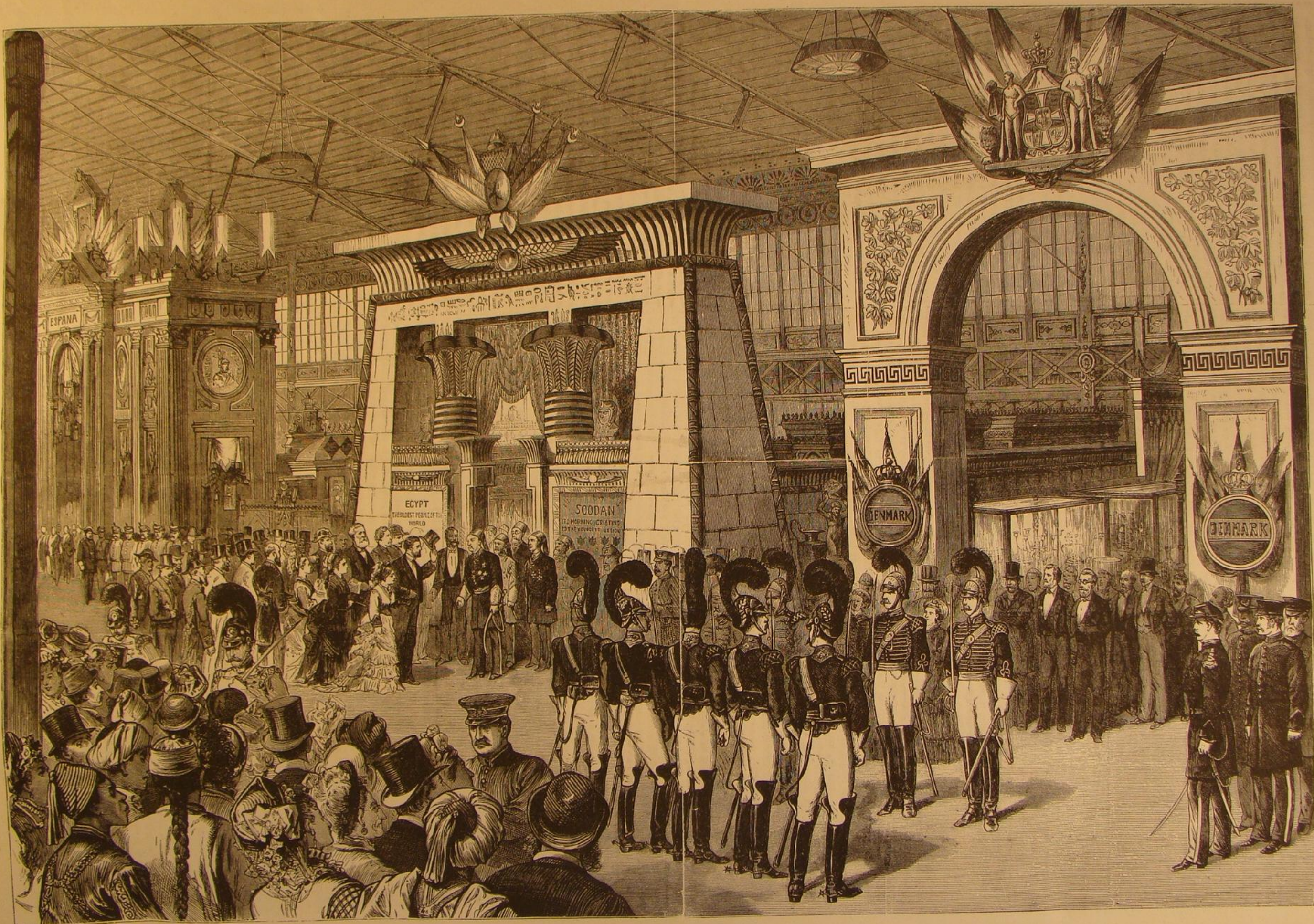
The foregoing we clip from a recent account of the Keely motor obtained by a *Sun* reporter, at the factory of Messrs. Sergeant and Cullenworth in this city, where a 100 horse power apparatus is alleged to be in process of construction. The italics are ours; and in the sentence thus emphasized, the claims of the deluded believers in the trick are reduced to a point to which, sooner or later, we always considered they must come. It scarcely needs any explanation to prove that the above is simply an assertion of the possibility of the perpetual motion; and that after all, those engineers who have committed themselves to Keelyism stand before the world in the professionally unenviable position of upholding the actuality of that mechanical *ignis fatuus*.

There is no simpler principle in Science than that whatever work is spent in moving a body, through a certain course in one direction, is exactly regained by letting the body return along the same track, friction being avoided. And this is true for every case of natural law. The Keely motor, according to the above, performs two operations, one by which the water is vaporized, the vapor acting on a piston, and the other involving the work which recondenses the vapor. Obviously the work (no matter what its nature may be) required to vaporize the water, acting in one direction, is precisely equal to the work required to condense it, acting in the other direction, other circumstances being equal. Therefore work, drained off to impel other machines, comes from nothing, and the apparatus reduces itself to a self-sustained continuous mechanical motive power. In simpler terms, it is the long-sought problem, exemplified in its simplest form in attempts to lift one's self over a fence by one's boot straps.

Both criticism and speculation regarding the Keely motor must here terminate; for in this enlightened age, no thoughtful person can waste time on that which is so obviously a chimera, unless to contemplate the curious phase in the human mind which sets at naught the dicta of mechanics and mathematics and the admitted laws of Nature. As regards those who have been deceived by the juggler, with its attending fog of unknown forces etc., we can best quote from the preface of Dirck's work on the *Perpetuum Mobile*: "The theoretical and practical engineer, unhappily led away by this substitution of prolific fancies in place of sound judgment, is the last person to be convinced by the most obvious obstacles to success in the fulfilment of his views and statements. To himself, all his opinions stand for realizable objects. We cannot avoid having some, though a very chastened, sympathy with such enthusiastic projectors, who would seem to pride themselves on the strongly expressed notion that 'genius to madness is near allied.' It is unquestionably in such cases a constitutional weakness, ill fitting its possessor for that calm, cool, reflective character which alone commands confidence and secures respect."

How to Make Small Racks for Gears.

To cut small racks, to fit pinions made from pinion wire. Secure the blanks, on which the teeth are to be cut, in slots cut in a mandrel of large diameter. Put the mandrel in a lathe, and arrange the screw gears to cut a thread of the same pitch as the teeth in the pinion; and with a tool of the proper form, cut the teeth in the blanks. The pitch of the thread will not be appreciable if the racks have a narrow face



THE CENTENNIAL EXPOSITION.

We give on the opposite page a fine engraving of a portion of the interior of the Main Building at the Centennial. The artist has also represented the procession which, headed by President Grant and the Emperor of Brazil, passed through the different edifices immediately after the opening ceremonies. The distinguished party was received by the various foreign commissioners, who, with their respective committees, had posted themselves in front of their departments and along the principal aisle. The three gateways, shown in the illustration, belong to Spain, Egypt, and Denmark, and are the most elaborate temporary decorations which have been erected. Egypt surrounds her entire section with a low wall of wood and canvas, painted to imitate stone. There is a noticeable absence of display of this kind in the departments of England and France. England, especially, avoids even ornamented show cases, and presents her exhibits in plain but handsomely made cases, which do not distract the eye from the articles themselves.

THE JUDGES.

The most important event of the past week has been the organization of the board of judges. The formal ceremony took place on May 24, in the Judges' Hall, into which first marched the Centennial Commission, headed by General Hawley, and followed by the American judges. As the foreign judges entered all rose, and patriotic airs were performed by the band. General Hawley then extended a welcome to the foreign members, and Mr. Goshorn delivered a brief speech relative to the duties of the Board.

THE UNITED STATES EXHIBIT—SIGNAL BUREAU.

In our review last week of the general condition of affairs at the Exposition, lack of space compelled us to omit mention of the United States Building, the arrangements in which are nearer completion than in any other part of the Exhibition. On each side of the main portal is arranged a formidable collection of cutlery. There is a mammoth 20-inch Rodman gun, and several Dahlgren smooth bores and Parrott rifles of smaller proportions. These are mounted on their carriages and provided with all fittings and appurtenances. Inside the building one of the most interesting displays is that of the Signal Service Bureau. It is intended to show a signal station with all its appliances. The principal instruments exhibited are as follows: Lieutenant Gibbon's barograph, or self-registering barometer is the usual siphon-shaped mercurial barometer, in the short leg of which an iron float rests upon the column of mercury. The slightest change in the level of the column makes this float rise or fall, and its motion is communicated by a cord running over a pulley to the circuit breaker of an electromagnet. The armature of the magnet communicates its motion to a pen which dots the surface of a cylinder moved slowly by clockwork, thus registering the slightest change and the exact moment of its occurrence. The paper with which the surface of the cylinder is covered is ruled to cover a space of fourteen days; and as each paper is removed, it is filed away as a permanent record of that period of time. Foreman's barograph is in its leading characteristics like the one above described, and has also an attachment which automatically prints in figures each change of one thousandth of an inch.

Hough's thermograph is a self-registering thermometer. It consists of a siphon tube, the short leg of which is expanded into a larger tube with a closed end. In this short leg is placed alcohol, which is confined there by a column of mercury in the longer leg, which is open at the top. The thermometer operates by a contraction and expansion of the spirit by cold or heat, raising the column of mercury as the spirit expands, and letting it sink as it contracts. Upon the surface of the mercury is a float, which rises and falls with the column, and, by a very delicate apparatus, operates a circuit breaker of an electromagnetic circuit. This again, as in the case of the barograph, is made to record the changes of a revolving cylinder.

A marine barograph is constructed much like the one first described, except that the tube containing the mercury is made of iron instead of glass. It has an attachment to hang it up by, which keeps it always in a perpendicular position.

Eccard's evapograph is an instrument for determining the amount of moisture in the atmosphere, and registering the result. This is determined by the rapidity with which water, exposed to the atmosphere, will evaporate. The instrument is an open cylindrical vessel filled with water, resting upon a delicate scale; as the water evaporates, the vessel is lightened and rises, the slightest change being sufficient to operate the circuit breaker of an electromagnet, which, as in other instruments, records the changes on the cylinder moved by clockwork. The motion, of course, is always upward, as evaporation continually goes on with greater or less rapidity.

Gibbon's electrical rain and snow gage records in like manner the depth of the rain or melted snow which falls in any given time. A receiver is situated on the roof of the building, the area of the upper section of which is a certain number of times as great as the base of the cylinder of the instrument, with which it is connected by a tube. Upon the water in the lower cylinder is a float, which, as it rises, communicates its motion by an electromagnet to the recording apparatus as before described.

Eccard's rain gage dispenses with the electro-magnet, the float communicating its motion by a counterpoise to the clockwork. This is a very simple and effective instrument.

Gibbon's anemograph measures and records the velocity and direction of the wind. Upon the roof of the observing station, four hemispherical cups, placed vertically on horizontal arms, catch the slightest movement of the air and

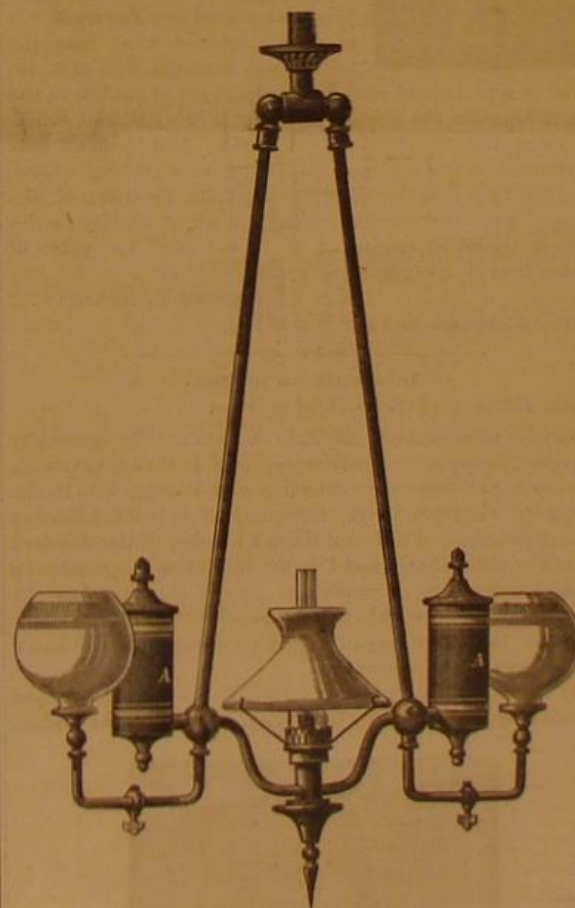
cause the arms to revolve a certain number of revolutions, equaling, in the distance traveled, the distance traveled by the wind; then an electric circuit closes, and an electromagnet records the same on a revolving cylinder. This cylinder, moving by clockwork, should there be no movement of the magnet, will cause the pencil to make a long, straight line; with a high wind the record is frequently made, and the line is broken up into longer or shorter sections, corresponding with the velocity of the wind. The direction is indicated on another cylinder. There are four magnetic circuits, connected with the four points of the weather vane, corresponding with the four points of the compass. Once in four minutes the clockwork makes a record, and that record is made by the pen of whichever circuit the weather vane has at the time closed. Eccard's anemograph dispenses with the electric circuit, and makes its record on the cylinder by entirely mechanical means. The weather vane, in turning, revolves the rod to which it is attached, which communicates its motion directly, or by gearing, to the pen, without the intervention of an electromagnet.

An ingenious apparatus has been constructed to provide the weather necessary to work these different instruments. It includes a shower bath to produce an artificial rainstorm, and a fan blast, which generates gales of any force, from ten to sixty miles per hour. The manner of printing the weather maps, which are sent to all parts of country, is fully illustrated in this department.

CLARK'S COMBINED GAS AND OIL CHANDELIER.

The exorbitant price charged for gas in some large cities has resulted in a greatly increased use of oil, which is much the cheaper mode of illumination. Various devices have been introduced to combine oil lamps with gas fixtures, so that the latter, being already in most city houses, may still be utilized and the expense of separate lamp holders saved. To this class belongs the present invention, which ingeniously arranges a lamp in connection with a gas fixture, so that either gas or oil, or both, may be burned, as desired.

The construction consists simply in carrying a separate gas pipe to each arm of the fixture. To each pipe is attached an oil tank, A; and these tanks communicate, by tubes supported in bulbs, to, but do not intersect, the gas pipes, with the argand burner in the middle. The gas is lit at the extremities of the arms; and the light is increased at a small cost by the oil illumination, or the gas may be unused, and only the lamp lit.



One advantage of this arrangement is that it does not compel the cutting-off of the gas, as is the case when a lamp is fitted directly over the burners; so that, while lamplight may be ordinarily employed on special occasions, when greater illumination is desired the gas burners may be ignited. The invention will doubtless be quite popular not only with consumers but also with gas companies, since it tends to prevent the return of meters and total abandonment of the gas facilities, as might otherwise follow a substitution of oil.

Patented May 9, 1876, through the Scientific American Patent Agency. For further particulars regarding sale of patent, rights, etc., address the inventor, Mr. George P. Clark, P. O. Box 327, Newton, Mass.

A Metal More Fusible than Tallow.

M. Lecoq de Boisbaudran, whose recent discovery of the new element gallium, and whose subsequent researches thereon we have from time to time noted, has recently, for the first time, succeeded in obtaining a grain and a half of the metal in a pure state. This has enabled him to determine the remarkable fact that gallium melts at 85.1° Fah., so that it liquefies when held in the hand. When solid, the

metal is hard and resistant, even to a few degrees below the melting point. It can be cut, and possesses a slight malleability. When fused, it adheres easily to glass, on which it forms a beautiful mirror, whiter than that produced by mercury. It oxidizes but very superficially when heated to redness in the air, and does not become volatile. The density at 59° Fah. is 4.7, that of water at 39.2° Fah. being 1.

Excepting mercury, which only becomes solid at -37.9° Fah., there is no other element which liquefies at so low a temperature as gallium. Fusible alloy, of 1 part lead, 1 part tin, and 1 part bismuth, melts at 201°, and phosphorus at 111.5°. Wax and tallow have melting points respectively at 142° and 92° Fah.

MOLL & ALTHEIDE'S IMPROVED AIR PUMP.

The accompanying illustration represents an improved air pump, which, the inventors claim, produces an absolute vacuum. The valves are operated by means of cams and levers, insuring a positive motion and a greater efficiency than it is



possible to secure where atmospheric pressure alone is relied on to open and close the valves. We have never seen the apparatus: but it is stated by the inventor that the perfection of this machine is such that it may be used by manufacturers of thermometers, barometers, sphygmometers, Geissler tubes, and other physical apparatus, to advantage. It is also said that manufacturing chemists and sugar refiners can by its use obtain superior productions in less time and with less expense than by excessive heat.

The apparatus consists of a cylinder placed on a platform, which is secured to two vertical standards, at the top of which a crank shaft is supported in suitable bearings. A spur wheel is keyed on one end of this shaft, which takes its motion from a pinion on the shaft, which is shown at the back of the machine. There is a balance wheel and also a hand crank for operating the machine on this last mentioned shaft. A crosshead on the end of the piston rod is connected to the crank shaft by means of a connecting rod.

A cam is fixed on the end of the crank shaft (at the left hand in the engraving) which operates the induction valve by means of the rod shown near the side of the machine, which carries a roller which engages with the cam. The lower end of the rod just mentioned is connected with a lever which operates the induction valve, and is weighted so that, when the cam is not in contact with the roller, at the upper end of the rod, the weight will hold the valve closed.

On the other side of the machine, a cam is attached to the side of the spur wheel, which operates the eduction valve through a lever carrying a roller at its upper end, and having a fulcrum at the cross bar, which connects the vertical standard just above the upper end of the cylinder, and is connected at the lower end with the valve. Near this lever, a standard is fixed to the platform, which supports a right-angled lever carrying a weight at its outer end, and a flanged roller at its inner and lower end, which bears upon the lower end of the valve-operating lever.

Atmospheric pressure is depended on to operate the valves, as they are opened by the cams, and closed by the weighted levers. By this arrangement, it is claimed that the instant of opening and closing the valves can be regulated to better advantage than when they are arranged to operate automatically. This pump is provided with valves of new and peculiar construction, and also an improved packing for the piston, which add to the efficiency of the machine.

Patented October 19, 1875. For further information, address the inventors, C. F. Moll and J. H. Altheide, Quincy Ill.

Production of Silver in the Whole World.

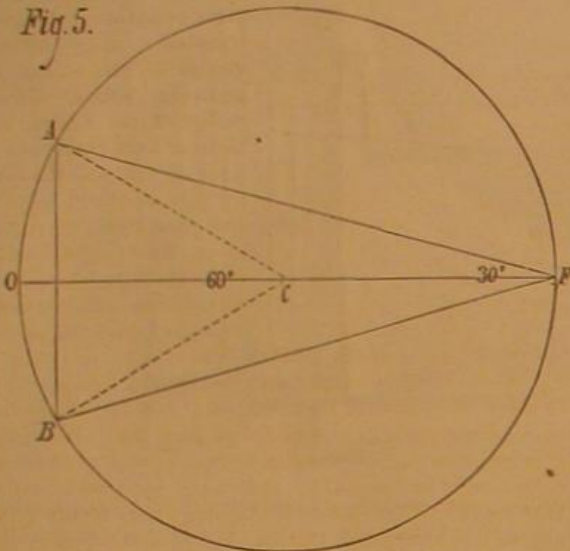
According to recent statistics, the production of silver in the whole world in 1800 was \$35,000,000, which rose in 1850 to \$42,500,000, in 1854 to \$47,500,000, and in 1865 to about \$62,500,000. The production of this precious metal during the year 1873 is subdivided as follows: England and its colonies, \$10,000,000; Norway, Sweden, and Denmark, \$250,000; Russia, \$500,000; Austria, \$1,020,000; Germany, \$3,000,000; France, \$2,000,000; Spain, \$2,000,000; Sardinia, \$500,000; Mexico, \$20,000,000; Central and South America, \$8,000,000; Canada, \$900,000; the United States, \$36,500,000, which gives a total of \$85,250,000. Including the year 1873, it is estimated that the total production of silver, since the discovery of the New World by Christopher Columbus, has been \$715,000,000, the largest source of accession, during late years being due to the Nevada mines.

(Continued from first page.)

to minute experiment by Professor Tyndall. That scientist finds the device to be of greater efficiency, while its cost is about one quarter of that of the Fresnel apparatus of similar power, with which it was compared. The Italian government has also conducted comparative experiments between the Balestrieri and lenti alar systems, in a lighthouse at Civita Vecchia, and the official commission report the exceeding superiority of the new apparatus.

It being proposed to adapt the invention to the lighting of cities, experiments were lately tried in Rome. The light was placed on the Piazza del Popolo, so as to illuminate the Corso. An oil lamp of considerably inferior power to that used in a lighthouse of the second order was caused to throw a light by which a letter, written in fine characters, could be read at a distance of about 2,000 feet. The inventor has recently devised a smaller apparatus which, at a distance of 224 feet, projects a beam 80 feet in diameter, the source of light being a single butterfly gas burner. This is especially adapted to the lighting of our streets and buildings with great economy of gas.

Fig. 5.



Another important application of this invention is the accumulation not merely of light but of heat rays. A lens 3.2 feet in diameter has an area of 1178.1 inches, and supposing this to reduce the sun's image to 0.15 inch, then the emergent light is condensed 7,854 times. Now, under the most favorable circumstances, a Fresnel lens does not transmit more than one fourth the heat it receives; hence the sun's heat is condensed but 5,236 times. It is possible, says *Les Mondes*, to make a Balestrieri apparatus of two, three, four, or five times the size of the lens; and the calorific effects, increasing directly as the squares of the diameters, will be four, nine, sixteen, or twenty-five times as great as those of a lens of the above-stated size. It seems possible, therefore, to obtain a calorific intensity capable of reducing even the most refractory substances.

[This is a notable example of the way in which American inventions are "re-invented" and the credit monopolized by Europeans. Substantially the same device was patented in this country, as a locomotive headlight, on July 18, 1871, by C. S. Lee and W. M. Baldwin, of Troy, N. Y., and was described in the *SCIENTIFIC AMERICAN* at that time.—EDS.]

Newly Discovered Mechanical Action of Violet Light.

M. Paul Bert's recent investigations as to the cause of changes of color in the chameleon have led him to a discovery of considerable importance, since it indicates a mechanical effect of light, and more especially of the violet rays, hitherto entirely unknown. He traces the changes of hue of the reptile to minute corpuscles or chromoblasts, which are located either below the dermis or at the surface of the skin, according as they are affected by certain nerves which are respectively analogous to the vaso constrictors and vaso dilators. When the chameleon is placed half in red light and half in violet light, obtained by passing sunlight through colored glass, the portion on which the red light falls remains of the normal yellow color, while that affected by the violet light changes to a greenish black hue. This same effect can be produced by suitable nerve excitations and divisions, showing that the accession of color on the skin is absolutely caused by the rising of the colored corpuscles to the surface; while, when the latter remain inert, the natural yellow hue of the creature continues unchanged. Hence it would appear that the colored corpuscles, like certain chemical substances, are not equally affected by all the rays of the spectrum, and that in the violet blue rays alone resides the property of mechanically moving the chromoblasts and drawing them to the surface.

Similar action on contractile substances has already been noted as caused by heat and electricity; but that light should possess an exciting effect of this description is certainly remarkable.

M. Bert proposes to continue his researches to determine the influence of light on contractile matters under other circumstances, and he especially hopes to discover the reason of the favorable influence of light on the skin of children and of lymphatic persons. It seems to us he might go further and observe whether the color in the human skin, either that normally existing, as in the case of negroes, or that obtained by direct exposure to sunlight (tanning or burning), is attributable to any similar cause.

There is one fact worthy of remark here about M. Bert's discovery, and that is that it happens at a singularly opportune time, to be taken advantage of by those who are inclined to consider seriously the supposed influence of sunlight filtered through various colored glasses on phenomena of growth and of disease. Dr. Ponza, an Italian physician, has recently stated that light of certain colors has a beneficial effect on lunatics and other persons suffering under nervous ailments; and since M. Bert has demonstrated in the chameleons the direct influence of light on a nervous system, it appears not improbable that Dr. Ponza's alleged results may have some foundation.

Correspondence.

Intermittent Springs.

To the Editor of the *Scientific American*:

J. S. O.'s assumption, on page 283, vol. 34, though theoretically plausible, will not upset the accepted theory of intermittent springs, as the following facts will show: Some years ago, while residing in a small village where a club pleasure ground was kept, I was requested to engineer a couple of drinking fountains, one situated on a hillside and the other about 20 feet below, on the main walk. I led the water by a gentle descent from the springs by the pipe,



A, to the upper basin, from which the overflow was to be carried through the larger pipe, B, to the lower fountain. Business called me away at the time the pipe connections were being made; the plumber made a change in my plan, producing a comical effect. All were laughing at my fountain when I returned, and one old gentleman described his experience thus: "I was walking on the lower walk, and saw a large stream flow from the fountain; I walked up and took the cup for a drink, when it suddenly stopped. My wife came up, and we were both much surprised. I thought something had got in the pipe, and stooped down to look, when I heard a gurgling sound; and my wife and I were splashed all over with water. You have played us a fine trick." I at once suspected what was the matter, and found in fact that, instead of a perforated plate being placed at the outflow of the upper fountain, the plumber had bent it into a siphon, thinking to prevent the entrance of rubbish. I had a small hole perforated at the top, and the intermittent spring ceased. The theory is that the water, falling from the crown of the siphon, when the pitch is vertical or great, rapidly carries with it the small amount of air in the bend, the place of which is at once occupied by water.

GEORGE H. HENSHAW.

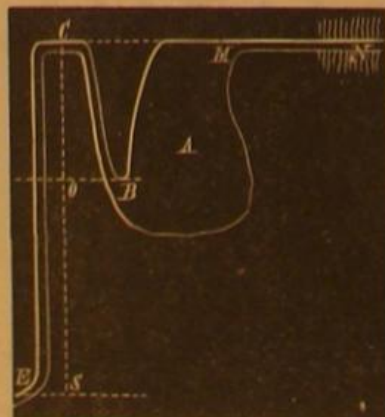
Ste. Anne Bout de l'Isle, Canada.

Intermittent Springs.

To the Editor of the *Scientific American*:

In your issue of April 20, J. S. O. says: "The generally accepted theory of intermittent springs is that a cavity in the earth has two water channels, one leading into it, the other out, the former being the smaller." Is this the theory? I have examined at different times a number of the standard works on this subject, and I do not think that we must take into consideration so much the size of the tubes as the amount of water which flows through them. More water will flow through a long tube held vertically than through a shorter one of the same bore.

In the engraving, A is the cavity, M N a horizontal tube conducting the water into the cavity, and B C E the siphon



tube of the same size as M N, tube through which the water flows out. If only enough water is collected in the tube M N, to keep it constantly full, the velocity of the water, as it flows through the tube, may be expressed thus:

$v = \sqrt{g d}$ (g representing the force of gravity, and d the diameter of the tube). As the water flows into and fills the cavity, it also fills the shorter arm of the siphon; and because it is just as large as M N, the water will rise to the top of the siphon at C. As the siphon is now charged, the water will flow down the longer arm, increasing in velocity at every instant, according to the laws of falling bodies, until it reaches the end at E, when it will flow through the whole siphon with a velocity equal to $\sqrt{2 g h}$ (h being equal to the height of

the water in the cavity above the spring, at E). Now as $2 h$, in the formula, may be very much greater than d , so may the velocity be much greater in flowing out than in flowing in; hence, the cavity will be emptied and the water will stop flowing out until it is again filled, and so on. When the water first begins to flow out, h is equal to C S, but when it has fallen in A to B, h has decreased to O S; so, as the water falls in the cavity, the velocity of the flow constantly decreases. If the diameters of the tubes be 1 inch, and C S be 20 feet, the velocity of the flow into A will be about 1.6 feet in a second of time; and that of the flow out, at first, about 35.8 feet.

In all intermittent springs, the velocity of the flow, as it continues, must decrease; and as the cavity is shallow or deep, this decrease is small or great.

Canonsburgh, Pa.

JAMES F. RAY.

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.

Position of Planets for June, 1876.

Mercury.

On June 1, Mercury rises at 5h. 44m. A. M., and sets at 8h. 44m. P. M. On the 30th, Mercury rises at 3h. 36m. A. M., and sets at 5h. 58m. P. M.

Mercury was at its greatest elongation on May 21, but can be seen after sunset for some days later, probably through the first week of June, as it sets at a point north of that at which the sun is last seen.

Venus.

Venus must be known to all who at this time observe the western sky. It does not attain the greatest brilliancy until June 7.

Venus rises on the 1st at 7h. 26m. A. M., and sets at 10h. 33m. P. M. On the 30th, Venus rises at 6h. 18m. A. M., and sets at 8h. 36m. P. M.

Mars.

Mars is very small. It can be found by its nearness to Venus, setting an hour later than Venus, on June 1, and at almost the same time on June 30.

Jupiter.

Jupiter is now well above the horizon in the evening, and can be seen as soon as twilight is over. It rises on the 1st at 5h. 56m. P. M., and sets at 3h. 42m. of the next morning. On the 30th, Jupiter rises at 3h. 49m. P. M., and sets at 1h. 39m. the next morning.

The satellites of Jupiter revolve around the planet in such short periods that their changes of position can be seen in a watch of a few hours, and on almost any evening one may pass across the disk of Jupiter, making what is called a transit; or it may be hidden by passing into the shadow of Jupiter, in eclipse; or Jupiter may come between us and one of its moons, as in occultations.

These phenomena can be very nicely seen on June 15. According to the *Nautical Almanac*, on this evening the shadow of the first satellite passes across the disk of Jupiter; this cannot be seen without the use of a good telescope. At 9h. 26m. (Washington time) the third satellite, which is the largest, reappears, having been behind the planet for several hours; at 9h. 52m. the first satellite leaves the disk, having been in passage across it for more than two hours, and at 12h. 6m. the third satellite disappears by going into the shadow of Jupiter. On this evening only two of the satellites will be seen from 8 to 9.30 P. M.

Saturn.

Saturn is coming into better position. It rises on the 1st at 0h. 36m. A. M., but on the 30th comes above the horizon at 10h. 39m. P. M., and sets at 9h. 25m. the next morning.

Saturn is among the small stars of *Aquarius*, about 2° south of the star λ .

Uranus.

Uranus is among the stars of *Leo*. It rises, on the 1st, at 9h. 30m. A. M., and sets at 11h. 35m. P. M. On June 30, Uranus rises at 7h. 45m. A. M., and sets at 9h. 45m. P. M.

Neptune.

Neptune cannot be seen without a good glass, and at present is very unfavorably situated, as it comes to the meridian in the daytime.

Sun Spots.

The report is from April 20 to May 21, inclusive. During the past month, the surface of the sun has been remarkably free from spots. The present seems to be the minimum of the sun spot period. On May 6 a small spot appeared coming on. The observation of May 11 showed that this had divided into an elongated pair, which was followed by two very small ones. On May 11 these had disappeared, and the elongated pair had united into one, which was not seen after May 13. From that date till May 21 no spots have been found.

Dyeing Cotton Blue.

For 5 lbs. goods, dissolve 1 oz. copperas in 4 gallons of soft water. Wet the goods in warm suds, put them in the copperas water, let them remain 10 minutes. Dissolve in another vessel 2 ozs. prussiate potash in 4 gallons soft water. Wring your goods, put into this solution, let them remain 5 minutes; wring out again, now add 1 oz. oil of vitriol to the potash water, and stir well; put the goods in again and bring to a boiling point, letting them remain until you obtain the desired shade.

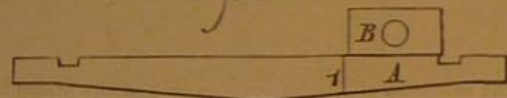
[For the Scientific American.]

TO ASCERTAIN THE PROPER LENGTH OF A CONNECTING ROD.

It is not often that the owner of a steam engine possesses any detail drawings of it; and hence when it requires renewal in its various parts, taking up the wear and lost motion, with a view to keep the parts in line and as nearly as possible of the original dimensions, is left largely to the judgment of the repairing engineer. In the case of connecting rods, however, this is at times neither practicable nor desirable, for the reason that the bearings of main shafts are apt to vary in their distance from the cylinder, by reason of the wear in the bearings or brasses, which wear tends in engines in which the crank shaft is above the cylinder, to shorten the distance between the two, the reverse being the case when the cylinder is above the crank. In horizontal engines, this is not so appreciably felt, for the reason that the wear is not so much in the direction of the length of the piston rod. When the main bearing brasses, of either vertical or horizontal engines, have been much worn, and have had the lost motion taken up at various times, they will be found, in most instances, to have varied in their distances from the steam cylinder, which may be compensated for when taking up the lost motion of the connecting rod, by making the length, from center to center of the brasses, equal to the distance from the center of the main shaft to the center of the guide bars.

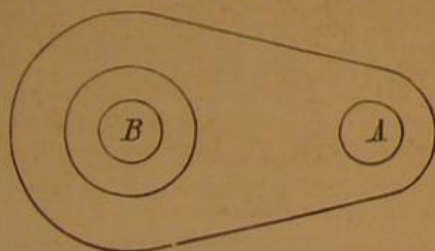
In renewing the main shaft bearings or the connecting rod, however, it is better to ensure that, the bore of the main shaft being in the center of the brasses, the length of the connecting rod is made such as to leave the clearance, between the piston head and the cylinder covers at the ends of the stroke, equal, and not to take it for granted that such is the case when we measure from the center of the guide bars or crosshead journal to the center of the main shaft. It will

Fig. 2.



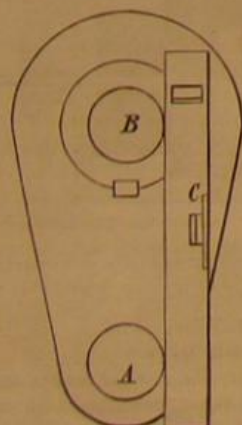
not do to measure from the center of the crosshead journal to the center of the crank pin when the latter is at midstroke, because, when the crank pin is in that position, the crosshead does not stand in the center of its travel on the guide bars, because of the angle at which the connecting rod

Fig. 3.



stands. The piston head will, in all cases when the crank stands at the center of its stroke travel, stand nearer to the cylinder head which is nearer to the crank than it does to the opposite cylinder head, the amount of the difference being dependent upon the length of the connecting rod as compared to the length of the engine stroke. If the connecting rod be shorter than the stroke, the greater is the difference referred to. From these considerations, it becomes necessary to make the connecting rod of a length to ensure that the clearance shall be equal at the ends of the piston stroke, which should be done as follows:

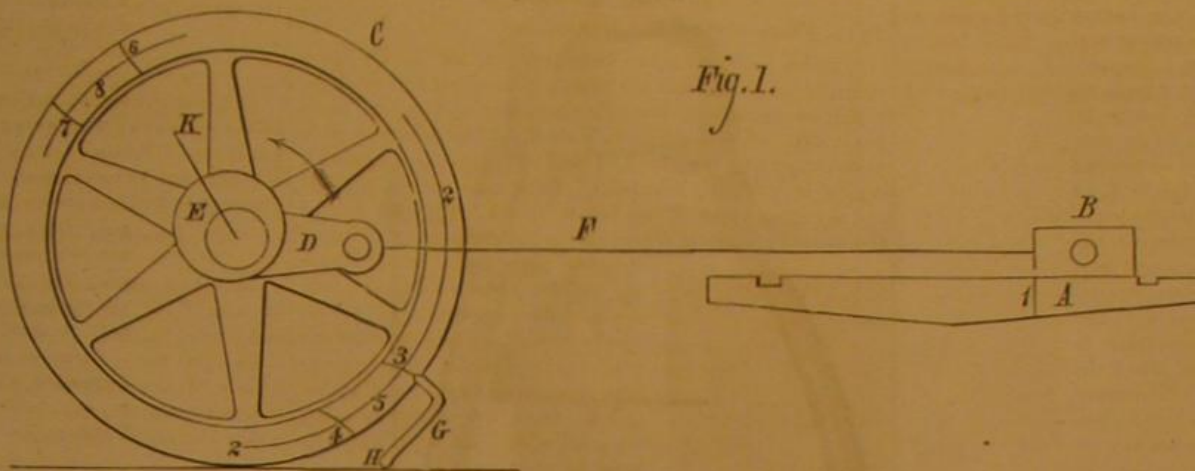
Fig. 4 I



the same time overlapping the face of the guide bar, we mark on the face of the latter the line, 1, which will then be quite even with the end face of the guide block. We then (after chalking it to make the marks show plainly) mark on the

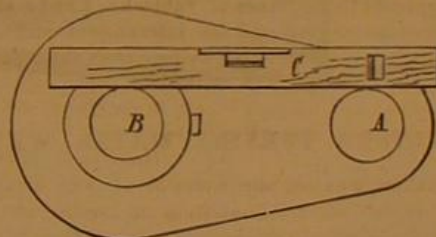
face of the wheel the line, 2, which should be true with the center of the main shaft, but which can be marked from the rim of the wheel with a pair of compass callipers, provided that rim has been trued up in the lathe. We next, with a piece of iron wire or rod, bent as shown by G, make, at some fixed point, such as shown at H, a centerpunch mark; and resting one end of the scribe, G, in the fixed centerpunch mark, we scribe with the other end upon the edge of the wheel the line, 3, as shown in the illustration. Our next operation is to move the wheel forward in the direction in which it is to run, so that the crank will move to the dead center, and the guide block will leave the line, 1, as shown in Fig. 2; and the motion of the wheel being continued, the guide block will return to the mark, 1, the wheel being moved very slowly indeed, so that there will be no trouble to

Fig. 1.



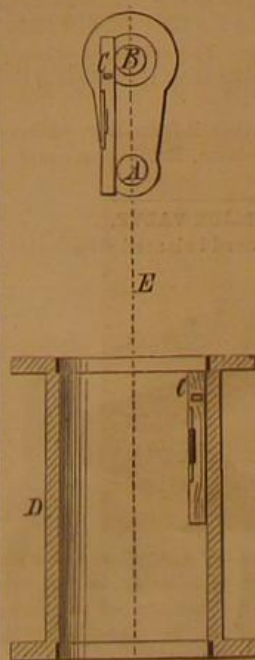
so move it that the end of the guide block will come to rest exactly fair with line, 1. We then take our wire scribe, rest one end in the fixed point, and with the other edge mark, on the edge face of the wheel, line 4, which will then occupy the place that line, 3, does in our engraving. Our next duty is to find the center between the lines 3 and 4, which we mark with a fine centerpunch mark, as shown at 5. And it will be readily perceived that, if we move the wheel round so that the scribe, G, rests in the fixed center point, as shown in Fig. 4, at A, the other will be true with the centerpunch mark, 5, and the motion block; and hence the piston and crank will be exactly on the dead center at that end of the stroke.

Fig. 4 II



Then place the crank on its dead center, by the process here given. On the end face of the crank, and from the center of the shaft, strike a circle equal in diameter to the crank pin, as shown in Fig. 3, A representing the crank pin journal and B the circle referred to. Then take a spirit level, and place one end of it on the crank pin journal and the other end even with the circle, above referred to, as shown in Fig. 4,

Fig. 5



vertical cylinder, the spirit level must be applied in the cylinder as shown in Fig. 5, in which A represents the crank pin, B the circle, C in each case the spirit level, D the engine cylinder, and E the center line of the cylinder, it being obvious that it would be useless to apply the spirit level in any position, relative to the crank, in the cylinder. The crank and piston being thus placed in position at corresponding

ends of the stroke, the length of the connecting rod is the distance from the center of the crosshead journal to the center of the crank pin.

JOSHUA ROSE.

New York city.

No More Wooden Nutmegs.

At a reception recently given by the Turners' Company of London to Lieutenant Cameron, R. N., as a recognition of his services in exploring the African continent, the guest of the evening, alluding to what he saw in his travels, said: "The country of Nyangwe, I firmly believe—in fact, I am sure—may be reached by the Congo; and hereafter I hope that where my steps have been we shall see a system of English trading stations for the purchase not only of ivory, for the richness of the vegetable products of the country is something beyond description. I have walked along for fifty or sixty yards under a grove of nutmeg trees, with the whole ground covered with nutmegs, and no one knew what they were worth. Besides that, there are many other vegetable products in abundance, many different species of cotton, and oil-producing palms. Up the valley of the Congo, to a height of 2,600 feet above the level of the sea, the country is crowded with oil palm; and hereafter that trade alone, leaving the question of ivory altogether on one side, will be sufficient to well repay any enterprising merchants of England who embark in it."

"What do our readers," says the *London Grocer*, "think of this? We join with them in hoping that Lieutenant Cameron's discovery will turn out to be quite true. It would be cruel for him to deceive us on so vital a point, as cheap nutmegs—such as the public understand by cheapness—have been looked for in vain ever since they were first imported; and we are convinced that in this, as in numberless other cases, it is the supply alone that creates the demand. Give us cheap, sound nutmegs, and the consumption of them will rapidly increase, and limed, worm-eaten, or wooden nutmegs of Yankee celebrity, will gradually become as rare as they are now comparatively common. It is, therefore, to be hoped that the hint thrown out by Lieutenant Cameron with reference to the enterprising merchants of England will be adopted, and that new and profitable channels of trade will be speedily opened up with that secluded corner of the globe."

A Remarkable Surgical Operation.

About two years ago, a waiter in a Parisian restaurant undertook to imitate the feats of the Chinese sword swallowers, by introducing a fork, handle foremost, into his throat, taking care to hold the tines in his teeth. The attempt was successful, and a repetition was demanded by the loungers in the saloon. The man complied; but while the fork was in his oesophagus, one of his comrades made an ill timed joke; the performer grinned, let go the fork with his teeth, and down it went. The pain was intense. A physician was summoned, who managed to seize the fork with a forceps; but just as he was drawing it up, the patient was seized with convulsive coughing, the doctor was compelled to relax his hold, and the fork slipped down all the way to the stomach. The symptoms of asphyxia at once disappeared, and the man suffered no inconvenience for about two weeks. At the end of that time, however, severe gastric affections manifested themselves, and the patient was sent to a hospital, where he has since, until last month, remained suffering great agony.

In the month of October last, it was decided by the hospital physicians to practise the extraordinary operation of gastrotomy, that is, to cut directly into the stomach and extract the obstacle. It was at first attempted to determine adhesions of the viscera from out, inwards, by means of caustics; but this not succeeding, a triangular zone, wherein no essential organs were included, was selected as the point of perforation. In April, the incision was made, the layers of tissue being dissected away one after another. The envelope of the stomach was attained, cut, and a piece removed. The stomach itself was then opened, and pincers introduced; and after a few attempts, the fork was grasped and withdrawn. The wound was closed, and is now nearly healed, the patient suffering only from a slight stomache fistula, already in process of obliteration. The fork was perfectly black, but otherwise unchanged.

Turbines.

In 1854, Emile Geyelin made a wheel at Saltillo, Mexico which was a double turbine (that is, a turbine receiving water between two movable wheels on the same shaft, which counterbalanced each other, and avoided the necessity of resisting the thrust from the head of water), for 160 feet fall, producing 125 horse power, and turning at a speed of 1,850 revolutions per hour. This double turbine, though only 11 inches in diameter, propels a cotton mill of 10,000 spindles.

RESTORATION OF FADED WRITING.—Moisten the paper a little with water, and brush over it a solution of sulph-hydric ammonia. Since most inks contain iron, it is easy to understand that there will be formed sulphide of iron, which is black.

IMPROVED TURBINE WHEEL.

The object of the invention herewith illustrated is to overcome the well known defect of the turbine, namely, a diminished percentage of power when less than full gate is used. To this end, the wheel is made adjustable, and may, without variation of its assigned proportions, by a combined inner and outer gate, have its capacity altered in accordance with the changes of the gates and chutes, and with regard to the power required or modifications in the head. This is claimed to be accomplished without loss in coefficient of useful effect. Fig. 1 represents the wheel complete, and Fig. 2 is a section, showing the inner gate broken away and partly open.

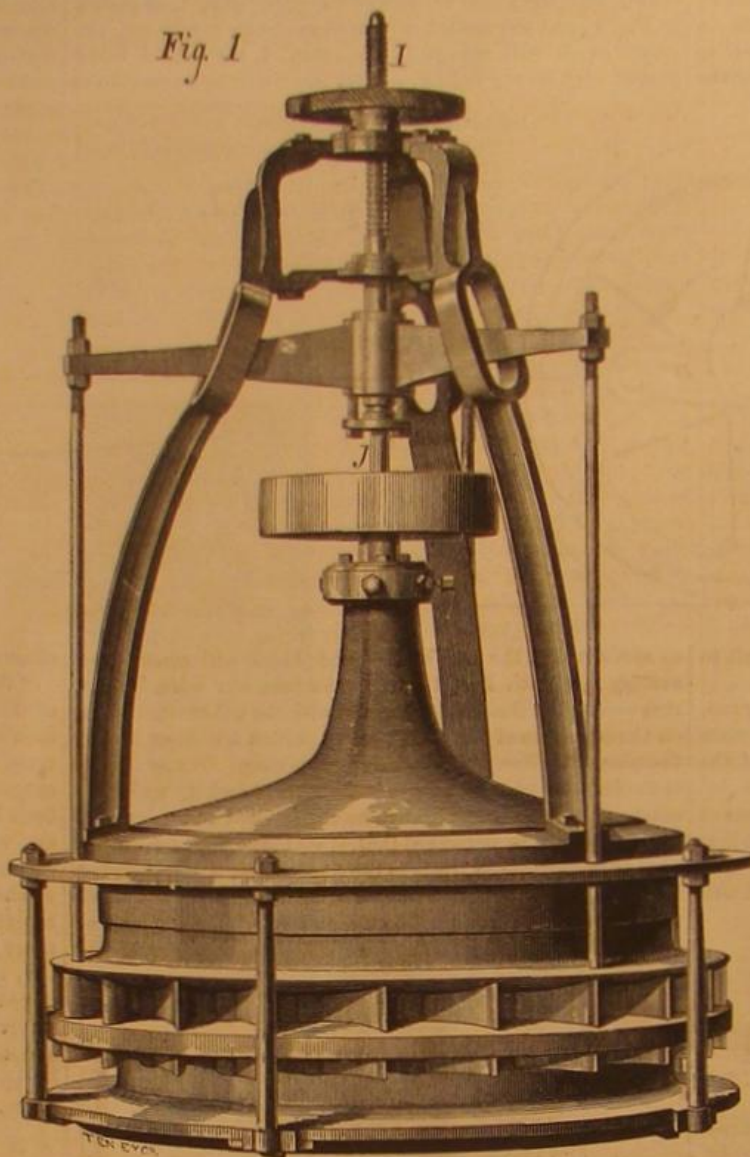
To the crown plate, A, which is cast on the hub, are bolted the annular plates, B, to the lower of which are attached a series of partitions, C, Fig. 2, which form the curved channels or bucket spaces. The casing consists of a dome, as shown in Fig. 1, supported on a curb whose bottom flange rests on the foundation and supports the spider, D, Fig. 2. An adjustable step rests on the center of the spider and forms the lower bearing of the main shaft. The upper flange, E, of the curb is indented, and, inclining downward outwardly, forms the bottom of the chutes. From the edge to the vertical part of the curb extend a series of slots, corresponding in shape to the chute guides, F, and through which the said guides move freely in a vertical direction (dotted lines) when the gates are elevated or depressed. The dome is secured to the curb by pillars, and its bottom edge is beveled inward to repel any obstacles that may collect on the upper side of the gate rim. The outer gate consists of a vertical ring, with a small flange at the top and an indented rim, G, below, having a narrow flange projecting slightly inward under the inner gate. This flange and the edge of the curb beneath it form the shutting surfaces of the outer gate. The width of the small upper flange is proportioned so that the pressure of water under it may counterbalance the weight of the gate and its appendages. It slides on the inner surface of the dome and is packed watertight. The rim forms the upper surface at the mouth of each chute, and it curves downwards so as to direct the water into the chutes and permit sediment to be carried off.

The inner gate, H, is connected by a perforated plate to the hub. Its bottom is made with slots corresponding to the partitions, C, not fitting watertight, however, but having clearance enough to admit water above the plate.

At I is a screw rod, supported in a frame as shown, and operated by the hand wheel. This fits into a corresponding female screw in the hub, and is attached to a spider from which depend rods, secured to the flange of the outer gate. To the hub of the spider, by a ball and socket connection, is attached a rod, J, which passes within the tubular shaft, and is secured to the hub to which is attached the plate of the inner gate, I. The rotation of the hand wheel thus elevates or depresses both gates simultaneously; and the ball and socket connection permits the inner

wheel by friction against it. In order to facilitate the discharge, the lower plate, B, which forms the bottom of the buckets, inclines downward at its inner edge. This form of bucket is applicable to both inward and outward discharge wheels. The guides, F, are arranged around the wheel, so as to throw the water to the center. Through these guides and the other surfaces bounding the chutes, the elevation or depression of the outer gate increases or diminishes, not merely the gate area at the opening and shutting edges, but the entire capacity of the chutes.

Fig. 1



WALTON'S TURBINE WATER WHEEL.

The shallow grooves, shown cut in the tops of the partitions, C, permit water to pass from one bucket into another over the diaphragm, to balance the pressure from below, and keep it equipoised at any elevation in the bucket. The bolt heads, by which the upper plate, B, is fastened to the crown plate, form stops, which prevent the diaphragm from coming into contact with said plate, and preserve more or less space and water passage at all times in the upper part of the bucket.

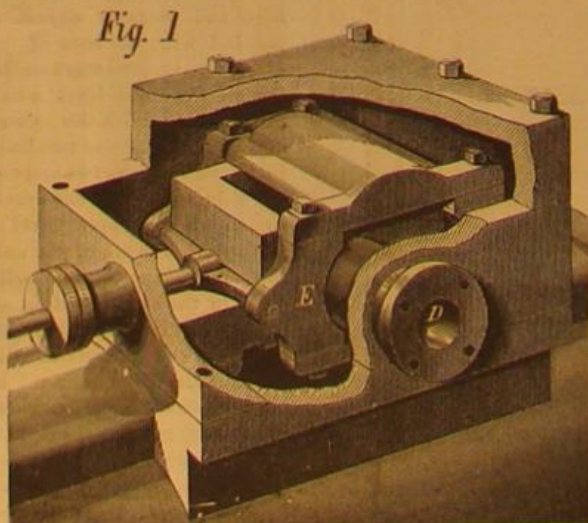
It will be observed that this arrangement constitutes a device which operates both outer and inner gates, which enlarge and diminish alike the chute and bucket spaces simultaneously, while the wheel is in motion or at rest. The wheel is thus kept properly proportioned and the inlet current maintained constantly at the same angle. The result, as already stated, is the full percentage of power at all elevations of the gate.

Patented July 14, 1874. For further information, address the inventor, Silas Walton, Moorestown, Burlington county, N. J.

IMPROVED BALANCED SLIDE VALVE.

We illustrate herewith an improved balanced slide valve,

Fig. 1



gate to rotate with the water wheel, while the movement of the outer gate is only vertical.

The impact side of each partition, C, is curved inward to a distance somewhat greater than the width of the chutes, and extends thence so as to form a smooth, continuous surface throughout its whole length. The convex side forms a thin edge with the concave side, and curves inward on a different center from the latter. A recess or offset is then produced, and the remainder of the partition is a thin-edged plate. The recess prevents the discharging current from coming in contact with the curved side of the partition after passing the annular point, so that the issuing liquid vein passes clear of the wall of the succeeding bucket, and does not retard the

The principal advantages claimed are that there is very slight pressure of the valves on their seats, and that, through there being double steam and exhaust ports, the steam acts more rapidly on the piston, and is exhausted more rapidly, with less back pressure.

A perspective view, with the chest broken away to show the valve, is given in Fig. 1. Fig. 2 is a vertical section and Fig. 3 a plan view, the cover being removed. The steam ports, A, lead into the passages, B, Fig. 2, at each end of the cylinder. Each passage, therefore, has a double port. The exhaust ports, C, lead into a common exhaust, D. The two slide valves are constructed in the usual manner and are connected by bolts, as exhibited in Fig. 1, said bolts passing through projections on the valves and supports, E. Upon each bolt is a spring to permit the valves to open and discharge condensed water from the cylinder, thus preventing the bursting of the latter. As shown in Fig. 2, steam is entering on the right hand side.

The valve obviously is little subject to wear. It is especially adapted for engines the motion of which it is desirable frequently to reverse, as locomotives and hoisters, since the engineer is afforded control of the machine without requiring steam to be shut off. The valves and ports, being parts of the steam chest, are easily detached, and thus may be readily and economically repaired.

Patented April 7, 1874. For further information relative to sale of rights, territory, etc., address Messrs. Wisner & Strong, Pittston, Pa.

Sinking of an Hotel into the Earth.

The St. Louis Journal relates the following occurrence, that happened in that city on May 12: "Considerable excitement was created in East St. Louis, yesterday morning, on the discovery that Belleville House, a two-story frame building, just south of the Pittsburgh Railroad and Coal Company's dike, near the southern limits of the city, had disappeared in the quicksand. The circumstances connected with the unusual occurrence are as follows: The house, which is used as a hotel, was built on piles, and but a few days before showed evidences of an inclination to sink into the earth. On Thursday night it sunk about two feet; but the proprietor, Mr. F. Decker, not apprehending anything serious, paid very little attention to the matter. On Friday night, the guests went to bed as usual; but at a late hour the clerk, Mr. George Huebner, discovered that the premises were getting rather unsettled, and gave the alarm. Before the inmates could realize what was going on, the building had sunk forty-eight feet, carrying with it ten persons. After considerable difficulty they were all rescued, badly frightened but not hurt. The back water from the river soon surrounded the place where the house stood, and would very probably have carried it away if the gable end, all that is visible, had not been securely fastened to terra firma. Mr. Decker's loss on the building is about \$6,000, and on furniture about \$1,000. The house was recently purchased

Fig. 2

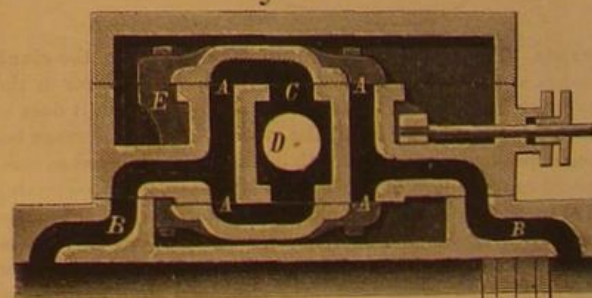
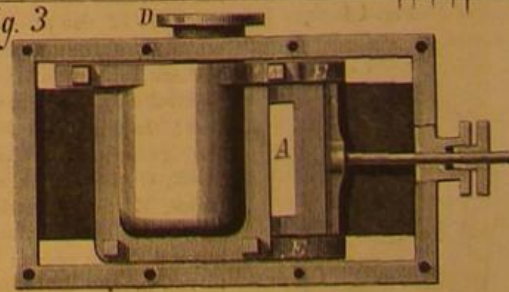


Fig. 3



by the present proprietor; and in all probability it entirely disappeared last night, as very little of it was visible at a late hour."

Powder for Producing Ozone.

In order to produce artificial ozone, Mr. Lender makes use of equal parts of peroxide of manganese, permanganate of potash, and oxalic acid. When this mixture is placed in contact with water, ozone is quickly generated. For a room of medium size two spoonfuls of this powder, placed on a dish and occasionally diluted with water, would be sufficient. The ozone develops itself; it disinfects the surrounding air without producing cough.

TEA AND TEA CULTURE.

Some time in the third century, says tradition, there lived in China a hermit of great piety. His vigils were long, his prayers constant; but despite a stomach normally empty from fasting, he was ordinarily sleepy. (This part of the story fails to agree with Mr. Buckland's recent assertion that hunger is a prime cause of insomnia, but the discrepancy is immaterial.) The constant disposition of our hermit's eyelids to close begat in him a holy wrath against the weakness of the flesh; and with sublime indifference to physical pain, the voracious chronicler (scorning physiological probability) asserts, thereupon he cut off the offending eyelids and hurled them to the ground. To a convenient god, who lived near by, this little act of self-abnegation was

especially gratifying, and accordingly the eyelids were caused to sprout and grow, generating, not an eyelid plant but the tea plant, in the leaves of which may yet be traced the lids and eyelashes of the pious hermit. While this tradition may not be strictly true, it perhaps is as veracious as any other Chinese fable accounting for the origin of tea; for as to who first found the leaf and brewed "the cup that cheers but not inebriates," history is altogether silent. On the first day of February last, there existed in stock in England alone 105,100,000 lbs. of Chinese tea, representing a value of nearly \$40,000,000. The quantity exported from China to the United States, for the year ending June, 1874, was 49,831,800 lbs., representing a value of \$21,212,334. These figures are sufficient to indicate the enormous com-

merce comprised under the name of the tea trade; but they do not by any means represent the proportions of the total tea traffic, since they relate to that of but one country. China tea is perhaps the best grown; but in South America it is superseded by the leaf of the *Ilex Paraguensis*, or Paraguay tea plant; and in Java and Sumatra, coffee leaves are greatly preferred by the natives. Among the other kinds of tea known are Labrador tea, made of the dry leaves of the marsh *ledum* (*ledum palustre*), indigenous to North America, Abyssinian tea or *chaat*, Tasmanian tea, or the dried leaves of various *myrtaceae*, found in large quantities in Australia. Faham tea is the leaves of a fragrant orchid found in Mauritius; Appalachian, Oswego, Mountain, and New Jersey teas are all from plants found in the United States.



THE CULTURE AND PREPARATION OF TEA IN SIKKIM, INDIA.

Sloe and strawberry tea are perhaps the best substitutes for the Chinese production. There are also Mexican tea, a Brazilian tea—the aromatic *capitão da matto*—a Santa Fé tea, Indian tea, Toolsie tea; beside tea made from the leaves of scores of other plants, however, unlike the above, have never come even into a limited use.

In the face of gigantic statistics relating to its consumption, and of the great profusion with which Nature has provided the herbs suitable for the beverage, it is a little startling to find that tea is, after all, a poison, one capable of producing functional nervous disarrangements when taken in excess. It exerts an astringent action; and by the presence in it of an organic substance, *theine*, it exercises its special influence. "In poverty-stricken districts," says Dr. Richardson, in "Diseases of Modern Life," "among the women who take tea at every meal, an extremely nervous semi-hysterical condition from the action of tea is all but universal. In London and other fashionable centers, in which the custom of tea drinking in the afternoon has lately been revived under the old name of 'the drum' (kettledrum is the society name for these social parties in the United States), these same nervous symptoms have been developed in the richer classes of society, who, unfortunately, too often seek to counteract the mischief by resorting to alcoholic stimulants. 'The maladies caused by tea are deficiency of saliva, destruction of taste for food, biliousness, nausea, nervousness (often extreme), and nightmare whenever sleep is obtained.' A formidable indictment, truly, for the harmless looking and fragrant contents of one's tea caddy. It is more pleasant to contemplate the reverse of the picture, and agree with a Chinese writer that 'drinking it tends to clear away all impurities, drives off drowsiness, removes or prevents headache,' or with Dr. Edward Smith in his recent work on Foods, in which he says that the beverage stimulates respiration, and 'powerfully promotes the assimilation and transformation of other foods.'

To enter into all the varied details of tea culture would be far to transcend our present limits. An excellent idea, however, of a tea farm will be obtained from the large engraving given herewith, which is taken from photographs of new plantations near Dargeeling, in British Sikkim, India. Tea flourishes best on mountain slopes where there is plenty of rain, but where the water does not stagnate about the roots of the plant, and where the annual mean temperature varies from 65° to 76°. These conditions are fulfilled especially in those parts of Sikkim which are situated from 2,000 to 4,000 feet above the sea, and the tea produced is of exceptionally fine flavor. The tea seed is planted by drills in what are termed nurseries; and when the plant has grown to be 3 or 4 inches in height, it is transplanted finally into a garden. The leaf is plucked by women and children from the middle of March up to November, when the cold season has begun, and cultivation commences. The leaves are then rolled into a form called a *dullah*; and after these have fermented and turned brown, they are broken up and placed in a bamboo vessel over a sharp, clear, charcoal fire until roasted. The tea then passes to women, who pick out all red leaves and stalks. It then goes to the sifter, who separates the different kinds of tea. After this it is again returned to another set of women, who fan out all chaffy leaves by shaking it up in a round shell bamboo basket. The tea is then heated over a slow fire, and finally packed for transportation. No. 1 of our engravings is a general view of the plantation; 2 represents the leaves being weighed; 3 shows the hands employed in plucking the leaf. In 4, the leaves are being rolled; in 5, they are represented in large baskets withering in the sun; 6 shows the reolling operation by machine; 7, withering in the factory; and 8, a machine for sorting the various kinds.

Few articles of commerce are more adulterated than tea. The *London Times*, in 1873, published some interesting revelations on this subject, and once stated that, "out of twenty samples, nineteen were found to be adulterated with plumbago, lie tea, iron filings, and sand. Since tea naturally contains a large quantity of tannin, there are thus brought together the two chief constituents which enter into the composition of ink, and by appropriate treatment a bottle of good ink actually was made from the tea in question." The *London Medical Examiner*, of recent date, very fully examines the various adulterations of the Chinese leaf, and says that these, for the most part, consist in redrying and rearing exhausted leaves. It is quite impossible to tell to what extent this is done, as the leaves can be made to look as good as new, and can be mixed with fresh ones without much chance of detection. Another method, practised in Canton, is the production of scented and green teas from the leaves of other plants. Whole chops of tea, consisting of 1,000 packages each, and called Canton gunpowder tea, have been exported, composed entirely of rose leaves painted green. The facing powder used in these cases is Prussian blue and sulphate of lime or gypsum. Willow leaves are frequently employed as adulterants; and an ingenious fraud, capable of deceiving even experienced tea dealers, is perpetrated by boiling rice and dropping the congee or rice water into tea dust. This done, it is impossible to tell the quality of the article until the liquor is distilled from it.

A wreck brings a great and profitable harvest to tea dryers. Several years ago, the steamer *St. Petersburg* was lost with a cargo of tea, and after being immersed for sixty days the chests were regained. The tea was rather salty to the taste; but as many thousand barrels full were obtained, it is probable that it was all revamped and sold to the retail trade.

Three words as to making tea by way of conclusion, and these are: Don't boil it; to do so is a barbarism. Theine in tea, like caffeine in coffee, is a volatile principle

which boiling drives off, leaving only a decoction of the bitter astringent residue, for which we know no better name than liquid headache generator. It is a strong stomach that can withstand more than a pint of the simmered abomination, sold in most restaurants under the name of tea. Tea well made is fragrant, aromatic, and exceedingly grateful to the taste; tea badly made has a flavor like boiled brooms. The rule for making good tea is first to scald the teapot, put in the tea, pour on fiercely boiling water, cover tightly, and if green tea, serve immediately, or if black tea, stand near a fire for five minutes. Certainly no rule could be simpler than this; and yet in the average household, there is none for which the Irish handmaid entertains a more profound contempt.

NEW METHOD FOR THE DETECTION OF NICKEL IN THE PRESENCE OF COBALT.

BY MALVERN W. ILES, PH.D., SCHOOL OF MINES, COLUMBIA COLLEGE, NEW YORK CITY.

In October, 1875, I began comparative experiments upon various nickel and cobalt salts, in hopes of detecting some characteristic difference, which would serve for qualitative purposes. I was soon surprised at the intimate relationship existing between these elements; and although I was not led to believe that nickel and cobalt were one and the same element, as has been thought by some chemists, yet I will unhesitatingly state that a search for qualitative and quantitative methods for these metals has been as great a source of annoyance to chemists as was the discovery of these elements in an ore by any of the old German miners, who attributed their occurrence to the evil spirits *Kobold* and *Nick*.

The literature upon these metals alone would fill volumes; yet all that is known in regard to this subject has not yet been made public, since the metallurgical treatment of nickel and cobalt ores is kept in the greatest secrecy. Long before I had completed my researches into the literature of the subject, and before I had performed the various qualitative reactions suggested, I was overwhelmed with the magnitude of the undertaking. My investigations have, however, led to the discovery of a new and yet undescribed salt of nickel, eminently characteristic of this element. Its formation could, I think, be more advantageously applied upon a metallurgical scale than in the qualitative laboratory. The qualitative method which I suggest, which has been successfully used at the School of Mines for some time, may be stated as follows: Remove the metals precipitated by hydrochloric acid and hydrosulphuric acid as usual; then add ammonium chloride, ammoniac hydrate, and ammonium sulphide; the precipitate may contain aluminic and chromic hydroxides, also zinc, manganese, iron, nickel, and cobalt sulphides. Treat the precipitate with dilute hydrochloric acid, and gently warm; all the metals will be dissolved as chlorides, except the nickel and cobalt sulphides, which will remain as a more or less granular black residue. In order to insure the complete removal of the other metals, especially iron, which would interfere with the subsequent proceedings, it will generally be found advisable to wash the black residue several times with warm dilute hydrochloric acid. The residue is next tested in a borax bead. If it is brown, the student may safely conclude the absence of cobalt, and only the presence of nickel.

Since, however, the beginner in qualitative analysis frequently mistakes a dark residue of iron sulphide, which often occurs at this point, mechanically enclosed in the separated sulphur, for a residue which contains nickel or cobalt sulphide, it is generally advisable to recommend that, in case a brown bead is obtained, to dissolve a small portion of the residue in dilute *aqua regia*, and test for iron by the addition of potassium ferrocyanide. In case iron has been found, the remaining residue is to be digested several times with dilute hydrochloric acid, until no reaction for iron is obtained or the residue completely dissolved. If a blue bead has been obtained, indicative of cobalt, then nickel is to be looked for in the following manner:

(a) Dissolve the black residue in as small a quantity of concentrated nitric acid as possible; evaporate almost to dryness (this step should not be overlooked, since the next step taken is the addition of ammonia, which would have to be added in considerable quantity if the nitric acid was not at least partially expelled). (b) Add ammoniac hydrate until the nickel and cobalt hydroxides are dissolved. (c) Add glycerin, $\frac{1}{10}$ or $\frac{1}{2}$ of the volume of the liquid upon which the experiment is made. Heat until the solution has acquired a purple or rose tint. (d) Filter. (e) Add potassium ferricyanide in slight excess, and heat to boiling for a few minutes; a light red precipitate, or a white flocculent precipitate, which soon settles, indicates nickel. If the ammonia be quite strong, or if considerable has been added, boil several minutes. A few drops of dilute hydrochloric acid will shorten the operation; but its use is not to be recommended in a qualitative laboratory, since the students are too apt to continue adding the acid till acid reaction ensues, in which case the cobalt will be precipitated. Even a large amount of cobalt, treated as above, remains perfectly clear.

When potassium ferricyanide is added (e), the solution acquires a beautiful red tint, similar to the coloration produced when ammonium sulpho-cyanide is added to a ferric salt. When this red tint is very intense, it is very advisable to dilute the solution slightly, in order that the analyst may easily see through the liquid; and then, on heating, in case nickel is present, a cloudiness will occur at the top of the test tube, which soon spreads through the entire liquid; and then, on heating still further, distinct floccules will make their appearance, which settle readily, having no tendency

to adhere to the sides of the test tube. In case nickel is not present, the liquid clears up considerably.

I have been greatly aided in studying the chemical changes that take place by Professors Gibbs and Genth's "Researches upon the Ammonia-Cobalt Bases," from which I take the following: "An ammoniacal solution of chloride or cobalt (also nitrate?) absorbs oxygen readily from the air, becomes at first brown, and then gradually passes through various shades of color to a deep red." This solution "leaves upon the filter a quantity of hydrate of sesquioxide of cobalt, which is sometimes almost inappreciable, sometimes in comparatively large amounts." The glycerin, I think, plays no important part until the addition of the potassium ferricyanide. Since, however, a large number of samples of glycerin contain some lime, which can easily be detected with the spectroscope, and also since the ammoniac hydrate invariably contains some ammonium carbonate, there will be a slight precipitate of calcium carbonate, after the addition of the glycerin and the application of heat. We see, therefore, from the above that the filtration (d) has a twofold object: First, the removal of $\text{Co}_2(\text{HO})_3$, and second, the removal of CaCO_3 .

The facility with which alkaline solutions of many of the metallic protoxides, say Professors Gibbs and Genth, absorb oxygen from the air attracted the attention of chemists at an early period. The proto-salts of iron, manganese, and cobalt are particularly remarkable in this respect. The object, then, of the boiling (c) is twofold: 1. The separation of CaCO_3 . 2. The formation of purpureo-cobalt.

"The salts of purpureo-cobalt are often found among the direct products of the oxidation of ammoniacal solutions of cobalt. They are often formed from the salts of roseo-cobalt by heating or by boiling, or with strong acids, the cobalt passing, as we conceive, from one modification to another. The salts of purpureo-cobalt are distinguished by a fine violet red or purple color, which is common to nearly all of them, and which is very different from the comparatively dull red of the salts of roseo-cobalt."—*Researches upon the Ammonia-Cobalt Bases*.

Professor Gibbs' explanation of the action of ammonia on a protoxide of cobalt may be briefly stated as follows: "The protoxide is converted into sesquioxide of cobalt, which, at the instant of its formation, unites with a certain number of equivalents of ammonia, so as to form an integral portion. The new base partakes, in some measure, of the properties of the alkalis, the peculiar character of the salts of cobalt being wanting."

There are various other elements that form compounds analogous to the ammonia-cobalt bases. For example, Claus obtained ammonia-rhodium and ammonia-iridium, bases corresponding to roseo-cobalt, and, like this, triacid bases. Professors Gibbs and Genth say: "We have made many experiments in this direction, without, as yet, interesting results. Iron and manganese promised to afford similar classes of compounds; yet, in their behavior towards ammonia and oxygen, the proto-salts of these metals exhibit no analogy to those of cobalt. With chromium, the case may be different; but we cannot as yet pronounce, with certainty, on this point. Experiments with nickel failed entirely, and yielded ammonia salts of the protoxide."

In regard to the precipitation of cobalt with potassium nitrite, Dr. Fleitman says (*American Chemist*, November, 1875, page 193): "In the case when less than 1 part cobalt in 100 parts nickel is present, the precipitation of the former by KNO_2 is by no means accurate." Professor Wolcott Gibbs says, in regard to this subject: "The complete precipitation requires 48 hours, and rarely succeeds, unless in experienced hands."—*Chemical News*, March 17, 1865, also *American Journal of Science and Arts*, January, 1865.

I have found, when the amount of cobalt is large, that 48 hours is not long enough. Yet this method of separating cobalt from nickel is the one upon which very great stress is laid by nearly all the writers on chemistry. It is the one placed in the hands of beginners in the science of chemistry. No one, however, seems to raise a cry of objection except the poor tortured qualitative student, who finds, at the expiration of the 48 hours, that something is wrong; no yellow precipitate has formed; and even if a yellow precipitate has formed, in the filtrate, when evaporated to dryness and the residue tested in a borax bead, very frequently a beautiful cobalt blue looms up, beautiful in itself, but most aggravating to behold at this stage of his expended patience!

The French Exposition of 1878.

A law has been passed by the French Legislature, decreeing the opening of an International Exposition in Paris, on May 1, 1878, and the continuance of the same to October 31, of the same year. A commission has been appointed to make preliminary preparations; and of this, a sub-committee under M. Viollet-le-Duc, the celebrated French architect, was charged with the devising of a project for the grand buildings. M. Viollet-le-Duc's committee has reported as follows:

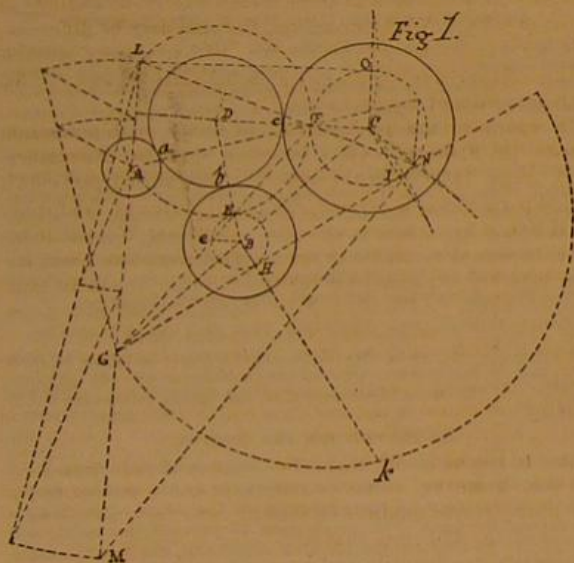
"Your sub-commission thought that it was necessary to have the covered space amount to 2,255,000 square feet in the Champ de Mars, and that it was proper to adopt rectilinear dispositions of the inclosure, forming a compact whole, which might be easily divided off according to the nature of the products exhibited in one direction and according to the nationality of the exhibitors in the other, a sort of Pythagorean table, upon which, on following one direction, a range of similar products might be inspected, while on taking an opposite direction to the first the nationalities would show their different merchandise. In the middle of this vast building are to be arranged saloons to receive an exhibition of objects of art submitted by masters in every coun-

try, of models and of drawings of art more especially relating to industry, and perhaps a retrospective exposition. This principal building, which will occupy the middle part of the Champ de Mars, will be joined to the other buildings of the Exposition, by means of a large covered gallery that will cross the quays and the bridge of Jena at some distance above the ground, so as to allow free circulation to foot passengers and carriages to pass under it. This gallery will be bordered by spaces reserved to exhibitors whose works have a mixed character, such as objects fit for teaching, for libraries, and for typographers. This vast gallery will serve as the center, while buildings, disposed in an amphitheater on the Trocadero, will contain exhibitions of agriculture, horticulture, the training of domestic animals, the products of agriculture and mineral exploitation, and engines relating to the navigation of rivers and seas. These buildings on the Trocadero will occupy a surface covering 512,500 square feet, with intermediate courts and gardens. On the summit of the Trocadero and in covered communication with the gallery, there will be a great saloon erected, able to hold 10,000 persons, comprising the tribunes, and which will be intended for concerts, for testing the musical instruments, for public *réunions*, and for the solemnities of the opening and the distribution of prizes. Between the Military School on one side and the quay on the other and the buildings of the Champ de Mars, gardens will be planted, and will contain *cafés* and restaurants, none of which will be suffered to exist under any pretext within the inclosure itself of the palace. The rectilinear disposition of the roofs in plan and section for the palace of the Champ de Mars will have the advantage of making an economical structure, and of allowing the buildings to be erected in haste and to be pulled down in the same way, as well as to be used afterwards for other purposes, so that the sale of the materials after the close of the Exposition will be easy and profitable. These constructions should be in iron, filled in with bricks and masonry. As to the buildings of the Trocadero, they could in most cases be built in timber, as also the gallery of communication. This gallery, well constructed, should be a fine architectural work of an original aspect, particularly at its passage over the bridge, where it could partly be arranged with trusses, leaving the arches completely independent.

"The beautiful outlines of the Trocadero give us a reason for erecting picturesque buildings, which will be crowned by the grand saloon, from the top of the platform of which visitors will enjoy a ravishing panorama."

AN OLD PROBLEM.

In a recent letter a correspondent asked for an explanation of the method of drawing a circle tangent to any three given circles. Intending to refer him to some good treatise on practical geometry, we examined the principal ones, and found that they contained no mention of this question. On making further investigation, we ascertained that it was a celebrated problem among the ancient geometers, and was



subsequently solved by Vieta, and later by Sir Isaac Newton. It is contained in some foreign works on geometry, and a solution is given in Hutton's "Mathematical Recreations," which seems, however, to be incorrect. It is probable, therefore, that the solution is not generally accessible; and as the problem is unusually interesting and instructive, we lay it before our readers, in as simple a form as possible. The problem itself may be of little importance, but the principles upon which its solution depends are of general utility in geometrical constructions.

The construction in question is one of a class in which the solution is best obtained by indirect methods, changing the nature of the problem by successive steps in order to simplify it. As it is not at once evident what those steps should be, it will be advantageous to make the supposition that the problem has been solved, and see if some conditions can be obtained which may be fulfilled by construction. If such conditions can be discovered, it will, of course, be easy to make the required construction. It may be added that this method is of general application to all intricate geometrical problems.

Referring to Fig. 1, the three given circles have their centers at A, B, C, with radii, Aa, Bb, Cc. Suppose that D, the center of the required tangent circle, is known; it is evident that this will also be the center of a circle with radius, Df, passing through the center, A, of the smallest circle, and tangent to two circles with centers at B and C, and radii, BE, CF. Hence, by the use of these auxiliary circles, the prob-

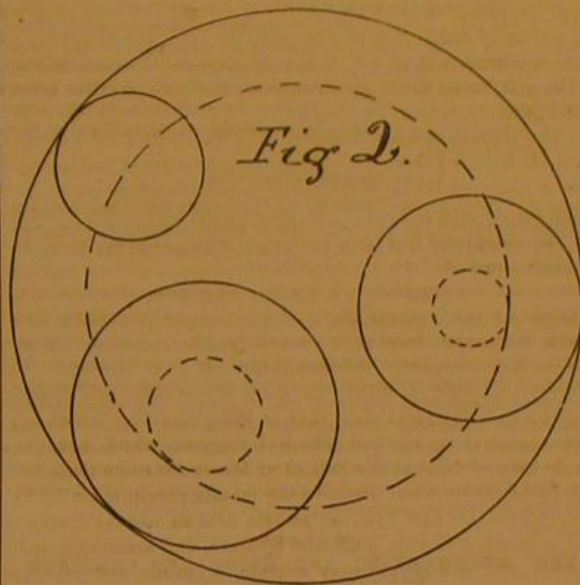
lem can be changed into another, in which it is required to draw a circle through a given point, and tangent to two given circles. Suppose this to be done, and draw the line, GHN, tangent to the two auxiliary circles; draw also the line, CBG, through the centers of the auxiliary circles, the line, GEF, through the points of tangency of these circles with the required circle, the line, GAL, through the center of the small circle, and the radius, Be. Then, from the principles of geometry, we obtain the relations:

$$\frac{GC}{GB} = \frac{GF}{Ge} = \frac{GF \times GE}{Ge \times GE} = \frac{GL \times GA}{(GH)^2}$$

From these conditions we can find a point, L, in the circumference of the required circle, so that, if the circle is drawn through the points, L and A, and tangent to one of the auxiliary circles, it will also be tangent to the other; hence the original problem can be reduced to the case in which it is required to draw a circle through two given points, and tangent to a given circle. Suppose the circle with radius, CF, is the given circle, and that the required construction is made. Through the point of contact, F, draw the straight lines, LFN and AF; at N, draw a tangent, NM, to the given circle, produce the line, LA, to its intersection with the tangent at M; and from L, draw the tangent, LO, to the given circle. Then we will have the relations:

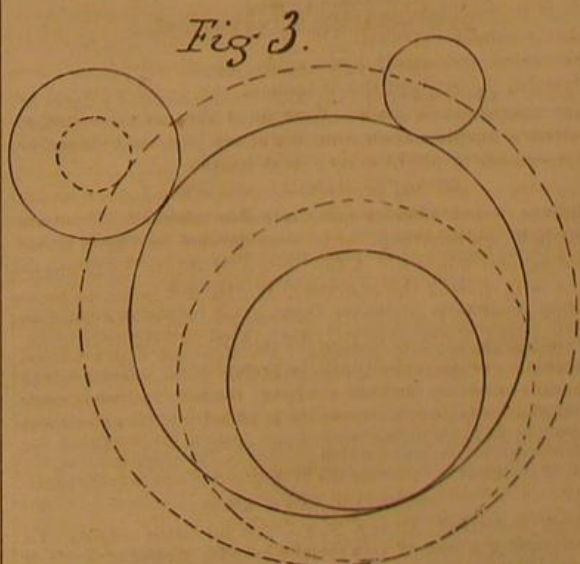
$$\frac{LA}{LF} = \frac{LN}{LM} \text{ or } LA \times LM = LF \times LN = (LO)^2$$

From these conditions, we can find the point of intersection,



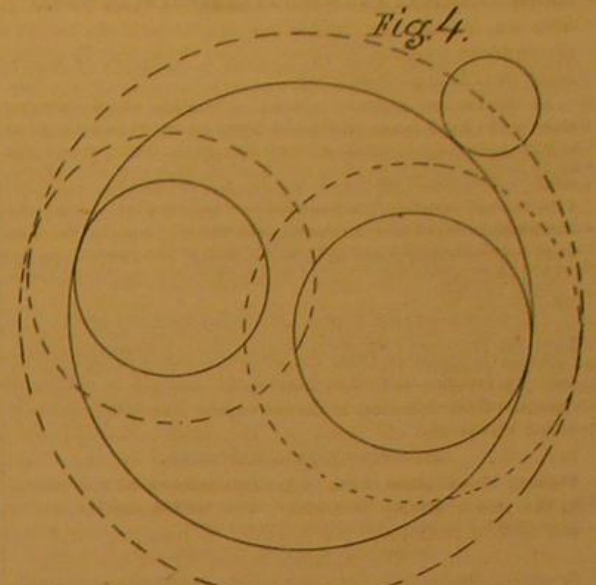
M, the point of tangency, N, and the point of contact, F, so that the original problem is finally reduced to the simple one of finding the center of a circle which shall pass through three given points, A, L, F. The reader may find it profitable to verify the geometrical principles which have been stated above. We now pass to the method of making the construction, having shown the principles involved. All the auxiliary constructions are given in the figure, except such a simple one as the bisection of a line; but it has not been thought necessary to explain the methods of making them, as they will be found in an elementary text book. The reader will find it instructive to make the constructions as they are detailed below.

We have given the three circles in full lines, with centers at A, B, and C. It is evident that the problem admits of several solutions, as the tangent circle may touch the given circles externally, internally, or some of them internally and some externally. Several of these cases are illustrated in Figs. 2, 3, and 4. In any case, the first thing to do is to draw two auxiliary circles, whose centers are coincident with the centers of the two larger circles, and whose radii are such that a circle drawn from the same center as the required tangent circle, and passing through the center of the smallest of the given circles, will be tangent to the auxiliary circles. In Fig. 1, where the given circles touch the tangent circle externally, the radii of the auxiliary circles are the radii of the larger circles, each diminished by the radius of the smallest; and the method of drawing the auxiliary cir-



cles for different cases is illustrated in the other figures. In whatever manner the tangent circle is drawn, after the auxiliary circles are properly proportioned, the rest of the con-

struction is the same for all cases; so that, in the remainder of the explanation, reference is made to Fig. 1.



Having drawn the auxiliary circles, with radii BE, CF, draw IH, tangent to both circles, and produce this tangent to its intersection with a line, CBG, drawn through the centers of the auxiliary circles. From G, the point of intersection, draw a straight line through A, the smallest of the given circles, and prolong it indefinitely. Next find the length of HK, the side of a square whose area is to the area of the square constructed upon GH as the line, GI, is to the line, GH. Then, considering GA to be one side of a rectangle whose area is equal to the square constructed upon HK, find the other side, GL; and the point, L, so determined, will be a point of the circle whose center we wish to find. We have now reached that part of the problem in which it is required to draw a circle through the points, L and A, and tangent to the circle whose radius is CF. Produce the line, LG, indefinitely; and from L, draw a tangent, LO, to the given circle. Find LM, the second side of a rectangle of which LA is the other side, and whose area is equal to the square constructed upon LO. From M, so determined, draw a tangent, MN, to the given circle, and connect the point of tangency, N, with the point, L. F, the point in which this last line cuts the given circle, is the point of contact of the given and required circles; so that it only remains to find D, the center of a circle passing through the points, A, L, and F.

We have been greatly interested in bringing the above problem to its present shape, in which it can be readily illustrated by a single figure, and many of our readers may be equally interested in repeating the construction. It will be necessary to use great care in all the steps, in order to secure satisfactory results. As it is not improbable that there are other solutions known to some of our readers, we may add that we will be glad to hear from any of them who think they can improve upon the method explained above.

Cleaning Silver Watch Dials.

Take about a teaspoonful of saltpeter and mix it with about two dessert spoonfuls of finely powdered charcoal; willow coal is the best. Let these be ground together with a little water on a piece of slate, with the blade of a knife; then by the aid of a camel's hair pencil, spread a portion of the mixture evenly over the surface of the dial, which must then be laid on a piece of charcoal; and with a blowpipe and the clear flame of a lamp or gas jet, it must be made just red hot, and kept so till the wet powder has ceased to fly about; it must then be thrown from the charcoal, hot as it is, into a mixture of sulphuric acid and water (in the proportion of about one fluid ounce of acid to three half pints of water); it will then have a snow-white appearance, and must be washed with brush and soap in clean soft water and put into fine sawdust, or, what is better, rose wood raspings, till quite dry.

New Drawing Instrument.

The Hartford Curve Scribe Company has recently exhibited to us an ingenious instrument for drawing curves and scroll ornaments, for use of designers, wood carvers, etc. It consists of an attachment to the ordinary compasses, in which is a small wheel, the periphery of which rests on the paper in place of the pen or pencil point. So long as the plane of the wheel is at right angles to its axis, it describes a complete circle when the compasses are turned; but the slightest inclination from that angle causes the line drawn to curve out or in, according to the direction and degree in which it is moved from the right angle. It is an efficient instrument for its purpose, and will be found a great help to pattern makers and designers. See advertisement on another page.

The East River Bridge.

The question of continuing work on the East river bridge will shortly be argued before the United States Circuit Court in this city. A lessee of one of the United States bonded warehouses, situated on the river side above the piers of the bridge, has presented a petition for an injunction, restraining the Mayors of New York and Brooklyn, the bridge company, and others interested from building the bridge "over the East River at the height of 135 feet above mean high water, or at any other height that shall obstruct, impair, or injuriously modify the navigation of said river." The petitioner declares that the structure would irreparably injure his business.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SCRAPER.

Prosper Coupal, St. Anne, Ill., assignor to himself and Joseph Delpay, of same place.—While the scraper is being loaded, the handles are held in the ordinary position. When the scraper is to be unloaded the handles are raised, which causes the forward edge of the bottom to catch upon the ground, and, at the same time, causes rods to push back a catch plate which releases the rear edge of the bottom, and allows said bottom to revolve, discharging the load. As the bottom revolves, the handles are lowered, which brings the catch plate forward to receive and hold the rear edge of the bottom as it completes the half revolution, and, at the same time, the forward parts of the side edges of said bottom are caught and held by spring catches.

IMPROVED FRAME FOR EXHIBITING DRESS GOODS.

Lewis H. Springer, Claremont, Minn.—This is a base socket with an upright standard, carrying a curved cross beam with bent-up ends. It is intended to be moved on the counter, and to be moved to any part thereof, so as to shade and expose the goods to the best possible advantage.

IMPROVED GLOVE FASTENER.

William Hassall, New York city.—This consists of two plates, hinged to each other at their lower ends, slotted longitudinally, and having a ring passed through the said slots.

IMPROVED COUPON CUTTER.

Salem M. Schafer, New York city.—This consists of a shears with angle blade contrived to cut two sides of a right angle at one and the same operation, whereby the coupons may thus be cut off the bond in one operation, instead of two, as required in the use of common shears.

IMPROVED AUTOMATIC FAN.

Ervin G. Gollner and Emil Fretz, Dallas, Tex.—This consists of a fan attached to the pendulum of a clock mechanism. The pendulum is provided with paws, in combination with the scape wheel, in such a manner as to give a quick strong movement to the fan.

IMPROVED BRICK KILN.

John W. Brown, Milton, Vt.—The construction here is such that, by fully opening flues, the moisture and steam can be quickly expelled, and then, by closing the said flues less or more, the heat, during the process of burning, may be controlled as may be desired.

IMPROVED PLATFORM SCALE.

Austin W. Comstock, Mount Pleasant, Iowa.—This is a new and ingenious mechanical device, which furnishes an apparatus easily adjusted, strong, durable, and not likely to get out of order. It is not practicable to explain the construction without drawings.

IMPROVED SHEARS.

Henry Dornburgh, Olmsteadville, N. Y.—This consists of a bar for the support of the pivot, sustained on one of the blades outside of the other blade, so that the pivot has a bearing at each end. The strain is thus applied in the middle, in such a manner that, in connection with broad bearings, the blades are prevented from opening laterally along the edges, as they do when the pivot goes through one blade and screws into the other.

IMPROVED OIL TANK.

John C. Chadwick, Baltimore, Md.—This invention relates to an improved construction of oil cans for grocers and other retailers of oil, which can be adapted to receive the contents of one or more barrels, and affords greater facilities for cleaning out the tank, by reason of a hinged segmental cover upon the rear upper portion of the can, and by reason also of the detachable character of the hood.

IMPROVED PENCIL ATTACHMENT TO SLATES.

William E. Thomas, Ford's Store, Md.—This invention is a tube, open at its ends, to receive the pencil, and hinged to a rod attached to one of the bars of the slate frame, which latter is recessed to accommodate the tube. When the pencil is required for use, the tube is turned out of the recess, but otherwise the pencil is retained in the tube by reason of the ends of the latter abutting the end wall of the recess.

AUTOMATIC AIR VENT ATTACHMENT FOR BUNGS.

James Talley, Jr., Kansas City, Mo.—The invention relates to an automatic vent tube, having certain peculiarities of construction, and a bung provided with a recess or cavity in its top portion to adapt it to protect the upper projecting end of the vent tube, the two being permanently attached, thus forming a combined bung and vent.

IMPROVED SHOE FASTENING.

John M. Cayce, Franklyn, Tenn.—This latchet is formed essentially of two metal plates, one of which is hook-shaped, to adapt it to catch up a button attached to the opposite flap, while the other is pivoted to the hook, and so constructed that, when adjusted in a certain position, it will prevent the hook becoming accidentally disengaged from the button.

IMPROVED PAPER JEWELRY.

Frederick W. Seidewitz, Baltimore, Md.—The object of this invention is to provide a cheap form of jewelry emblems and badges for temporary use, which, while presenting to the eye all of the appearance of the precious metals, are of very cheap production. It consists in ornamental devices embossed and stamped out from thin, gilded paper, and provided with a pin fastened in a fibrous disk, which is cemented to the back of the design.

IMPROVED METHOD OF ROASTING COFFEE.

Joseph B. Underwood, Fayetteville, N. C.—The object of this invention is to improve the quality of roasted coffee, and to obviate, to a great extent, the loss in weight; and it consists in a method of roasting coffee, whereby the volatile products are utilized by being conveyed to a closed communicating chamber for cooling the coffee, wherein the said flavoring and aromatic exhalations are restored to the coffee as it is cooled, and the roasted coffee preserved and rendered less susceptible to the damaging effects of the atmosphere.

IMPROVED PLUG TOBACCO BOX.

Benjamin F. Jaques, Petersburg, Va.—The box is so constructed as to permit the tobacco plugs contained therein to be conveniently inspected without the necessity of removing them. The box is rectangular and preferably oblong in shape, having flanged sides and open ends, one of which latter is hinged or removable. The tobacco is exposed to view the whole length of the box, and also at its ends, and the cover may be readily removed to allow insertion or removal of the tobacco.

APPARATUS FOR HEATING AND MIXING OLEAGINOUS SEEDS.

William M. Force, Newark, N. J.—This is an apparatus for mixing oleaginous seeds, so that the seeds, crushed or otherwise, are properly heated, mixed, and tempered for the expression of the oil. The invention consists of a series of spirally arranged revolving stirrer pipes that are supplied with steam from a central upright shaft.

IMPROVED TILLER HOLDER ATTACHMENT FOR VESSELS.

William E. Thomas, Ford's Store, Md.—In this attachment a single block is fixed to the forward end of the tiller and a double block near its middle, the shears in the latter being situated side by side, transversely. On each side of the rudder, single blocks are lashed to staples on the deck. A rope attached to a staple, fixed to the tiller, below the double block, runs, successively, through one of the blocks on the deck, the double block, (around the sheave on the same side), the single block at the forward end of the tiller, the double block (around the opposite sheave), and the opposite block on the deck; its end, then passing forward, is belayed to a cleat or pin on the tiller. By turning a set screw in the block on the forward end of the tiller, pressure is applied to the rope and the tiller fixed in any desired position.

IMPROVED BEE HIVE.

Christopher Ellis, Level Land, S. C.—The object of this invention is mainly the production of a hive adapted for the application of active and efficient means of preventing the ravages of the moth, without, at the same time, destroying or injuring the bees. To this end, the hive is provided with a broad chamber or box, which is separate and preferably detachable, and a perforated metal plate is applied to an opening formed in the bottom board. The moth egg or young worm is destroyed by pouring hot water between the contiguous sides of the hive and the brood chamber, the perforated plate allowing the water to escape from the hive without drowning the bees, or otherwise injuring them. The invention likewise embodies certain other features of construction and arrangement of parts whereby advantages are attained in hiving, handling, and transporting bees.

PROCESS FOR SEPARATING WOOL FROM MIXED FABRICS.

Dr. Joseph Wilkins, Baltimore, Md.—This invention relates to an improved process for separating wool fiber from its admixture with cotton for the purpose of utilizing the wool mixed with cotton in old rags. The improvement consists in the use with any of the active acids (SO_2 , HCl , and NO_2) of chromic acid or any of its compounds, from which it may be liberated by the action of the other acids, which chromic acid, by reason of its affinity for the albumen of the wool, prevents the injurious action of the more active acids, and, while permitting the elimination of the cotton by the well known action of the actual acids, prevents the bad effects of the same upon the wool.

IMPROVED BEER TAP.

George C. Drinen, Brooklyn, N. Y.—The novel feature in this tap consists in making the valve cylinder independent of the bush, and removable without detaching the latter. This allows the barrel to be easily cleansed.

IMPROVED ICE CREAM FREEZER.

David J. Rogers, Bardstown, Ky.—This invention consists of a handle with three holes to fit over the square end of the dasher shaft. When the latter is inserted into the hole nearest to the middle of the handle, a projection on the latter strikes upon a projection on the upright sleeve of the can cover, and prevents the dasher from revolving independently of the can, which does not happen when the end of the shaft fits in either of the other holes. On the edge of the can cover is a curved catch, which, in conjunction with a hinged stop on the cross bar of the tub for the freezing material, allows the can to rotate but in one direction.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DEVICE FOR GREASING AXLES.

Alfred G. Curtis, Ottawa, Ill.—This invention relates to an improved construction of devices for lubricating the skein of vehicle axles, and it consists in a filling tube and a plunger fitting therein, which, together, are employed for charging a longitudinal reservoir in the skein with grease, the said reservoir running the entire length of the skein and opening through a slot upon the surface of the skein, by means of which construction the axle is rendered self-greasing until the reservoir is exhausted. The latter may be refilled without taking off the wheel.

IMPROVED FOUR-WHEELED VEHICLE.

William Buckeridge, Port Huron, Mich.—This invention is an improvement in the class of four-wheeled vehicles provided with a jointed reach to facilitate turning within narrow limits. The front and rear axles are connected by a jointed reach without the aid of any supplementary device, and the body of the wagon is pivoted to the front axle, and supported on the rear axle by means of friction rollers, so that it moves freely thereon whenever the wagon is turned to the right or left.

IMPROVED ARCH BAR FOR FIRE PLACES.

Isaac McCown Wickersham, Harrodsburg, Ky.—The ordinary support for the brick arch of chimney fire places is a flat iron bar, made either straight or slightly curved. The chief objection to this—apart from the total lack of ornamental design or configuration—is the liability of obstruction to the passage of smoke by reason of the thickness of the brick arch or wall resting on the bar. To obviate this objection, and also secure certain other advantages, the inventor employs an arch bar formed of a vertical front plate, having a horizontal top flange to support the brick wall, and of a back plate, projecting upward and inward from the lower edge of the front plate, at an angle of about 45° , for the purpose of directing the smoke.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHBOARD.

John S. Washburn, Jersey City, N. J.—This consists of a series of round bars, around which a strip of wood is passed and fastened. The strip being bent upon a curve will not be liable to break or crack, and thus will not cut nor tear the clothes.

IMPROVED HANGING SHELVES.

Richard St. Leger Brodrick Chinnery, Kankakee, Ill.—These are so constructed that they may be lengthened and shortened to adjust it to the breadth of the place where they are to be hung.

IMPROVED CHAIR AND LOUNGE.

James W. Barnes, Navasota, Texas.—This invention relates to certain improvements in invalid chairs, designed more particularly for persons afflicted with pulmonary affections and with weakness or curvature of the spine. It consists mainly in the attachments to and adjustments for the back of a chair; the first of which consists of adjustable and detachable and horn-shaped supports, which are adapted to fit beneath the armpits and sustain the weight of the patient, and the second of which consists in the adjustment of the back of the chair to facilitate the getting out of and into the same.

IMPROVED STOVE KNOB.

Ralph Strickland, Albany, N. Y.—This invention consists of a knob made of a shell of thin metal filled with plaster of Paris or other suitable non-conducting material. The shell is in two parts, a body and a cap, through both of which a screw passes centrally, serving to attach the cap to the body, and the knob to the stove door, by means of a nut on the inside of the latter.

IMPROVED BED LOUNGE.

William E. Buser, Chillicothe, Ohio.—The lounge has a removable top and a hinged adjustable bottom, which latter may be raised or lowered at will. The said bottom is supported upon its hinges when raised to a horizontal position, and the hinges lie flat when the bottom is lowered. The head of the lounge is also hinged, and may be adjusted in position to correspond with the bottom.

IMPROVED HOT AIR GLOBE AND SHADE HOLDER.

Leander E. Fish, Washington, D. C.—This invention is designed to impart steadiness to the flame of argand gas burners which are used with cylindrical chimneys, and more particularly to those burners which are exposed to drafts of air, as street lamps and outdoor lights. The invention consists in the application of an outer globe or cylindrical chimney to the chimney proper, which outer globe is drawn inward at the bottom to form, with its holding device, a closed hot-air chamber around the chimney proper, so that the air which feeds the flame is compelled to pass down the annular space between the two chimneys, or the chimney proper and the globe, before it reaches the flame, whereby the air is fed to the flame hot, which is an advantage, and the flame is completely protected from flickering or blowing-out even when exposed to a heavy wind. The invention also further consists in the clamping device for holding on the outer globe or chimney with an airtight connection, and also in the construction and arrangement of a shade holder attached to the same globe-holding devices.

IMPROVED SHUTTER FASTENER.

Joshua E. Brooks, Baltimore, Md.—This invention consists of two tumbler latches in a metallic box inserted in the window sill, and which are pressed by pivoted springs against a spear-headed catch, fixed to the shutter. The tumbler latches are connected by a rod which pivots in opposite ends of each. The tumbler latches are released from the spear-headed catch by the aid of a handle which passes up from one of the latches, through a curved slot in the metallic box.

STOPPER FOR WASH BASIN OVERFLOW OPENINGS.

Bzra Webb, New York city.—This is a plate provided with a number of small projections to enter the holes in the overflow opening in the side of the wash basin. The object is to prevent the outflow of sewer gas at that point.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CLOD CRUSHER.

John M. Crockett, Dallas, Texas.—This implement consists of two series of flat parallel bars, which are curved or bent twice, and attached at their ends to the same cross bars. The bends of the bars of one series are at such points as bring them out of alignment with those of the others; and hence, when a clod escapes being crushed by a bar of one series, it will ordinarily pass laterally under the next bar, and thus be subjected a second time to a crushing action. The clods are thus broken up, and the land leveled. The implement is light, cheap, strong, durable, and effective.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PERPETUAL AUTOMATIC CALENDAR ATTACHMENT FOR TIME PIECES.

Miner H. Paddock, East Clarkson, N. Y.—The calendar, with its attachment, is arranged for the days, weeks, and months, with indicating hands for each, and, while being practically automatic, is also perpetual: that is to say, the mechanism is such as to compensate for the irregular number of days occurring in the different months, by a system of skipping, whereby a single day wheel of 31 subdivisions is made to indicate, successively and in proper order, the different number of days (28, 30, or 31) as they occur in the successive months of the year.

IMPROVED WATER COIL STEAM GENERATOR.

Benjamin S. Benson, Baltimore, Md.—This invention relates to a novel construction of steam generator adapted to be also used as a boiler. It belongs to that class of generators in which a cylindrical coil of pipes is employed above a furnace or heating chamber, to generate the steam; and it consists in the construction and arrangement of the coils, which are made to project at one point beyond the containing shell, and are provided, upon the outside of the shell, with peculiarly constructed elbow joints, which permit the ready removal of the deflector or worn-out sections of the coil, and also give easy access to the pipes for cleaning out the same. The invention also consists in the peculiar construction and arrangement with the coils of a thermostat or automatic relief chamber for the surplus water not evaporated by the generator.

SPRING POWER AND TREADLE FOR SEWING MACHINES.

James H. Morley, Holyoke, Mass.—This is a combination of foot power and spring power. One of the treadles works the machine directly, and the other is connected to the spring power for winding it up.

IMPROVED ROTARY ENGINE.

John R. Peters, Dover, N. J.—This consists of plain flanges attached to the hub and extending out as far as the pistons move, with stationary packing rings pressing on the edges of the flanges and against the case. This is claimed to prevent the radial end wear of the pistons by the packing rings and the loss of steam through the necessary clearance between the inside edges of the circumference of the flanges and the case. The invention also consists of compound pistons, consisting of two or more plates in each groove in the hub, the ends and tops of which may be so formed as to prevent serrated edges, and constitute with condensed steam what is called water packing.

IMPROVED ROLLER GAGE FOR SAWMILLS.

Aaron Reppard, Savannah, Ga.—An adjustable roller guide is employed, on the side of which the boards are cut, with a shifting lever and a scale for setting it for boards of any thickness. Said roller is located just in advance of the saw, so that, by setting the log against it, every board will be gaged exactly alike as to thickness. The roller gage is mounted in a bracket, which slides on the bed piece, and the lever is connected to it by a link, and to the bed piece by a bracket.

IMPROVED TYPE WRITER.

Philander Deming, Albany, N. Y.—The object of this invention is to so improve the type writer that it may be made available in an effective manner for short hand reporting, and that the speed of the same in copying common writing may be considerably increased. The invention consists of a double escapement in connection with the rack bar of the carriage of the printing cylinder, the escapement being operated by an anvil and key, that may be brought in connection with the space key.

BOILER FEED WATER HEATER AND REGULATOR.

Frank W. Keys, New York city.—This consists of a couple of tanks, with water supply and boiler connections, and with valve mechanism, by which they are alternately opened to exhaust and fill. They are in communication with the boiler, the pressure being balanced. The invention also consists of another tank in connection with the two first-mentioned, to receive the water before it enters the others, and also to receive the exhaust steam for heating the water.

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. R. H. Allen & Co., N. Y.

For Bolt Forging Machines and Power Hammers. Address S. C. Forsyth & Co., Manchester, N. H.

Owners of Steam Engines.—We guarantee 25 per cent extra power or an equal saving in fuel, by applying the Ransom Syphon Condenser. T. Sault, Consulting Engineer, General Agent, New Haven, Conn.

For Sale or Rental.—Cotton Stalk Puller, patented April 11. Address T. P. O'Connell, San Antonio, Tex.

Rubber Hydrant Hose, Hose Pipes and Couplings. best quality. Send for Prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Wanted.—Situation as Supt. or Foreman of Machine Works or Shop, by Machinist of 22 years' experience. Address Machinist, P. O. Box 383, Chicopee, Mass.

"Dead Stroke" Power Hammers.—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 148 North Third St., Philadelphia, Pa.

Power and Foot Presses and all Fruit-Can Tools. Fernacute Wks., Bridgeton, N. J. & C. 27, Mehy, Hall, Cent'1.

Johnson's Universal Lathe Chuck.—Awarded the highest Premium by the Franklin Institute of Phila., for "Durability, Firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

Metallic Letters and Figures to put on Patterns of Castings, all sizes. H. W. Knight, Seneca Falls, N. Y.

Wanted.—A means of Waterproofing Manila Paper at a cost not exceeding 2 or 4 cents a lb. Address Chas. R. Chute, Minneapolis, Minn.

We beg to call the attention of our readers to the advertisement of Geo. W. Read & Co., No. 200 Lewis St., where the largest assortment of Rare and Fancy Woods for amateur workers is constantly to be found.

Safety and Economy.—Eclipse Sectional Steam Boiler. First Class references. Lambertville Iron Works, Lambertville, N. J.

Woman's Shoes.—Patent for Sale, either whole or State Rights. Address C. Steckel, 199 Allen St., N. Y.

To Umbrella & Parasol Makers.—Improvement in Handles for Sale. Address N. P. Fassett, Elmira, N. Y.

Water Wells.—Wanted descriptive circulars, best apparatus for boring or driving, and best terms to agent. W. P., 1407 Ripley St., Davenport, Iowa.

Engine Builders and Mill Furnishers, send Circulars or Card to Benson Brothers, Centralia, Ill.

For Sale.—35 in. 16½ ft. Lathe, \$400; 18 in. 10 ft. do., \$125; 15 in. 8 ft., \$100; 12½ in. 7 ft. Stover do., \$215; 9 ft. Planer, \$400; 6 ft. Planer, \$25; 12 in. Slotter, \$300; Profiling Machine, \$250. Shearman, 45 Cortlandt St., N. Y.

Lawn Mowers for Hand, Pony, or Horse.—Prices reduced. Largest stock in the city. A. B. Cohn, 197 Water St., New York.

Wanted.—25,000 lbs. 2nd hand light T rail. E. B. Seeley, Bowling Green, Ky.

For Sale.—Complete outfit of machinery for the manufacture of cotton waste, cost \$2,200. Price \$700. Forsyth & Co., Manchester, N. H.

For Sale.—24 in. x24 ft. Lathe, with Chuck; two 13 in. Lathes; one 7 ft. x24 in. Planer; two 8 in. Shapers. E. P. Ballard, 48 Beckman St., New York.

The Photo-Engraving Co. have been obliged to remove from 62 Cortlandt St. to a larger building at 67 Park Place. Their Relief Plates for Newspaper, Book, and Catalogue Illustrations are rapidly taking the place of Wood Cuts and are unsurpassed. See advertisement in another column of this paper.

For the best Patent Self-Opening Gates for Carriages, in any style of Wood or Iron, address Cottam & Co., Dayton, Ohio.

400 Machines, new and 2d hand, at low prices, fully described in our printed list No. 6. Send stamp, stating just what you want. Forsyth & Co., Manchester, N. H.

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.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-2 to ½ horse power. Agents wanted. Address with stamp, 1,113 Chestnut St., Philadelphia, Pa.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 23 Platt St., New York.

First class Amoskeag Steam Fire Engine for Sale, 2d hand, \$1,200. Forsyth & Co., Manchester, N. H.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information address Munn & Co., 37 Park Row, New York City.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

For Sale.—Sturtevant No. 7 Hot Blast Apparatus, \$400. Forsyth & Co., Manchester, N. H.

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 39 Park Row, New York.

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

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

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

Hothkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

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

For Sale.—2 Hunsenman Hand Fire Engines with Hose Carriage, second hand, 5½ in. cylinder, 15 in. stroke. Price, each, \$425. Forsyth & Co., Manchester, N. H.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality.—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

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

Temples and Oilcans. Draper, Hopdale, Mass.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Ramsey & Co., Seneca Falls, N. Y., U. S. A.

See Boulton's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.



R. R. will find directions for tempering rock drills on p. 202, vol. 31.—R. N. will find directions for calculating the strength of boilers on pp. 116, 165, vol. 28.—J. C. N. will find a description of the speed indicator for railway trains on p. 271, vol. 33.—R. N. will find a recipe for lemon sugar on p. 378, vol. 30.—B. & S., W. C. J., F. H. S., M. F., H. D., 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) A. C. H. asks: What is the best cement to resist the action of bisulphide of carbon? A. One of the best cements for this purpose is a solution of glue in warm dilute glycerin.

(2) F. B. says: Our schoolhouse is 30 x 50 feet on the ground, with only one floor. The ground is clayey and hard to drain. The frost rises very badly. Is it practicable to set it on iron posts in such a way that the frost will not move it? A. Under each post of the building, place a timber post of good size, extending into the ground about five feet, and foot it upon the middle of a mudsill, of the same size and eight feet long, laid horizontally. Secure the foot of the post to the sill by an iron clevis bolted through the post, and provide a timber brace upon either side, from the post to the end of the mudsill. In filling in the trench, let the filling around the post be of large stone. If you are willing to take still greater precautions, you can lay another mudsill, at right angles to the one above described, to each post, and brace it in the same manner.

(3) E. P. R. says: I have a roof 16 x 24 feet, with a pitch of 3 feet, covered with shingles. It leaks badly. Is there anything that can be applied so the shingles that will make a perfect roof? A. The roof (about 1½ inches to the foot) is too flat. Elevate it so as to give a pitch of 6 inches to the foot, and then ordinary repairs will make it tight.

(4) B. J. M. says: I want something to elevate as much as 1½ tons freight about 20 feet, that one man can handle. A. A differential pulley block and chain will answer your purpose. They may be obtained from any machinists' supplies store.

(5) A. P. McC. asks: How can we ventilate our schoolhouse? It is heated by steam through coils of pipe around the sides of rooms. The building is of brick; and there are 20 rooms, each about 30x60 feet. A. Without plans of your building we cannot answer you specifically; but we would suggest generally the introduction of fresh air upon the coils of heating pipe, in such a manner as not to create drafts, and its discharge at the ceiling on the opposite side of the room.

(6) G. J. B. says: A roof leaks; it is of galvanized iron, and has been on several years. When I purchased the house, I was advised to cover the iron with two or three coats of a mixture of coal tar, Portland cement, and lime, and did so, at a cost of \$50. I find, however, that the cement and lime get washed away, and that the cure is only partial. The iron is very good except in spots. How can these leaks be stopped? A. The iron is probably in large sheets, without the proper allowance for contraction and expansion; and this has opened the joints. A good roofer should be able to scrape all those places bare and clean and solder them tight, if the iron is not too much rusted away. In this way it might be made to serve a year or two; but the best job would be to put on a new tin roof in small sheets.

(7) H. asks: 1. If the Rumford method cannot be applied to show how much more light is concentrated upon a given surface by a concave reflector placed behind an artificial light than would be received from the same light at the same distance without the reflector, then by what process can the question be determined? A. The best way to find the utilizing power of concave mirrors is first to determine the loss of light by reflection of the material of which the mirror is made, then its size, its curvature, and the surface section of the bundle of parallel rays. 2. Is the following a correct rule to ascertain what proportion of light from a spherical source (a round charcoal set glow, for instance) will fall upon a page of a given size? "Compute the surface measurement of a sphere whose diameter is twice the distance of the page from the flame, and the proportion which a page of a given size bears to the entire surface of the sphere will be the proportion of the whole amount of light falling upon the page, provided the page is held at right angles to the rays of light." If the rule is as stated, to what extent should it be modified when applied to a flat flame? A. The rule is correct, and need not be modified for flat flames, as such flames give the same amount of light in all directions, either from the edges or from the flat surface; flames being perfectly transparent for the light of other flames, and every part of a flame transparent for every other part of the same.

(8) H. asks: 1. With two lamps, which are proved by the Rumford or any like method to emit equal quantities of light, as a basis for a test, can the Rumford method be applied to test the utilizing power of concave mirrors by placing one

of the lamps before a concave mirror, in its principal focus, and then varying the distance of the two lights from the screen until the shadows are sensibly equal in density? A. The method proposed could not give correct results, as the reflection from a concave mirror introduces complex circumstances, which make the comparison with a simple lamp impracticable. 2. Will the law of inverse squares apply to determining how many lamps, at the same distance, would be required to equal the amount of light thrown upon the screen by the lamp placed before the reflector? A. As soon as you place the lights in the focus of a concave mirror, you make the reflected rays parallel, and the law of inverse squares is no more applicable, being based on the divergence of rays from a point. 3. Will a test with the lights at any distance from the screen indicate with accuracy the relative utilizing power of the reflector, no matter what the distances? A. In order to determine correctly the relative utilizing power of reflecting surfaces, the only correct method is to use plane reflectors. 4. Can the photometric method be applied to make the same tests? A. The ordinary photometric method is the best for the tests in question, provided concave reflectors are excluded.

(9) J. G. C. asks: 1. Is any form of galvanic battery patentable? A. Yes, any new and useful form. 2. Can carbon plates for batteries be made out of plumbago? A. Yes. 3. Which is the best of all wood for insulation? A. The driest wood is the best. 4. Will oiling or polishing impair its insulating properties? A. No.

(10) I. E. T. asks: 1. Does the conducting power of a lightning rod depend on its surface or the area of its cross section? A. The latter. 2. Is there any gain in increasing the conducting power of a rod, without increasing the number of points? A. Yes, up to a certain point. 3. Is copper any cheaper for lightning rods than iron? A. No. 4. Why are iron wires so extensively used for telegraph lines? A. Because they are stronger.

(11) J. F. A. says: Please let me know the best method of case hardening thin steel plates so that they will not crack, twist, or bend in hardening. A. Cool them off between two flat gratings of cast iron, having small surfaces of contact.

(12) G. W. C. says: I was running a locomotive engine, when the firebox gave way. She had a solid gage of water in the boiler; but the crown and flue sheets sprang from the sides, and her flues were collapsed. She was carrying 135 lbs. pressure at the time. She had been known to stand on a grade for twenty minutes at a time before; and she would show water at the bottom cock, with a good injector at work all the time. I contend that the water getting low so often weakened the boiler, which, carrying a heavy pressure of steam, could not stand any longer. I also think that, if she had not been running at the time, the boiler would have exploded; but as she was pulling a train, a strong draft passed through the flues and helped to resist the pressure of steam. A. The boiler was, no doubt, weakened from the wide range of temperature, and therefore of expansion and contraction, which necessarily follows from letting the water get so low as to require to stand still on the road to fill up. Under such conditions, the destruction of the strength of the boiler is very rapid. Your idea as to the draft through the flues resisting the pressure is erroneous.

(13) J. M. M. says: I turned a paper calender roll so that it ran perfectly true. I then applied an emery wheel to finish with; but before the wheel had gone across the face of the roll, the roll ran out of true about ¼ inch. The lathe center ran true, the wheel post was firm, and everything else about the lathe was right. Why did the roll run out? My theory is that, in pressing the roll, the shaft was sprung; and in turning the paper off, the shaft sprung back, thus throwing the roll out of true. A. Your theory is probably a correct one.

(14) H. K. S. asks: 1. Would even a good lightning rod contain one of the heavier charges of lightning, such as would shiver a good sized tree to pieces? A. Yes. 2. What would you consider a good rod? A. An iron rod half an inch in diameter.

(15) P. C. C. asks: I have a rotary steam engine running at 4,000 revolutions per minute. The piston is 1x1½ inches. I hold 100 lbs. pressure on piston of engine. How many horse power has this engine? A. The horse power of rotary engines varies too much to admit of calculation, a remark which applies equally to consumption of steam, and hence to size of boiler.

(16) R. D. W. says: We are having some trouble in making a quarter twist belt run. We have been running a 6 inch rubber belt which ran all right; but now we wish to change to a 6 inch leather belt, which will not run anywhere with the pulleys in the same position as the rubber belt. Is the trouble with the shafting? A. Since your rubber belt ran properly, the shafts must be right; hence a wider leather belt will remove your difficulty.

(17) I. H. S. says: I have had lightning rods placed on my house this spring, but I am doubtful if they have been properly put on or not. They are galvanized, are run up about four feet above the chimneys, one on each end of the house, and run along the ridge of the roof, joining in the center, thence down the roof on to a back kitchen, when another branch joins on from the kitchen chimney, and all run down to about 4½ feet in the ground, which the person who put them up says is sufficient, as the ground is only about 8 or 10 feet above the level of Lake St. Louis. I would like to know if it is proper to have the rods laid on to the shingles, as has been done, and merely fastened on with tacks and strips of zinc. Is a galvanized conductor as good as a

copper one? A. Iron has only about one fifth the conducting power of copper. The value of the rod depends upon its size. If it has a diameter of half an inch, it will answer. There ought to be several conductors leading into the earth. Four and a half feet is not sufficient for a ground. You should dig down until you reach water, then dig several lateral trenches, say 10 feet in length, lay down in them iron bars or rods, the larger the better, and connect all your rods to them. Your rods should be welded together so as to leave no bad joints. There is no objection to nailing the rods to the woodwork or shingles.

(18) F. E. N. says: Has not atmospheric electricity small quantity with great intensity? A. Atmospheric electricity may possess both great quantity and great intensity.

(19) I. V. R. says: In No. 17, vol. 1, of your SUPPLEMENT I noticed an article in relation to the increase of the spark of an induction coil. I have a very fine six inch coil made mostly from instructions which you have from time to time published in the SCIENTIFIC AMERICAN, and upon which I tried the following experiment without any result: I attached one end of a copper wire to the street water pipes, and the other to one of the secondary poles of the coil; and the spark remained in every respect as before. Judging from the article above referred to, I should have obtained a lengthening and strengthening of the spark. Did I work correctly or not? A. You should touch the two ends of your induction coil wires together to get a spark.

(20) W. D. E. asks: 1. How powerful a battery would it require to light 100 gas jets at an average distance of 100 feet from the battery? A. Use 100 cells of the gravity battery, or 75 cells Leclanché. 2. What would be the original cost of battery, and what the cost of keeping in operation? A. The cost would be about \$150. The cost of maintenance would be small.

(21) A. N. H. says: I have erected a private telegraph line (stove pipe wire, painted and well insulated) 800 feet in length, having a sounder and relay at each extremity, and wish to connect another set about midway, without local battery. I have applied five cells of Daniell's battery at one end of line, and one cell Watt's battery (electroplating) at the other; but I do not get as strong a current to operate instruments as I desire. How many cells should operate said line? A. A greater number of cells will be required to work a line 800 feet in length if the earth is used for a return than if a wire is used to complete the circuit. 2. If I place different kinds of batteries in the circuit, having unequal dynamical power, will they not unitedly give a steady electrical force, in whatever juxtaposition the cells are placed in line of battery, provided the anodes and cathodes are properly arranged? A. You can use different kinds of battery cells upon one wire without difficulty. 3. Please give a definite idea of one ohm of electrical resistance, or actual power of said unit of measure. A. An ohm is equal to the electrical resistance of about 400 feet of the best quality of No. 8 iron wire.

(22) J. R. C. says: I have read of a telegraph by which it is possible to send and receive two messages at the same time, over the same wire, without either message interfering with the other. Can you help me to find out the particulars of the experiments above referred to? A. The Western Union Company are extensively using apparatus by which four messages are simultaneously transmitted over one wire. See p. 151, vol. 33.

(23) G. L. B. asks: What can I put on a brass plate so that the fingers and the damp air will not tarnish it? A. Try lacquer.

(24) C. S. P. asks: What shape of stationary cutter should I use to turn wood in a lathe, so as not to tear the wood? A. A flat cutter made with a lip on the top face, with a keen edge, will answer your purpose.

(25) G. A. M. asks: Can a person in a very deep well see stars in the daytime? A. Yes, if the atmosphere is clear. 2. If so, why? A. Because the light reflected from the surrounding objects on the earth is cut off, and there is not light enough reflected from a column of clear air, of the size of the well, to obliterate the light of the larger stars.

On Thursday in America, what day is it in Europe? A. It will be Thursday also, at any time before about 6 o'clock P. M., Washington civil time. The day changes at every place at midnight.

(26) J. B. says: I cannot give my crayon drawings a fine finish, and wish to know what paper is best. A. We believe your trouble is in the paper. To make smooth drawings, the paper should have a close body with a very fine tooth. Hold effects (to be examined only at a distance) may be made on the coarser paper.

(27) V. M. D. asks: Is cow hair used for any purposes other than for plaster? A. Yes; it is made up into cloths.

(28) A. L. I. says: 1. What is gelatin of which magnetic fish are made? A. It is refined glue. 2. What is the process by which the fish are made? A. By stamping from sheets that have already been rolled to the proper thickness.

(29) J. F. & J. G. say: What causes hair to turn gray in young persons? A. It may be congenital or accidental, depending upon some constitutional peculiarity in the organization of the individual; causes which have been observed to produce it are mental emotion, disease, and injuries. Grief and terror have been known to cause it, varying in time from a few hours to years. Richat says: "The different passions of the mind have a remarkable influence over the internal structure of the hair; often, in a short period of time, grief effects changes in its color, bleaching the hair, probably by means of absorption of the fluids contained in its tissues." The treatment is to re-

move the causes of the debility existing in the constitution by tonics, especially chalybeates and phosphoric acid, and (where defective nutritive power prevails) by means of preparations of iron and arsenic, and to stimulate the skin locally by abundant brushing and some gentle stimulant, such as cologne and aqua ammonia used at the same time.

(30) H. L. H. says: What will make a cheap jet composition, such as is used for making cheap jet ornaments, which can be worked at the heat of an ordinary fire? A. We believe the materials that have been employed for this purpose are pure asphalt, plumbago or animal charcoal, and gutta percha.

(31) J. S. W. says: I have two rain water cisterns, the water of which is quite offensive. Can any solution be introduced in the cisterns which will correct it? A. Try the remedy recommended to I. R. S., on this page.

(32) W. F. B. asks: On p. 268, vol. 33, you give a formula for writing ink. What is the best process by which to prepare this ink? A. Digest the crushed galls with a portion of the water (hot) for about 48 hours. Then add by degrees the sulphate of iron in a fine powder, with constant agitation until completely dissolved. When this is effected, gradually add the sulphate of indigo, with continued agitation, and allow to cool. Dissolve the gum in the remaining portion of the water (cold), add this solution to the former, stir well, and allow to stand in closed vessels for several weeks. Finally, filter through a bag of fine muslin, and bottle. The ink improves by age.

(33) S. W. asks: Will carbonic acid gas injure the color of fabrics of silk, cotton, and wool, and rust metals? A. No; but in the presence of moisture and carbonic acid, some of the metals rust very rapidly.

(34) J. E. S. says: I have a rain water cistern 12 feet deep; it holds water well, and so far as the cistern is concerned, there is no imperfection. The water at this time of year becomes putrid, having a slimy look and taste; it emits a scent and has the taste of water in which there are dead animals. Can you tell me a remedy? A. Try the addition of a bushel or two of well burnt charcoal in coarse powder.

(35) J. S. says: I am using raw beef hides for covering saddle trees, and use chrome yellow to get a beautiful color, but do not get it perfect. How can I get the hide perfectly transparent, to have the yellow show through? A. This is impossible.

(36) B. S. C. asks: Is there any chemical process that will turn the hair gray? A. Frequent washing of the hair with a diluted mixture of strong nitric and muriatic acids will accomplish this result. The proportions should be about 1 part of nitric and 3 parts hydrochloric acids, and 20 or 30 parts warm water. The nitric acid will stain the flesh slightly yellow, but this is not permanent.

(37) C. B. M. asks: How can I make asbestos waterproof, and not liable to rot, if placed 3 or 4 feet underground? A. Asbestos is waterproof, and is not liable to decay or rot under either of the conditions mentioned.

(38) W. S. M. says: I have seen a small blood tester, with a ball at one end and a glass cylinder at the other. In this cylinder, there is a lemon-colored liquid with a little glass figure (bottle) in it. If the blood is very warm and feverish, you can keep this liquid bubbling, and this keeps the figure up. Please explain this. A. The liquid is probably ether, and the bulb and cylinder is filled with the ethereal vapor, the air having been completely expelled. The boiling point of ether being very low, the heat of the hand is sufficient, under these circumstances, to cause ebullition; and the increased tension thereby caused in the bulb grasped in the hand causes the liquid to move from bulb into cylinder.

(39) J. M. S. asks: 1. What are the proportions of elements in champagne? A. Analysis of genuine champagne, of specific gravity 10341 at 60° Fah., gives the following: Absolute alcohol 7.95, sugar 10.63, total acidity 0.52, potash 0.05, water 89.85; total, 100. 2. How are liquids clarified? A. As a general rule, heat to about 170° Fah., filter, and bottle.

(40) C. J. D. asks: Which can be seen the further, a white or red light? A. A white one.

(41) W. S. G. says: 1. Your recipe for marine glue gives 1 lb. glue to 2 quarts skimmed milk. I find the following difficulties: 1. Small white specks through it after cooling. 2. It molds if exposed to the air. 3. It dries or sets very slowly. I made it in an earthen vessel in a water bath, using the best white glue, and as fresh skimmed milk as I could obtain. Can you help me? A. Filter the milk just before using, and add a little alcohol or spirits of wine. 2. What is acid chromate of lime? A. It is a combination of lime with two equivalents of chromic acid. 3. When a recipe calls for parts, and there are liquids and solids mentioned, what am I to understand? A. They are parts by weight.

(42) J. B. asks: Is there any alloy which melts at about 1,000°, suitable for the cylinder of a toy engine? A. Try the following: Melt together 4½ lbs. tin, and ½ lb. each bismuth, antimony, and lead.

(43) J. S. asks: Please describe the process of clarifying raw beef hides? A. When the hides are received fresh from the slaughterhouse, they are washed, if water be abundant, and the horns are removed. Dried or salted hides are soaked in water for 10 or 14 days, with occasional friction; and in some cases a kind of fulling mill is used to produce the soft, supple condition which is necessary for the working. After the washing, green hides are worked with a knife on the flesh

side, to get rid of the flesh and fatty matters. The next operation is to get rid of the hair and scarf skin, for which purpose the hides are put into troughs or pits containing a mixture of lime and water, of three or four different strengths in the different pits. They are left for a day or two in the weakest, and then transferred to the others in succession, until, in the course of two or three weeks, depending upon the texture of the hide and the state of the atmosphere, the lime has dissolved the hair sheath, and combined with the fat of the hide to form an insoluble soap. During the operation the hides are handled, or removed from the pits, and allowed to drain in a heap for several hours every day, in order to equalize the action of the lime. When the hair and epidermis yield to the touch, the skins are taken out and scraped upon a cylindrical table with a suitable knife, called the unhairing knife. The remaining flesh and fat are then completely removed from the flesh side of the skin; they are washed with water, and are then ready for tanning.

(44) F. D. says: I have attempted to coat wax figures with copper, by first giving them a good coating of plumbago; but when I lower them into the copper solution, the greater part of the the plumbago comes off. Please describe a remedy. A. When you have coated the figures with a fine even covering of plumbago, gently heat the surface.

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

A. J. W.—No. 1 is quartz rock with silicate of alumina. No. 2 is quartzite with oxide of iron. No. 3 is carbonate of copper. No. 4 is clay and decomposed in ca. No. 5 is quartz with clay and oxide of iron. No. 6 is quartz, iron, and lead, no silver. —M. S.—It is probably a variety of web resembling that of the spider. If it could be collected in any considerable quantity, there would be little difficulty in soon making a market for it.—R. L. They are sulphides of iron and copper.—J. F. M. E.—It is a variety of steatite, a kind of soapstone. —N. W. E.—No. 1 is a silicious clay containing a small percentage of lime and magnesia. No. 2 has some red ochre; but you must have more of it and a softer rock to be of use. No. 3 is a basalt. It contains some iron, but it could not be profitably extracted.

COMMUNICATIONS RECEIVED.

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

On Baling Cotton. By J. G. T.
On the Mississippi River. By J. S.
On the Financial Problem. By J. G.
On Ventilation. By W. M.

Also inquiries and answers from the following:
J. J.—J. H. R.—A. P. B.—J. M. B.—F. W. S.—J. K.—J. C. W.—W. B. A.—B. L.—J. B. D.—J. M.—M. B.—T. W.

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.

Inquiries 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 bicycle wheels? Who sells telescope eyepieces? Who is the best student's microscope? Who sells microscopic objects, mounted? Who makes the best chronometers?" 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,

May 9, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the 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 Mann & Co., 37 Park Row, New York city.

Abdominal supporter, M. A. Wilson.....	177,085
Anchor tripper, B. C. Sturges.....	177,226
Axle lubricator, A. G. Curtis.....	177,212
Bag, grain, A. McKenna.....	177,140
Bags, clip for traveling, W. Roemer.....	177,281
Bale tie machine, P. K. Dederick.....	177,221
Bale tie, wire, P. K. Dederick.....	177,222
Basin valve trap, wash, W. W. Hurd.....	177,126
Bath tub, portable, A. Sellberg.....	177,287
Battery, galvanic, Brunelle & Mohr.....	177,066
Bit stock, E. M. Boynton.....	177,099
Boat, A. Pittman.....	177,153
Bobbin winder, J. Schofield.....	177,162
Boiler, agricultural, J. W. Dougal.....	177,236
Boiler, steam, J. G. and J. H. Thompson.....	177,300
Boilers, supplying feed water to, W. E. Russell.....	177,160
Boot edges, polishing, R. F. Burns (r).....	7,101
Boot tacking machine, G. McKay.....	177,264
Boot, button, C. Stiekel.....	177,171
Bottle, nursing, S. A. Whitney.....	177,185
Bracket roller, T. T. Fracker.....	177,113

Bread cutter, J. B. S. Ward.....	177,179
Broiler, C. N. Knapp.....	177,132
Buckle, Junkin & Gunn.....	177,131
Buckle, W. Leser.....	177,133
Bulletin board, Crandall & Taylor.....	177,332
Bung air vent attachment, J. Talley, Jr.....	177,286
Burner, gas, A. W. Dinsmore.....	177,224
Burner, gas, S. C. Salisbury.....	177,285
Button, J. Keats.....	177,253
Calif weaner, Maughlin & Marr.....	177,261
Canister, J. J. Curran.....	177,211
Car coupling, Brown, Martin, & Gilbert.....	177,300
Car coupling, J. K. Griffin.....	177,228
Car coupling, W. Halsted.....	177,117
Car lamp, Hicks & Smith (r).....	7,103
Car, propelling, J. W. D. Eekles.....	177,229
Carbonizing iron or steel, S. W. Young.....	177,189
Carbureter, I. Cook.....	177,210
Carbureter, W. S. & G. H. Deeds.....	177,104
Carriage spring, W. H. Richards.....	177,156
Carriage thill, N. Mitchell.....	177,145
Cartridges, loading, Davidson & Bean.....	177,000
Cartridge shells, punching heads of, A. C. Hobbs.....	177,067
Cartridge shells, drawing, A. C. Hobbs.....	177,068
Cattle from stalls, detaching, H. S. Neff.....	177,146
Chair, J. W. Barnes.....	177,193
Chandelier, combined gas and oil, G. P. Clark.....	177,096
Churn, W. B. Nunn.....	177,148
Churn, rotary, G. C. Eastman.....	177,108
Cigar lighter composition, W. J. Littlefield.....	177,134
Clocks, starting pendulum, E. A. Lourdelet.....	177,137
Coach pad tree, L. O. Smith.....	177,081
Cock, compression, M. S. Clark.....	177,096
Cock, stop, H. Watkeys.....	177,180
Coffee pot, J. Lundgren.....	177,229
Coffee pot, S. Theobald.....	177,173
Coffin, J. Gilbert.....	177,234
Coffin, artificial stone, T. E. Daniels.....	177,101
Collars, pasting the ends of, E. Cary.....	177,304
Cooker, feed, Rogers & Winters.....	177,284
Coop, folding, C. C. Allen.....	177,190
Corn huller, G. W. Richmond.....	177,158
Corn stalk cutter, etc., I. & J. F. Wentzell.....	177,304
Cotton gin feeder, I. F. Brown.....	177,199
Crucibles, preparing, J. Irwin.....	177,127
Cultivator, Ellwood & Pitcher.....	177,063
Cultivator, W. Louden.....	177,228
Cultivator, wheel, H. H. Perkins.....	177,152
Curry comb, W. E. Lawrence.....	177,255
Dental plugger, Richmond & Warner.....	177,157
Dental plugger, etc., I. M. Seaman (r).....	7,107
Dish drainer, V. Chandler.....	177,307
Door and window fastener, J. H. Daniels.....	177,102
Drafting implement, W. A. Lorenz.....	177,257
Drawing, stop motion, etc., E. Boyden.....	177,068
Drop lifter, F. Seward.....	177,164
Drop light, H. Iden.....	177,143
Drying apparatus, S. Davis.....	177,103
Electric apparatus, I. L. Pulvermacher.....	177,274-275
Elevator, hay, W. Carroll.....	177,203
Elevator, hay, M. M. Shellabarger.....	177,166
Elevator, hay, H. & C. Toofs.....	177,173
Elevators, safety clutch for, W. S. Smith.....	177,290
Engine valve gear, steam, G. H. Corliss.....	177,069
Equalizer, draft, J. F. Donoghue.....	177,107
Fan, automatic, J. A. Williams.....	177,310
Feed box, W. M. & J. J. Walton.....	177,178
File, W. T. Nicholson.....	177,070
File blanks, stripping, W. T. Nicholson.....	177,071
File blanks, stripping, W. T. Nicholson.....	177,072
Files, cutting, W. T. Nicholson.....	177,073
Filter, reversible faucet, M. S. Clark.....	177,094
Fire bricks, S. P. Harbison.....	177,118
Fireplace arch bar, I. M. Wickersham.....	177,308
Flat iron stove lid, G. R. Moore.....	177,069
Fork, horse hay, J. L. Saunders.....	177,286
Furnace, house-heating, Peterson & Irwin.....	177,076
Furnace, regenerator, F. H. Eichbaum.....	177,230
Gage, water, J. Nicholas.....	177,309
Garbage box, B. Burling.....	177,091
Gas making, W. H. Tupper.....	177,313
Gate, sliding, S. E. Daniel.....	177,314
Gearing, frictional, M. Ray.....	177,278
Generator, sectional steam, B. Denmore.....	177,223
Glass melting furnace, E. Jones.....	177,130
Glassware, making, A. A. Adams.....	177,087
Grinding machine, roll, G. Gavil (r).....	7,102
Gypsum, treating, C. T. Tomkins.....	177,301
Hammer, spring power, R. F. Livermore.....	177,135
Harness, C. H. Corey.....	177,098
Harrow, P. J. Jacoby.....	177,128
Harvester, J. H. Elward.....	177,231
Harvester, J. Harris.....	177,241
Harvester, J. J. Piggott.....	177,270
Hats, blocking, H. V. Snow.....	177,169
Health lift, H. U. Johnson.....	177,251
Hides, drying, J. Finnigan.....	177,111
Hoe, G. Wright.....	177,311
Holdback, W. P. White.....	177,184
Hoof parer, Burroughs & Carrothers.....	177,301
Hook, button, S. M. Brougham.....	177,197
Horsehoe nails, finishing, N. W. Goodrich.....	177,237
Hose pipe adjustable nozzle, T. Haley.....	177,239
Ice creeper, Abrahams & Rummig.....	177,065
Ice pick, H. F. Darnell.....	177,106
Injector, W. B. Mack.....	177,313
Inkstand, J. Osterling.....	177,49
Invalids, supporting rest for, P. T. Clement.....	177,29
Ironing board, Catt & Harrod.....	177,80
Ironing board, folding, J. Rayner.....	177,77
Jack, lifting, G. G. Howe.....	177,25
Jar lifter, C. E. Gillespie.....	177,236
Journal and coupling, T. Weaver.....	177,181
Kettle and cooking apparatus, B. Temple.....	177,083
Kiln, brick, F. F. Ingersoll.....	177,249
Knit mittens, making, W. H. Abel.....	177,096
Ladder, fireman's, I. H. Corbin.....	177,097
Lamp, C. E. Ball.....	177,191
Lamp, car, Hicks & Smith (r).....	7,103
Lantern, submarine, Striedinger et al.....	177,172
Last, J. M. Barnett.....	177,192
Last block fastening, H. J. Pratt.....	177,371
Leather, punching, Hickey et al.....	177,159
Lock, hasp, E. S. Young.....	177,312
Lock, time, S. A. Little (r).....	7,104
Loom, temple, W. W. Dutcher.....	177,227
Looms, protection rod for, G. Hetherington.....	177,244
Measure, liquid, J. D. Muller.....	177,307
Middlings, purifying, etc., R. L. Downton.....	177,062
Mill staff, Dale & Eastell.....	177,213
Mine hoist, safety, N. Libotte.....	177,296
Mosquito net, S. P. Whitcomb.....	177,306
Motor, water, I. P. Good.....	177,115
Ores, drying and roasting, Walker et al.....	177,303
Ore-concentrating table, J. U. Tolles.....	177,174
Organ stop action, E. H. Schofield.....	177,163
Oven, W. H. Teeling.....	177,299
Oyster opener, Lum & Sanford.....	177,198
Painter's wheel horse, A. D. Osgood.....	177,190
Pan, bake, J. Gilbert.....	177,114
Pan roasting, Peace & Wingfield.....	177,151

Paper box, H. Ritter.....	177,329
Paper cop tube machine, L. Smith.....	177,167
Paper-drying apparatus, H. Braunhold.....	177,196
Paper-drying drum, E. Cary.....	177,306
Peg boat, G. Davis.....	177,314
Planter, corn, A. Horneman.....	177,195
Planters, marker for corn, C. W. Spear.....	177,280
Plow, I. R. Kern.....	177,254
Plow, gang, Richardson & McInnes.....	177,078
Plow, hand, Mays & Tigrett.....	177,301
Plow, side hill, H. F. & G. F. Shaw.....	177,090
Plowshares, bar for, I. N. Pyle.....	177,154
Power, foot, W. F. & J. Barnes.....	177,088
Press, baling, P. K. Dederick.....	177,316-317-318
Press, hay, P. K. Dederick.....	177,220
Printer's tank galley, J. F. Hannan.....	177,240
Printing on cans, J. B. Weaver.....	177,182
Propeller, vibrating, H. Mulhollen.....	177,306
Propellers, steering, F. G. Fowler.....	177,064
Pulley rope, strain equalizer, S. Woolston.....	177,188
Pump, chain, W. A. Cherry.....	177,308
Pump, force and lift, F. Miller.....	177,143
Pump, rotary, O. F. Schultz.....	177,079
Railway rail, compound, M. Feeley.....	177,322
Railway rail fastener, Houston <i>et al.</i>	177,124
Railway rail joint, H. Allen (r).....	7,100
Railway switch chair, Fox & Hayward.....	177,112
Rake, horse hay, J. Hlatt.....	177,065
Rake, horse hay, J. F. Trader.....	177,174
Ram, hydraulic, I. B. Millington.....	177,144
Rein, driving, J. P. Tolman.....	177,302
Reflector, W. S. McLewee.....	177,141
Regulator, draft, I. Hayes.....	177,121
Roof, sheet metal, C. A. Smith.....	177,168
Saddle tree, slide, O. V. Flora.....	177,233
Sash fastener, E. H. Fenton.....	177,110
Sash fastener, I. W. Sylvester.....	177,291
Sash holder, R. Holcroft.....	177,347
Sash holder, D. P. Shaw.....	177,289
Sawdust, separating waste from, D. C. Newell.....	177,284
Saw frame, buck, Hayten & Potter.....	177,243
Saw gummer, E. McCloy.....	177,263
Saw set, H. Hiltchcock.....	177,246
Saw set and clamp, E. Day.....	177,215
Scales protector, platform, D. A. Gilbert.....	177,235
Scarf, C. Loeb.....	177,134
Screws, making wood, C. D. Rogers.....	177,282
Screws, threading, C. D. Rogers.....	177,282
Separator, grain, J. W. Johnson.....	177,282
Separator, middlings, T. Hart.....	177,242
Sewing machine presser foot, D. A. Sutherland.....	177,226
Sewing machines, operating, G. L. Townsend.....	177,084
Shoe, E. Shaw.....	177,288
Shoe, J. C. Well.....	177,183
Sleigh runner, W. G. Calkins.....	177,092
Snow plow, R. S. Van Zandt.....	177,177
Spinning machine flyer, Abbot & Smith (r).....	7,099
Steamer, culinary, H. S. Neff.....	177,147
Stove, A. A. Pittz.....	177,372
Stove door knob, R. Strickland.....	177,294
Stove pipe elbow machine, W. T. McMillan.....	177,285
Stove extension shelf, A. T. Jones.....	177,129
Stoves, etc., Hines, Eagan & Plumb.....	177,228
Sun dial, M. Wheeler.....	177,305
Teaching penmanship, L. D. Harvey.....	177,126
Thermostat, J. H. Guest.....	177,116
Thill coupling, E. Soper (r).....	7,106
Ticket holder, D. Shamberger.....	177,163
Tobacco box, plug, B. F. Jaques.....	177,250
Tongs, pipe, G. M. Curry.....	177,100
Top prop operator, G. N. Spink.....	177,170
Toy wind wheel, P. Raffa.....	177,155
Trace, rope, P. Hayden.....	177,122
Tree protector, fruit, S. W. Hill.....	177,245
Trunk stay, J. M. Strout.....	177,082
Tubing, colling, H. Dornling.....	177,228
Umbrella tip cup, F. S. Brown.....	177,198
Vacuum pan, J. Fairburn.....	177,109
Valve gear, exhaust, G. H. Corliss.....	177,099
Valve grinding machine, W. T. De Luce.....	177,106
Vehicle hub and axle, A. B. G. A. Williams.....	177,309
Vehicle spring, W. F. Whitney.....	177,307
Ventilator, A. J. Robinson.....	177,280
Vessels, water closet for, A. B. Sands.....	177,161
Vise, J. E. Brundage.....	177,090
Voltic battery, I. L. Pulvermacher.....	177,273
Wagon body, extension, J. K. Milnor.....	177,142
Wagons, side bar, E. Soper.....	177,291
Wagon spring, G. W. Marble.....	177,260
Washing machine, S. L. Denney.....	177,261
Watch ratchet stop, etc., J. D. McAnlis.....	177,139
Water closet for vessels, A. B. Sands.....	177,161
Water wheel, turbine, T. Holmes.....	177,123
Whip socket, T. L. Whitacre.....	177,186
Wind wheel, W. Bowes.....	177,067
Windmill, E. Williamson.....	177,187
Window blind, metallic, M. & V. Rathknecht.....	177,277
Window, show, O. B. Potter (r).....	7,103
Yarn, etc., making rosettes of, O. Boehme.....	177,101

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents a line.
Engravings may have advertisements at the same rate
per line, by measurement, as the letter press. Ad-
vertisements must be received at publication office at
early as Friday morning to appear in next issue.

M. SELIG JUNIOR, & CO.,
Importers of American Machinery, Tools, Agricultural
Implement, Wholesale and Export Hardware and Ma-
chinery Merchants. Est'd 1866, 85 Queen Victoria St.,
LONDON, E. C., ENGLAND.

FOR LEASE,

At South Chicago, Ill., a Shop 100x30 feet, 2 stories,
18 inch concrete walls, Engine, Boiler, Shafting, &c.;
Frame Store House, 45x60, 2 comfortable Dwellings, and
Blacksmith's Shop, all on lot 194 feet by 150 feet, opposite
principal Depot in center of the town, six miles South of
Chicago. Advantages for manufacturing unequalled by
any town in the West. Five Trunk Railroads and Lake
navigation. Largest Lumber market known at this point.
More ground adjoining can be leased if wanted. Address
WM. H. DILLINGHAM, Louisville, Ky., Owner.

Portland and Keene's Cement.

From the best London Manufacturers. For sale by
JAMES BRAND, 85 Beekman St., New York.
A Practical Treatise on Cement furnished for 25 cents.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufactur-
ers, Trenton, N. J., or 117 Liberty St., New York.
Wheels and Ropes for conveying power long distances.
Send for Circular.



REYNOLDS & CO.,

145 EAST ST., NEW HAVEN, CT.,
MANUFACTURE
Iron and Steel Set Screws, Round, Square, and Hexagon
Head; Machine and Cap Screws; Piano, Knob, and Lock
Screws; Machine, Bridge, and Roof Bolts; Bolt Ends,
Blanks, Nuts, Washers, etc., of every description.
Send for Price List.

**SCREW PROPELLERS, THEIR SHAFTS AND
FITTINGS.** By Hamilton W. Pender, M. E. An
able treatise, showing the present practice. Its advan-
tages and defects. With 25 figures. Price 10 cents. Con-
tained in No. 4 of SCIENTIFIC AMERICAN SUPPLE-
MENT. To be had at this office, and of all news agents.

LEHIGH UNIVERSITY.—TUITION FREE.—
Civil, Mechanical and Mining Engineering; Chemis-
try and Metallurgy; A Classical Course; French and Ger-
man; English Literature; International and Constitu-
tional Law; Psychology and Christian Evidences. Address
The REV. JOHN M. LEAVITT, D. D., Pres., Bethlehem, Pa.



[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the
United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this
agency, at home and abroad, than through any other in
the world.

They employ as their assistants a corps of the most ex-
perienced men as examiners, specification writers, and
draftsmen that can be found, many of whom have been
selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed them-
selves of Munn & Co.'s services in examining their in-
ventions and procuring their patents.

MUNN & CO., in connection with the publication of
the SCIENTIFIC AMERICAN, continue to examine in-
ventions, confer with inventors, prepare drawings, spe-
cifications, and assignments, attend to filing applications
in the Patent Office, paying the government fees, and
watch each case step by step while pending before the ex-
aminer. This is done through their branch office, corner
F and 7th streets, Washington. They also prepare and
file caveats, procure design patents, trademarks, and re-
issues, attend to rejected cases (prepared by the inventor
or other attorneys), procure copyrights, attend to inter-
ferences, give written opinions on matters of infringement,
furnish copies of patents, and, in fact, attend to
every branch of patent business both in this and in for-
eign countries.

A special notice is made in the SCIENTIFIC AMER-
ICAN of all inventions patented through this agency, with
the name and residence of the patentee. Patents are of-
ten sold, in part or whole, to persons attracted to the in-
vention by such notice.

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
for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to Novem-
ber 26, 1867, can be supplied with official copies at reason-
able cost, the price depending upon the extent of
drawings and length of specifications.

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 of-
fice \$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.

A pamphlet containing the laws and full directions for
obtaining United States patents sent free. A hand-
somer bound Reference Book, gilt edges, contains 140
pages and many engravings and tables important to every
patentee and mechanic, and is a useful handbook of re-
ference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets, Wash-
ington, D. C.

ROOTS' ROTARY HAND BLOWER.



FOR ALL KINDS OF

BLACKSMITHING.

DOES MORE AND

BETTER WORK,

SAVES ROOM, LABOR, AND COAL, AND LASTS

TEN TIMES LONGER THAN BELLOWS.

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

S. S. TOWNSEND, Gen'l Ag't, 31 Liberty St., NEW YORK.

DAMPER
REGULATORS
BEST
MURRILL & KEIZER, 44 Holliday St., Balt.

THE NATIONAL
Steel Tube Cleaner.

For
Cleaning
Boiler
Tubes.
PATENTED
JULY 28
1874.

Adopted by U. S. Navy. For sale by dealers. Send for
Circular.

NON-COMBUSTIBLE STEAM BOILER & PIPE
COVERING

WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St., N. Y.; 132 N. 2nd St., St. Louis, Mo.

IRON BRIDGE BUILDING—A complete de-
scription, with dimensions, working drawings, and
perspectives of Girard Avenue Bridge, Philadelphia, Pa.
With foundations of piers. Ten engravings. Price 30
cents. Contains Nos. 1, 2, and 4 of SCIENTIFIC
AMERICAN SUPPLEMENT. 10 cents per copy. To be
had at this office, and of all news agents.

To Roofers, Builders, & Property Owners.



A complete Roofing for \$3 per square, durable, eco-
nomical, and fireproof. Send for Samples and Circulars.
E. H. MARTIN, General Roofing Materials,
P. O. Box 4784,
70 Malden Lane
and 9 Liberty St., N. Y.

WHIPPLE'S
Patent Door Knob.

Awarded a Bronze Medal at the American Institute Fair
for 1874. The Judges say: "We consider this method of
fastening DOOR KNOBS a great improvement over any-
thing yet invented for the purpose, as it obviates the use
of side screws and washers, and can be regulated to suit
any thickness of Doors." Send for Circular.
THE PARKER & WHIPPLE COMPANY,
West Meriden, Conn.; or 97 Chambers St., N. Y.

BUILDING PAPER!
FOR SHEATHING, ROOFING, DEAFENING, CARPET LINING, AND PLASTERING

Todd & Rafferty Machine Co.

MANUFACTURERS OF

The celebrated Greene Variable Cut-Off Engine, Lowe's
Patent Tubular and Fine Boilers, Plain Slice Valve Sta-
tionary, Hoisting, and Portable Engines. Boilers of all
kinds. Steam Pumps, Mill Gearing, Shafting, &c., Silk,
Tow Oakum, Bagging, Rope, Flax, and Hemp Machinery.
Agents for the New Haven Manufacturing Co.'s Machin-
ery Tools, for Judd's Governors and Stop Valves,
Sturtevant's Blowers, and Differential Pulley Blocks.
WAREHOUSES, 88 LIBERTY STREET, NEW YORK.
WORKS, PATERSON, NEW JERSEY.



**BOGARDUS' PATENT UNIVERSAL ECCEN-
TRIC MILLS**—For grinding Bones, Ores, Sand, Old
Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn,
Corns and Cobs, Tobacco, Snuff, Sugar, Salts, Roots,
Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica,
etc., and whatever cannot be ground by other mills.
Also for Paints, Printers' Inks, Paste Blacking, etc.
JOHN W. THOMSON, successor to JAMES BOGAR-
DUS, corner of White and Elm Sts., New York.

WROUGHT
IRON
BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.
The attention of Engineers and Architects is called
to our Improved Wrought-Iron Beams and Girders (pat-
ented), in which the compound welds between the stem
and flanges, which have proved so objectionable in the old
mode of manufacturing, are entirely avoided. We are pre-
pared to furnish all sizes at terms as favorable as can be
obtained elsewhere. For descriptive lithograph, address
Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

PERFECT
NEWSPAPER FILE.

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

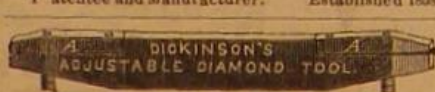
Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

H.W. JOHNS' PATENT.

ASBESTOS
MATERIALS.

Asbestos Roofing, with the Improved White Asbestos
Fire Proof Coating, for steep or flat Roofs in all climates.
Asbestos Roof Coating, for old Leaky Roofs.
Asbestos Cement, for Repairing Leaks on Roofs.
Asbestos Roof Paint, for Tin Roofs, Ironwork, &c.
Asbestos Paints—all colors—for structural purposes.
Asbestos Fire Proof Coating, for wood work, &c.
Asbestos Steam Pipe and Boiler Coverings.
Asbestos Steam Packing, flat and round, all sizes.
Sheathing Felts, Vermiculite-Proof Lining, &c.
These articles are ready for use, and can be easily ap-
plied by any one. Send for Pamphlets, Price Lists, &c.

H. W. JOHNS, 87 Maiden Lane, N. Y.,
Patentee and Manufacturer. Established 1868.

and Shaped Diamond Carbon Points, indispensable for
Tracing Emery Wheels, Grindstones, Hardened Steel
and Paper Calendar Rollers, Drilling, Planing, Moulding
and sawing stone. J. DICKINSON, 64 Nassau St., N. Y.

NOYE'S
Mill Furnishing Works

are the largest in the United States. They make Burr
Millstones, Portable Mills, Smut Machines, Packers, Mill
Picks, Water Wheels, Pulleys and Gearing, specially
adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.



These are the best
and most economical
goods; impervious to
dampness, heat and
cold. Send for sam-
ples to B. E. HALE
& CO., 56 and 58 Park
Place, New York.

FOR THE LATEST IMPROVED

MACHINERY,

For Manufacturing SPOKES, HANDLES, AND HUBS.

Address J. GLEASON, cor. 3d & Diamond Sts., Phila.

Brayton Ready Motor.

It has no boiler, is safe, economical, started by any
one in one minute, occupies small space, and gives an
unsurpassed steady, reliable power. Address
Penna. Ready Motor Co.,
132 N. 3d St., Philadelphia, Pa.



The BEST MILLSTONE DRESSER—GHRSCOM
& Co., Manufacturers and Patentees, Pottsville, Pa.

Machinists' Tools.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

Do Your Own Printing!

Print for cards, labels, envelopes, etc.
Larger class for larger work.
Business Men do their printing and adver-
tising, save money and increase trade. Planes and
presses in Amateur Printing. The Girls or
Boys have great fun and make money fast at
printing. Send two stamps for full cat-
alogue of presses, type, etc., to the Black-Schoen-
KELLEY & CO., Meriden, Conn.

**VELOCIPED CARRIAGES, OF LIGHT CON-
struction, fast speed. Worked by hand cranks;
also by foot treadles. Illustrated in SCIENTIFIC AMER-
ICAN SUPPLEMENT No. 8. To be had at this office
and of all news agents. Price 10 cents.**

EAGLE FOOT LATHES.

With Scroll and Circular Saw Attach-
ments, Slide Rest, Tools, &c.; also Small
Engine Lathes, Metal Hand Planers, &c.
Neatest designs, superior finish. Low
Prices. Our new Catalogue describes
these and every tool necessary for the Am-
ateur or Artist. Send for it.
WM. L. CHASE & CO.,
95 & 97 Liberty St. New York.

TRADE
MARK.
CONCORD
GENUINE
CONCORD AXLES

The Standard—Best Stock—Finest Finish—

MANUFACTURED ONLY BY

D. ARTHUR BROWN & CO., Fisherville, N.H.

**ROGERS' TANNATE OF SODA BOILER
SCALE PREVENTIVE.**
JOS. G. ROGERS & CO., Madison, Ind.
Send for book on Boiler Incrustation.

PORTLAND CEMENT

For Walks, Clusters, Foundations, Stables, Cellars,
Bridges, Reservoirs, Breweries, etc.
Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St., New York

HARTFORD

STEAM BOILER

Inspection & Insurance

COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
I. B. PIERCE, Sec'y.

FOREIGN PATENTS

AND

THE CENTENNIAL.

There is no doubt that our Centennial Exposition will
attract to our shores multitudes of representative people
from all parts of the world, and they will take home with
them many of our best improvements to introduce into
their own manufactures.

An unusual opportunity will be offered for selling to
these people such foreign patents as have been secured on
good American inventions in the respective countries
from which these visitors come.

At the reduced prices for which patents are obtained
abroad, our people will lose a chance not likely to occur
again, if they do not avail themselves of the opportunity
of securing their inventions in foreign countries at once
so as to have their patents ready to negotiate during the
coming summer.

For cost of patents in the different countries and the
conditions on which they are granted, send for pamphlet
containing full information.

Address
MUNN & CO.,
37 Park Row, New York.
BRANCH OFFICE, cor. F and 7th Sts.
Washington, D. C.



OF THE

SCIENTIFIC AMERICAN,

FOR 1876.

THE MOST POPULAR SCIENTIFIC PAPER

IN THE WORLD.

THIRTY-FIRST YEAR.

VOLUME XXXIV.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN
beg to announce that on the first day of January,
1876, a new volume commenced. It will continue
to be the aim of the publishers to render the con-
tents of the new volume more attractive and use-
ful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pur-
suits should think of doing without the SCIENTIFIC
AMERICAN. Every number contains from
six to ten engravings of new machines and inven-
tions which cannot be found in any other publica-
tion.

The SCIENTIFIC AMERICAN is devoted to the
interests of Popular Science, the Mechanic Arts,
Manufactures, Inventions, Agriculture, Commerce
and the industrial pursuits generally; and it is val-
uable and instructive not only in the Workshop
and Manufactory, but also in the Household, the
Library, and the Reading Room. Each volume
contains hundreds of Notes, Receipts, and Sugges-
tions and Advice, by Practical Writers, for Work-
ing Men and Employers, in all the various arts.

TERMS OF SUBSCRIPTION—POSTAGE
PAID BY US.

One copy Scientific American, one year... \$3.20
One copy Scientific American, six months... 1.60
One copy Scientific American, three months... 1.00
One copy Scientific American and one copy
Scientific American Supplement, both
for one year, post-paid... 7.00

The Scientific American Supplement

A weekly paper, uniform in size with the SCIENTIFIC
AMERICAN, but a distinct publication. It
contains working drawings of engineering works,
and elaborate treatises on every branch of Science
and Mechanics, by eminent writers, at home and
abroad. An illustrated cover protects the hand-
somer printed sheets. Price, \$5.00 per annum.
Single copies 10 cents.

Remit by postal order, draft, or express.
Address all letters and make all Post Office or-
ders and drafts payable to

MUNN & CO.

37 PARK ROW, NEW YORK

The "Scientific American" is printed with
CHAS. ENCK JOHNSON & CO.'S SINK, Tenth and
Lombard sts., Philadelphia, and 29 Gold St., New York

SCIENTIFIC AMERICAN

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

Vol. XXXIV.—No. 25.
[NEW SERIES.]

NEW YORK, JUNE 17, 1876.

\$3.20 per Annum.
[POSTAGE PREPAID.]

THE LAMMERGEYER OR BEARDED VULTURE.

The bearded vulture, called in Germany (where it is most common) *lammergeyer*, is the largest and most powerful of European birds of prey; and its German name is derived from its propensity to seize and carry off young lambs, a feat for the performance of which a bird must be largely endowed with strength and audacity. The bearded vulture, when fully grown, is about 4 feet high, measuring from 9 to 10 feet from tip to tip of its wings; the head and neck are completely clothed with feathers, and the base of the bill is hidden by projecting bristles; the bill is long, strong, straight, and laterally compressed, with the tip curved and sharp, a tuft of stiff bristles projects forward like a beard from the base of the lower mandible; the wings are long, the second and third quills being the longest and nearly equal; the tarsi are short and covered with feathers; the anterior toes are united at the base with a membrane; and the claws, especially those of the inner and hind toes, are curved part of the head, the neck, and the under parts are whitish, tinged with orange, deepest on the breast; the wings and tail are grayish black, and the back deep brown; the wing coverts are dashed with orange white; the beard and the space round the eye are black, and the bill horn-colored. The bird is found also in Asia and Northern Africa.

It is by no means uncommon for the *lammergeyer* to frighten its prey over a precipice, and then to descend and devour the carcass. In the admirable engraving* presented here-with, its strength and ferocity are shown to be successfully resisted by the maternal instinct of the chamois, whose pavid offspring, well aware of the besetting danger, crouches in timidity behind its mother. The upward thrust of the chamois' head, armed with short, firm, retroverted horns, has evidently struck the marauder a severe blow, and his affrighted scream is almost audible as we look on his spread tail and displaced feathers.

Use of Steam Carriages.

The mechanical difficulties in the application of steam as a motive power for carriages have gradually come to be appreciated; and with the somewhat more complete knowledge of the conditions and requirements, it is probable that the next attempts, made in earnest by skilled and informed mechanics, will effect more satisfactory results. It is a settled conclusion that the adhesion of the wheels, or of a pair of them, sustaining half the load, is ample for the purpose of propulsion at any grades practicable for ordinary road use, only noticing that the contact or bearing of the drivers upon the ground must be positive and uniform. A four-wheeled vehicle with axles attached to a rigid body, when standing or running on the uneven—generally twisted—surface of a road, will obviously rest or have its bearing only upon three of its wheels, and this condition of three points of bearing attaches to the tram road locomotive, as well as to the common road one. Balance bars or gimbal-hung swinging axles will secure the equal distribution of weight upon drivers, or,

what in the road carriages is equally essential, on directing wheels. The possibility of driving around any curve, as the directing wheels may lead or trail, is secured by the jack-in-the-box motion of the traction engine, which applies the force to either driver of a pair of wheels, imparting to either wheel, in whatever proportion is requisite, the motion or rotation it should have when running upon a curved line. Of course, the abrading action of the tires (like that of the faces of a mortar mill) upon the ground yet remains; and the wear on them and on the road bed at the place of turning will still be large, but the leverage to overcome this grinding, and the amount of grinding, will be so much

work. The utilization of the momentum of stopping may be available to help the starting of a carriage. This has already been elucidated as possible on railway trains; but in this case the gain from all the momentum lost at a stoppage bears so small a proportion to the labor of the locomotive engine as not to be worth saving. The necessity of two speeds, at least, is acknowledged; but with the gearing of the jack-in-the-box, there is no great objection to double speed wheels in addition. The total motive power of the engine demanded is about what is rated at two horse power, at the most, and the engine becomes very small. The success of the three-cylinder engine, now made by the thousand, al-

most, in England, and its peculiar facility for the use of the expansive force of steam at high velocities, seems to open a ray of light into the darkness where the steam carriage of the future now lays. The recognition of the fact that the interstices of a mass of coal, on a given surface, present an equal area for any size of lump, whether coarse (large) or fine, only that all the lumps or grains must be sorted to the same size, is slowly being made; and as our fine anthracite coal, of pea size, runs like water, it follows that automatic firing of the small boiler will be the finality for the purpose of the steam carriage (as well as the possible finality of the firing of marine, if not all, steam boilers). This, with suitable automatic arrangement for feeding, will permit the steam carriage to be run by one man alone. Only some of the salient points of the mechanism of the coming carriage have been noticed here; others of nearly equal importance present themselves, which can be discussed or settled in the same way, by those especially interested.

Eventually, the steam carriage will be as distinctive as the locomotive engine, and will have its nationalities as the locomotive has, and its individuality, as the American locomotive of to-day has William Mason inscribed upon it.

The steam carriage, when in use on the public highways or tram tracks, will be much more safe from accident of any kind than the ordinary vehicle or the street car. The requirement or penalty can be made as stringent, as letting all statute laws out of the question will allow the enforcement of common law; and under the impulse of such penalties—safeguards, catchers, detenters or arresters—automatic contrivances of all kinds will multiply to the point that will give security to the other

traffic, quite as great as that now attendant upon the average driver and the carriage horses; while the control of the apparatus, either to start or to stop, can be made certainly as effective as the present ordinary carriage, however carefully driven.—*Journal of the Franklin Institute.*

HARDENED GYPSUM, boiled with stearic acid or paraffin, much resembles meerschaum. The resemblance may be much increased by coloring the mixture with solution of gamboge and dragon's blood.

A PIECE OF WOOD cut from a tree is a good electrical conductor. Let it be heated and dried, it becomes an insulator. Let it be baked to charcoal, it becomes a conductor again. Burn it to ashes, and it becomes an insulator once more.



DOE AND FAWN ATTACKED BY A VULTURE.

less than that which accompanied the action of wheels rigidly attached to an axis that it can be surmounted or endured. The conditions of leading the tram road carriage around the curve differ altogether from those of guiding the ordinary road carriage. The tram road carriage will guide itself, with either the Bissell two-wheeled truck, or more perfectly still with the old German six-wheeled wagon arrangement (in which the axles adjust themselves radially to any line of curvature); while the ordinary road carriage must have the swinging axle only for a guide.

In the application of power to the steam carriage, it is apparent that the starting resistance is the most difficult to overcome; and although many methods suggest themselves, none has yet had practical application in service in parallel

*From "The Life and Habits of Wild Animals," illustrated with designs by Joseph Wolf, engraved by the Brothers Wympie, and published by Messrs. Macmillan & Co., of London and New York.

Scientific American.

ESTABLISHED 1846.

MUNN & CO., Editors and Proprietors.

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

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included.....2 70

The postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

Scientific American Supplement.

A distinct paper from the SCIENTIFIC AMERICAN, but of the same size, and published simultaneously with the regular edition.

TERMS.

One year by mail.....\$5 00
SCIENTIFIC AMERICAN and SUPPLEMENT, to one address.....7 00

Single Copies.....10

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

Subscriptions received and single copies of either paper sold by all the news agents.

VOLUME XXXIV., No. 25. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JUNE 17, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural machinery.....	322	Lard, adulterating (19).....	36
Air, breathed.....	325	Light, the theories of.....	38
Amalgam, electric.....	328	Magnetism, history of.....	392
Answers to correspondents.....	335	Meerschmied, imitation.....	393
Asbestos.....	331	Metallic, new applications of.....	390
Bees make honey, do.....	338	Mexico at the Centennial.....	345
Bell, the form of a (11).....	335	New books and publications.....	323
Belts, rubber and leather (5).....	335	Oil used for tempering (17).....	325
Blacken brass, to.....	330	Patent decisions, recent.....	333
Blasting cartridges.....	336	Patents, American and foreign.....	333
Bollers and stoves (10).....	335	Patents, official list of.....	331
Business and personal.....	335	Pangenesis, the theory of.....	381
Carbonic acid, applications of.....	336	Pattern making.....	338
Carving and paneling machine.....	330	Pendulum in a mine (8).....	335
Cellar floors (7).....	335	Photo dry plates.....	333
Cement, bichromate (12).....	335	Photo printing bath.....	339
Cement for cracks in floors (6).....	335	Photo printing plates.....	336
Centennial exposition, the.....	335	Pleasanton's experiments, Gen.....	338
Centennial-printing machinery.....	331	Plows.....	332
Cheese, American vs. English.....	333	Practical mechanism—No. 5.....	338
Cotton, baling.....	331	Railway train, an express.....	333
Country homes, improved.....	337	Russian exhibit at the Centennial.....	335
Crookes's experiments, Dr.....	338	Saw gages (4).....	332
Cut-off mechanism, new.....	338	Saving, power for (24).....	332
Dastardly, another.....	338	Shellac solutions, to clarify.....	336
Distal carriages, how to.....	339	Sleep the best stimulant.....	331
Distal carriages, with soap (10).....	339	Soap made with salt.....	333
Domes, steam.....	338	Spectroscopy, a witness, the.....	335
Engine cylinders, cracked (21).....	335	Speller, a champion.....	337
Engines, proportions of (30).....	335	Stable hours (9).....	335
English enamels at the Centennial.....	331	Steam cleaning, the use of.....	333
Fountain, an economic.....	335	Sweden at the Centennial.....	335
Grasshopper pest, the.....	338	Tuberoses, growing.....	333
Gunpowder, making.....	331	Varnish, being-proof (22).....	335
Hoes.....	332	Varnish for paper, waterproof.....	330
Incubator, heat in a (1).....	335	Vicksburg cut-off, the.....	338
Ink, printing, drying (15).....	335	Vortex atoms.....	335
Inventors, an opportunity for.....	331	Vulture, the bearded.....	333
Iris, wintering, clearing.....	331	Walls, clearing smoky (2).....	335
Iron in puddling, physicking.....	335	Water thrash h pipes, etc. (23).....	335
Israelites, longevity of.....	335	Wood as an insulator, etc.....	335
Japanese articles at Centennial.....	335	Wooden pavements successful.....	336
Kalsomine, a good.....	333	Wood, petrifying (16).....	335
Lammerger and doe.....	333		

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 25.

For the Week ending June 17, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876. With 15 illustrations. —Brazilian Exhibits, 1 engraving.—Swedish Iron and Steel Exhibits. —Steam Engines, Notices of the Prominent.—Manufacture of Life Bar- rels at the Exhibition, 3 figures.—The United States Building.—The Ja- panese at the Centennial.—Japanese Saws, 7 figures.—Japanese Bronzes. —Sewing Machine Exhibits.—Book Exhibit, 1 engraving.—Entrances and Turbulences, 2 engravings.—Torpedoes at the Exhibition.—Michigan Ap- ples.—The Cornell Measuring Machine at the Centennial, 2 engravings. —The Megatherium, 1 engraving.—Bohemian Display of Glass.—Mexican Exhibits.—Institute of Mining Engineers.
II. MECHANICS AND ENGINEERING, 29 figures.—Railways in Brazil.— Steel Rails.—Steel-Headed Rails.—Air Compression.—New Floating and Depositing Dry Dock, with 5 figures.—Spiral Steam Jacket, 2 figures. —The Casson-Dormoy Mechanical Puddling Furnace, 4 figures.—Physi- cal Constitution of Steam.—Oils and Fat Destructive to Iron.—Billings' Machinery for Reducing Steel Ingots, 4 figures.—Three Cylinder Steam Engine, 1 engraving.—Elastic Pipe Jointing, 6 figures.—How to Build Cheap Boats, 6 figures.—Deepening Channels.—Improved Breakwater, 2 figures.—Ammonia Process for Ores.
III. TECHNOLOGY.—Recovery of Indigo from Spent Vats.—To take up- pressions of Leaves.—Detecting Arsenic in Paper Hangings.—To Make Waterproof Bags.—Recovering Varnish from Loom Harness.—Prepara- tion of Half Woolen Garments for Dyeing.—Fixing Eosine.—Solution of Coagulated Albumen.—Flax Manufacture.—Value and Strength of As- tringents.—Fixing of Indigo.—Manufacture of Alum under Pressure.— Preparation of Caustic Soda.—Phylloxyanin as a Reagent.—Dyeing Re- cipes.—Preparation of Malt Sugar, for Brewing.—Labor in Massachu- setts.—New Coating for Wood.
IV. ELECTRICITY, LIGHT, HEAT, ETC.—Influence of Temperature on Magnetization.—Explosions in Mines.—Perception and Direction of Sound.
V. NATURAL HISTORY, ETC.—The Caspian Sea.—Solrfe of the Royal Microscopical Society.—New Coloring Agent for Tissues.—The Wonder- ful Salt Mines of Nevada.—Free Soda taken up by Plants.—Resources of Africa.—M. Bert's New Researches on Chameleons, 4 engravings.
VI. MEDICINE, HYGIENE, ETC.—Immediate Cure for Cold in the Head. —Hypodermic Use of Morphine.—Change in Color of the Hair.—Salicylic Acid in Rheumatism.—The Carbolic Acid Spray.—Development of Ova.— Presence of Bile Colors.
VII. MISCELLANEOUS.—Invalidity of State and Local Laws concerning the Sale of Patent Rights, with Decision of United States Court.—Ice Skat- ing in Summer.—Opening of the New Skating Rink, London.

The Scientific American Supplement

Is a distinctive publication issued weekly; every number contains 16 oc-
tavo pages, with handsome cover, uniform in size with SCIENTIFIC AMER-
ICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid,
to subscribers. Single copies, 10 cents. Sold by all news dealers through-
out the country.COMBINED RATES.—The SCIENTIFIC AMERICAN and SCIENTIFIC AMER-
ICAN SUPPLEMENT will be sent together for one year, postage free to sub-
scribers, on receipt of \$10.To SCIENTIFIC AMERICAN SUBSCRIBERS WHO WISH TO TAKE THE SUPPLE-
MENT.—A subscriber to the SCIENTIFIC AMERICAN may change at any time
to the SUPPLEMENT, or may have both papers sent to him, by remitting to us
the difference between the amount already paid for the SCIENTIFIC AMER-
ICAN and the SUPPLEMENT prices above mentioned.
Remit by postal order. Address

MUNN & CO., PUBLISHERS,

37 Park Row, New York.

All the numbers of the SUPPLEMENT from its commencement, January 1,
1876, can be supplied; subscriptions date with No. 1 unless otherwise or-
dered.Single copies of any desired number of the SUPPLEMENT sent to any
address on receipt of 10 cents.

DARWIN'S THEORY OF PANGENESIS.

Seven years ago, Mr. Charles Darwin first presented the the-
ory of pangenesis. After continued study during the inter-
val, he now reaffirms the hypothesis, and once more submits
it, remodeled and fortified by a host of new facts and ob-
servations, in the recently issued second edition of "Animals
and Plants under Domestication." The doctrine of natural
selection presupposes variability as a necessary characteris-
tic of every organism, and this theory has been substantiated
by a vast aggregation of observed facts. Of this accumula-
tion, the work above referred to forms no inconsiderable
part, since it deals with observations showing the amount
and nature of the changes which animals and plants have
undergone while under man's dominion, or which bear on
the general principle of variation. It is in order to bring all
the phenomena of diversity in growth under one law that
Mr. Darwin enunciates a supposition which implies that
every separate part of the whole organization reproduces
itself. So that ovules, spermatozoa, and pollen grains, the
fertilized egg or seed, as well as buds, include and consist
of a multitude of germs thrown off from each separate part
or unit. This connects and serves to explain a series of
phenomena otherwise isolated and inexplicable; and of these
a brief analysis is necessary to the proper comprehension of
this very important and far-reaching theory.

Reproduction may be divided into two classes, namely,
sexual and asexual. The latter is effected in many ways, by
the formation of buds of various kinds, and by fissiparous
generation, that is, by spontaneous or artificial division. Be-
tween the production by fissiparous generation of two or
more complete individuals and the repair of even a very
slight injury, there is so perfect a gradation that it is im-
possible to doubt that the two processes are connected; and
thus the several forms of budding, fissiparous generation,
the repair of injuries, and development are all essentially
the results of one and the same power. From well under-
stood cases of parthenogenesis and a variety of other in-
stances, the distinction between sexual and non-sexual
generation is proved to be not nearly so great as hitherto
supposed, and in fact they do not essentially differ; and
therefore Mr. Darwin concludes that, with the power of re-
growth and development, they are parts of the same law.

A few of the more striking phenomena, coordinated under
this law, may first be examined. A multitude of the lower
animals and vertebrates possess the wonderful power of re-
production of amputated parts. Spallanzani cut off the legs
and tail of the same salamander six times successively.
Tadpoles are capable of reproducing lost members, though
full grown frogs are not. A crab regains lost legs; and
gasteropod mollusks, whose heads are likely to be bitten off
by fishes, have the power of reproducing those important
members. In the case of those animals which may be bi-
sected and chopped to pieces, and of which every fragment
will reproduce the whole, power of regrowth must be diffused
throughout the whole body.

It is well known that buds may be inserted into a stock,
and that plants thus raised are not affected in a greater degree
than can be accounted for by changed nutrition. From this
every-day, though little understood, operation of grafting is
deduced the very important fact that formative elements
capable of blending with those of a distinct individual (and
this is the chief characteristic of sexual generation) are not
confined to the reproductive organs, but are present in the
buds and cellular tissue of plants.

A marvelous series of phenomena grow out of the circum-
stance that in the case of plants the male element may affect
in a direct manner the tissues of the mother, and with ani-
mals may lead to a modification of her future progeny. Gal-
les, fertilized an orange flower with pollen from the lemon,
and the fruit bore stripes of perfectly characterized lemon
peel. Not merely is the ovule affected, but the partially de-
veloped tissues of a distinct species, as is exemplified in a
case where an Arabian mare bore a hybrid to a quagga. Sub-
sequent colts by an Arabian horse were more striped even
than the quagga itself, and presented other marked charac-
teristics of that animal. Another well known instance is
that of a fine bred slut, which, when once crossed by a mongrel,
frequently thereafter bears none but tainted offspring, and
is thus ruined for breeding purposes. Among human beings,
the children of a woman by her second marriage often ex-
hibit traits peculiar to her first husband.

We next reach the question of development, which is
either slight and slowly effected, as in human beings, or
great and sudden, like the metamorphoses of insects. By
several distinct groups of facts, Mr. Darwin is led to the be-
lief in the independence of parts successively developed.
Again, physiologists agree that the whole organism consists
of a multitude of elemental parts, which are to a great ex-
tent independent of each other; and a most curious array of
facts may be adduced to support this view. The spur of a
cock, after being inserted into the ear of an ox, lived for
eight years, became nine inches long, and acquired a weight
of nearly fourteen ounces. The tail of a pig has been grafted
into the middle of its back, and reacquired sensibility. Ollier
inserted a piece of periosteum from the bone of a young dog
under the skin of a rabbit, and true bone was developed. A
French zouave once drove a thriving trade in Paris by sell-
ing marvelous rhinoceros rats. He imitated the horn of
the rhinoceros by grafting a freshly removed rat's tail to
the forehead of a second rat.

Lastly, we meet the phenomena of variability and inheri-
tance. Variability is not a principle coordinate with life or re-
production, but results generally from changed conditions act-
ing during successive generations. By inheritance a multitude
of newly acquired characters are acquired by offspring. A
horse becomes trained to certain paces, and the colt inheres

similar consensual movements. A retriever taught to fetch
and carry will transmit its endowments to its descendants.
On the whole it may be concluded that inheritance is the
rule and non-inheritance the anomaly. Reversion is not a
rare event, but occurs so regularly that it is evidently an
essential part of the principle of inheritance. In fine, in
every living creature we may feel assured that a host of
long-lost characters lie, ready to be evolved under proper
conditions.

It is clear that, through all of these phenomena, there may
be traced a possible action of the innumerable elements com-
posing every organism, each possessing its own attributes
and to a certain extent independent of all the others. Now
it remains to connect all under the law. It is universally
admitted that the units of the body increase by self-division
or proliferation, retaining the same nature, and that they
may ultimately become converted into the various tissues
and substances of the body. But besides this means of in-
crease, Mr. Darwin assumes that the units throw off minute
granules which are dispersed throughout the whole system;
that these, when supplied with proper nutriment, multiply
by self-division, and are ultimately developed into units
like those from which they were originally derived. These
granules may be called gemmules. They are collected from
all parts of the system, to constitute the sexual elements, and
their development in the next generation forms a new being;
but they are likewise capable of transmission in a dormant
state to future generations, and may there be developed.
Their development depends on their union with other par-
tially developed cells, which precede them in the regular
course of growth. Gemmules are supposed to be thrown off
by every unit, not only during the adult state, but during
each stage of development of every organism: but not ne-
cessarily during the continued existence of the same unit.
Lastly, it is assumed that the gemmules in their dormant
state have a mutual affinity for each other, leading to their
aggregation into buds or into sexual elements. Hence it is
not the reproductive organs or buds which generate new or-
ganisms, but the units of which each individual is composed.
These assumptions constitute the provisional hypothesis,
to which Mr. Darwin has given the name pangenesis.

ANOTHER DASTARDLY ATTACK!

The Chicago Tribune says: "The wrongs of women and
negroes have monopolized public attention for many years.
Serious as some of them are or have been, the wrongs of
boys are as bad, if not worse. For a series of years, the
boys of America have been shut out, more and more com-
pletely with each year's advance, from the chance of learn-
ing a trade. The trade unions, with almost incredible blind-
ness, have adopted rules which prevent the employment of
any except a very limited number of apprentices. These
rules forbid a master to employ an apprentice unless he em-
ploys a certain number of journeymen; and in some trades,
the proportion is one boy to twenty men. The few places
left vacant by apprentices becoming journeymen are soon
filled. Tens of thousands of boys are thus deprived of the
opportunity to become reputable and self-supporting artisans.
When they leave school and try to do something for them-
selves, they find the doors shut in their faces. Instead of
becoming blacksmiths, silversmiths, carpenters, compositors,
cabinet makers, coachmakers, hatters, machinists, bakers,
tanners, tinnies, tailors, masons, shoemakers, stonecutters,
plasterers, bricklayers, weavers, they have to become boot-
blacks, newsboys, errand boys, loafers, dead-beats, paupers,
thieves, etc. No one of the occupations open to them offers
any education, except in a sort of cunning which is often a
curse. If the members of the so-called liberal professions,
the journalists, lawyers, teachers, doctors, and ministers,
should successfully combine to prevent the education of boys
and young men in any of their specialties, there would be a
universal howl of complaint. A far greater wrong is com-
mitted, however, when trade education is prevented. Many
more boys are affected, for one thing, and most of them must
go to work at once and labor constantly in order to live.
If they do not this, and do not steal, they must starve."

When will respectable papers, like the Chicago Tribune,
learn to cease such dastardly attacks as the above upon the
workmen of our country and their trade societies? The
workers comprise the vast majority of the population. Is
not all the wealth of the country the result of their labors?
Do they not pay the taxes? Do they not support the govern-
ment, as well as their own families? If they prefer to do
all the family work in person, shall they not enjoy the privi-
lege? To be sure, their boys would be benefited by indus-
try; their mothers and sisters would be rendered more com-
fortable and happier if the family income were increased by
the earnings of the lads. But if the fathers, who form and
govern the societies, prefer to do all the work, and exclude
the young fellows, it is their privilege, and the Chicago Tri-
bune need not complain about it.

Not long ago, the legislature of this State passed a bill re-
quiring that felons and other criminals in certain prisons
should be compelled to work. It costs, say, \$3 a day to sup-
port each one of these rogues, which expense, as everybody
knows, is paid, indirectly, out of the earnings of the work-
ing people. But strange to say, the moment the bill passed,
the Governor was waited upon by officers of trade societies,
representatives of the working masses, the voters, request-
ing that the bill should be vetoed. Labor, they argued, is so
scarce that, if the thieves are allowed to work, we honest
people will have nothing to do. "Very well," perhaps thought
the Governor, "it is your own affair. You may continue,
since you prefer it, to tax your earnings and distress your
families, in order to support these wretches in idleness." So
the bill was vetoed.

VORTEX ATOMS.

Any one who has ever witnessed a cannonade on a still day can hardly have failed to remark the great rings of smoke, which often arise from the cloud belched forth by the guns, and float aloft for a considerable period before becoming dissipated. The same rings are produced on a small scale by smokers of tobacco, by a sudden expulsion of air from the mouth, the lips being placed in a peculiar position. There is also an easy way of making them for purposes of examination, which consists in providing a box having a round aperture at one end, and its opposite extremity covered only with cloth. The bottom is sprinkled with a strong solution of ammonia, and a dish of common salt and sulphuric acid is inserted. The gases arising from the salts and acid combine in the shape of smoke, and the latter may be expelled in beautiful rings through the aperture by striking suddenly on the cloth back.

When the behavior of these rings is critically investigated, it appears that they have peculiar properties. When two impinge, they act as if made of solid elastic material, and vibrate independently after the shock; or vibrations may be produced in them by ejecting them through a square instead of a circular hole. The circle is the position of equilibrium, and the irregularly-shaped ring vibrates about that form. Another curious result is that, if the two rings are moving in the same direction, with their centers in the same line and their planes perpendicular to that line, the pursuer contracts and moves faster, while the pursued expands and moves more slowly, so that they alternately pass through one another. If they are moving in opposite directions, under like circumstances, both expand indefinitely, and move slowly and slowly, never reaching one another.

Now each ring or vortex contains not merely the matter in fine division forming smoke, but a certain definite proportion of smoky air, which, in virtue of the vortex motion, has become a different substance from the surrounding air, and moves through it very like a solid body. If there were no such thing as fluid friction in the atmosphere, the ring would go on moving for ever; and not only this, but the portion of the fluid containing the smoke and marked thereby would remain precisely the same set of particles of the fluid as it moved through the rest. Consequently those thus marked by the smoke would be, by the fact of their rotation, differentiated from the surrounding atmosphere, and could not by any process short of an act of creative power be made to unite with the latter.

Helmholtz has shown that the properties of every vortex ring are, first, that every part of its core is essentially rotating. As a ring approaches the observer, every portion of the inner side is moving forward, and every portion of the outer side is moving backward; and if the face be placed in the path of a large ring, a sudden blast of air will be felt flowing through the center of it. Thus the vortex ring not only involves in itself rotating elements, distinguished from other elements of the fluid, but it also is associated necessarily with other movements through the non-differentiated air, and especially a forward rapid current of air, passing through its center in the direction in which it is going. Helmholtz has further shown that such a ring is indivisible. The sharpest knife will not cut it. It wriggles around the blade and moves away. It is not that it cannot be cut, but you cannot so much as get at it so as to try to cut it.

Again, vortex filaments existing in a continuous medium of any kind must either be endless, or else the ends must be in the free surface of the liquid. The last condition any one can realize by drawing his teaspoon over a cup of tea and lifting it from the surface. There will be a couple of little whirlpools going round in the tea, rotating in opposite directions, the two moving forward (as do their sides which are nearest one another) in the direction in which the teaspoon was drawn. These two little eddies are simply the ends of a half vortex ring, and they are on the free surface of a liquid.

We are now in a position to understand Sir William Thomson's recent theory of vortex atoms, which Professor Tait explains in his "Recent Advances in Physical Science," from which we have freely drawn for the foregoing. We have shown that, given a perfect fluid, nothing but creative agency could produce a vortex ring in it, or destroy one already there. No process at our command could enable us to do either; because in order to do it, fluid friction is essentially requisite. Now, by the very definition of a perfect fluid, friction does not exist in it. Sir William Thomson suggests that the Universe is filled with something which we have no right to call ordinary matter (though it must possess inertia) but which we may call a perfect fluid. In this vortex, motion once produced by creative act remains until the same power removes it. Thus, he argues, this property of rotation may be the basis of all that to our senses appears as matter. All atoms of matter are vortex rings; and in a perfect fluid filling all space and having no surface, there can be no ends. All vortex atom rings, therefore, must be endless, that is to say, must have their ends united together after any number of convolutions. Lastly, the indivisibility of a ring shows that, in that sense, at least, it is literally an atom.

This idea enables us to explain a great many properties of matter, but it carries with it a host of mathematical difficulties. The theory has passed its first trials, and, being admitted as a possibility, it is left to time and the mathematicians to settle whether really it will account for everything experimentally found. If it does so, and if it, in addition, enables us to predict other phenomena, which in their turn shall be found to be experimentally verified, it will have all the possible claim on our belief that any physical theory can ever have.

THE CENTENNIAL EXPOSITION.

The attendance at the Exposition is now steadily increasing. On Decoration Day, fully 50,000 people passed the gates, and the Main Building and Memorial Hall were, for the first time, uncomfortably crowded. The twenty-eight groups of judges have completed their organization, and the members are busily at work preparing their reports. The system adopted of dividing the duties, each member making his own examination of the articles submitted, instead of requiring the exhibits to be investigated by committees of several judges, as has heretofore been done in other expositions, is said to work admirably, saving an immense amount of time to the commission, and, without doubt, it will give as good satisfaction to the exhibitors. Considerable comment has been aroused regarding alleged injuries to the pictures committed by careless visitors, and the Austrian Commission had their gallery closed until railings around the works of art were erected. It has since been found that but two pictures were damaged, and in neither case could the mishap be charged upon visitors, as the injuries were discovered to have occurred during transportation. Horticultural Hall, in which the display at the opening was not large, is being rapidly filled. The latest arrival is a fine selection of tree ferns from Australia. The English rhododendrons are now in full bloom, and present a magnificent appearance, although they show evidence of the long voyage disagreeing with them. A much handsomer display of these beautiful flowers may be seen at the present time in Llewellyn Park, Orange, N. Y. Between the British Government and the T. A. B. fountain, a Canadian lumber merchant has erected a house built of rough lumber, just as it comes from the yard. The roof is made of huge unbarked timbers, each twenty-four inches in diameter, and the sides are composed of boards piled to form a wall a foot thick. Inside, a monster section of a pine tree is exhibited. The big Krupp cannon has at length reached the grounds, and is being placed in Machinery Hall. The pumps annexed to that building are now at work, producing a miniature Niagara for three hours daily. The Brewers' Building is rapidly approaching completion. A curious section of elevated railway is being constructed between Agricultural and Horticultural Halls. The cars are built something after the Swiss cottage pattern.

THE JAPANESE BRONZES AND LACQUERED WARE

We have already alluded to, as one of the most remarkable portions of the general display. The grotesqueness of Japanese art is employed in these with wonderful effect. There are cups and saucers of lacquered wood, as light as corks, colored with reds, blues, and yellows, protected by the famous Japan varnish, which will withstand the hottest water. Perfection of joiner work, unique ornamentation, and exquisite selection of colors are especially noticeable in the cabinets, some of which, scarcely larger than a modern music box, range in price from \$125 to \$1,000. It is in the modeling and the preliminaries to the casting of the bronzes that the peculiar genius and perseverance of the Japanese are disclosed. The models are made in wax; and in that material everything, down to the smallest feather of a bird's wing or the hair of a spider, is elaborated with scrupulous care. The wax model is then painted all over with a coating of finest sand, held together by a fireproof mucilage. The first coat is laid on with exceeding care, so as to fill every tiny interstice. So with all following coats, which may number hundreds, until sometimes six months are consumed in the work of painting a cumulative mold three or four inches thick. When the latter is rendered sufficiently strong, the wax model inside is melted and removed. The bronze is then poured in, and the whole object completed in a single casting. The mold is subsequently removed with care only second to that employed in its construction, leaving the bronze without a crease or flaw. From this process emerged the magnificent incense burner which stands at the entrance of the Japanese section. It represents a vessel elevated upon worn sea rocks, inhabited by a dragon and surmounted by an eagle and flanked by flocks of birds. The price was \$4,500, and it was purchased for the English South Kensington Museum.

As there are no patent laws in either China or Japan, the mode of preparing the patina given to these bronzes has remained secret for ages, and has been handed down from father to son. Chemical analysis has, however, revealed the composition of the alloys, and M. Morin has discovered that the patina of the celebrated black bronzes is due to the use of an alloy composed of 80 per cent of copper, 4 of tin, 10 of lead, 2 of zinc, 4 of iron, besides small proportions of gold, nickel, arsenic, and sulphur. Some of the bronzes analyzed show a proportion of lead varying from 10 to 20 per cent, added at the expense of the copper, and a quantity of 7 per cent of tin. Molded in thin plates, this bronze is very easily worked, and the patina appears of itself when the metal is subjected to a high temperature in a muffle furnace. It is, however, very brittle. Chemical analysis is certainly of little use in this case, unless it leads to synthesis; and in that respect the labors of the French investigators have been attended with remarkable success, and have resulted in the production of bronzes even better than those of the Japanese, since they have a strength equal to that of ordinary bronze. The process consists in preparing a ground by the action of chemicals having oxides and sulphides of copper as their bases. If different tints, black, brown, red, or green, be desired on the same object, it is sufficient to cover with a protecting varnish all portions of the surface except those to which it may be desired to give a certain hue; then when they have been treated for a sufficient time, they are covered with varnish, while the other parts of the surface now exposed are subjected to the action of the chemicals, and so

on for as many tints as are required. The inlaid enamel work which is performed by oriental artists with so much skill and patience, and at the same time with such primitive appliances, is now executed by simpler and quicker means. The object to be inlaid is entirely covered with varnish, portions of which are removed by a graver so as to form the design; and thus prepared, it is subjected to the action of a galvanic bath of gold or silver, which deposits the metal in the places laid bare by the graver. Another method is, however, mentioned by M. Morin. After the removal of the varnish, according to the pattern made by the graver, the object is plunged into a solution of cyanide of silver. The salt is deposited on the lines from which the varnish has been removed; the object is heated in a muffle furnace, and the metal appears on the black patina. Inlaid patterns of gold and silver may be obtained, either of their natural brightness or with a dead surface, the latter being effected by different processes of oxidation; so that, on the same object, by making use of the protecting varnish, designs in gold and silver of various degrees of luster may be combined.

THE ENGLISH ENAMELS.

It is a notable fact that the present specimens of Japanese and Chinese enamels are fairly approximated by those exhibited by the Messrs. Elkington, of Birmingham, in the English section. The *cloisonné* work forms an imperishable picture capable of resisting everything but intense heat and great violence, and is a material which lends itself with especial readiness to rich and harmonious coloring; while the delicate bright metallic lines bordering the *cloisons* form a pleasing contrast to the comparative dullness of the opaque glass.

THE RUSSIAN EXHIBIT.

which two weeks ago existed only in packing boxes, now bids fair to attract remarkable interest. Portions of it will remind one of the famous reply of Prince Demidoff, who, when a lady somewhat ostentatiously exhibited to him a set of malachite jewelry, carelessly remarked: "Yes, I have a mantle piece made of that." From the celebrated mines owned by the above dignitary, several superb malachite urns, table tops, and mantle pieces, have been sent, valued at several hundred dollars each. There is besides a pair of *lapis lazuli* vases in this collection, valued at \$500. The Russian machinery is not yet in place; but as thirty car loads arrived in a single day recently, a fine display may be anticipated.

MEXICO

astonishes visitors to her section by exhibiting a circular mass of pure silver weighing 4,000 lbs., and valued at \$72,000. The mineral contribution of this country is exceptionally good. There are some fine cannel coal and a collection of beautiful opals and precious gems imbedded in ore. In textile manufactures, Mexico compares favorably with other nations, and exhibits cloths and cassimeres of the finest workmanship. There is a large display of medicinal plants, coffee, and tobacco, and also a valuable exhibit, showing the many uses of the agave. The fiber of this plant is made into rope, paper, and cloth, and its flower yields an intoxicating drink called *pulque*.

SWEDEN

carries off the palm for the best show of iron and steel. Twenty-eight exhibitors contribute, and among them the two largest establishments in the kingdom, those of the Molota and of Sandark. Huge columns, pyramids of iron and steel bars and pipes, and great screens towering to the roof of the building, on which are arranged tires, bars, and ingots, are on every side. A very tasteful exhibit is the bow of a Viking's vessel, the mast and rigging of which are made of various forms of iron; and the ornamentation is entirely composed of the same metal, in the shape of rivets, nails, etc. Professor Lödermann's plaster figures attract a great share of attention; and they embody admirable representations of the costumes and appearance of the Swedes and Laplanders. Such great care is taken to insure absolute correctness in details that, when the hand of one of the figures was broken in transit, it was supplied by a cast taken from the hand of a Swedish girl in the employ of the commission. The expressions of the countenances and the attitudes of the figures are wonderfully natural. One of the groups represents a hunter and his family, gathered in front of a deer that has just been shot. Another admirable group is that of a Laplander, in his sledge drawn by a reindeer, who stops to chat with a fur-clad woman carrying her baby slung to her neck in a kind of trough. There are various other groups, representing bridal parties and household gatherings, equally fine. Numerous cases of matches form a prominent feature of the Swedish exhibit, for with this commodity Sweden furnishes all Europe. Some of the finest carpentry work in the Exposition is shown in two garden pavilions contributed by a Stockholm maker. A large collection of building stones illustrates the richness of the country in these materials; and a table of red porphyry, with mosaic work in many colored stones, forming a center piece, exhibits the skill and taste of the Swedish artisans using them. The woolen fabrics displayed are as good as those in the English department, and excel those contributed by Germany. The ceramic collection contains many curious objects. The most striking is a porcelain stove about 12 feet high, of a delicate blue, ornamented in gold and darker blue. Its price is \$1,000. There is also a peculiar kind of ware made apparently of *repoussé* silver and porcelain. The notice of the Swedish exhibits in the Machinery and Agricultural Halls, we are obliged to defer till another issue.

Equal parts of fine filings of zinc and tin, mixed with sufficient mercury to form a thick paste, and pulverized when partly hardened, makes an excellent amalgam for electrical machines.

INDUSTRIAL APPLICATIONS OF CARBONIC ACID.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY
PROFESSOR A. R. LEEDS.

The list of investigators of carbonic acid begins at the opening of the seventeenth century with the Dutch philosopher Van Helmont. It was then known as *spiritus sylvestris*, and the word *spiritus*, being translated literally, became *geist* in German and ghost and gas in English. The word gas was originally employed in connection with carbonic acid. Van Helmont recognized the identity of the gases evolved in fermentation and in the burning of lime. He also pointed out the fact that the poisonous gas in the Grotto del Cane, in Pyrmont, and that obtained from limestone by the action of acids, were the same *spiritus sylvestris*. As an example of the crude analysis of his time, we read that he burnt 62 lbs. of wood, from which he obtained 61 lbs. of ashes, which leaves a difference of 1 lb. for carbonic acid. Hoffmann, the next investigator, discovered that this gas reddened the blue coloring matter of litmus. The Scotch philosopher Black proved that this gas must be entirely different from air, and recognized the fact that it was an acid. The lecturer then showed the action of carbonic acid on lime water. A perfectly clear solution of the latter was at first rendered turbid and milky from the precipitation of carbonate of lime; and then, on continuing to pass the gas through it, it became clear again from the resolution of the carbonate of lime by the excess of the carbonic acid. This circumstance showed Lord Cavendish that the water of springs, rivers, etc., containing carbonic acid, could take up lime and other earths from the soil and deposit them again on evaporation of the gas. This is the origin of the troublesome boiler incrustations. It was next shown that the gas exhaled from the lungs was carbonic acid, by applying the lime water test. The lecturer showed this experiment by means of a little glass tank filled with clear lime water colored by litmus, which was placed in the lantern and reflected on the screen. On passing the breath through the solution, the color changed to red, and the turbidity arising from the precipitation of carbonate of lime was apparent on the screen.

The first industrial investigation of carbonic acid was made by no less a person than Dr. Priestley, the discoverer of oxygen. He resided near a brewery, and studied the gas given off there on a large scale by fermentation. His experiments were illustrated by Professor Leeds, who had a large vessel of fermenting malt liquor on the stage. A lighted match held above the liquor was instantly extinguished. The gas being very heavy, it could be scooped out with a quart measure, and poured from one vessel into another without danger of loss. After pouring it back and forth several times, a candle was extinguished by merely emptying the vessel over it. Water poured back and forth, in the atmosphere of carbonic acid contained in the large vessel of malt liquor, absorbed a sufficient quantity of the gas to become milky on the addition of lime water. Priestley thought that the antiseptic properties of this body could be utilized by impregnating water with it, and conducted the gas made from limestone into a vessel of water by means of a leather tube.

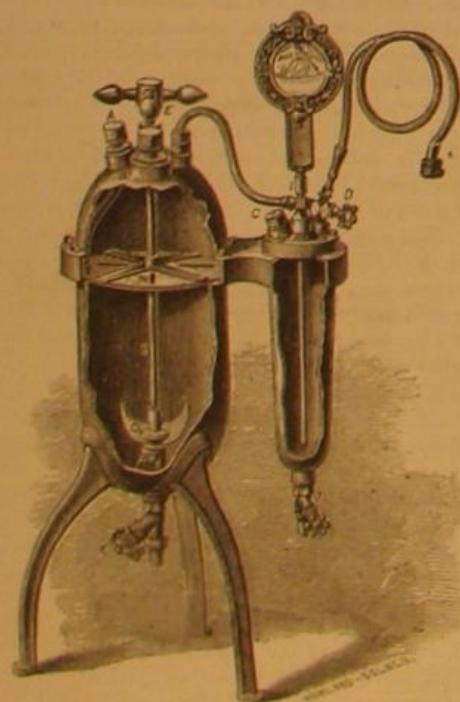


Fig. 2—GAS GENERATOR AND WASHER.

From this primitive device of Priestley to the beautiful and elaborate apparatus of Mr. John Matthews, of this city, which was exhibited upon the stage and is represented in Fig. 1, was indeed a giant stride. On the left is the gas generator, the construction of which will become clear by inspection of Fig. 2. From the generator, the gas passes through a smaller vessel containing water, which washes it, and is then conducted into the fountain on the right under high pressure. Fig. 2 exhibits the internal arrangement of the gas generator and washer. A mixture of sulphuric acid and water is introduced through the bung, A,

and the marble dust is poured in through B. The acid liquor passes to the bottom of the vessel; but the marble dust is arrested by a diaphragm, M, furnished with several slits, through which the marble dust is made to sift when the shaft, S, is caused to revolve by turning the handle, E. At the same time the agitator, O, facilitates the evolution of gas by keeping the mixture constantly stirred. As soon as a pressure of 105 lbs., indicated by the gage, L, is reached, the stop valve, G, of the fountain (Fig. 1) is opened, and the gas is made to pass into it slowly, by gradually opening the stop valve, D, of the gas washer. When enough gas has come over, the valves are closed, the pipe, F, is disconnected, and the fountain is made to revolve in its frame for about ten minutes to aid the absorption of gas by the water. It is then ready to be placed in one of those artistic Matthews so-

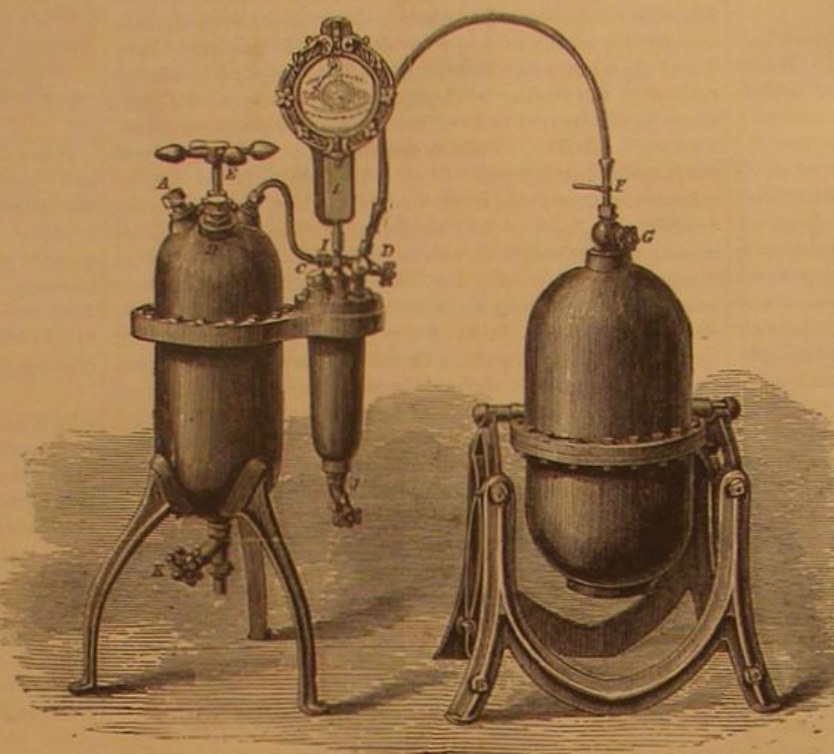


Fig. 1—CARBONIC ACID GAS GENERATOR.

da water apparatuses, which are so familiar to all as to need no description. The generator and fountain just described are made extremely strong and constructed with the utmost care, not only to prevent accidents from explosions, but also to obtain a product of the utmost purity. They are lined throughout with tin, and all the connections are covered with the same metal. If the sulphuric acid came in contact with iron, hydrogen would be generated and would contaminate the gas; if the carbonic acid liquid came in contact with

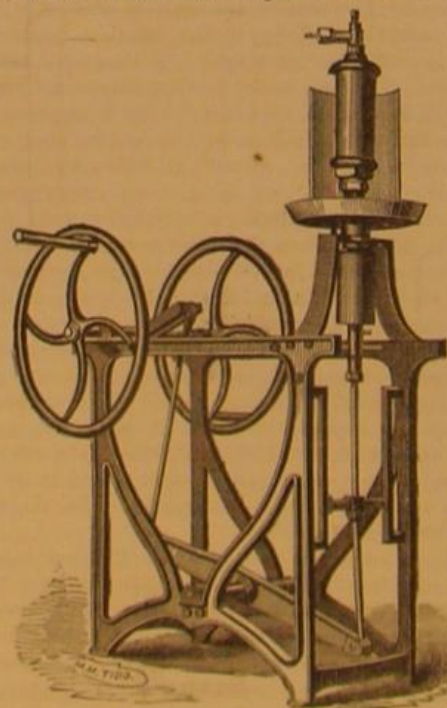


Fig. 3—LIQUEFYING AND SOLIDIFYING CARBONIC ACID.

lead, it would dissolve enough to produce poisonous effects. To illustrate the solution of lead by carbonic acid water, the lecturer agitated some soda water in a piece of lead pipe, and then proved the presence of lead in the water by adding sulphide of ammonium and obtaining a black precipitate. As an illustration of the immense proportions to which the soda water business has attained in this country, he estimated that no less than a hundred million glasses were consumed annually.

A large number of ingenious varieties of soda water bottles and siphons, together with the apparatus for filling the latter, were exhibited. They had been loaned for the purpose by the manufacturer, Mr. John Matthews. The filling apparatus consists of an iron frame which firmly holds the siphon in place in a favorable position for filling. When the siphon is inserted, the screen is made to slide over it to prevent accidents caused by bursting, and to keep it in place; the fountain valve is opened, and the treadle is pressed down with the foot, by which the siphon spout is pressed into the filling head.

Numerous natural mineral waters, renowned for their curative properties, have been analyzed, and are now prepared artificially and charged with carbonic acid gas. A number of them were tested before the audience for various constituents.

Another industrial application of carbonic acid is in the manufacture of aerated bread. In ordinary bread, the yeast produces a fermentation by which carbonic acid is evolved, which gives to bread its spongy character. The same thing is accomplished without yeast by forcing carbonic acid gas under pressure into the dough.

The successful extinction of fires in mines by means of carbonic acid gas has developed a new industry, that of the fire extinguishers, of which the Babcock is the most common. This consists of a portable cylinder, in which a charge of sulphuric acid can, at a moment's notice, be inverted into a quantity of marble dust, and the pressure developed by the resulting gas employed to project a stream of water, in case of fire. There is hardly enough gas present to be of much service as an extinguisher; the advantage of the apparatus lies in its convenience. To show its action, some benzine was poured on the floor of the stage, kindled, and then put out by a stream from a Babcock apparatus.

The lecturer next proceeded to the interesting experiment of liquefying and solidifying carbonic acid. For the purpose of accomplishing this, high pressure and cold are necessary. The pressure was obtained from Ritchie's improved form of Natterer's apparatus, Fig. 3, which stood on the stage, and was driven by steam power derived from the engine in the basement of the Institute. In this apparatus the gas is conducted into a bronze receiver capable of resisting a pressure of 200 atmospheres, and is condensed by means of a steel force pump. The receiver is surrounded by a copper cylinder containing a mixture of ice and salt. When enough of the gas was thus liquefied, it was caused to pass through a tube terminating in a fine rose of wire gauze and into a lined woolen bag. On passing out, the cold produced by evaporation was so intense as to freeze the liquid carbonic acid, which formed a deposit resembling snow; in fact, the lecturer made a little snowball of some of it, and threw it among the audience, with the caution not to allow it to melt in their hands, as it would blister them. Numerous experiments were made with this substance, the most interesting of which was the freezing of mercury in a white hot platinum capsule. Water placed in the latter assumes the spheroidal state, in which it does not really touch the vessel, being separated from it by a layer of steam; if now solid carbonic acid, mixed with ether, is introduced into the water, enough heat is absorbed by the evaporation of the carbonic acid to freeze a small quantity of mercury placed in the mixture.

C. F. K.

Wooden Pavements made Successful in London.

After a sufficient comparative trial, the contest between granite, asphalt, and wood for carriage ways has been decided in favor of the last, and the recent conclusion of the Corporation of London may be regarded as a final confirmation of that decision. Mr. Heywood, engineer for the city, has shown that before a horse falls he may be expected to travel on granite 132 miles, on asphalt 191 miles, and on wood 446 miles; and although between the two last materials there is a trifling advantage in the cost on the side of asphalt, that is much more than counterbalanced in other ways. In easy traction and the absence of noise there is no comparison between wood and granite, and since the surface water has been kept out by means of asphalt, wood has become one of the most durable of pavements. The rapidity with which it can be laid and the ease with which it can be repaired are not the least of its merits, while the flooring of planks, which is now laid as a superstructure, gives great elasticity, and, by distributing the weight equally over the whole pavement, adds to its power of endurance.

To Blacken Brass.—To Clarify Shellac Solutions.

The *Bulletin Belge de la Photographie* gives the following as a good and convenient method of blackening brass surfaces for photographic purposes. The metal, having been thoroughly cleaned, is brushed over with a solution of bichloride of platinum, known as chemical bronze. If one or two drops of solution of nitrate of silver be added to $\frac{1}{2}$ of a cubic inch of the platinum solution, its action is considerably augmented. For clarifying solutions of shellac, the same journal recommends the addition, to the varnish it is required to clear, of a quantity of powdered chalk equal to the weight of lac used. After thoroughly mixing, and heating to 60°, the mixture is allowed to settle, when three quarters of the bulk may be poured off perfectly clear, or, if necessary, it may be filtered with the greatest ease.

Photo Printing Plates.

M. J. Husnik employs the following formula for the production of engraved plates by means of photography. It is based upon the use of bichromatized gelatin, the necessary grain being given by chloride of calcium. The formula consists of gelatin, 24 parts; bichromate of ammonia, 4 parts; alcohol, 72 parts; chloride of calcium, 4 to 5 parts; water, 240 parts. This is spread upon glass or other suitable support, and, after exposure and washing, is used for the production, by the galvanoplastic method, of a plate, from which the prints are pulled in the usual manner.

IMPROVED COUNTRY HOMES.

Mr. Woollett, in his book on "Villas and Cottages, or Homes for All," published by A. J. Bicknell & Co., New York city, describes a villa of frame structure designed for erection on a stone foundation, with cellar, with heavy sill, corner posts, girts, and plates, and filled in with brick. The house being intended for a central location between other buildings, on a lot of moderate width, has a nearly symmetrical front. Individuality is given to the detail by using panels and bands, covered with cut shingles in place of clapboards, on rough boarding. The roof is also covered with shingles; and both those of the roof and bands are painted in deeper tints than the main wood-work. The finish of the interior is to be in white ash and butternut. The estimated cost of the house is about \$8,000.

A New Profession.—A Champion Speller.

Spelling bees, which went out of fashion here a couple of years ago, have been for several months past the subject of a *furor* in England. Our English cousins have vanquished us fairly in turning these meetings into money-getting affairs. The most we ever made was admission money at the door, and the victors in the match usually proudly bore away a copy of Webster's "Dictionary." In England, however, halls are hired, and large money prizes are offered to the best spellers, the contestants being charged an entry fee similar to that put up by the backers of horses in a race. The managers, of course, find their profit in these deposits. The most curious part of the whole is that the fact of the money awards being offered has given rise to a new business, that of "champion speller." Several people, who have a fair knowledge of orthography to begin with, have literally crammed themselves with dictionary lore, so that they are proof against the pitfalls of ordinary catch words. Thus mentally equipped, they reverse Dr. Watts' hymn, and gather money every day from every opening bee. Their attainments render them easy victors; and one individual, who has reached the pinnacle of the new profession, says that he makes over a hundred dollars a week by his winnings.

NEW CUT-OFF MECHANISM.

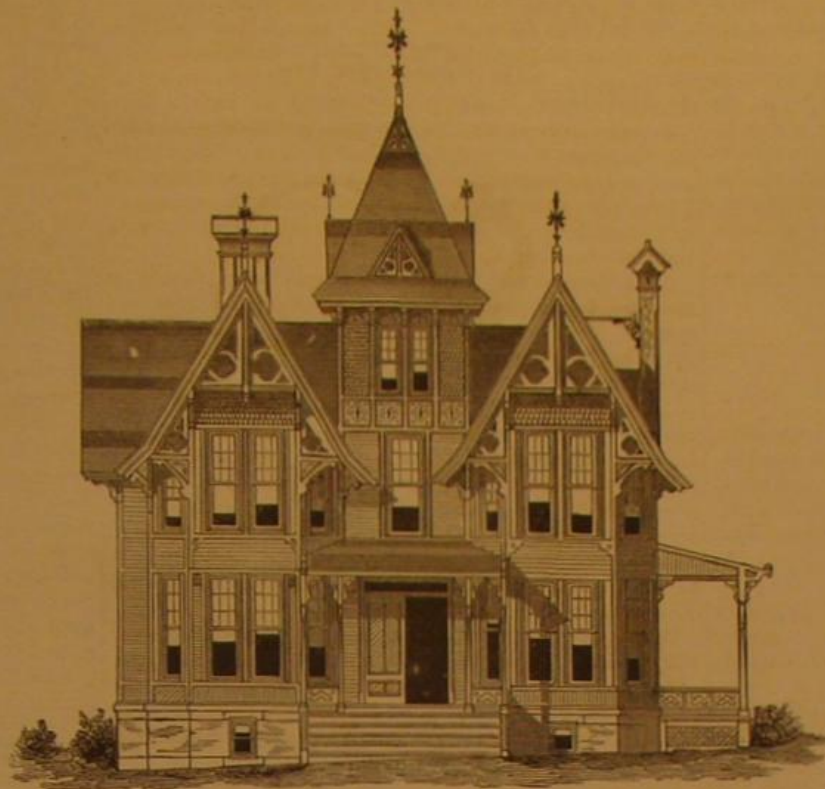
We extract from the *Bulletin du Musée* the annexed engravings of a new and simple cut-off mechanism, the inven-

tion of M. F. Wannieck, of Brunn. The engine to which it is represented as applied is of the horizontal type. The governor travels at high speed, and its changes are transmitted by a very simple set of levers to a rod which rises and descends in a support attached to the cylinder and carrying on its lower extremities a horizontal cross piece. This disposition is represented in detail in Figs. 1 and 2, in which $o o'$ is the cross piece. The higher the elevation of the

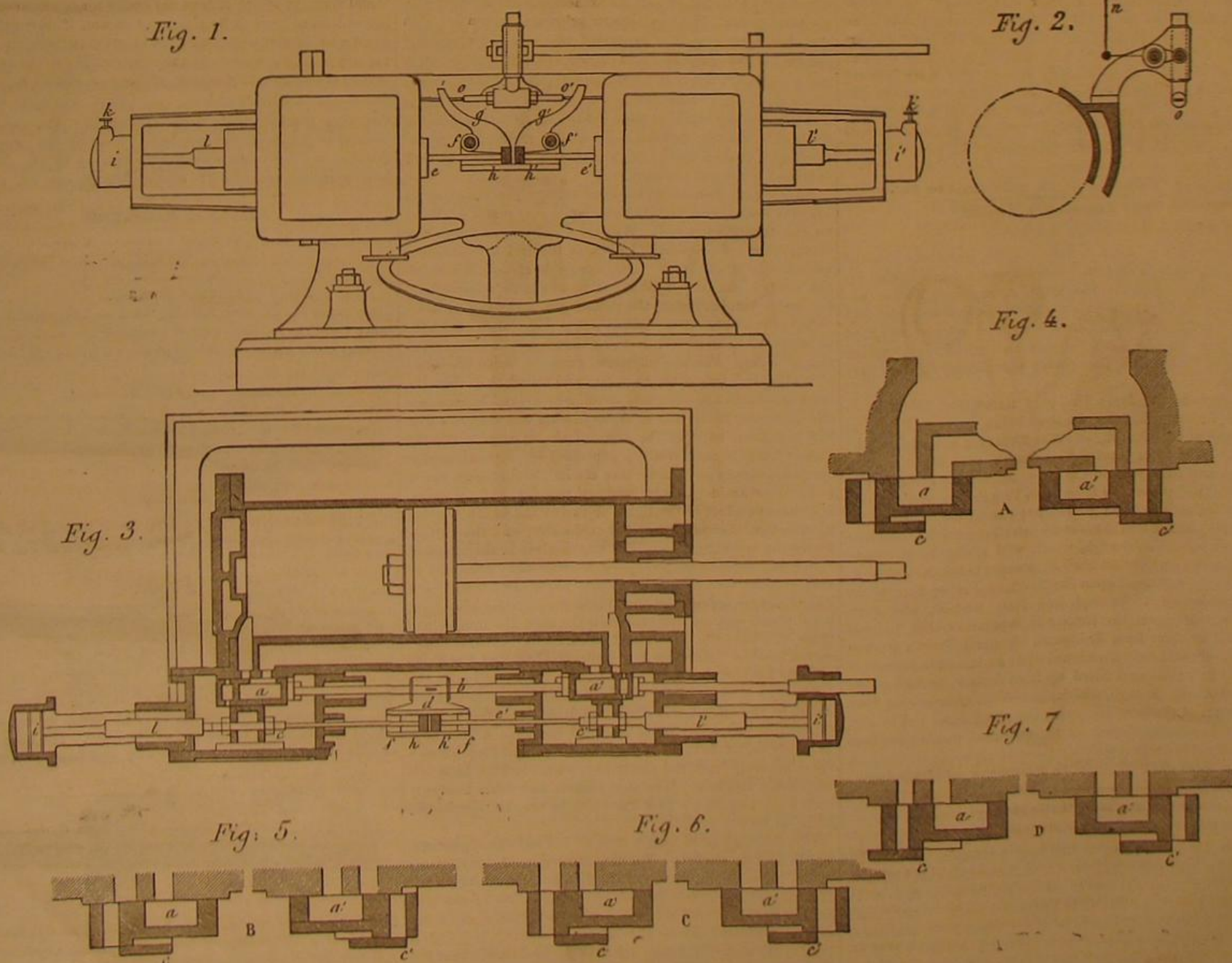
the pistons, $i i'$, are re-enforced toward $l l'$; so that when the valve chests are filled with steam, an excess of pressure is always produced on the said sections, $l l'$, and so that the valves left to themselves are always pushed outward by the steam in the boxes. The screws, $k k'$ (Fig. 1), permit of the regulating, at will, of the outward pressure exercised on the rods, $l l'$, and consequently of the action of the cut-off valves, $c c'$, according as the air is, by the adjustment of the screws, allowed to escape slowly or freely from before the pistons, $i i'$. The fact should not be lost sight of, in following the subjoined description, that the two valves, $c c'$, are not immediately connected, but normally are subject to an outwardly pushing pressure.

On the middle of the valve rod, b , is secured a crosshead, d (Fig. 3) which surrounds the extremities of the cut-off valve rods so as to serve as a guide for the two rectangular ends, $h h'$. This crosshead carries two pawls, $g g'$, which turn around axes, $f f'$, and which, through their gravity, tend always to fall, as shown in Fig. 1. These pawls, in the forward part of their lower extremity, have notches in which the rectangular heads, $h h'$, engage, so that the rod, b (Fig. 3), is pushed toward the right or left, according as it engages one of the other of the cut-off valve rods. The pawl then falls on the head of the rod, and draws the latter in the return movement of the rod, b . We may remark here, in order to prevent misunderstanding, that in Figs. 1 and 3 the heads, $h h'$, of the cut-off valve rods are placed in a median position and represented as both engaged with the pawls, a condition which never can occur while the engine is in operation.

We will consider first the forward motion of the engine during a stroke, and suppose the return movement of the piston to take place from left to right. In such case, it is clear that the rod, b (Fig. 3), with its two valves, $a a'$, will have already been pushed toward the left by the eccentric up to the point where the left hand valve, a , establishes communication with the exhaust, as indicated in Fig. 4: which also shows the extreme position of the valve and the point to which the pawl, g , of the crosshead, d , has been carried (to the left) in order to engage the head, h . During the return movement, the valve, a , moves from left to right, and at the same time carries the left cut-off valve, c , attached to it by the pawl, g , while the right cut-off valve, c' , which has not been engaged by a



A MODERN VILLA RESIDENCE.



WANNIECK'S CUT-OFF MECHANISM.

pawl, remains at rest in extreme position to the right, Fig. 5. Fig. 6 shows the steam port still more open; the right valve, *a'*, establishes communication with the condenser, and the corresponding cut-off valve, *c'*, is in repose. In the position which occurs immediately after (Fig. 7), the upper curved arm of the pawl, *g*, impinges upon the left hand extremity of the horizontal piece, *e e'*, and the left cut-off valve is freed and returned to its extreme left hand position. The rod, *b*, continuing its advance, the pawl, *g'*, operates in turn exactly like the pawl, *g*, so that one or the other of the pair is continually in play.

The general arrangement is quite simple and certain in action. When sudden variations occur in the work, the piece which carries the traverses, *e e'*, lifts or lowers instantly, and the action of the pawls is accelerated or slackened, so that, in the first case, the admission of steam is interrupted sooner, and, in the second case, it continues longer. The mechanism, as a whole, is reported to be remarkably sensitive.

Correspondence.

Steam Domes.

To the Editor of the Scientific American:

That steam boilers of all kinds would be cheaper, safer, and more durable without domes, there can be no question. The question is: Can steam be supplied to the cylinders, drier and cheaper, from the top of a dome, than from a perforated pipe, placed inside and close up to the crown sheet of the boiler? The perforations, of course, are to be made in the upper side, and nearly the whole length of the pipe, which extends the whole length of the boiler. Engineers who have run locomotives, both with and without domes, for from 10 to 25 years, say that they can see no practical advantage in the dome; and some of them hold that an engine is less liable to prime or throw water into the cylinders with a perforated pipe than with a dome with the throttle valve and steam pipe arranged in the usual way: for the reason that the aggregate area of the perforations far exceeds the capacity or area of the cross section of the steam pipe. Consequently, when the engine is at work, there is no rush or tendency of steam to a special point, as in case of the dome; the perforations can be made so plentifully as to exceed five or ten fold, if necessary, the capacity of pipe to conduct off the steam, the throttle valve being placed in the smoke arch end of the pipe.

The Boston and Albany company have been building the no-dome type of locomotive many years in their shops in Springfield, and are still at it. Mr. Eddy, their indefatigable machinist, tells me that their first engine of this type was put on the road in April, 1851, and that this engine is still at work with the same boiler, with the exception of the fire box. Since that time he has been constantly building precisely this style of engine for the company, in connection with their extensive repairs, till now, of the 246 locomotives belonging to the company, a large portion are of the no-dome type. Surely, such an experiment, which has been so persistently and successfully carried out for a term of 25 years, ought to have some weight in deciding the dome question.

F. G. WOODWARD.

Worcester, Mass.

The Vicksburg Cut-off.

To the Editor of the Scientific American:

On page 329 of your current volume, under the title of "The Vicksburg Cut-Off," there appear some singular errors. One is that, the Mississippi river makes its way under the bluff of Vicksburg by sharp deflections, east and west, nearly fifty miles from its direct course; and that boats pass up and down through the cut-off, avoiding the *détour* to Vicksburg, thus saving about thirty miles of navigation.

As regards the first: The only immediate deflection is above Vicksburg, from the bend below Young's Point, to the bluff of Vicksburg, and it is about six miles in length; for the river, after leaving Vicksburg, runs direct to Hard Times, and nearly so to Natchez. As for the second: The cut-off is only about five miles from Vicksburg, and the saving of distance to boats would not exceed ten miles at the furthest; and it would make no interference with the trade or business of Vicksburg, which will always be of importance, being on the first bluff of moment below Memphis.

When in command upon the Mississippi river, I urged the fortification of Vicksburg and Port Hudson, and commenced work upon the former in September, 1861, but was stopped by order from Richmond. General Grant's attempt at a cut-off was only abandoned after an immense amount of labor; and the canal filled up from deposit, instead of the river working through, which showed the error arising from ignorance of the laws governing the river. But had he succeeded in making the cut-off, the operation would have been equally a failure in a military point of view.

New York city.

C. G. DAHLGREN, of Mississippi.

Do Bees Make Honey?

To the Editor of the Scientific American:

Is it not astonishing to find that professors at this day state that bees make honey? A good common stand of bees, having but short distance to travel, will increase their stock of honey from 1 to 2 lbs. in 12 hours fair work. What chance is there here for a digestive process? Place 3 lbs. loaf sugar sirup within easy reach of such a stand at 8 o'clock P.M.; it will all be taken up and stored away before sunrise next morning. I once thus experimented: After feeding, to about

40 hives, 9 barrels of Cuba honey, upon examination I found no difference between that in the comb cells and that in the barrels, only the former was clearer from dirt. The honey becoming exhausted, I then fed the bees during the rest of the fall season with loaf sugar sirup. Upon examination next spring, I found the comb cells filled solidly with well grained loaf sugar, precisely like that I had dissolved to feed the bees with. Other comb cells were partly filled with Cuba honey and partly with ground loaf sugar.

South Union, Ky.

H. L. EADES.

The Grasshopper Pest.

To the Editor of the Scientific American:

In your issue of May 20, I notice some statements from the Minnesota State Commission and Professor Riley, in regard to grasshoppers, from which I beg leave to differ. As I have had experience with the pests during two visitations in Kansas, in the years 1867-8 and 1874-5, I think I have a right to a hearing.

As to the sack which contains the eggs being affected by moisture, I will quote an instance. In the fall of 1867, the grasshoppers deposited eggs on a dry slough on the Missouri river; early in the spring the place was overflowed, and remained under water till late in the summer of 1868, when it dried up; and the young hoppers came out just as lively and able-bodied as if they had been hatched under the most favorable circumstances. As to their being affected by freezing (as I have seen stated at different times), in the winters of 1874-5 the mercury ranged as low as 29° below zero, and the ground was frozen to the depth of 2½ feet. But the young hopper came out as gaily and festively as if he had laid in a greenhouse all winter, though the eggs did not average an inch under ground.

With all deference for such high authorities as Professor Riley and the Minnesota State Commission, these are facts, as hundreds can testify who have studied entomology in the school of sad experience. If all crops, when sown, were as sure of a bountiful harvest as grasshopper eggs, Kansas and Louisiana, Mo. societies would soon be out of business.

Louisiana, Mo.

J. F. DUNWOODY

(For the Scientific American.)

THE CORPUSCULAR AND UNDULATORY THEORIES OF LIGHT—THE EXPERIMENTS OF CROOKES AND PLEASANTON.

One of the brightest luminaries of the scientific firmament in the seventeenth century was a believer in the corpuscular theory of light. Sir Isaac Newton thought that the sun sent out from its surface fine particles of some kind of matter, which flew with immense velocity against the retina of the eye and produced the sensation known as light and vision. The succeeding age substituted for this improbable theory another, namely, that light is due to vibrations in an extremely thin ether which pervades all space. So many phenomena have been explained by this latter theory, especially those in regard to the interference of light, the diffraction spectrum, and Newton's rings, that the undulatory theory, notwithstanding the difficulty of conceiving of an all-pervading ether, imponderable and disobeying most of the laws of matter, has been accepted as a truth. Nay, more; the length of each wave of light has been measured, as well as those of heat and actinism.

Some recent discoveries have led certain gentlemen to revive the long abandoned corpuscular theory; and of these we may mention two only, William Crookes, the discoverer of thallium and of psychic force, and General A. J. Pleasanton, of blue glass fame. The former is already known to our readers, not only by his contributions to spiritualism, but by his last invention, the radiometer. The latter, illustrated in the SCIENTIFIC AMERICAN, p. 392, volume XXXII., he supposed to be set in motion by the impact of flying particles of light. Another physicist, however, tried the effect of floating this pretty toy in water, and found that then the arms stood still and the glass envelope revolved in an opposite direction, indicating that the motion was due to a mutual repulsion between the arms of the apparatus and the glass. This is most readily explained by supposing that the molecules of extremely rare air in the envelope are in rapid vibration, for this is supposed to be true of all gases, and that the effect of the light, or rather the heat attending it, increases this motion of the molecules, and thus either drives the arms in one direction or the glass in the opposite.

General Pleasanton published a little blue pamphlet in 1871, printed with blue ink on blue paper, and bound in a blue cover, to inform the world how much better blue light is for plants and animals, and how the sick, the insane, and those who have the blues could be cured by "getting blue" by his process. Recently our military blue bird has again brought his theories before the public, chiefly through the columns of a daily paper, and boldly attempt to overthrow not only the undulatory theory of light, but the laws of gravitation and many other accepted dogmas. His theory, as briefly stated, is that the particles of light moving through space generate frictional electricity, which in turn produces magnetism and heat. The sun, planets, and other heavenly bodies are magnets, a fact known to be true as regards our earth, at least.

It is interesting to note a few of his curious arguments and their flimsy nature. For the attraction of gravitation, which varies as the square of the distance, he would substitute magnetism, which diminishes as the cube of the distance, and which will not only attract but repel, a phenomenon not observed among the heavenly bodies. Magnetism falls so far short of filling the rôle of gravitation that the sooner General Pleasanton abandons this theory, or modifies it to suit the facts, the better.

The sun sends us light, but no heat: the heat which we seem to obtain from him being due to the friction produced by the particles of light passing through our atmosphere. "The sun, in its daily course, being above the earth, if it had any calorific rays, could not send them to the earth below it." Why? Because, in our rooms, a stove does not throw its heat down towards the floor, but only upward. When this philosopher used the term up and down as regards the relative position of sun and earth, we at first took it for pleasantry; but he seems to be in dead earnest, for he gives several illustrations of the tendency of heat to ascend. Among others, he states that a thermometer stood at 12° on the floor, 10 feet from a red hot stove, in a room used as a meteorological station on Mount Washington.

"Blue glass produces heat" is another of his assertions, based on the fact that, on a bright day in March, the temperature of his grapery (a portion of the glass being blue) was 110° Fah., while the temperature out of doors was 76° lower. This difference of temperature he attributes to the few panes of blue glass alternating with clear ones, and he believes blue glass to be a good substitute for stoves! We wonder if every florist has not observed a similar production of heat by the use of clear glass; and why do hotbeds possess such advantages, except that they act as traps for the sunbeams, allowing heat to enter and preventing its escape? The abundant ignorance of well known facts and long established laws is surprising in one who attempts to overthrow the laws of Newton, and make fearful onslaught on Tyndall.

Because Pleasanton attempts to build a wild, fantastic structure on the corpuscular theory, and because Crookes' radiometer admits of explanation on the undulatory hypothesis, are not conclusive reasons why Newton's theory of light was wrong, or ours is right; but, gentlemen, we want some better proof.

E. J. H.

New York city.

A Railway Train Lifted by the Wind.

The St. Louis and New Orleans express train was struck by a tornado soon after passing Neoga, Ill., at 5:15 P. M., May 6, 1876. Mr. W. K. Ackerman, General Auditor of the road, who was on the train, says that he first saw the smoke stack of the locomotive sailing off through the air. "The next instant the whole train was lifted on one side; and though moving at the speed of 25 miles per hour, the cars ran some distance on the left hand trucks, the right hand trucks being lifted into the air. Then, with a terrible shock, the cars went over to the eastward, falling clear of the track, and stopping almost instantly on striking the ground. The whole damage was done so instantaneously that no one had time to prepare for the crash, nor could it possibly have been avoided."

The passengers and employees were badly bruised, but only one, a brakeman, was dangerously injured. Mr. Ackerman had his right collar bone and left shoulder blade broken, and his wife was also badly bruised. The cars fell on the east side of the track and lay on their sides perfectly clear of it; the engine, weighing 35 tons, was partly displaced, though the front trucks remained on the tracks. The cars were somewhat wrecked, but not badly, most of the trucks remaining on; the track was hardly injured at all, showing how clean had been the lift which took the cars off.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number V.

PATTERN MAKING.

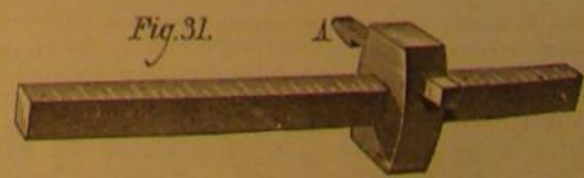
Of gages for drawing marking lines at any regulated distance from the finished edge or edges of the work, there are several kinds; first we have that shown in Fig. 29, which is



the kind ordinarily sold; others have, instead of the set screw, a wedge running lengthwise, as shown in Fig. 30. A



better gage, however, than either of these is that shown in Fig. 31, in which A represents the tightening wedge, standing at a right angle to the rod of the gage. The advantage of this design is that it requires only one hand to work it,



inasmuch as the wedge may be loosened or tightened by striking it, as if it were a hammer, against anything that may happen to lay on the bench. Thus the gage may be set and adjusted with one hand, while the other is holding the work, as is often necessary when marking small work. The

marking point should be a piece of steel wire fitted tightly in the stem, the protruding part being ground or filed to a wedge, with the two facets slightly rounding, and whose broad faces stand at a right angle to the stem of the gage, the point or edge only projecting, sufficiently to produce a line clear enough to work by, otherwise it will not be suitable for accurate work. The mortise gage is similar to the above as regards the stem and sliding piece, but it is provided with two marking points, their distance apart being adjustable. Fig. 32 represents the gage referred to, the head screw working in brass nuts. On account of the narrowness



of the base afforded by the sliding piece on the common gage, there is not sufficient steadiness to gage to any great width, so that for widths above ten or eleven inches we must have recourse to the gage shown in Fig. 33. It is called the

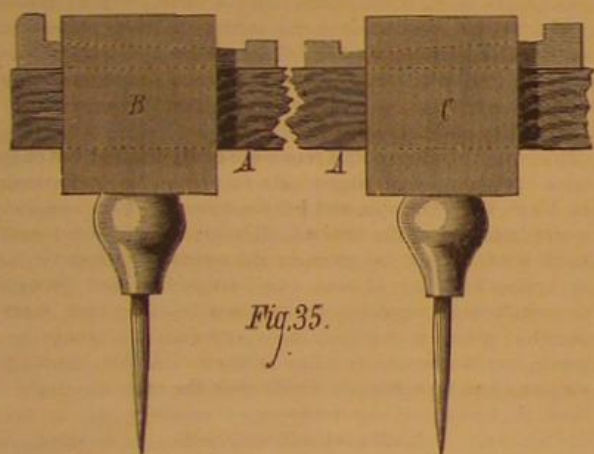


panel gage; its sliding piece may be seven inches long and the stem two feet; the rabbeting at A forms a steadying base, the part of the rod about the marking point being raised to correspond with the distance from the rabbet to the stem nut. Next we have the cutting gage, shown in Fig. 34, in which a



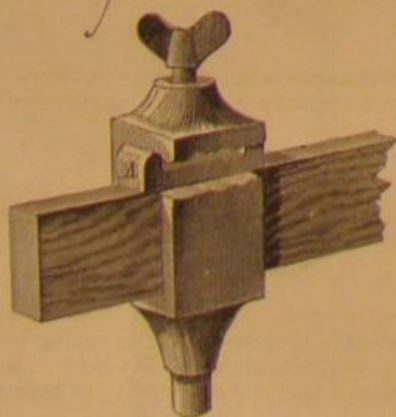
steel cutter takes the place of the marking point, being wedged in position. It is employed to cut thin strips of wood, that is to say, of thicknesses up to about a quarter of an inch. The cutter point should be tempered to a dark straw color.

For marking off curves or large circles, we require a pair of beam compasses or trammels, as shown in Fig. 35. They



are composed of two sliding sockets made of either wood or metal, fitted, at a sliding fit, to a staff. They are made of various designs to suit the taste of the maker, and are often made by the patternmaker himself during his term of probation; the style shown in Fig. 35 is one very easily made. A A represents a staff of any desired length, composed of common pine. B and C are the two sliding sockets or holders; the mortises in them are made to fit the thickness of the staff, but they are longer than they are wide, to admit of the fastening wedge. They may be made of some hard wood,

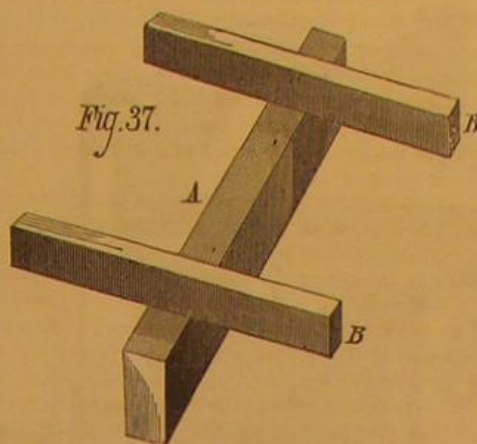
Fig. 36.



such as maple. The lower parts being turned and fitted with brass ferrules, a small hole is then drilled up the turned end of each, into which bradawls of large size are driven; they are then pointed on a grindstone. The wedges are made with a gib head on the small end so as to prevent them from flying out when tapped back to loosen the sliding sockets from the staff for adjustment. If maple be used for the sockets, then the wedges may be made of a dark colored wood, sandpapered and varnished two or three times, which will give them a neat appearance. Made as above described, the trammels will be light and almost everlasting; and as the materials are always at hand, the cost is a minimum.

In place of the wedge, a screw may be and sometimes is used, in which case a packing piece of either wood or sheet brass should be inserted, as shown in Fig. 36, at A, which will protect the staff from being indented by the end of the screw when the latter is tightened up.

Our next requirement is the straight edge which, for small work, is better of steel than of wood. A straight edge is a piece of stuff whose edges are straight and parallel to each other, which is necessary because they are sometimes used in conjunction with the square. A pair of straight edges, termed winding strips, are indispensable; their use is shown in Fig. 37, in which A is a piece of work requiring to have its edge



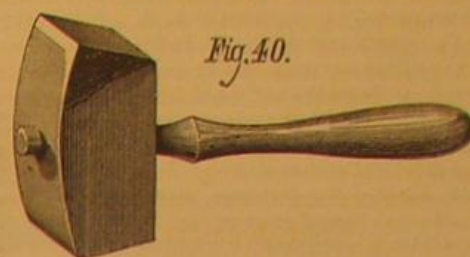
true, and B B are the winding strips, placed on the work as shown, so that by casting the eye along the upper edge of one strip, and leveling the head so that the edge of one strip will be brought nearly horizontally level with the other, it will readily be perceived whether the two are level one with the other, and hence whether the face of the work is true. Winding strips are simply pieces of wood made parallel and true, and generally about two feet long, three or four inches wide, and about five eighths of an inch thick. When the edges have been made as straight as possible with the truing plane, one of these should be lightly chalked on its edge face and laid upon the other, and then moved back and forth through a distance of about one half inch. The upper one should not be pressed to the lower but allowed to lie of its own weight, otherwise it will spring to suit the outline of the lower one, or bear upon it at the points pressed by the hands. Before separating the two, take a blacklead pencil and make a mark on one side of each, so as always to be able to bring the pieces together in the same way. Then separate them and ease away the high places, continuing the truing operation until they bear all over. In placing them upon the work, be careful that they stand parallel to each other, that is to say, that the distance between them is about the same at each end, otherwise the eye will be misled in sighting them when on the work.

In Fig. 38, we have an ordinary screwdriver, the point of which should be shaped as shown at A, in Fig. 39, and not as shown at B, as is usually the case, because if the part entering the screw head is tapered, it not only raises a burr on the screw head, but it is liable to slip out, even from a screw that drives easily, and much more from one that drives hard. To grind it to the shape shown at A, it should be ground on that side of the stone in which the latter is running toward you, the length of the screwdriver being at a right angle to the plane of the stone, and the handle held in one hand, while the driving end is held in the other which should be supported by the grindstone rest. If the stone is a small one, the screwdriver, while being ground in this position, should be moved a little, so that first one corner and then the other will approach the stone, so as to prevent the grinding from being hollow, which would weaken the screwdriver point by thinning it in the middle. Screwdriver, should be made of cast steel, and tempered at the point to a blue color.

The mallets should be of hickory and of the form shown in Fig. 40, the sizes being, one 2 1/2 x 3 x 5 inches long, and another about 3 x 3 1/2 x 5 1/2 inches long, the handles being mortised and properly wedged to the head.

Of oilstones there should properly be two, one for roughing and one for finishing. Wichita or Arkansas stones are even in grain and cut well, and are the best for our purpose. In addition to the large oilstone, a number of slips of oilstone are necessary, some being flat, others half round and flat, with round edges, their uses being for gouges and other tools in which the cutting edges are hollow or curved. The general oilstone should be kept with a flat face, otherwise it will be impossible to properly set plane blades, firmer and paring chisels, and other similar tools upon it. With this object in view, the workman should set small tools upon the ends, so as to prevent the stone from becoming hollow in the middle. When it becomes necessary to grind the face of the oilstone, it may be done upon the grindstone, but a better plan is to take a flat board and liberally supply it with clean sand and water, and then grind the oilstone on it by hand,

leaving the face a little rounding in its length by easing it off at each end, but leaving it flat across the face, by which means it will last longer without regrinding. There are some stones which are used with water instead of oil; they do not cut, as a rule, very freely, but the finer grades of them will cut unusually smooth; these are the descriptions used by the Japanese workmen, who use two stones, one to rough cut, which cuts very freely, the other to finish, which seems to grip the metal firmly, rendering it easy to keep the tool at the necessary angle and level, while at the same time it cuts very finely indeed. The first is a bright yellow stone, the latter is of a green slate color, hot water being used on both



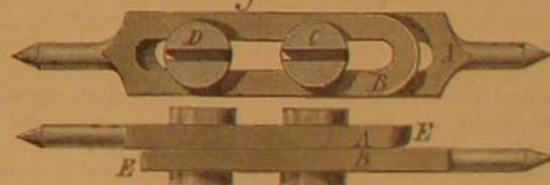
of them. Aside from those already mentioned, we have the Turkey stone, a close grained and amber-colored stone, which cuts freely or fine, according to the grade of the stone. For all ordinary purposes the Arkansas stone will suffice, and it is obtainable at almost every hardware store. The oilstone for general use should be fitted into a block of wood, having a margin outside of the stone of one half inch on each side, and about an inch at each end, the block being hollowed on the bottom face so that it will stand firmly and not rock when in use. It should also be provided with a cover to prevent dust and dirt from accumulating upon it.

Two pairs of inside and three pairs of outside callipers are necessary to the pattern maker, the smallest of each pair being large enough to take in diameter up to four inches, the largest from four up to about ten inches. The other pair of outside callipers may be large enough to use upon diameters from ten to eighteen inches. For bores above ten inches a wire gage may be used, by bending a piece of wire as shown in Fig. 41, which may be shortened by being bent more, or

Fig. 41.

lengthened by being straightened. It is preferable to make an adjustable gage, such as shown in Fig. 42, in which A and B represent two sliding pieces of steel, and C and D screws and nuts. It is obvious that, when the screws are loosened sufficiently to just let the sliding pieces move by a slight tap, the gage may be extended by striking the ends, E, or either of them, their inside edges being rounded off to prevent them from burring. It is better to set them at first a little below the required size, and to perform the adjustment by opening them, so as not to require to strike the point at all. The points should, however, in any event be tem-

Fig. 42.



pered to a blue. It is an excellent plan to file away the screw heads on two sides, a little, say 1/2 inch, thus forming a sliding piece under each head to fit into the slot of the gage, which will prevent the screws from turning when screwed or unscrewed, and in the end save much annoyance. A small machinist's square and a steel rule are also necessary for small fine work, the wooden ones being too clumsy; the edges of the rule should be trued so that it may be used as a straight edge.

Photo Printing Bath.

M. D. Batti, in the *Revista Fotografica*, gives the following as an economical printing bath, producing excellent results: Nitrate of silver, 40 parts; nitrate of ammonia, 40 parts; white sugar, 40 parts; water, 1,000 parts. The best description of paper to use with this solution is one very lightly salted, about 2 parts of salt to 1,000 of albumen being the strength mentioned by the author; the toning and subsequent operations are the same as those in general use. After the solution has been once used, it is shaken up with ten drops of washed animal charcoal, which is allowed to remain in the bottle in order to keep it colorless. It is strengthened from time to time by the addition of a due quantity of similar solution, but containing two and a half times the proportion of silver.

How to Disinfect Carriages.

The best method of disinfecting carriages is to burn one ounce of sulphur inside the carriage, the doors and windows being closely shut, and the loose cushions stood on end. The clothes should be disinfected with sulphurous acid, as in the last case; except that, if the sulphur be burnt in an ordinary room, about four ounces of sulphur should be used; but if possible, the clothes should be placed in a chamber of small size, or large box, heated by gas or fire, and exposed to a temperature of from 250° to 250° Fah. as well as to sulphur fumes. Exposure to heat will do, with or without the addition of sulphur. Of course nothing that will bleach must be exposed to sulphurous acid gas, unless the owners are first told that the color of the article will probably be destroyed.

IMPROVED CARVING AND PANELING MACHINE.

There seems to be a growing demand among workers in wood for machinery which will effect a decrease in the waste of the raw material corresponding to its advancing cost, and enable them to utilize new methods of designing and working in wood in such a manner as further to lessen the expense of production.

Among these new methods is that of paneling or carving moldings in the solid wood, instead of producing them separately and then attaching them to the article being made. For this purpose special machines are being constructed.

The accompanying illustration is from a machine recently brought out by J. A. Fay & Co., Cincinnati, Ohio. It is designed to produce carvings and recessed or relieved panels on the surface of lumber, also for edge molding and ornamenting the edges of bracket and fret work, etc., in a rapid and perfect manner. It is especially adapted for furniture, coffin, piano, and organ manufacturers, etc.

The machine is constructed on a hollow iron column of a form to best meet the requirements of the working parts, the neck being extended to support the cutter spindle over the center of the table. The table is adjusted to the proper height, and regulated, to form the desired depth of molding or carving, by a hand wheel and screw. It has a sufficient movement to allow stuff four inches thick and under to be worked. The elevation of the table to bring the material in contact with the cutter is accomplished by a notched treadle, and its depression, in order to remove the stuff, by an auxiliary treadle, which disengages a pawl, allowing the table to fall to its original position.

The cutter is reversible in its motion, and is placed in a tapered split sleeve extending through the spindle and fastened or released by a hand wheel at the top. The reversible motion of the cutter is produced by the method of belting with a cross and straight belt, alternately shifting from a loose to the tight pulley as the nature of the work may require. The handle of the reversing lever is under the table, within easy reach of the operator, and is provided with stops to retain it in proper position.

In the operation of carving, the pattern is placed over the piece to be worked, and guided by a fixed collar attached to the spindle, or a loose collar on the shank of the cutter. Any diameter of cutter can be used without altering the size of the guide collar. There being an opening between the pattern and the piece being carved, the cutter and its working are at all times in plain view of the operator.

Attached to the spindle is a fan blower, which removes all dust in the contrary direction from the operator, and keeps the surface of the work free from obstruction. The points claimed for the machine are that it is convenient, efficient, and durable, and that its comparatively low cost places it within reach of all who are in want of such a machine.

This labor-saving machine can be seen by any of our readers in daily operation at J. A. Fay & Co.'s display at the Centennial Exposition, columns 61, 62, 63, Machinery Hall, and is not least among their very attractive exhibition.

Further particulars can be obtained from the manufacturers, as above, who, we are informed, have, in addition to their already large list of premiums, been awarded medals at the late Chilian International Exposition, for superiority of their machines over others of the class exhibited.

SOME NEW APPLICATIONS OF METALINE.

In the *SCIENTIFIC AMERICAN* for January 10, 1874, we published a description of the material known as metaline, intended as a substitute for lubricating oil in machinery. Reference to that article will show how the substance is pre-

pared, and can state that such as we have seen run smoothly and without heating. From testimonials exhibited to us, it further appears that, according to the opinion of actual users, the wear is practically imperceptible.

The second new application of metaline, illustrated in Fig. 2, is its employment as a packing, or, more correctly, as a lubricant and packing combined. This is prepared by spreading metaline in a pulverized state upon strips of crash, and joining the latter in ribbons of from half an inch to eight inches in width. A few turns of braided hemp or cotton packing are first driven into the stuffing box. Above this comes the metaline packing, which is wound about the piston rod, and finally another layer of hemp packing is added before inserting the gland. The metaline packing is claimed greatly to outlast ordinary packing, besides possessing the lubricating advantages of the metaline alone.

For cotton spindles, a new mode of applying the material has been devised, which consists in simply inserting a tube of solid metaline in the bolster and step, the bottom of the spindle being allowed to run in a metaline plug. This adaptation, we are informed, has proved very successful, and in cotton factories, where the use of oil constantly invites conflagrations, the invention will doubtless be found of considerable value.

For our part, we question whether metaline or any other like substance will ever displace oil for all kinds of machinery, and the efficacy of the aforesaid material on railroads yet

remains to be proved. There is no doubt, however, that there are a variety of circumstances under which the use of oil is objectionable, sometimes dangerous, and always costly. It is but fair to state that, in many such cases, as well as in others of general occurrence, where the work is moderate, the results of employing metaline are such as to give every promise of its widely extended substitution for liquid lubricants.

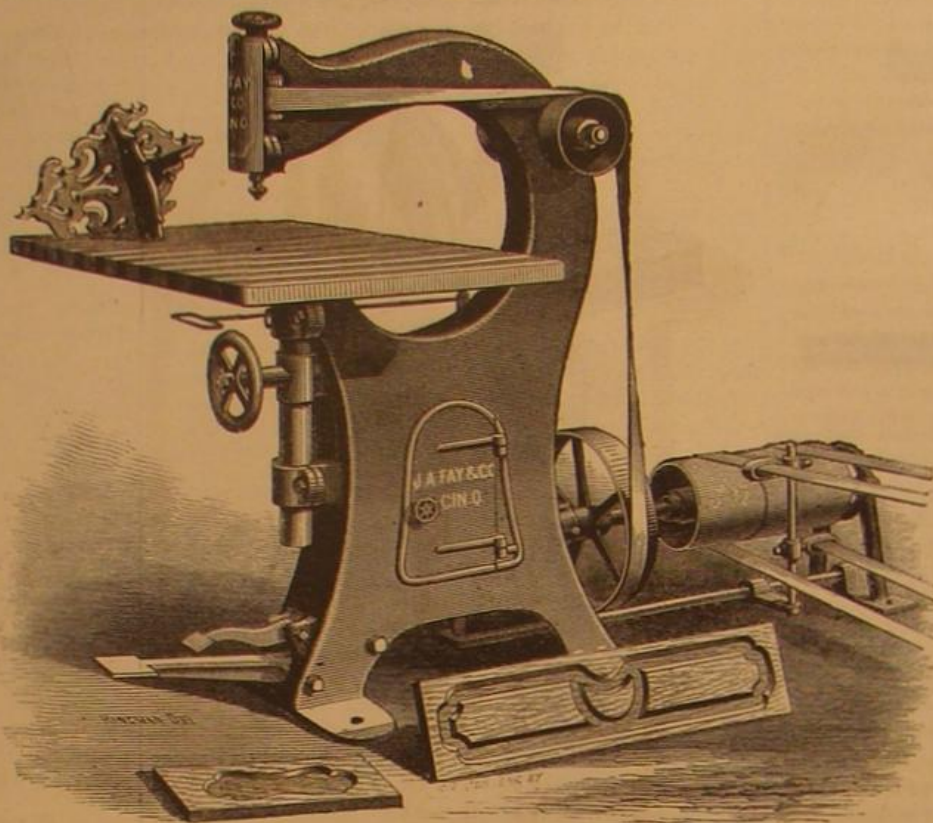
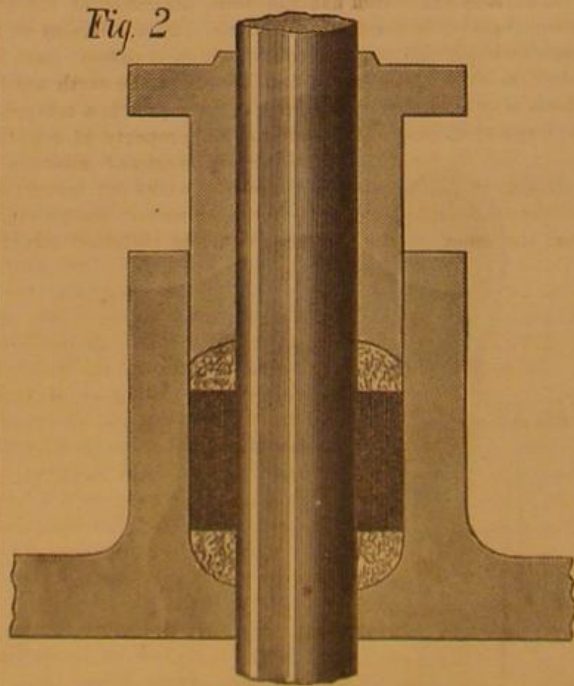
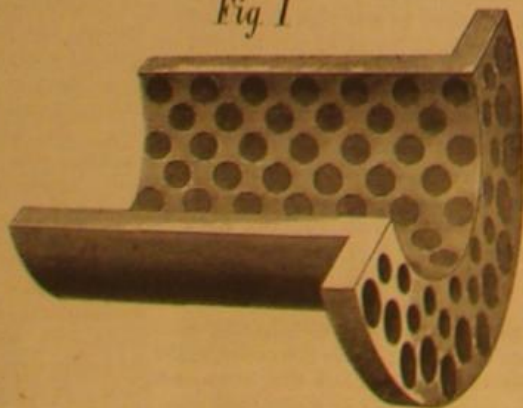
For further information, address the American Metaline Company, 61 Warren street, New York city.

AN ECONOMIC FOUNTAIN.

We are indebted to Mr. Etienne Gillet, of 13 Barclay street, this city, for information concerning a new and very ingenious method of augmenting the jets of fountains, devised by M. Turrettini, of Lyons, France. The principle of the invention is the same as that on which the Giffard injector is based, and will be understood from the accompanying engraving. A is the service pipe, having a narrow end, from which a small jet is forcibly discharged into the enveloping tube, B. The effect is to draw the water already in the basin into the flaring lower portion of tube, B, and to cause it to mingle with and so augment the jet. A large stream is thus obtained by a comparatively small expenditure of water, that in the basin being of course used over and over again. In order still further to increase the size as well as beauty of the fountain, the inventor adds an intermediate envelope, C, between A and B. The effect of the water jet passing through this is to draw in air through the pipe, D, which, mingling with the water, tends to convert it into a mass of spray. The latter, being lighter than water alone, volumes being equal, is accordingly projected to a higher elevation.

Apart from the superior elegance of the fountains thus obtained, we are informed that an economy of about three fifths the water otherwise employed is realized. This has been proved by tests on the city fountains at Geneva, Switzerland; and in Lyons, France, the engineer in charge of the water works of that city states that, while on a fountain without the apparatus 33 cubic feet of water was used in one minute and twenty-two seconds, with it, the same supply lasted two minutes and five seconds.

Mr. Gillet has brought the invention to the notice of the officials in this city, with a view to its adoption in the fountains in our public parks. Fountains just now, however, in New York are something of a luxury. The supply of water is far below the needs of the city; and we have learned to view with some complacency the empty basins and dried-up spouts of a very elaborate and costly but not very artistic granite fountain, opposite our office, knowing that, did the possible columns of glistening spray greet our eyes, there would be a waste hardly to be excused. M. Turrettini's device (if there be sufficient head of water, and we doubt if there is, in most of our parks) may possibly give us back our fountains. At all events it will be found, we think, an excellent and economical invention for cities which, unlike this metropolis, do not squander on a hideously ugly and outrageously constructed court house nearly as much money

J. A. FAY & CO'S CARVING AND PANELING MACHINE.**Fig. 2****Fig 1**

pared. It will suffice here to say that it is a solid, resembling plumbago, but not necessarily containing the same, and is composed of a large number of ingredients of widely differing natures. It is molded in the form of small plugs, of some quarter of an inch in diameter, which are inserted in shallow cavities made in the inner surface of the box or bearing.

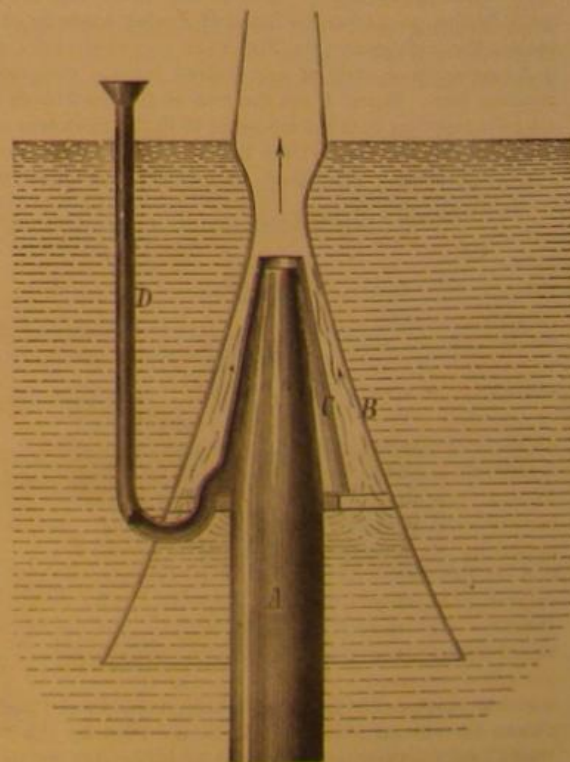
Since the period of our previous article, the manufacturers have carried on extended experiments into the nature and adaptations of the preparation, and at the same time

pared, and can state that such as we have seen run smoothly and without heating. From testimonials exhibited to us, it further appears that, according to the opinion of actual users, the wear is practically imperceptible.

The second new application of metaline, illustrated in Fig. 2, is its employment as a packing, or, more correctly, as a lubricant and packing combined. This is prepared by spreading metaline in a pulverized state upon strips of crash, and joining the latter in ribbons of from half an inch to eight inches in width. A few turns of braided hemp or cotton packing are first driven into the stuffing box. Above this comes the metaline packing, which is wound about the piston rod, and finally another layer of hemp packing is added before inserting the gland. The metaline packing is claimed greatly to outlast ordinary packing, besides possessing the lubricating advantages of the metaline alone.

For cotton spindles, a new mode of applying the material has been devised, which consists in simply inserting a tube of solid metaline in the bolster and step, the bottom of the spindle being allowed to run in a metaline plug. This adaptation, we are informed, has proved very successful, and in cotton factories, where the use of oil constantly invites conflagrations, the invention will doubtless be found of considerable value.

For our part, we question whether metaline or any other like substance will ever displace oil for all kinds of machinery, and the efficacy of the aforesaid material on railroads yet



as would suffice to render the water supply ample for the requirements of the city, both for the use of its million population and the ornamentation of its parks and public squares.

WATERPROOF VARNISH FOR PAPER, ETC., is obtained by precipitating a solution of tallow or resin soap by aluminum, iron or copper sulphate, and dissolving the precipitate in a liquid hydrocarbon, or in carbon bisulphide.

NEW WINTER-FLOWERING IRIS

This, when seen peeping through the ground in winter or early spring, reminds one of the common netted iris (*i. reticulata*); but its growth is rather taller, and the fall petals are broader and more conspicuously spotted, or rather blotched. Its color is a rich bluish purple, flushed towards the base of the petals with rose pink, the markings being of the deepest purple relieved by a medial ridge or crest of gold in the center of the three external perianth segments. Its leaves are, like those of the netted iris, four-angled; and like that beautiful plant, this also belongs to the bulbous group. When seen pushing through the earth at Kew, England, in the winter of 1874, there was a little patch of snow beside the flower, and nothing could have set it off to better advantage than this, and a tuft of the vivid green *poa annua*, with which it was also associated. This iris is described as a native of Mount Lebanon and also of Mount Gerizim; it was sent to Kew by M. Berbercy, of La Ferrière, near Geneva, in March, 1873, who describes it as nearly related to *i. reticulata*, from which it differs not only in structural character, but in flowering six weeks earlier than that species. Its culture is by no means difficult. Treated like the last named species, it grows and blooms freely. Our engraving shows the size of the flower, and its color as far as can be done by an engraving. This, with its allies, *i. reticulata* and *i. stylosa*, says a correspondent of the English *Garden*, is well worth a place in sheltered position in warm and deep rich soils, and in every garden.

Sleep is the Best Stimulant.

The best possible thing for a man to do when he feels too weak to carry anything through is to go to bed and sleep for a week if he can. This is the only recuperation of brain power, the only actual recuperation of brain force: because, during sleep, the brain is in a state of rest, in a condition to receive and appropriate particles of nutriment from the blood, which take the place of those which have been consumed or in previous labor, since the very act of thinking consumes or burns up solid particles, as every turn of the wheel or screw of the splendid steamer is the result of consumption by fire of the fuel in the furnace. The supply of consumed brain substance can only be had from the nutritive particles in the blood, which were obtained from the food eaten previously; and the brain is so constituted that it can best receive and appropriate to itself those nutritive particles during a state of rest, of quiet, and stillness of sleep. Mere stimulants supply nothing in themselves; they goad the brain, and force it to a greater consumption of its substance, until that substance has been so exhausted that there is not power enough left to receive a supply, just as men are so near death by thirst and starvation that there is not power enough left to swallow anything, and all is over.

PRINTING MACHINERY AT THE CENTENNIAL.

While the American firm of Hoe & Sons is justly celebrated for the construction of rapid printing presses, another New York establishment claims to have succeeded in producing presses which surpass all others in nicety of adjustment and perfection of work produced. The Campbell Printing Press Company's apparatus has long been used for printing the *Aldine* and other fine art publications in this city; and the Company has erected a large and handsome building in the Centennial grounds, near Machinery Hall, in which is a completely equipped newspaper office, with editorial, composing, and press rooms. The structure is 124 feet long by 88 feet broad, and is, as will be seen in our engraving, a very ornate affair. One of the Company's rotary printing and folding machines is here to be seen, producing an edition of the *Philadelphia Evening Herald*. In the same building is a job office containing ten cylinder presses, one of which exhibits the heliotype process. There are also six job presses, all in operation. The other rooms are divided into business offices, waiting and reception rooms for members of the

press, correspondents, etc., together with a telegraph and post office.

A very attractive feature of the exhibit is the original printing office of Isaiah Thomas, built in Boston in 1770. It is complete, including the press upon which the first copies of the Declaration of Independence were printed east of New York (from the Antiquarian Society of Worcester), the imposing stone (from the Worcester *Spy*), two cases, one stand, two chases, and two composing sticks (from Tyler & Sugrue, Boston). Many anecdotes and more than one romance are connected with the history of this old office, which will probably be rehearsed by editors and printers who visit it. Taken as a whole, the exhibit of the Campbell Press



THE IRIS XIPHION HISTRIO.

Company makes one of the largest and most interesting individual displays on the grounds.

Asbestos.

A curious exhibition has just been organized at the Simonetti Palace, on the Corso, in Rome. It is a display of asbestos in all the stages through which it passes, from the time that it is taken out of the bowels of the earth until it appears as a manufactured article. Asbestos is a compound of silicate of magnesia, and has the property of resisting fire. The ancients had discovered a means of weaving it, and with it made napkins for meals, wicks for lamps, and winding sheets for the dead for purposes of cremation, so that the ashes of the deceased could be collected unmixed

with those of the wood which had formed the funeral pyre. The process of working this textile has been again discovered by the Marquis de Batres, as well as the means of making with it incombustible paper and cardboard at a low price.

Blasting Cartridges and Powder-Making Machinery

The value of an improvement or invention is by no means proportional to the cost of the article produced. This is well illustrated in the simple little contrivance adopted by General P. A. Oliver, in making blasting cartridges for the use of miners and quarrymen. Every one who has had experience at the mines must have noticed the wasteful and inconvenient manner in which cartridges are prepared. A miner makes his own, using about twice as much paper, etc., as is necessary, his own time being worth from \$2.50 to \$3 a day; the cost of manufacture amounts to many times what it would if made by machinery, as are many similar articles. When the ground is wet, he has to use soap also, to make his cartridge waterproof; even then he is very often far from successful, and loses a portion of his powder by getting it wet.

Oliver's cartridge is made by machinery; those for dry ground have the end riveted with a copper or tinned rivet, and those for wet holes have the end formed of a double cup of tin, one setting into the other, and holding the paper of the cartridge between them. The cartridge is then coated with a waterproof coating, and is ready for use. They are made of various lengths, so that the miner has rarely to cut one, and if he has, the loss is, at most, but a few inches of paper. Manufacturing them on a large scale, the patentee can sell them at much less than it costs a miner to make his cartridges himself.

General Oliver, the manufacturer of this ingenious and useful article, has met with great success in the manufacture of powder by his patent machinery, having, during the past five years, fully established the reputation of his powder as having no superior for strength and effectiveness, and of his method of manufacture, for simplicity, safety, and economy. In his mill there is never, except in the drying house, more than some 50 or 70 lbs. of powder in any one place, so that, should it ignite, nothing more serious can result than the loss of a few pounds of powder. His well ordered works, near Wilkesbarre, Pa., with its beautiful machinery, is one of the most interesting establishments with which we are acquainted; and General Oliver has deserved well in devising a method of manufacture, by which powder, of a quality not surpassed by that of any other maker, not only can be, but has, for some years, been produced almost without risk, and at a cost for plant greatly less than in ordinary powder mills. His improvements are well worthy the attention of powder manufacturers everywhere.—*Engineering and Mining Journal*.

An Opportunity for Inventors.

A correspondent writing from Houston, Texas, calls our attention to the necessity of an invention which will prevent cotton bales expanding after leaving the press. By powerful machinery the average bale is reduced to some ten inches in thickness; it is then tied, and, the pressure being relaxed, it is removed. The bale then expands to from 14 to 16 inches in thickness, and of course occupies about twenty-five per cent more room than would be the case were it possible to keep it at the thickness to which the press reduces it. This augmentation in size obviously results in an enormous increase of freight room required, and consequently a large enhancement in cost of freight and handling. Our correspondent, who has had considerable practical experience in the subject, thinks that the trouble could be remedied if the iron bands with which the ball is strapped could be drawn tight enough while the cotton is in the press. At present, the tying is done by hand, and for each press five men have to be employed. Could all this be done by machinery, great saving would be effected.



THE CAMPBELL PRINTING PRESS COMPANY'S BUILDING

AGRICULTURAL MACHINERY.

Our extracts from Knight's "Mechanical Dictionary,"* this week, include a variety of plows and other cultivating apparatus.

The originator of the double plow was Lord Somerville, who, in 1799, devoted much attention to the practical details of agriculture. His plow, Fig. 1, which he termed a double

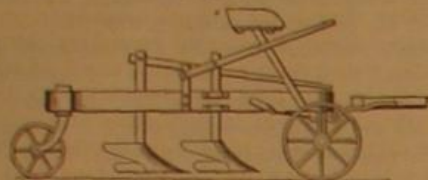
Fig. 1.



Somerville's Double-Furrow Plow.

furrow plow, consisted of a beam suitably bent for the attachment of two plows, one placed laterally and to the rear of the other. Another example is shown in Fig. 2, where the plows are moved vertically by levers. The axle is bent

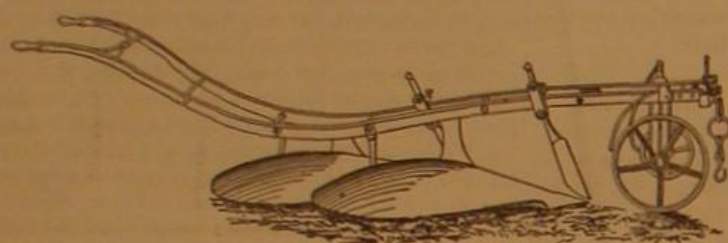
Fig. 2.



Gang Plow.

to depress the furrow wheel, and the tongue is attached to one side of the center to suit the position of the horses. The English or skim-colter plow is shown in Fig. 3. This has

Fig. 3.



English Double-Plow.

a share attached to the colter to turn down the top soil with its weeds and refuse. The latter is covered with the main furrow slice thrown over by the larger following plow. In England and in this country another form of the same plow has been used, in which the forward portion is not merely a flange on the colter, but is a regular moldboard plow of smaller proportions, higher than, and in front of, the main plow. This is known as the Michigan double plow (Fig. 4). It requires four horses. Fig. 5 is a double shovel plow. The shovels are placed at a short distance apart, and one a little in rear of the other. It is used for cultivating purposes. Fig. 6 exhibits a double moldboard plow. A moldboard is placed on each side of the sheth, so as to throw the soil to the right and left. It is used in hilling potatoes and cabbages, but not for corn, as the rows are too far apart. Two forms of

DRAINING PLOWS

are shown in Fig. 7. A B has three colters, two mold boards, and a share. The middle colter is vertical, and splits the soil in the middle of the furrow; the two side cutters are inclined to cut the sloping sides of the ditch; the share cuts the bottom, and the moldboards lift the soil in two slices, which are deflected laterally and delivered on the respective sides of the ditch. When it is desired to cut a trench deeper than can be effected by the ordinary mode of using the plow, the arrangement shown at C is employed. An anchor or hook, *l*, is inserted in the ground, and to this is secured the pulley, *k*. The wheel, *h*, is operated by the handle above, and the plow, *c d*, is thus drawn through the soil. The arrangement at *a b* enables the operator to give the required depth to the furrow. A roller, *g*, resting on the ground supports the forward part of the plow.

HOES

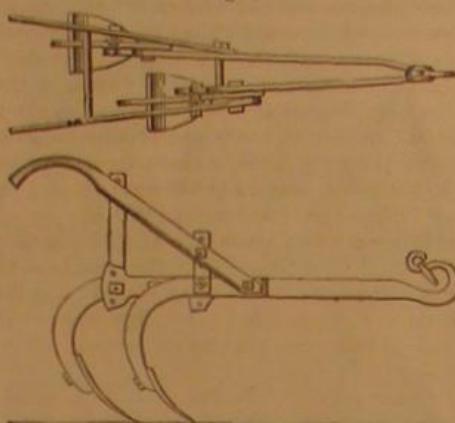
were formerly made by forging, but now they are more often cut out as blanks and then struck in dies. On the left of Fig. 8 are exhibited various forms adapted to different purposes. *a* is a hoe for marking out fine drills, *b* a hoe for marking small ridges, *c* a hoe for working two sides of small plants, *d* a hoe for drawing a pair of parallel ridges. *e* is a combined hoe and rake, a very common implement, used by amateur gardeners. *f* has a serrated blade, *g* a sectional one. *k, i, j, l* are Dutch hoes, known as scuffle or thrust hoes, operated by pushing instead of striking or pulling. They are

Fig. 4.



Michigan Double-Plow.

Fig. 5.

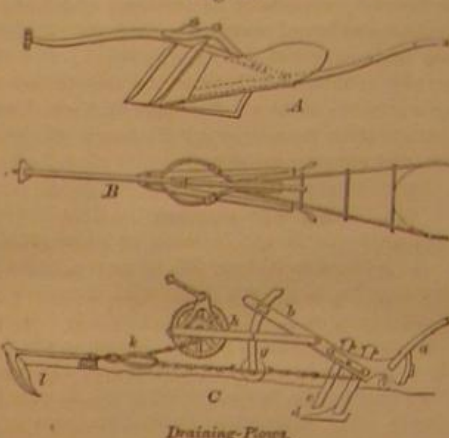


Double-Shovel Plow.

useful in extirpating weeds under bushes, and loosening the soil around growing plants. *l* shows a mode of attaching the blade to the tang, *m* a mode of wedging it in a ferrule. *n*,

English horse hoes, *b*, have a range of shares spaced like the drills, so as to work in the intervals between the rows of plants, such as wheat and turnips. Other English horse hoes, *a, c*, have castor wheels in front and rear, a broad middle share, and two or more side shares. The rear share may be curved or flat, as shown at *c* and *a* respectively. It is

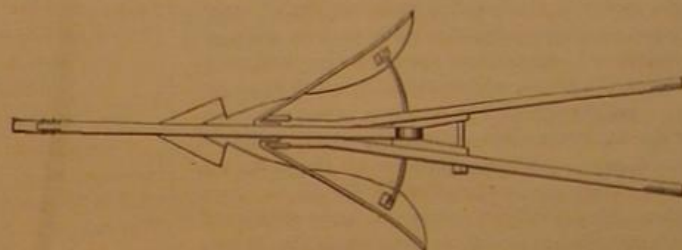
Fig. 6.



Draining-Plows.

what we should call a cultivator, but there is more of it than we regard convenient. If the tool be well proportioned, and the animal hitched to it rightly, it needs no wheel. For turning at the end of a row of corn or potatoes, it is too long. A man would need 12 feet of ground to come out on to turn, and it is not necessary to withdraw so large a marginal strip of the field for such a purpose.

Fig. 7.



Double-Moldboard Plow.

Bucknall's horse hoe, *b* (English), has a gang of 10 shares in a frame, adjustable by a lever as to height, and also as to angular presentation of the shares to the ground. It is intended for hoeing wheat.

The horse hoe, at *d*, is designed for chopping gaps in the rows, and has a set of revolving hoes on a shaft parallel with the line of draft, and driven by bevel gearing from the main axle of the machine. As the machine advances, the hoes chop transversely across the row of plants, making intervals therein equal to the lengths of the blades.

History of Magnetism.

The earliest references to the properties of the magnet occur in the annals of the Chinese nation, who used it as a means of guiding the wayfarer over the vast and trackless plains of Eastern Asia, long before it was applied to maritime purposes. To the Emperor Hoang Ti, who lived 2,000 years before our era, is attributed the invention of a chariot, upon which stood an elevated figure pointing to the south, independently of any position of the chariot. Nearly ten centuries later, we find the learned Tchou-Koung presenting and teaching the use of the tchi-nankiu, or chariot indicating the south, to some envoys from You-tchang, a southern maritime province. The compass, or, as it is even now called in Chinese, tchi-nan, appears to have been first used at sea by this remarkable nation about the third century of our era, during the Tsin dynasty.

When the compass became known in Europe is disputed; Gilbert refers its introduction to Marco Polo about 1260, but it is probable that earlier accounts of it were brought from the East by the crusaders, an accurate description of it occurring in a poem entitled "La Bible," written by the minstrel Guilot de Provence, about the year 1190. A Latin letter ascribed to Peter Adsiger, 1269, preserved among the manuscripts of the university of Leyden, contains the following remark on the declination of the needle: "Take notice that the magnet as well as the needle that has been touched by it, does not point exactly to the poles, but that part of it which is reckoned to point to the south declines a little to the west; and that part which looks towards the north inclines as much to the east. The exact quantity of this declination I have found, after numerous experiments, to be five degrees."

The discovery of the dip of the needle is due to Robert Norman, a nautical in-

Fig. 8.



Hoeing-Machines.

Hoe.

*Published in numbers by Messrs. Hurd & Hough-ton, New York city.

instrument maker at Wapping, near London, who is described by Gilbert as "a skillful sailor and ingenious artificer." He found that, after being touched by a magnet, the needle always appeared heavier at its northern end; and making an instrument to determine the greatest angle formed with the horizon, he observed the inclination in 1576 to be $71^{\circ} 56'$.

In the early part of the following century, the variation of the declination was clearly ascertained, and was attributed by Bond, a teacher of navigation in London, to the motion of two magnetic poles.

In the year 1600 was published the celebrated treatise "De Magnete," by Gilbert of Colchester, who was pronounced by his great contemporary Galileo to be "great to a degree that might be envied."

American vs. English Cheese.

About one year ago we copied, from an Irish agricultural paper, an article in which the editor was lamenting over the loss the farmers of Ireland were experiencing from the large importation of superior American cheese. He berated the Irish farmer for allowing a deterioration in his products such as to make the home consumer prefer the American cheese to the home manufacture. Now comes the London *Agricultural Gazette*, containing an article from a Lancashire correspondent on the same subject, in which he gives the English cheese makers some wholesome advice.

"On every hand," he says, "we hear people talking about cheese making being unprofitable, and discussing to what purpose they can turn their milk to a greater profit; and in some cases they are considering the prospects of feeding cattle in place of keeping a milking stock. This sort of talk amongst farmers is a new thing. For several years past cheese has fetched high prices, and such has been the demand that even inferior sorts could find a market at far above their relative value, the greatest loss being that of weight, the lowest qualities having to be kept to the last of the season, while the finest were often bought before they were made, so anxious were buyers to secure the few really fine. While prices kept up, farmers were very 'upish'; they would not listen to any suggestions about improving their mode of making, and expected buyers to take the fearfully unsaleable cheese they made late in the season, a kind of stuff you could not properly call cheese. These late-made cheeses resembled cheese in shape only; they possessed no solidity to the touch, and were in consistence more like very stiff bookbinder's paste. They never ripened, because they were obliged to be kept so cool, otherwise they would have swollen and become inflated like bladders; on the approach of heat, they cracked and became out of shape. Year after year many dairies finished up by making a certain weight of the kind of cheese I have been describing; and so long as dealers would buy them, so long were they quite indisposed to improve. I long felt sure that this state of things would come to an end, and that solid and firm American cheese would render such rubbishy late-made cheese unsaleable. And this has come to pass. Indeed, I feel sure that pasty, spongy, springy, late-made cheese will become unsaleable at any price. The wonder is where people have been found to eat such a salvy, pasty material; I was once told that those who bought them consumed them in the shape of toasted cheese, and that no one could eat them in any other shape. I suppose the rich milk at the latter end of the season will, in future, be turned into butter; heretofore, farmers would not be troubled by changing from cheesing to churning. Making that kind of cheese was sure to become unprofitable so soon as a sufficient supply of good cheese was obtainable from America. Now, what is the lesson to be learnt from all this? What are keepers of milking stock to do? I wonder how many of them think of associating themselves in any way for trying to learn how to remedy their shortcomings. No business will be long profitable if it is based upon ignorance, or if those engaged in it will not take the trouble to march with the times. The times are changed; consumers are no longer confined to the cheese made at home, and they will no longer be content with an inferior home-made article, be it cheese or anything else. Cheese making, like any other producing, will only be profitable when the article produced is of first class quality. If you turn out inferior or bad grain, or potatoes, or animals, they will be difficult of sale and unremunerative to the producer; and the same with cheese or butter. Farmers have been enabled to live in past days by using their hands, but they will now (like those in other occupations) have to use their brains as well. They will need to know their deficiencies, and seek to remedy them; to discard all doings—however time-honored—that lead to the production of inferior articles; they will need to learn to improve. They will find it only a loss of time to be grumbling, and better to start off learning; the latter is the only wise course, and the only one that will lead to permanent profit. They will need to avail themselves of every opportunity afforded them for obtaining useful information, whether by information from better informed neighbors, or books, or lectures, or such societies as the National Dairyman's Association. Ignorance will land them at length in poverty; intelligence and industry are the only road that will secure profit and comfort."

Dry Plates without Collodion.

The following formula was given in the *Moniteur de la Photographie* for the preparation of dry plates without the use of collodion: Albumen, 125 grammes; honey, 110 grammes; iodide of potassium, 4 grammes; bromide of potassium, 1 gramme; sea salt, 0.3 gramme. Beat the whole into a froth, let it stand for twenty-four hours, then filter. Coat a perfectly clean plate with this liquid, dry it in the drying box, and, when cold, sensitize in the usual manner.

In this formula the needful addition of water seems to have been overlooked, in consequence of which omission the liquid filters but slowly.

A Transcontinental Express Train.

As we go to press a special train is rushing across the continent, attempting to travel from New York to San Francisco in the unprecedented time of 88 hours, or in 60 hours less time than is now occupied by regular trains. The start was made from Jersey City at 1 A. M., on June 1, three cars being attached to a new engine, the tender of which carried 2,400 gallons of water and 136 bushels of coal. The ninety miles between Jersey City and Philadelphia were covered in ninety-nine minutes. At 10:40 o'clock on Thursday morning, Pittsburgh was reached; and at 10 o'clock on the same evening, the train stopped at Chicago, having completed the distance of 907 miles in 20 hours and 57 minutes, averaging over 43 miles per hour. The distance from New York to Pittsburgh, 439 miles, was made without changing locomotives. Both before and after reaching that city the speed of a mile a minute was often attained. At 4:15, on the afternoon of June 2, Willow Island, 250 miles west from Omaha, was reached. This was the halfway station; and the total distance from New York, 1,645 miles, was accomplished in 39 hours and 12 minutes, showing an average of over 42 miles per hour.

The train reached Council Bluffs at 9:27, 39 minutes ahead of the schedule time. It made the run from Chicago to the Missouri river in 11 hours and 15 minutes. It made one run of 79 miles in 75 minutes, and another of 45 miles in 44 minutes. This is an average of a mile, respectively, in 58 and 58.6 seconds. The fastest time made since the train left New York is stated to have been on the Chicago and North-Western Railway, where $2\frac{1}{2}$ miles were run in 2 minutes, or 1 mile in 48 seconds, being at the rate of 75 miles an hour. This is said to be the longest and fastest continuous run that has ever been made on any road in any country.

The Spectroscope a Witness in a Forgery Case.

A remarkably ingenious and novel application of the spectroscope as a witness in a case of alleged forgery, now on trial in this city, was recently made by Dr. P. H. Vander Weyde. A suit was brought to recover, on a check, a large sum of money from a bank which, the plaintiff alleged, had certified the document. The bank in defense claimed that the certification was a forgery, and among other statements asserted that the ink used was not the same as that employed on other checks certified by the same person on the same day. Dr. Vander Weyde was called as an expert witness to determine this point, and he appeared in court armed with a powerful microscope having a spectroscopic eye piece.

By carefully observing the spectrum of sunlight reflected from the surface of the paper covered with different inks, and then passed through the spectro-microscope, he previously had satisfied himself that all inks, other than black, such as Prussian blue, carmine, anilin red, etc., absorb certain parts of the solar spectrum, so that it would be a certain and easy way of recognizing the identity of the two inks to note the fact that both produced an absorption of and so blotted out exactly similar parts of the solar spectrum. This, of course, was spectrum analysis produced otherwise than by examining the incandescent vapor of the substance, an obviously impracticable proceeding here.

On the witness stand, Dr. Van der Weyde was given a variety of checks from the bank, together with the particular document on which the suit rested. The microscopic part of his instrument magnified the writing so highly that the dot on an i was sufficient for all purposes. The result was that the ink of the alleged forged signature and that of the bank's genuine writing gave exactly the same absorption spectrum, and hence were pronounced identical, and this although the check in suit had been handled and exposed to the light until the ink had faded considerably. We will soon publish a complete account of this very interesting investigation.

Growing Tuberoses.

To cultivate that tuberose, the most beautiful of all plants, says an experienced horticulturist, put the bulbs in six inch pots, three in each, and use a mixture of equal parts turfy loam, peat, and leaf mold, and place them in a pit. Give very little water at first; and as they commence to grow freely, increase it, and keep near the glass. When they begin to push up their flower spikes, they will of necessity require to be placed where they will have sufficient space for the proper development of the tall spikes. These will come into bloom from August to October, when they will require a temperature ranging from 60° to 70° , the latter being preferable.

Direct Manufacture of Soap with Salt.

If grease, fat, or rosin, which are commonly employed to make soap, are heated with an excess of common salt, ammonia, and water, a soda soap separates, leaving chloride of ammonia in the liquor, together with the excess of ammonia and salt. This reaction is the consequence of the great solubility of ammonia soap in ammoniacal water, and the insolubility of soda soap in water containing more than $\frac{1}{4}$ per cent of salt. The ammonia at first unites with fatty acids; then the sodium in the salt exchange places with the ammonia in the soap, forming, as we said, a soda soap and chloride of ammonia. It is essential that there be an excess of ammonia and salt present in order that the reaction take place. One hundred parts of grease requires 15 to 20 parts ammonia, 20 to 30 parts salt, and 200 to 300 of water.—*T. N. White-lane, in Chemisches Centralblatt.*

Physiologic Iron in Puddling.

An invention of Mr. John Haythorne, of Clifton, near Bristol, England, has for its object improved means of producing from the puddling furnace a superior quality of iron by the use of a certain composition, which is thrown into the puddling furnace while the metal is in a fluid state, before it comes to nature, and by which means the impurities still remaining in the iron are removed, and its quality improved. The composition, which he has found to answer in practice, according to the London *Mining Journal*, consists of peroxide of manganese $\frac{1}{4}$ lb., oxide of tin, zinc, or lead $\frac{1}{4}$ lb., quicklime, potassa, or soda $\frac{1}{4}$ lb., saltpeter or ammonia $\frac{1}{4}$ lb., brick-dust or calcined clay $\frac{1}{4}$ lb. = 2 lbs. These are to be carefully reduced to a fine powder, and thoroughly dried. These proportions may be modified or increased as found desirable, according to the quality of the pig iron used.

Superior Longevity of Israelites.

Dr. B. W. Richardson, of London, last month delivered a lecture on this subject. The result of his research has shown that, both on the Continent and in England, Jews possess a higher vitality than do the general community by whom they are surrounded. Tracing the causes for this greater longevity, the lecturer said he could not attach too much importance to the sanitary laws that obtained among the Jews, instancing those in regard to diet, cleanliness, and abstinence from strong drink. In fact, the Decalogue, from beginning to end, is one sanitary lesson, teaching them to subdue the passions which torment the brain and distress the body.

A Good Kalsomine.

Take 4 lbs. Paris white, put in a pail, cover it with cold water, and let it stand over night; put into a tin kettle a handful of glue, cover with cold water; in the morning set the glue on the stove, and add enough warm water to make a quart, and stir until dissolved; add the glue to the Paris white, stir well, and pour in enough warm water to make a pail three quarters full; then add bluing, a little at a time; stir well until it is very slightly bluish. Use a good brush; go over one place in the wall until thoroughly wet; if your brush dries quickly, add more warm water, as the mixture is too thick; the brush must be kept wet. This mixture costs 38 cents.

NEWSPAPER and other publishers will be supplied with electrotypes of the Centennial Buildings and most of the other engravings which appear in the *SCIENTIFIC AMERICAN* and *SUPPLEMENT*, on very cheap terms. For prices address the publishers, and indicate at the same time what engravings are desired, and the date of the issue in which they appeared.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT BUSH BUSH.—GEORGE B. CORNWELL vs. LOMAX LITTLEJOHN.

Johnson, C. J.:

A decision on a preliminary application for an injunction is not of controlling weight in another circuit. The Cornell reissued patents Nos. 5,036 and 5,037, of August 6, 1873, the one being for a bush and the other for a wrench for operating such bush by direct positive engagement, are not infringed by the use of a bush and a wrench in which the engagement is effected by frictional contact, and in which the bush is so constructed that the patented wrench cannot be used with it. (S. A. Goodwin, for plaintiff. S. A. Duncan, for defendant.)

NEW BOOKS AND PUBLICATIONS.

THE PACIFIC TOURIST, a New Illustrated Transcontinental Guide of Travel from the Atlantic to the Pacific Ocean. Price \$1.50. Edited and Published by H. T. Williams, 45 Beekman street, New York.

The fast train which, at the time we write, is attempting the extraordinary feat of crossing the continent in eighty-eight hours will, without doubt, draw renewed attention to the modern facilities for reaching the most picturesque and beautiful portions of our national domain. To those who contemplate a trip to San Francisco over the Union Pacific Railroad, the above-named volume will prove of much use, as it not only embodies information regarding the railroads, stage routes, distances, and fares to a principal points, but it describes the wonders of Western scenery, supplementing the description with a lavish display of illustrations.

A CENTENNIAL PICTURE.—A large and handsomely executed Centennial national commemorative picture has just been issued by Wittenman Bros., 184 William Street, New York. The central portion is occupied by an equestrian portrait of Washington; the ornamental border is filled with appropriate legendary devices. See advertisement in another column.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COTTON-GIN FEEDER.

John W. Webb, Union Springs, Ala.—This is an improved machine for feeding cotton regularly to a gin, and so constructed as to allow sand and other hard substances to drop out. To this end the cotton passes over a pivoted rack, made of wood or wire, placed at a suitable distance apart.

IMPROVED CAR COUPLING.

Rocco Misso and Bishop J. Warner, Macon, Miss.—This consists of a drawhead with lateral rock bar, with outside rest piece and weight that is struck by a bumper at the end of a forwardly projecting arm of the connecting drawhead to drop the pin-holding rod.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED WIRE FENCE.

Schuyler Jenks, Jefferson, Wis.—This consists in the combination, with double T posts and twisted wire rails, of the wire staples and a long vertical wire. The staples secure the wire rails, and are themselves fastened by the vertical wire.

IMPROVED GAGE FOR TEACHING PENMANSHIP.

Lorenzo Dow Harvey, Sheboygan, Wis.—This is a gage made of transparent substance, having lines cut upon it in such a manner that it may be used for measuring the length, width, slant, and spacing of letters and figures in writing.

HEATER FOR MELTING WAX FROM ELECTROTYPE CASES.
John E. Parker, Boston, Mass.—The case is made with steam-tight double walls upon its bottom, top, sides, and back, to form a steam space. The steam spaces at the top and bottom of the case are connected by pipes, to increase the heat in the interior. In the center of each lower bottom is a pan—the two being concentric—the outer one receiving the water of condensation. Between vertical guide bars, on the inner case, wax cases are inserted edgewise. With this apparatus, when the shells have been removed from the cases, the cases are inserted between the guide bars and the wax, as it melts off, runs down into the inner pan, where it is kept melted ready to be again used.

IMPROVED TICKET HOLDER.

Daniel Shamberger, Beckleysville, Md.—This is a slotted holder applied by a screw pin, and securing the ticket by a clamping screw. The ticket is thus tightly and securely retained and conveniently exhibited for inspection when applied to the coat or hat.

IMPROVED ICE PICK.

Herman F. Dornell, Athens, N. Y.—This consists of a number of tines, or a cutting blade, set into a sectional head, and attached by fastening screw bolts. By extending the recesses of the head, a cutting blade may be inserted into the head, and the tool then be used for separating the cakes when taken from the ice house.

IMPROVED COMPOSITION FOR CIGAR LIGHTERS.

William J. Littlefield, Philadelphia, Pa.—Small glass rods are dipped into a mixture of lime, charcoal, cascarilla bark, gum and water, until a sufficient deposit is formed to make heads. The latter are then tipped with fulminate. When lit, the head becomes a red hot coal and lasts some time, and the glass, being a nonconductor of heat, enables the lighters to be conveniently handled.

IMPROVED APPARATUS FOR DRYING HIDES.

John Finnigan, Houston, Tex.—By the mode of drying the hides here patented, they are spread over portable frames constructed to keep the inner surface of the hides from coming in contact with each other, to allow the air to circulate between their sides freely, and to allow the rain to run off, so that bad weather will not harm them.

IMPROVED STOP ACTION FOR REED ORGANS.

Eugene H. Schofield, Mendota, Ill.—This consists of stop draws connected by crank shafts and connecting rods with the valves in such manner that the action is improved. The stop draws may be located more closely together in the front board, and the latter may be shortened so as not to extend beyond the keys, and thus do not obstruct the sound so much as the board used in the common arrangement.

IMPROVED ABDOMINAL SUPPORTER.

Cyrene Smith, New York city.—This consists of a supporter that is laced at the back, and adjusted by upper front and lower rear gussets, with lacing strings, in connection with the front and side gussets, with elastic bands, to the condition of the abdomen. The front part is stiffened by stays, and extended to sufficient length to take up and support, by a curved anterior pad, the weight of the abdomen, and transfer it to the hips and back.

IMPROVED SLATE.

Claudius Verdier, Detroit, Mich.—This consists of a school slate whose frame is arranged with a pencil receptacle at each side, closed by a door. There is also a pencil-sharpening device.

IMPROVED ANIMAL NOSE BAG.

Craton H. Williams, New York city.—This consists in suspending the nose bag by knotted ends which pass over pulleys on the head stall, and are slipped over the cheek rein hook. The horse can thus raise his nose to the top, but not outside of the bag, and is prevented from scattering and wasting his feed, while he is allowed to chew his grain without breathing directly into the bag.

IMPROVED BUTTON BOOT.

Christoph Stickel, New York city.—By this construction, there is no seam upon the top of the foot, and upon the heel where the most of the wear from a dress or pantaloons leg comes, so that it will not rip, and at the same time a neatly-fitting, stylish boot will be produced. By cutting the shoe in two pieces, it will give any additional height and shape, thus enabling the foot to be fitted perfectly and the employment of only a half seam behind.

IMPROVED BUCKLE.

Joseph M. Junkin and John Gunn, Red Oak, Iowa.—This consists in arranging a buckle tongue on a detachable shaft, and between loose spacing tubes. The contrivance is desirable for repairing a buckle or replacing a broken one, the buckle being in this case easily taken off from the strap.

IMPROVED WHIP SOCKET.

Thomas L. Whitacre, East Rochester, Ohio, assignor to himself, Edward F. Whitacre, and George T. Whitacre, same place.—This invention consists of a whip socket with clamping spring and locking cam.

IMPROVED PEN RACK.

Carol E. Kusel and Carl H. E. Bechert, Oroville, Cal.—This is a pen rack applied by springs to an ink bottle or stand, and having bent wire arms, forming racks for penholders.

IMPROVED LAMP BURNER.

Benjamin Franklin Flint, Westfield, Pa.—This is a device for removing the snuff of lamp wicks in a convenient manner, without extinguishing the light and requiring the taking off of the chimney. It consists of a spring and hook-shaped cutter, that is carried by a suitable lever device.

IMPROVED SKIRT PROTECTOR.

Albert Lyons, New York, assignor to James W. Chisholm, Brooklyn, N. Y.—This is a compound skirt protector and trimming, formed of a ply strip and an ornamental strip, connected by binding near the upper end. The trimming is sewed at its lower edge to the upper part of the hem of the ply strip.

IMPROVED SHADE STANDARD.

Henry F. Walton, Woodman, Wis.—This is a standard for holding a shade or umbrella. It has a joint at the base for lying down flat when not required for use; also, a joint for turning the shade around to any direction, and also a joint for shifting the shade to any desired inclination.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

William B. Nunn, Edmonton, Ky.—This invention consists in means for securing the churn barrel in place. The upper end of the dasher shaft revolves in a socket in the cross bar, the ends of which enter mortises in the side cross bars of the frame. The cross bar is held down upon the end of the dasher shaft by a wedge inserted in the wide mortise above the end of the cross bar.

IMPROVED HAY ELEVATOR.

Michael M. Shellabarger, Hamilton, Mo.—When the block from which the fork is suspended rises near to the beam, it strikes the dropping roller frame and lifts the rollers out of a check to allow the carriage to be drawn along to the place of discharging by the hoisting rope. At the same time, the frame closes the retaining

jaws under the hoisting block, and holds it from falling until it drops into the check again. There is also a contrivance of a return cord for drawing the carriage back, so that its connection with the carriage is by a grip of the hoisting block with the check frame when the block comes up to it. This connection ceases when the block drops, leaving the return cord free to run back as long as the hoisting cord does, and the horse moves back, by which the slack of the return cord is avoided.

IMPROVED HAY ELEVATOR.

Hector Toofs and Clinton Toofs, Jefferson, Ind.—This consists of a claw lever arranged with the carriage from which the hoisting fork descends, and with the hoisting ropes. There is a stop piece against which said hook lever strikes when the carriage runs out to the place of taking the load, so that it hooks under the head of and engages the hoisting fork, to hold it while running in the barn with the load and out again, and disengages it at the moment the truck comes out to the hoisting place.

IMPROVED CORN HULLER.

George Washington Richmond, Springfield, Ill.—This relates to improvements in corn-hulling machinery for producing hominy, and constructed in such a manner that the corn is fed continuously at the top and discharged in hulled state at the bottom. The shaft with the rasp-cut hullers is revolved with great rapidity without being liable to breakage or injuring the machine.

IMPROVED GRAIN BAG.

Arthur McKenna, New York city.—This grain bag may be readily filled and securely closed without sewing up the mouth. It has stitched corners or shoulders and an interior mouth-closing flap, and an exterior overlapping flap that is retained by a suitable fastening device.

IMPROVED WHEEL CULTIVATOR.

Hazen H. Perkins, Osceola, Ill.—This is an improved riding cultivator, which includes a large amount of new and ingenious mechanism, so arranged that the plows may be readily guided and controlled, when at work, by the driver with his feet, and may be supported above the ground when passing from place to place.

IMPROVED BAR FOR PLOW SHARES.

Isaac N. Pyle, Decatur, Ill.—This invention consists in iron and steel bars, as a new article of manufacture, rolled flat upon one side, with a wide bevel to an edge along the forward edge of the bar, and a narrow bevel not to an edge along the rear edge of the bar.

IMPROVED HORSE POTATO FORK.

George C. Clark, Freehold, N. Y.—The rake head is made in two parts, which are bolted together, and in the adjacent faces are formed notches to receive teeth, which are thus clamped between the parts of the said head. The teeth are bent in opposite directions, to keep them from longitudinal movement, and to give them somewhat the shape of a scoop shovel, bringing them into better position for doing their work.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE HUB.

Antonius Van Geel, Rahway, N. J.—When the spokes are driven into the socket ring, wedge rings spread the spoke ends, and produce the rigid socketting of the same, the spokes being firmly held against side motion by metallic binding strips. Slits in the spoke ends admit the ready spreading of the same, and their elastic seating in the hub.

IMPROVED CARRIAGE SPRING FASTENER.

Franklin Miller, Indianapolis, Ind.—This invention consists of a seat block or plate and a cap plate of peculiar construction, for mounting and securing the springs of carriages on the axles. The novelty consists in the combination of the cap plate, having bolt hole projections, with the plate or seat block having similar bolt hole projections, the said projections of both plates being extended beyond the faces, to prevent lateral movement of the springs.

IMPROVED WAGON BODY AND FRAME.

Isaac G. Sallee, Montgomery, Ky.—This is so constructed that the body may be detached without affecting the frame, so that the wagon may be used with a frame or a body, as may be desired.

IMPROVED HARNESS.

Charles H. Corey, San José, Cal.—These are improved winker stays of rubber, for harness, which are so constructed that they will not become limp and lose their shape from use or wet.

IMPROVED SASH PULLEY.

Arthur R. Watterson, San Francisco, Cal.—This invention consists in securing the shaft of a sash pulley by fins formed thereon, and fitting in corresponding elongated slots of the pulley and of one of the side plates.

IMPROVED CARRIAGE THRILL.

Nelson Mitchell, Ellsworth Falls, Me.—In order to improve the construction of carriage thrills, so as to prevent them from being broken should the horse accidentally step upon them. This inventor proposes to provide them with a rubber forward end.

IMPROVED ROPE TRACE.

Peter Hayden, New York city.—This is an improved device for connecting the end of an ordinary rope trace with the hame and the whiffletree. It consists in a tapering ferrule, having a screw hole through its base, and a tapering eye screw, in combination with each other, to receive and hold the end.

IMPROVED SHEET METAL ROOF.

Charles A. Smith, Hanoverton, O., assignor to himself, Nathan A. Halderman, and Charles Chandler, of same place.—This sheet metal roof may be laid in a perfectly weatherproof manner, without the use of nails, screws, or rivets passing through the roof plates. Lap joints with interlocking anchor caps are placed immediately, and folded to extend over the adjoining flanges of the sheets.

IMPROVED BARN DOOR FASTENING.

Perry A. Peer, Comstock, Mich.—This consists of a strong hook of cast iron, with a beveled nose to the hook end, having considerable breadth of surface, for sustaining the shocks and wear of a heavy barn door. Said hook is pivoted in a strong base, adapted to be attached to the side of a barn, and support the hook outside of the battens of the siding, so that when the door swings open it will strike the nose of the hook and swing it back, pass the hook nose, and strike a strong arm projecting beyond the pivot. The hook is thus swung so as to engage and secure the door.

IMPROVED WINDOW SHADE FIXTURE.

Charles De Quillfeldt, New York city.—A metallic cap is attached to the end of the roller, and has a hollow axial drum, on which the cord for rolling up the curtain winds. A metal disk for carrying centrifugal pawls is clamped against the end of the hub. The pawls are fitted on pivot studs, which are so located that, when the disk swing out to lock the roller, the toes touch the hub of the disk and hold them in the position for locking. These studs are cast together with the plate. A notch in a cam disk receives the

pawls and locks the roller when the motion is quick enough to throw them out into it by centrifugal force. Said notch is so located that the pawls are kept out of it by gravity when the motion is slow enough for the gravity to exceed the centrifugal force. The parts are all simple, and they are so contrived that but little labor is required in fitting them to the roller.

NEW TEXTILE MACHINERY.

IMPROVED METHOD OF MAKING ENDLESS WOVEN FABRICS.

David Bailey, Dresden, Ohio.—This invention is an improvement in the manufacture of endless cloths, such as are known as felts for paper makers' and others' use. The cloths or felts are woven in different layers, with folds on the opposite sides of the loom, formed by working the filling or weft in the different layers passing around the fabric in regular order, through the layers one after the other, and thus producing the endless fabric. The felts can be made in any desired length and width, and of the different qualities required by paper makers.

NEW HOUSEHOLD ARTICLES.

IMPROVED WASH BASIN VALVE TRAP.

William W. Hurd, New York city.—This consists of a trap formed of a casting made with an open side, so formed as to fit against the side of a wash basin, and with an opening in its bottom, closed with a valve. The object is to prevent escape of sewer gas.

IMPROVED ROASTING PAN.

John G. Peace and John S. Wingfield, Salem, Mo.—This consists of a drip pan with a closed top, for inclosing the article to be roasted, and having a water pan in the bottom, below a perforated support for the roast. The water pan is so arranged that it can be drawn out at any time for filling without disturbing the roast, the object being to maintain an atmosphere of steam surrounding the roast, to protect it from burning by too much heat.

IMPROVED IRONING BOARD.

Eli O. Catt and Henry H. Harrod, Red Oak, Iowa.—This invention consists of a board with a spring at one end, suitable for straining the neck and shoulders of a shirt against, and a roller at the other end pressed against it by springs. This is contrived to pinch the body of the shirt against the end of the board, and strain the bosom tightly over the board, so as to draw it smooth and hold it with elastic tension for ironing it.

IMPROVED GARBAGE BOX.

Benjamin Burling, Whitehall, N. Y.—This box is formed of a case provided with two drawers, and with a dome inclosing a perforated part of its top. The dome has an upper orifice, closed with a screw cap. A disinfectant is put through the dome aperture, and the dome is covered with a cap to more thoroughly confine the disinfectant and prevent it from escaping into the air.

IMPROVED ASH-SIFTING SHOVEL.

Edward B. Neal, Wiscasset, Me.—This is an improved shovel for sifting the ashes of furnaces, and cooking and other stoves, without the annoying and penetrating dust that is raised by the common ash sifters. It has wire tines and side guards applied to a fastening head and handles.

IMPROVED SHUTTER.

Gustav Hampe and Adolf Schallert, St. Louis, Mo.—This consists of a shutter made in sections, that slide in guides of the window casing, and form a covered panel in front of the window sill. The window may readily be closed in part, or throughout, by raising one, two, or all the sections, as desired. When the shutter is entirely opened the sections are entirely stored away back of the innermost or panel shutter, at the lower part of the window in a convenient manner.

IMPROVED SPRING BED BOTTOM.

Joseph Eckart, New York city, assignor to Louisa Eckart, of the same place.—Angle straps are attached to the base slats of a spring bed bottom, to adapt it to receive a detachable cover, the straps having knobs which enter eyelet holes in the latter. The cover is designed to prevent the mattress from being worn by the springs, and when worn or soiled it may be detached and mended, or replaced.

IMPROVED DRUM ATTACHMENT TO HEATING STOVES.

Richard L. Ball, Terre Haute, Ind.—This consists in a flange about the fire chamber, connected with tubes that pass through a top drum, and provided with a register. Inside of the drum is a cylinder which, when closed, throws the heat into the surface of the drum so as to prevent the direct escape of the same through the hood and pipe.

IMPROVED STOVE PIPE SUPPORTER.

James L. Loring, Dallas Center, Iowa, assignor to himself, Fortunatus Hubbard, and Judson Purinton, of the same place.—This is an improved stovepipe supporter, by which stovepipes may be readily suspended from the ceiling or supported on the walls. It consists of a stovepipe encircling ring that is applied to a recessed block having a fixed wire rod with threaded edge.

IMPROVED WASHING MACHINE.

John M. Gano, Newport, O.—This consists in an outer washtub, a lateral clothes box, and a step-shaped perforated plunger combined. The machine works in the nature of a pump, and draws the water continually through the clothes, which are squeezed at each down stroke so as to expose them to the influence of the water drawn in by the next up stroke, and so on until the clothes are entirely cleaned.

IMPROVED DESK.

Henry M. Elbreg, Greenfield, Ind.—This writing desk consists of a case having hinged doors, revolving cylindrical racks, stationary pigeon holes, and a pivoted table, together with suitable apparatus for supporting the same.

IMPROVED CURTAIN CORD FIXTURE.

Horace Resley, Cumberland, Md.—This invention relates to means whereby a curtain roll cord may be regulated and adjusted to hold the curtain at different elevations, in a quick, easy, and effective manner. It consists in passing the cord around a pulley or grooved cap on the upper end of a side-notched rod, bar, or plate, which has a stop or handle at bottom and slides in an obliquely arranged keeper whenever turned slightly out of its perpendicular position.

IMPROVED BAKE PAN.

John Gilbert, Newark, N. J.—This pan has straight sides and ends and scalloped corners. It is struck up out of sheet metal at one operation, and may thus be made more readily and at less expense than when made in the old way.

IMPROVED DOOR AND WINDOW FASTENER.

John H. Daniels, New York city.—This is composed of a wedge between a bottom and top plate, the latter being jointed to the former near the apex of the angle, so that, by removing the wedge from between the plates, the top one will drop and free the door to let it close or open. The bottom plate has a stud for pressing into the floor to prevent it from sliding.

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. R. H. Allen & Co., N. Y.

For Bolt Forging Machines and Power Hammers, address S. C. Forsyth & Co., Manchester, N. H.

Best Belt-Pulleys—A. B. Cook & Co., Erie, Pa.

Wanted—A good Feather Renovator. Address—giving price—Thompson & Co., 34 Wood St., Pittsburgh, Pa.

Steam Engines—25 per cent. extra power, or an equal saving in fuel guaranteed, by applying the R. S. Condenser. T. Sault, Const'g Eng'r, Gen. Agt., New Haven, Ct.

Centennial Exhibition, Philadelphia.—Examine the Allen Governors, Machinery Hall, D. 9, Par. 71.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Situation Wanted by a practical Rubber Manufacturer; understands using Old Rubber, and can get up goods at low cost. H. A. R., Boston, Mass.

Horse Nail Machines—Wanted correspondence with Manufacturers of Horse Nail Machines, for purpose of purchasing. J. W. Britton, 18th Ward, Cleveland, O.

400 new and 2nd hand Machine Tools, Wood Working Machines, Pumps, Water Wheels, Engines, Boilers, &c., for Sale. See first column, page 397.

Wanted—Shafting lathe, 2d hand. Address, Ohio, Box 773, N. Y. P. O., with price.

For Sale—35 in. 16½ ft. Lathe, \$400; 22½ in. 22 ft. do., \$250; 20 in. 7 ft. do., \$125; 15½ in. 6½ ft. do. and chuck, \$125; 9 ft. Planer, \$300; 12 in. Slotter, \$300; Profiling Machine, 2 spindles, \$250. Shearman, 45 Cortlandt St., N. Y.

Rubber Hydrant Hose, Hose Pipes and Couplings, best quality. Send for Prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Wanted—Situation as Supt. or Foreman of Machine Works or Shop, by Machinist of 22 years' experience. Address Machinist, P. O. Box 383, Chicago, Mass.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hall & Heiden Co., Danbury, Ct.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 48 North Third St., Philadelphia, Pa.

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

Johnson's Universal Lathe Chuck—Awarded the highest Premium by the Franklin Institute of Phila., for "Durability, Firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

Artesian Wells—Contractors for Boring will address John Y. Gill, Mayor of Fayetteville, Tenn.

Parties desiring an American (posted on Engines) as Chief Engineer, address A. M. C. E., Lawrence, Mass.

400 new and 2nd hand Machine Tools, Wood Working Machines, Pumps, Water Wheels, Engines, Boilers, &c., for Sale. See first column, page 397.

Safety and Economy—Eclipse Sectional Steam Boiler. First Class references. Lambertville Iron Works, Lambertville, N. J.

Woman's Shoes—Patent for Sale, either whole or State Rights. Address C. Steckel, 199 Allen St., N. Y.

Engine Builders and Mill Furnishers, send Circulars or Card to Benson Brothers, Centralia, Ill.

For Sale—24 in. x24 ft. Lathe, with Chuck; two 13 in. Lathes; one 7 ft. x24 in. Planer; two 8 in. Shapers. E. P. Bullard, 48 Beekman St., New York.

The Photo-Engraving Co. have been obliged to remove from 62 Cortlandt St. to a larger building at 67 Park Place. Their Relief Plates for Newspaper, Book, and Catalogue Illustrations are rapidly taking the place of Wood Cuts and are unsurpassed. See advertisement in another column of this paper.

For the best Patent Self-Opening Gates for Carriages, in any Style of Wood or Iron, address Cottom & Co., Dayton, Ohio.

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.

400 new and 2nd hand Machine Tools, Wood Working Machines, Pumps, Water Wheels, Engines, Boilers, &c., for Sale. See first column, page 397.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to ½ horse power. Agents wanted. Address with stamp, 1,113 Chestnut St., Philadelphia, Pa.

The French Files of Linet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 21 Platt St., New York.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information address Munn & Co., 37 Park Row, New York City.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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.

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

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality.—Whitinsville Spinning Ring Co., Whitinsville, Mass.

Rotary Fire or Supply Pumps, belted, two styles built—One, plain, \$125; the other, with water gage, safety valve, and air chamber, \$175. Capacity, 10 to 500 gals. per minute. M'f'rs, S. C. Forsyth & Co., Manchester, N. H.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

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

Temples and Oileans. Draper, Hopedale, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

Notes & Queries

R. G. S. will find directions for turning cast iron on p. 364, vol. 31.—W. H. S. is informed that we cannot recommend an incrustation preventive unless we know the nature of the impurities in the water.—M. will find a description of dynamite on p. 212, vol. 33.—C. H. M. will find full directions for making rubber stamps on p. 156, vol. 31.—W. C. E. can ascertain the amount of moisture in the air by using an hygrometer. See p. 116, vol. 33.—W. S. will find directions for ebullizing wood on p. 50, vol. 33.—F. C. will find directions for making baking powders on p. 123, vol. 31.—J. A. will find a recipe for black paint, suitable for iron smoke stacks, on p. 379, vol. 31.—J. E. C. will find directions for tinning iron castings on p. 362, vol. 31.—J. C. K. will find directions for transferring prints on p. 138, vol. 30.—G. R. W. can calculate the power of his steam engine by the formula and table given on p. 33, vol. 31. For formula for safety valves, see p. 107, vol. 31.—J. J. B. will find on p. 157, vol. 32, directions for making battery carbons. The amalgamation of zincs is described on p. 27, vol. 30.—G. R. will find a formula for safety valves on p. 330, vol. 32.—J. H. Z. should use aquarium cement for making his fish tank. See p. 80, vol. 31. This also answers W. H. —A. A. H. will find directions for gilding picture frames on p. 347, vol. 31.—G. W. B. can prepare soluble glass for painting outdoor work by following the directions on p. 315, vol. 31.—C. M. B. will find directions for making a phosphorus lamp on p. 10, vol. 27.—J. P. A. will find directions for casehardening malleable iron on p. 69, vol. 31.—J. H. will find directions for making paste blacking on p. 139, vol. 31.—F. L. can galvanize his shingle nails by following the directions on p. 346, vol. 31.—F. L. W. will find on p. 251, vol. 29, directions for waterproofing textile fabrics.—W. H. S. will find on p. 58, vol. 24, directions for making plaster molds.—J. C. M. should use marine glue to cement leather to pasteboard. See p. 42, vol. 32.—G. M. B. will find an answer to his query as to a motionless point on the circumference of a vehicle wheel in motion on p. 298, vol. 31.—W. H. P. should use coal tar from gas works for his concrete walks. See p. 185, vol. 33.

(1) F. B. L. says: How can I make automatic apparatus to regulate the heat in the incubator of which you speak in a recent issue? I use a lamp for heating, with a water radiator. A. Arrange a metal tube, which by its expansion and contraction will act upon the pinion of the lamp, raising or depressing its wick so as to increase or diminish the heat within the desired range. Some of the automatic dampers to heating apparatus are constructed on a similar principle; but they act upon the supply of air and not upon the supply of fuel, as this would in this case.

(2) G. I. J. says: 1. Please give me a recipe for cleaning smoky walls and ceilings. A. Wash with water and sponge, and scrape the walls, etc., with a dull-edged scraping knife, carefully, in such a manner as not to break the surface; then apply a coat of sizing consisting of hot water into which sufficient glue has been dissolved to thicken it; when this is dry, apply two coats of whitening with a soft brush, the second after the first is dry. 2. What is a good substitute for whitewash for indoor use? A. Use kalsomine. See p. 337, vol. 34.

(3) H. H. F. says: In your issue of April 29, you publish an engraving of a gravel and charcoal filter. How many gallons of ordinary river water would such an apparatus filter per hour? A. This question can probably best be answered by our first correspondent, who furnished us with the sketch of the filter referred to. If he has the filter in operation, he will be able to determine this point by actual experiment. Will he do so, and give us all the data and results of the test?

(4) F. S. S. asks: Is there such a carpenter's tool as a saw gage, consisting of a narrow thin strip of iron or steel running along the length of the hand saw, each end turning edgewise? The gage strip should be raised or lowered to suit the depth to which the saw is required to cut. A. Yes; there are such appliances already in use.

(5) D. C. P. and many others.—Rubber belts are, we think, in most cases superior to leather ones; the point, however, is a disputed one.

(6) R. N. Y. asks: Is there any kind of cement that can be used for closing up small cracks in a floor, that cannot be swept out, which, when water is put on the floor, will not get soft? A. If your floor is of wood, a cement of white lead and asphalt might answer the purpose; if of stone or like material, take Portland cement of the best manufacture.

(7) E. L. says: Water sometimes collects in my cellar to the depth of 2 or 3 feet, and remains there for several weeks. The ground around the house is so level that there is no chance of draining by ditching; neither will the water run away from the house if pumped out of the cellar. What can I do to prevent the trouble? Shall I dig up the bottom of the cellar when it gets dry, about 3 or 4 inches deep, and then pound in small stones and cover over with water lime, and plaster the sides of the wall with the same? Do you think the water will press up the bottom and come into the cellar after such treatment? A. If your water lime is a good cement, it may succeed. Mix small stones, gravel, and sand together, and sufficient cement and water to bind it well into a

solid mass when dry; lay this over the bottom of the cellar to 3 or more inches deep, and plaster a coat of the cement and sand over the top of this layer and upon the side walls about 1 inch deep.

(8) J. M. H. asks: Is there not an error in Professor Young's lecture, published on p. 245, vol. 34, where the Professor speaks of a pendulum vibrating in a mine 500 feet below the surface? A. Professor Young's statement is perfectly correct, depending on the curious theorem, first proved by Newton, that a body in a hollow spherical shell is attracted equally in all directions, no matter where the body is placed. Thus a body at



A, B, or C would be in perfect equilibrium, if the shell be of equal density. Therefore, if the earth were a sphere of equal density, "a pendulum carried to the depth of 500 feet would vibrate as though it were on the surface of a sphere, having a radius 500 feet shorter than that of the earth."

(9) C. A. B. asks: 1. What is the best material for a horse stable floor? I want something which will not absorb moisture. A. Brick set in cement makes a very good floor for horse stables. 2. Is the material made from gas tar and called asphalt as good as asphalt taken from the earth? A. No.

(10) R. M. says: I want sometimes to keep the heat from my stove away from my boiler. Can I do this by putting a pipe between the stove and the boiler, with a damper accessible from the outside? A. Run a coil of iron pipe around the inside of your stove near the top, and connect one end of it with the bottom of the boiler and the other end with the top. Also, a little way from the side of the boiler provide an upright pipe connecting with the said upper and lower branches. Place a cock on each branch near the boiler and one on the upright pipe; by means of these cocks you can make the hot water circulate through the boiler or through the upright pipe in place of the boiler; in the latter case the upright pipe must extend above the upper branch and be open at the end to discharge steam. The boiler is supposed to be an open one.

(11) C. C. W. asks: 1. If a bell weighing 1 lb. were made into a flat piece, of the same thickness as before, would it not make the same sound as in the former shape? A. No. 2. Why? A. Because the bell does not vibrate as a whole, but with a reciprocal movement of the opposite sides.

(12) J. T. asks: You recently published a recipe for making a cement to mend glass and other articles, with chrome cement, made of a solution of acid chromate of lime. Please give directions for making the solution. A. The acid or bichromate of lime is obtained as a by-product in the manufacture of bichromate of potassa. The chrome ore is decomposed by roasting it, in a fine powder, intimately mixed with chalk. The roasted mass is then ground with water, and sulphuric acid added till the liquid has an acid reaction, in which case the bichromate of lime is formed and remains in solution. The salt is purified by crystallization.

(13) A. B. asks: Is there a process by which India rubber can be deodorized? A. We do not know of any.

(14) J. H. C. says: You state that, by the addition of soap, when brandy, spirit of wine, or alcohol is distilled, it loses its empyreumatic odor and taste. A friend says that you cannot get up a heat higher than 212° Fah., without confining the steam, that alcohol boils at 178° Fah., that all the alcohol would pass over at 180°, that all the water would pass over in vapor at 212°, and that the temperature could not be raised to 215° without confining the steam, and that there would not be any wood spirit in brandy, spirit of wine, or alcohol to pass over. Please explain. A. The alcohol distills over at a temperature of 173° Fah.; and when the distillation is complete, by simply raising the temperature to 215°, the volatile or empyreumatic oils that have been retained by the soap are expelled, and it is thus revived for subsequent use.

(15) P. J. M. asks: What can be put into printers' ink to make it dry quickly? A. Use a quantity of good litharge.

(16) F. C. W. asks: How can I petrify dry white pine wood? A. Subject the wood for some time to a high steam pressure for several hours, and then introduce a strong aqueous solution of chloride of calcium, and continue the pressure for some time longer; finally place in a large vessel, and cover with a strong solution of water glass (silicate of soda), made by boiling the silicate in water.

(17) W. B. S. says: I find that, in your issue of January 16, 1875, you say that oil in which steel is repeatedly hardened will not lose its hardening property. J. E. E., of Pa., says it will. On which side is the weight of experience? A. The oil does not lose any of its original qualities if kept at a standard specific gravity, and free from impurities.

(18) C. G. W. asks: To what percentage is ordinarily pure air vitiated by being breathed once? A. The air which has passed through the lungs in the ordinary process of respiration is by no means deprived of its oxygen; it usually con-

tains about 4 per cent only of carbonic acid. The greater portion of the air which is expelled during expiration has not proceeded further than the larger ramifications of the bronchia.

(19) J. E. R. asks: Can lard be adulterated with sulphate of zinc? I hear that this can be done, and that the poisonous effect can be removed, and that the lard will then hold 20 or 25 per cent of water. A. This method of adulteration is somewhat unusual. If you suspect any sample of lard of having been treated in this manner, send it to us, and we will be happy to examine it for you.

(20) C. T. McM. says: 1. I see in your answers in "Notes and Queries" the dimensions of engines given as 2 x 10, 10 x 24, etc., the stroke being from two to five times the bore. Could you not get the most power for the least steam by having the bore as large as, if not a little larger than, the stroke? A. No. 2. How much power would an engine, 3 inches stroke x 4 bore, have, and where should it cut off to work most economically? A. The question is too indefinite to admit of a specific answer. 3. How large a boiler would such an engine need? A. Make it 2 feet in diameter and 3½ feet high.

(21) J. L. R. says: We have a steam cylinder that has been cracked by fire just behind the rim which holds the head on. The crack extends half way round the cylinder. Now could it be closed by rods extending through both heads, thus drawing both heads together? A. Put a sleeve over the cylinder, and drive a rust joint.

(22) J. F. asks: How can I make a varnish that will stick to wood, resist the action of brine, dry quickly, and be durable and incapable of imparting a flavor to anything that may come in contact with it? A. Try the following: Melt together in an iron vessel equal parts of common pitch and gutta percha. This may be employed hot or kept liquid under water.

(23) T. C. Jr. asks: How much more water will a pipe 2 inches in diameter run in an hour than a 1 inch pipe? A. A 2 inch pipe has 4 times the cross section of a 1 inch pipe, and a proportionate delivery, other circumstances being similar.

(24) D. K. says: In reply to P. M. H. A. K., who asked how many horse power it will take to run a 60 inch circular saw through a 2 feet log of hemlock or oak, your answer was "ordinarily about 20 horse power to every 1 inch of saw." We have a mill in which the saw runs two revolutions while the engine runs one. Will it not require more power to run this saw with a specified amount of feed than it would to run one connected directly on to the shaft of the engine? A. Yes. —J. E. E., of Pa.

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

J. W. F.—No. 1 is red hematite. No. 2 is oxide of iron.—C. B. N.—It is finely divided silicate of alumina. It is not injurious to the boiler.—H. A. B.—The china cement consists of pure (bleached) shellac; but it probably contains some resin.—H. M. H.—We should be happy to see a specimen of the tin ore mentioned.—S.—Send us a sample of the white stamping powder in question.—O. A.—Your statement is remarkable, but we cannot identify the plant from your description.—A. H. R. & H. L.—It contains sulphide of antimony, sulphur, nitrate of strontium, nitrate of potash, and gunpowder. The pyrotechnic recipes given on p. 235, vol. 32, are standard representations.

R. F. J. says: I have in my possession a hard boiled egg which is all white, without a particle of yolk in it. When I had half shelled it, noticing the peculiar odor, I cut it and found it of a uniform very light yellow throughout. Can any one explain this?—A. H. H. asks: How can I make red, blue, purple, and black ink, for printing with rubber stamps? How can I make indelible ink for the same purpose?

COMMUNICATIONS RECEIVED.

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

On Railroad Fares to Philadelphia. By F. C.
On the Time Lost by the Stars. By J. H.
On the Extraction of Gold. By J. T.

Also inquiries and answers from the following:

J. W. H.—O. W.—J. A. H.—H. M. W.—J. R.—J. L. H.—J. A. K. E.—M. E. E. R.—R. T. S.—G. U. D.—J. J.—A. G. H.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes machines for spinning curled horsehair? Who sells hand punches and shears suitable for cutting out plowshares and moldboards? Who sells machinery for preparing ramie fiber? Who makes machines for molding stearin candles? Who sells manganese?" 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.

May 16, 1876.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the 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, F. H. Sale	177,569
Alarm, burglar, C. H. Pierce	177,568
Alarm signal, audible, N. J. Holmes	177,567
Alloy, anti-oxidation, O. Holden	177,566
Anchor, F. Francis	177,565
Aspersorium, J. J. Dunn	177,564
Auger handle, J. Magers	177,563
Bag holder, A. J. Mosher	177,562
Balance wheel, F. W. Wild (r)	177,561
Bale tie, J. M. Goldsmith	177,560
Barrel headings, cutting, V. Groom	177,559
Bed lounge, F. Braun	177,558
Bed, adjustable bolster, J. Hoffmann	177,557
Blinder, temporary, R. O. Pierce	177,556
Blotter, rotary, S. Wales	177,555
Boiler, wash and feed, Alden & Irvin	177,554
Boiler, water tube, A. Sedgwick	177,553
Boilers, fire box for, A. Bauer	177,552
Bookcase, revolving, J. Danner	177,551
Book cover protector, G. W. Holden	177,550
Books, manufacture of, G. H. Reynolds	177,549
Boot heel stiffeners, forming, J. Kieffer	177,548
Boot-pegging machine, C. A. Carman	177,547
Boot soles, etc., moulding, S. Ross	177,546
Bouquet holder, J. Whitford	177,545
Box, dumping, J. W. Hlatt	177,544
Box, packing, J. E. Tarbox	177,543
Boxes, facilitating the delivery of, G. H. Perkins	177,542
Bracket, H. Schler	177,541
Bridge, ponton, D. Klein (r)	177,540
Bridge, safety, L. B. Frazer	177,539
Broiler, F. O. Badger	177,538
Buckle, minor & Granniss	177,537
Buckle, tag, H. C. Ward	177,536
Building, fireproof, L. Hornblower	177,535
Burning, gas, J. M. Clark	177,534
Burning sawdust, etc., R. Hodson	177,533
Bush-cutting implement, O. Pickering	177,532
Butter package, Van Skelline et al.	177,531
Button fastening, A. Morehouse	177,530
Button loop, S. Wales	177,529
Can, T. J. M. Jewell	177,528
Can, oil, G. R. McCrum	177,527
Can faucet and funnel, oil, F. Ochs	177,526
Car coupling, A. Wilson	177,525
Car doors, etc., fastening for, W. F. Beasley	177,524
Car, sledging, E. Blochman	177,523
Car starter, H. Schreiner	177,522
Car starter, A. Whittemore	177,521
Cars, safety device for freight, J. Davenport	177,520
Card clothing, utilizing leather of, F. E. Brummit	177,519
Carpet, W. Wallace (r)	177,518
Chair, tilting, P. Nilson	177,517
Chairs, coupling for, J. Peard	177,516
Chest, meal, E. G. Burgett	177,515
Churn, J. Christie	177,514
Churn, T. Simmons	177,513
Cigar holder, B. L. Blackford	177,512
Cigar-packing machine, S. & A. Woodard	177,511
Clamp, picture frame, A. Wieting	177,510
Clock case, S. H. Penley	177,509
Clock key, F. Hoelle	177,508
Cloth crusher, J. M. Crockett	177,507
Cloth-napping machine, M. H. Whitcomb	177,506
Clothes pounder, Prindle & Winsor	177,505
Coffee roasting, J. B. Underwood	177,504
Compressing granulated substances, J. Wanka	177,503
Cooler, milk, W. H. Johnson (r)	177,502
Cooler, water, C. B. Hutchins	177,501
Cork fastener for bottles, E. D. Weatherbee	177,500
Cultivator, G. Barcafar	177,499
Cutter body, J. Shire	177,498
Derrick, portable, S. Y. Reams	177,497
Desk, school, D. I. Stagg	177,496
Dice box, S. Thorne	177,495
Digger, potato, C. Harris	177,494
Digger, potato, Hobson & Beymer	177,493
Door securer, H. W. Ross	177,492
Doors, observation tube for, S. A. Smith	177,491
Drill for sowing and planting, C. De Fever	177,490
Dyeing yarn in skeins, W. McAllister	177,489
Effervescent liquids, drawing, T. Walker (r)	177,488
Egg beater, F. J. Seymour	177,487
Elevator, hay, L. W. & W. G. Miller	177,486
Engine governor, steam, J. Knowlson	177,485
Engine, steam, N. P. Stevens	177,484
Engine governor for air pump, G. H. Corlies	177,483
Equalizer, draft, A. E. Manchester	177,482
Fabrics, separating wool from, J. Wilkins	177,481
Fare register, Blackburn & Woodside (r)	177,480
Fare register and indicator, Korff & Atwell	177,479
Fashion chart, M. Landenberger, Jr.	177,478
Faucet, J. O. Waddell	177,477
Faucet, measuring, A. S. Libby	177,476
Fence-building machine, T. J. Tally	177,475
Fence post, A. Falor	177,474
Fence post, H. N. Houghton	177,473
Fence post, G. W. Leonard	177,472
Fire apparatus, Gérard & Turnbull	177,471
Fire screen, J. A. Pomeroy	177,470
Fishing rod reel, C. L. Noe	177,469
Fork and rake, E. L. Gebhardt	177,468
Fork, carrying, A. H. North	177,467
Furnace and boiler setting, T. R. Butman	177,466
Furnace, steel heating, W. Swindell	177,465
Furnaces, etc., heating air for boiler, H. Swindell	177,464
Furnace hydrocarbon injector, M. Boynton	177,463
Galley, congress, C. D. Bigelow	177,462
Gas and other pipes, A. Strecker	177,461
Gas, washing and absorbing, E. Solvay	177,460
Gas lighting, electric, A. L. Bogart	177,459
Gate, automatic, S. R. Emery	177,458
Gate, farm, E. Young	177,457
Glass mold, P. Blankinship	177,456
Glassware, forming joints in, D. C. Hipley	177,455
Glove fastening, F. G. Farnham	177,454
Glue, compound for, J. H. Craig	177,453
Grain header, Myers & Irwin	177,452
Grate, fire place, T. Brown	177,451
Hammer, E. A. Ely	177,450
Harness attachment, A. E. Rudolph	177,449
Harrow-seeding attachment, W. J. Covington	177,448

Harvester, J. J. Dewey	177,490
Hats, attaching sweat bands to, N. A. Baldwin	177,489
Hay cutter, E. Tremblay	177,488
Hay tedder, S. Perry	177,487
Heater, Boyd & Bridge	177,486
Hoe, wheel, C. H. Finson	177,485
Hoisting and conveying, F. Scholes	177,484
Hoop fastener, H. S. Smith	177,483
Horse collar, W. D. Gibbs	177,482
Horseshoes, making, H. H. Gilmore	177,481
Horseshoes, bending, W. Hay	177,480
Hose nozzle, Curtis et al.	177,479
Hose reel, J. F. Bartlett	177,478
Hydrant, J. Pennycook	177,477
Hydraulic lift, J. Canan	177,476
Ironing machine, Mackey et al.	177,475
Jack, wagon, E. S. Hollister	177,474
Japanning, shell imitation, A. J. Harris	177,473
Knife-securer machine, Hall & Lasher	177,472
Knitting machines, operating, I. & A. Tompkins	177,471
Lamp, S. S. Newton	177,470
Lamp, D. L. Westcott	177,469
Lamp wick trimmer, C. J. Nugent	177,468
Lantern, R. W. Proctor	177,467
Lathe, J. F. Crawford	177,466
Leather, stuffing and furling, J. A. J. Schultz	177,465
Letter box, F. Iersche	177,464
Locomotive, W. Mason	177,463
Loom, G. Crompton	177,462
Loom let-off motion, B. W. Nichols	177,461
Loom picker check, S. Greenwood	177,460
Loom temple bar, N. Chapman	177,459
Lubricating compound, T. H. La Roche	177,458
Mallet, A. Holbrook	177,457
Measure, liquid, T. Scantlin	177,456
Meat extract, C. Mensman	177,455
Meat hook, B. F. Clark	177,454
Millstones, proof staff for, J. Mills	177,453
Molder's task, T. F. Hammer	177,452
Molding machine, H. S. Smith	177,451
Mop, J. W. Cuthbertson	177,450
Mortising and tenoning, P. M. Andriot	177,449
Motor, electro-magnetic, A. Shedlock	177,448
Netting, spreading, P. C. Ritchie	177,447
Nozzle, hydraulic, H. C. Perkins	177,446
Nut lock, J. Curran	177,445
Nut lock, S. Henry	177,444
Nut lock, J. Nelson	177,443
Nut lock, A. Walton	177,442
Oil, paraffin from, J. B. Merriam	177,441
Organ attachment, reed, M. J. Matthews	177,440
Organ, reed, M. J. Matthews	177,439
Ovens, illuminating bakers', Meler & Denker	177,438
Paddle wheel, Brast & Boger	177,437
Painter's scaffold chair, J. R. Crockett	177,436
Paper dish, D. N. Russell	177,435
Paper dish, D. N. Russell	177,434
Passenger register, W. Mehan	177,433
Pencil case, slate, W. E. Thomas	177,432
Pipes, gas and other, A. Strecker	177,431
Planter, corn, G. W. Brown	177,430
Planter, distributor, M. O. Beatty	177,429
Planter, seed, C. H. Cronk	177,428
Planter check row device, W. W. Dunn	177,427
Plow, Cassidy, Lamb & Vaughan	177,426
Plow, Gossett & Stark	177,425
Plow, D. H. Jarrard	177,424
Plow, wheel, W. A. Buddick	177,423
Post driver, Wilkinson & Calnan	177,422
Press, baling, J. H. Page	177,421
Press, cotton, J. H. Snyder	177,420
Pruning implement, P. P. Flournoy	177,419
Pump, G. R. McCrum	177,418
Pump and blower, rotary, G. Shone	177,417
Pump, force, D. Johnson	177,416
Pumps, adjustable eccentric for, B. F. Spry	177,415
Punch, registering, J. B. Frost	177,414
Railway gate, Ball & Brewer	177,413
Railway signal, I. Robbins	177,412
Railway turn-out, street, A. Whittemore	177,411
Ranges, etc., bearing bar for, N. M. Simonds	177,410
Regulator, pressure, N. C. Locke (r)	177,409
Retorts, drawing, W. Foulls	177,408
Retorts, charging, W. Foulls	177,407
Rolling metals, H. Waters (r)	177,406
Rolling metal roll and conductor, S. C. Fox	177,405
Rolling pin, L. Blaul	177,404
Rolls, grooved, E. Richards	177,403
Roll coupling box, C. F. Johnson	177,402
Salve, I. W. and G. A. Emerton	177,401
Sand dryer, C. P. Dull	177,400
Sash fastener, G. Edwards	177,399
Sash fastener, J. S. Rodgrass	177,398
Sash holder, H. Powelson	177,397
Sawmill head block, Sonasson & Rice	177,396
Saw set, Itakin & Gregg	177,395
Saw sawge, C. Adams	177,394
Saw tooth, insertible, C. Adams	177,393
Saw tooth, insertible, H. Diaston	177,392
Scales, beam, J. J. Hopper	177,391
Scraper, B. Selph	177,390
Screw tap, S. W. Martin	177,389
Seat, school, J. Peard	177,388
Sewer cleaning device, S. Phillips	177,387
Sewing machine hemmer, H. C. Goodrich	177,386
Sewing machine trimmer, Bradford & Pelree	177,385
Sewing machine tuck creaser, H. C. Goodrich	177,384
Shackle, W. H. Leininger	177,383
Shaft coupling, universal, A. McDonald	177,382
Shaft, flexible, Fones & Baulieu	177,381
Sheep rack, D. P. Johnson	177,380
Sheet metal pipe joint, J. C. Stanton	177,379
Shoe fastening, P. Harris	177,378
Shutter fastener, J. E. Brooks	177,377
Siphon, mud, L. King	177,376
Skate, parlor, C. W. Saladee	177,375
Slate, W. J. Montgomery	177,374
Snow plow, A. L. Bausman (r)	177,373
Soap, making, A. J. Woodworth	177,372
Soapstone, etc., tool for sawing, P. H. Gafney	177,371
Spectacle case, J. Miser	177,370
Spokes, throating and finishing, W. Gallan	177,369
Springs, bending leaves of, W. M. Watson	177,368
Stable stalls, C. P. Thompson	177,367
Stair rod, W. T. Mersereau (r)	177,366
Stamp hand, J. K. Krieger	177,365
Steam trap, J. C. Getz	177,364
Stretch trap draw screw, J. A. Lowe (r)	177,363
Stereoscope and graphophone, J. Lee	177,362
Stone, making artificial, W. H. Smith	177,361
Stove, hydrocarbon, A. B. Hutchins	177,360
Stove pipe elbow blank machine, J. S. Lugg	177,359
Stove pipe elbow machine, J. S. Lugg	177,358
Stove platform, W. Westlake	177,357
Straw board, making, B. F. Field	177,356
Straw cutter, J. Dick Jr.	177,355
Straw cutter, J. Elliott	177,354
Syringe box, M. Mattson	177,353
Table and ironing board, J. B. Bohrer	177,352
Table, folding extension, J. F. Birchard (r)	177,351
Tank, oil, J. C. Chadwick	177,350

Telegraph wires, coupling for, S. M. Barbour	177,349
Theatrical apparatus, J. J. Stoddard	177,348
Ticket, Leavitt & Clark	177,347
Toy buzz, W. Conrad	177,346
Toy, detonating, G. B. Adams	177,345
Trace fastener, Quinlan & Peers	177,344
Transplanter, R. M. Widney	177,343
Trap, moth, J. R. Stephens	177,342
Truss, T. M. Merck	177,341
Umbrella case, ring binder, J. C. Hurcombe	177,340
Umbrella, folding, G. B. Kirkham	177,339
Valve, cut off, G. F. Meyer	177,338
Valve for steam cylinders, air, N. P. Stevens	177,337
Valve, globe, H. Atkinson	177,336
Valve, safety, R. Rodd	177,335
Valve, stop, O. E. McMurray	177,334
Valves, operating, J. Ward	177,333
Vault cover, L. A. Muzard	177,332
Vehicle body, S. H. Penley	177,331
Vehicle seat, J. W. Lawrence	177,330
Vehicle spring, J. W. Marks	177,329
Vehicle wheel, A. C. Fish	177,328
Vessel tiller holder, W. E. Thomas	177,327
Vine, O. H. Gardner	177,326
Wagon end gate, A. Soules	177,325
Wagons, dumping box for, D. J. Deen	177,324
Washing machine, J. H. Christopher	177,323
Washing machine, L. Cooley	177,322
Washing machine, F. M. Hellstrom	177,321
Washing machine, Saul & Church	177,320
Washing machine, Shipley & Wheeler (r)	177,319
Watering pot sprinkler, L. B. Foss	177,318
Well borer, J. M. Creal	177,317
Well tubing, oil, I. N. Hoadley	177,316
Wheat scourer, M. Sower	177,315
Wheels to axles, securing, A. Souhear	177,314
Wind power, compressing air by, M. A. Fulton	177,313
Wind wheel, C. W. Cathcart	177,312
Windmill, J. Ward	177,311
Window, A. H. Peterson	177,310
Window shade fixture, J. E. Dohen	177,309
Wood, block for splitting, J. C. Hubbs	177,308
Wrench, B. F. Joslyn	177,307

DESIGNS PATENTED.

9,276.—FLAG.—J. B. Altemus, Philadelphia, Pa.	177,306
9,277.—CARPETS.—J. L. Folsom, Brooklyn, N. Y.	177,305
9,278.—PIPE STEMS.—A. J. Harris, Providence, R. I.	177,304
9,279 to 9,286.—CARPETS.—O. Heinicke, New Utrecht, N. Y.	177,303
9,287, 9,288.—CASSIMERE FABRICS.—W. A. Walton, Providence, R. I.	177,302
9,289.—STEAM RADIATOR.—G. W. Blake, New York city.	177,301
9,290.—SHAWL PIZ.—T. S. Drowne, Boston, Mass.	177,300
9,291.—SMOKING PIPE.—J. K. Neal, New York city.	177,299
9,292.—HARNESSE ORNAMENTS.—W. S. Robbins, New Bedford, Mass.	177,298
9,293.—CASSIMERE.—W. Bürger, Utica, N. Y.	177,297
9,294.—PUMP CURB.—H. L. Fry, Oakley, Ohio.	177,296
9,295 to 9,300.—OIL CLOTHS.—C. T. Meyer et al., Bergen, N. J.	177,295

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

SCHEDULE OF PATENT FEES.

On each caveat	\$10
On each trade mark	\$25
On filing each application for a Patent (17 years)	\$15
On issuing each original Patent	\$20
On appeal to Examiners-in-Chief	\$10
On appeal to Commissioner of Patents	\$20
On application for Reissue	\$30
On filing a Disclaimer	\$10
On an application for Design (3½ years)	\$10
On application for Design (7 years)	\$15
On application for Design (14 years)	\$30

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

WANTED—QUAINT, COMICAL, OR GROTESQUE Statues, Fountains, &c., or other garden ornaments: Automatic Animals or Figures; Mechanical Surprises; live Swans, Ducks, Animals, steam or other motor Ruffs, Boats or peculiarities for ponds and pleasure grounds. Address ART GARDEN CO., 13 West St., Boston.

IMPROVED CEMENT PIPE MACHINERY—for making either bevel or hub-joint pipe—furnished, and use of same licensed under patents established by U. S. District Court. For further information, apply to CEMENT PIPE MACHINE PATENTS ASSOCIATION, New Bedford, Mass.

FINE TOOLS OF ALL KINDS—Foot Lathes, Scroll Saws, Twist Drills, Taps and Dies. Send 6 cents in stamps for Illustrated Catalogue and Supplement. JACKSON & TYLER, 15 German St., Baltimore, Md.

A MECHANICAL DRAUGHTSMAN & PRACTICAL Machinist wants engagement in either Branch. For particulars, ad. Draughtsman, 163 Seneca St., Buffalo, N. Y.

AGENTS. George Washington Centennial Memorial. Fine Art work; admitted at Memorial Hall, Territory given. WITTMANN BROS., 164 William St., N. Y.

\$16 only, for the Centennial Improved Air Pump. Double acting, and warranted to fill receiver, 1½ feet, in one minute, up to 15-20 pounds pressure. Sent on receipt of price. H. WEINDEL, 460 Dilwyn St., Philadelphia, Pa.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLIN, 390 S. Canal Street, Chicago, Ill.

This MUSTACHE produced by the use of DYKE'S HEAD EXTRACT, without injury, or will forfeit \$100. Safe and sure. With full directions, postage 25 cts. I. A. SMITH & CO., Agents, Palestine, Ill.

BARGAINS IN MACHINERY.

We offer the following for sale, the new Machines being marked (N), all others being second hand.

MACHINE TOOLS.

Planers, 16 ft. x 44 in. sq., \$1,325; 16 ft. x 31 in., \$900; 11 ft. x 30 in., \$500; 10 ft. x 30 in., \$450; 8 ft. x 30 in., \$400; 8 ft. x 24 in., \$350; 4 ft. x 24 in., \$200; 4 ft. x 18 in., \$150; 4 ft. x 12 in., \$100; 4 ft. x 8 in., \$50; 4 ft. x 6 in., \$30; 4 ft. x 4 in., \$20; 4 ft. x 3 in., \$15; 4 ft. x 2 in., \$10; 4 ft. x 1 in., \$5; 4 ft. x 1/2 in., \$3; 4 ft. x 1/4 in., \$2; 4 ft. x 1/8 in., \$1; 4 ft. x 1/16 in., \$1/2; 4 ft. x 1/32 in., \$1/4; 4 ft. x 1/64 in., \$1/8; 4 ft. x 1/128 in., \$1/16; 4 ft. x 1/256 in., \$1/32; 4 ft. x 1/512 in., \$1/64; 4 ft. x 1/1024 in., \$1/128; 4 ft. x 1/2048 in., \$1/256; 4 ft. x 1/4096 in., \$1/512; 4 ft. x 1/8192 in., \$1/1024; 4 ft. x 1/16384 in., \$1/2048; 4 ft. x 1/32768 in., \$1/4096; 4 ft. x 1/65536 in., \$1/8192; 4 ft. x 1/131072 in., \$1/16384; 4 ft. x 1/262144 in., \$1/32768; 4 ft. x 1/524288 in., \$1/65536; 4 ft. x 1/1048576 in., \$1/131072; 4 ft. x 1/2097152 in., \$1/262144; 4 ft. x 1/4194304 in., \$1/524288; 4 ft. x 1/8388608 in., \$1/1048576; 4 ft. x 1/16777216 in., \$1/2097152; 4 ft. x 1/33554432 in., \$1/4194304; 4 ft. x 1/67108864 in., \$1/8388608; 4 ft. x 1/134217728 in., \$1/16777216; 4 ft. x 1/268435456 in., \$1/33554432; 4 ft. x 1/536870912 in., \$1/67108864; 4 ft. x 1/1073741824 in., \$1/134217728; 4 ft. x 1/2147483648 in., \$1/268435456; 4 ft. x 1/4294967296 in., \$1/536870912; 4 ft. x 1/8589934592 in., \$1/1073741824; 4 ft. x 1/17179869184 in., \$1/2147483648; 4 ft. x 1/34359738368 in., \$1/4294967296; 4 ft. x 1/68719476736 in., \$1/8589934592; 4 ft. x 1/137438953472 in., \$1/17179869184; 4 ft. x 1/274877906944 in., \$1/34359738368; 4 ft. x 1/549755813888 in., \$1/68719476736; 4 ft. x 1/1099511627776 in., \$1/137438953472; 4 ft. x 1/2199023255552 in., \$1/274877906944; 4 ft. x 1/4398046511104 in., \$1/549755813888; 4 ft. x 1/8796093022208 in., \$1/1099511627776; 4 ft. x 1/17592186044416 in., \$1/2199023255552; 4 ft. x 1/35184372088832 in., \$1/4398046511104; 4 ft. x 1/70368744177664 in., \$1/8796093022208; 4 ft. x 1/140737488355328 in., \$1/17592186044416; 4 ft. x 1/281474976710656 in., \$1/35184372088832; 4 ft. x 1/562949953421312 in., \$1/70368744177664; 4 ft. x 1/1125899906842624 in., \$1/140737488355328; 4 ft. x 1/2251799813685248 in., \$1/281474976710656; 4 ft. x 1/4503599627370496 in., \$1/562949953421312; 4 ft. x 1/9007199254740992 in., \$1/1125899906842624; 4 ft. x 1/18014398509481984 in., \$1/2251799813685248; 4 ft. x 1/36028797018963968 in., \$1/4503599627370496; 4 ft. x 1/72057594037927936 in., \$1/9007199254740992; 4 ft. x 1/144115188075855872 in., \$1/18014398509481984; 4 ft. x 1/288230376151711744 in., \$1/36028797018963968; 4 ft. x 1/576460752303423488 in., \$1/72057594037927936; 4 ft. x 1/1152921504606846976 in., \$1/144115188075855872; 4 ft. x 1/2305843009213693952 in., \$1/288230376151711744; 4 ft. x 1/4611686018427387904 in., \$1/576460752303423488; 4 ft. x 1/9223372036854775808 in., \$1/1152921504606846976; 4 ft. x 1/18446744073709551616 in., \$1/2305843009213693952; 4 ft. x 1/36893488147419103232 in., \$1/4611686018427387904; 4 ft. x 1/73786976294838206464 in., \$1/9223372036854775808; 4 ft. x 1/147573952589676412928 in., \$1/18446744073709551616; 4 ft. x 1/295147905179352825856 in., \$1/36893488147419103232; 4 ft. x 1/590295810358705651712 in., \$1/73786976294838206464; 4 ft. x 1/1180591620717411303424 in., \$1/147573952589676412928; 4 ft. x 1/2361183241434822606848 in., \$1/295147905179352825856; 4 ft. x 1/4722366482869645213696 in., \$1/590295810358705651712; 4 ft. x 1/9444732965739290427392 in., \$1/1180591620717411303424; 4 ft. x 1/18889465931478580854784 in., \$1/2361183241434822606848; 4 ft. x 1/37778931862957161709568 in., \$1/4722366482869645213696; 4 ft. x 1/75557863725914323419136 in., \$1/9444732965739290427392; 4 ft. x 1/151115727451828646838272 in., \$1/18889465931478580854784; 4 ft. x 1/302231454903657293676544 in., \$1/37778931862957161709568; 4 ft. x 1/604462909807314587353088 in., \$1/75557863725914323419136; 4 ft. x 1/1208925819614629174706176 in., \$1/151115727451828646838272; 4 ft. x 1/2417851639229258349412352 in., \$1/302231454903657293676544; 4 ft. x 1/4835703278458516698824704 in., \$1/604462909807314587353088; 4 ft. x 1/9671406556917033397649408 in., \$1/1208925819614629174706176; 4 ft. x 1/19342813113834066795298816 in., \$1/2417851639229258349412352; 4 ft. x 1/38685626227668133590597632 in., \$1/4835703278458516698824704; 4 ft. x 1/77371252455336267181195264 in., \$1/9671406556917033397649408; 4 ft. x 1/154742504910672534362390528 in., \$1/19342813113834066795298816; 4 ft. x 1/309485009821345068724781056 in., \$1/38685626227668133590597632; 4 ft. x 1/618970019642690137449562112 in., \$1/77371252455336267181195264; 4 ft. x 1/1237940039285380274899124224 in., \$1/154742504910672534362390528; 4 ft. x 1/2475880078570760549798248448 in., \$1/309485009821345068724781056; 4 ft. x 1/4951760157141521099596496896 in., \$1/618970019642690137449562112; 4 ft. x 1/9903520314283042199192993792 in., \$1/1237940039285380274899124224; 4 ft. x 1/19807040628566084398385987584 in., \$1/2475880078570760549798248448; 4 ft. x 1/39614081257132168796771975168 in., \$1/4951760157141521099596496896; 4 ft. x 1/79228162514264337593543950336 in., \$1/9903520314283042199192993792; 4 ft. x 1/158456325028528675187087900672 in., \$1/19807040628566084398385987584; 4 ft. x 1/316912650057057350374175801344 in., \$1/39614081257132168796771975168; 4 ft. x 1/633825300114114700748351602688 in., \$1/79228162514264337593543950336; 4 ft. x 1/1267650600228229401496703205376 in., \$1/158456325028528675187087900672; 4 ft. x 1/2535301200456458802993406410752 in., \$1/316912650057057350374175801344; 4 ft. x 1/5070602400912917605986812821504 in., \$1/633825300114114700748351602688; 4 ft. x 1/10141204801825835211973625643008 in., \$1/1267650600228229401496703205376; 4 ft. x 1/20282409603651670423947251286016 in., \$1/2535301200456458802993406410752; 4 ft. x 1/40564819207303340847894502572032 in., \$1/5070602400912917605986812821504; 4 ft. x 1/81129638414606681695789005144064 in., \$1/10141204801825835211973625643008; 4 ft. x 1/162259276829213363391778010288128 in., \$1/20282409603651670423947251286016; 4 ft. x 1/324518553658426726783556020576256 in., \$1/40564819207303340847894502572032; 4 ft. x 1/649037107316853453567112041152512 in., \$1/81129638414606681695789005144064; 4 ft. x 1/1298074214633706907134224082305024 in., \$1/162259276829213363391778010288128; 4 ft. x 1/2596148429267413814268448164610048 in., \$1/324518553658426726783556020576256; 4 ft. x 1/5192296858534827628536896329220096 in., \$1/649037107316853453567112041152512; 4 ft. x 1/10384593717069655257073792658440192 in., \$1/1298074214633706907134224082305024; 4 ft. x 1/20769187434139310514147585316880384 in., \$1/2596148429267413814268448164610048; 4 ft. x 1/41538374868278621028295170633760768 in., \$1/5192296858534827628536896329220096; 4 ft. x 1/83076749736557242056590341267521536 in., \$1/10384593717069655257073792658440192; 4 ft. x 1/166153499473114484113180682535043072 in., \$1/20769187434139310514147585316880384; 4 ft. x 1/332306998946228968226361365070086144 in., \$1/41538374868278621028295170633760768; 4 ft. x 1/664613997892457936452722730140172288 in., \$1/83076749736557242056590341267521536; 4 ft. x 1/1329227995784915872905445460280344576 in., \$1/166153499473114484113180682535043072; 4 ft. x 1/2658455991569831745810890920560689152 in., \$1/332306998946228968226361365070086144; 4 ft. x 1/5316911983139663491621781841121378304 in., \$1/664613997892457936452722730140172288; 4 ft. x 1/10633823966279326983243563682242756608 in., \$1/1329227995784915872905445460280344576; 4 ft. x 1/21267647932558653966487127364485513216 in., \$1/2658455991569831745810890920560689152; 4 ft. x 1/42535295865117307932974254728971026432 in., \$1/5316911983139663491621781841121378304; 4 ft. x 1/85070591730234615865948509457942052864 in., \$1/10633823966279326983243563682242756608; 4 ft. x 1/170141183460469231731897018915884105728 in., \$1/21267647932558653966487127364485513216; 4 ft. x 1/340282366920938463463794037831768211456 in., \$1/42535295865117307932974254728971026432; 4 ft. x 1/680564733841876926927588075663536422912 in., \$1/85070591730234615865948509457942052864; 4 ft. x 1/1361129467683753853855176151327072845824 in., \$1/170141183460469231731897018915884105728; 4 ft. x 1/272225893536750770771035230265414569152 in., \$1/340282366920938463463794037831768211456; 4 ft. x 1/544451787073501541542070460530829138304 in., \$1/680564733841876926927588075663536422912; 4 ft. x 1/1088903574147003083084140921061658276608 in., \$1/1361129467683753853855176151327072845824; 4 ft. x 1/2177807148294006166168281842123316553216 in., \$1/272225893536750770771035230265414569152; 4 ft. x 1/4355614296588012332336563684246633106432 in., \$1/544451787073501541542070460530829138304; 4 ft. x 1/8711228593176024664673127368493266212864 in., \$1/1088903574147003083084140921061658276608; 4 ft. x 1/1742245718635204932934625473698532425536 in., \$1/2177807148294006166168281842123316553216; 4 ft. x 1/3484491437270409865869250947397064851072 in., \$1/4355614296588012332336563684246633106432; 4 ft. x 1/6968982874540819731738501894794129702144 in., \$1/8711228593176024664673127368493266212864; 4 ft. x 1/13937965749081639463477003789588259404288 in., \$1/1742245718635204932934625473698532425536; 4 ft. x 1/27875931498163278926954007579176518808576 in., \$1/3484491437270409865869250947397064851072; 4 ft. x 1/55751862996326557853908015158353037617152 in., \$1/6968982874540819731738501894794129702144; 4 ft. x 1/111503725992653115707816030316706075234304 in., \$1/13937965749081639463477003789588259404288; 4 ft. x 1/223007451985306231415632060633412150468608 in., \$1/27875931498163278926954007579176518808576; 4 ft. x 1/446014903970612462831264121266824300937216 in., \$1/55751862996326557853908015158353037617152; 4 ft. x 1/892029807941224925662528242533648601874432 in., \$1/111503725992653115707816030316706075234304; 4 ft. x 1/1784059615882449851325056485067297203748864 in., \$1/223007451985306231415632060633412150468608; 4 ft. x 1/3568119231764899702650112970134594407497728 in., \$1/446014903970612462831264121266824300937216; 4 ft. x 1/7136238463529799405300225940269188814955552 in., \$1/892029807941224925662528242533648601874432; 4 ft. x 1/14272476927059598810600451880538377629911104 in., \$1/1784059615882449851325056485067297203748864; 4 ft. x 1/28544953854119197621200903761076755259822208 in., \$1/3568119231764899702650112970134594407497728; 4 ft. x 1/57089907708238395242401807522153510519644416 in., \$1/7136238463529799405300225940269188814955552; 4 ft. x 1/114179815416476790484803615044307021039288832 in., \$1/14272476927059598810600451880538377629911104; 4 ft. x 1/228359630832953580969607230088614042078577664 in., \$1/28544953854119197621200903761076755259822208; 4 ft. x 1/456719261665907161939214460177228084157155328 in., \$1/57089907708238395242401807522153510519644416; 4 ft. x 1/913438523331814323878428920354456168314310656 in., \$1/114179815416476790484803615044307021039288832; 4 ft. x 1/1826877046663628647756857840708912336628621312 in., \$1/228359630832953580969607230088614042078577664; 4 ft. x 1/3653754093327257295513715681417824673257242624 in., \$1/456719261665907161939214460177228084157155328; 4 ft. x 1/7307508186654514591027431362835649346514485248 in., \$1/913438523331814323878428920354456168314310656; 4 ft. x 1/14615016373309029182054862725671298693028970496 in., \$1/1826877046663628647756857840708912336628621312; 4 ft. x 1/29230032746618058364109725451342597386057940992 in., \$1/3653754093327257295513715681417824673257242624; 4 ft. x 1/58460065493236116728219450902685194772115881984 in., \$1/7307508186654514591027431362835649346514485248; 4 ft. x 1/116920130986472233456438901805370389544231763968 in., \$1/14615016373309029182054862725671298693028970496; 4 ft. x 1/233840261972944466912877803610740779088463277936 in., \$1/29230032746618058364109725451342597386057940992; 4 ft. x 1/467680523945888933825755607221481541776926555872 in., \$1/58460065493236116728219450902685194772115881984; 4 ft. x 1/935361047891777867651511214442963083553853111744 in., \$1/116920130986472233456438901805370389544231763968; 4 ft. x 1/1870722095783555735303022428885926167107706223488 in., \$1/233840261972944466912877803610740779088463277936; 4 ft. x 1/3741444191567111470606044857771852334215412446976 in., \$1/467680523945888933825755607221481541776926555872; 4 ft. x 1/7482888383134222941212089715543704668430824893952 in., \$1/935361047891777867651511214442963083553853111744; 4 ft. x 1/14965776766268445882424179431087409336861649787904 in., \$1/1870722095783555735303022428885926167107706223488; 4 ft. x 1/29931553532536891764848358862174818673723299575808 in., \$1/3741444191567111470606044857771852334215412446976; 4 ft. x 1/59863107065073783529696717724349637347446599151616 in., \$1/7482888383134222941212089715543704668430824893952; 4 ft. x 1/119726214130147567059393435448696674694893198232232 in., \$1/14965776766268445882424179431087409336861649787904; 4 ft. x 1/239452428260295134118786870897393349389786396464464 in., \$1/29931553532536891764848358862174818673723299575808; 4 ft. x 1/478904856520590268237573741794786698779572792928928 in., \$1/59863107065073783529696717724349637347446599151616; 4 ft. x 1/957809713041180536475147483589573397559145585857856 in., \$1/119726214130147567059393435448696674694893198232232; 4 ft. x 1/1915619426082361072950294967179146795118211171715712 in., \$1/239452428260295134118786870897393349389786396464464; 4 ft. x 1/3831238852164722145900589934358293590236422343431424 in., \$1/4789048565205902682375737417947

Advertisements.

Back Page \$1.00 a line.
Inside Page 75 cents a line.
Engraving may be added at the same rate
per line, by measurement, as the letter press. Ad-
vertisements must be received at publication office at
early as Friday morning to appear in next issue.

M. SELIG JUNIOR, & CO.,
Importers of American Machinery, Tools, Agricultural
Implement, Wholesale and Export Hardware and Ma-
chinery Merchants, Est'd 1866, 35 Queen Victoria St.,
LONDON, E. C., ENGLAND.

Portland and Keene's Cement.
From the best London Manufacturers. For sale by
JAMES BRAND, 85 Beekman St., New York.
A Practical Treatise on Cement furnished for 25 cents.

Stone Channeling OR Quarrying Machine,



WARDWELL PATENT,
FOR CUTTING STONE INTO VARIOUS SIZES
AND DIMENSIONS IN ALL KINDS OF
QUARRIES.

STEAM STONE CUTTER CO., RUTLAND, VT.
SOLE PROPRIETORS AND MANUFACTURERS.



[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the
United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this
agency, at home and abroad, than through any other in
the world.

They employ as their assistants a corps of the most ex-
perienced men as examiners, specification writers, and
draftsmen that can be found, many of whom have been
selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed them-
selves of Munn & Co.'s services in examining their in-
ventions, and procuring their patents.

MUNN & CO., in connection with the publication of
the SCIENTIFIC AMERICAN, continue to examine in-
ventions, confer with inventors, prepare drawings, spe-
cifications, and assignments, attend to filing applications
in the Patent Office, paying the government fees, and
watch each case step by step while pending before the ex-
aminer. This is done through their branch office, corner
F and 7th streets, Washington. They also prepare and
file caveats, procure design patents, trademarks, and re-
issues, attend to rejected cases (prepared by the inventor
or other attorneys), procure copyrights, attend to inter-
ferences, give written opinions on matters of infringement,
furnish copies of patents, and, in fact, attend to
every branch of patent business both in this and in for-
eign countries.

A special notice is made in the SCIENTIFIC AMERI-
CAN of all inventions patented through this agency, with
the name and residence of the patentee. Patents are
often sold, in part or whole, to persons attracted to the in-
vention by such notice.

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 especially to foreign patents,
which states the cost, time granted, and the requirements
for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to Novem-
ber 26, 1867, can be supplied with official copies at rea-
sonable cost, the price depending upon the extent of
drawings and length of specifications.

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 of-
fice \$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.

A pamphlet containing the laws and full directions for
obtaining United States patents sent free. A hand-
somer bound Reference Book, gilt edges, contains 193
pages and many engravings and tables important to every
patentee and mechanic, and is a useful handbook of re-
ference for everybody. Price 25 cents, mailed free.

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets, Wash-
ington, D. C.

DAMPER BEST AND LEVER
REGULATORS GAGE COCKS.
MURKILL & KEIZER, 44 Holliday St., Balt.
NON-COMBUSTIBLE STEAM BOILER & PIPE
COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St., N. Y.; 132 N. 2nd St., St. Louis, Mo.

IRON BRIDGE BUILDING—A complete de-
scription, with dimensions, working drawings, and
specifications of Girard Avenue Bridge, Philadelphia, Pa.
With foundations of piers. Ten engravings. Price 30
cents. Contained in Nos. 1, 2, and 4 of SCIENTIFIC
AMERICAN SUPPLEMENT, 10 cents per copy. To be
had at this office, and of all news agents.

To Roofers, Builders, & Property Owners.



A complete Roofing for \$3 per square, durable, eco-
nomical, and fireproof. Send for Samples and Circulars.
E. H. MARTIN, General Roofing Materials,
P. O. Box 4784,
79 Maiden Lane
and 9 Liberty St., N. Y.

ROGERS' TANNATE OF SODA BOILER
SCALE PREVENTIVE.
JOS. G. ROGERS & CO., Madison, Ind.
Send for book on Boiler Incrustation.

FOR LEASE,

At South Chicago, Ill., a Shop 100x125 feet, 2 stories,
18 inch concrete walls, Engine, Boiler, Shafting, &c.;
Frame Store House, 45x60, 2 comfortable Dwellings, and
Blacksmith's Shop, all on lot 194 feet by 150 feet, opposite
principal Depot in center of the town, six miles South of
Chicago. Advantages for manufacturing unequalled by
any town in the West. Five Trunk Railroads and Lake
navigation. Largest Lumbermarket known at this point.
More ground adjoining can be leased if wanted. Address
WM. H. DILLINGHAM, Louisville, Ky., Owner.

GEO. W. READ & CO.,
STEAM BAND SAW
AND VENEER CUTTING MILL.
186 to 200 LEWIS ST., foot 5th and 6th Sts., E. R. N. Y.
Always on hand, FULL STOCK of SEASONED

Hard-Wood Lumber
AND CHOICE FIGURED VENEERS.
The LARGEST STOCK! The GREATEST
VARIETY! The Lowest Prices!
Enclose Stamp for Catalogue and Price-List.
Orders by mail promptly and faithfully executed.



Boul's Patent
Reverse Motion
Moulding and
Dovetailing
Machine,
cuts Panels of
any design or
style of mould in
the solid wood
with neatness
and dispatch. Is
a first class
Shaper, Edge
and Scroll
Moulder.
Does a general
Dovetailing with
thick or thin
stuffs. Simple,
Durable, and Efficient.

Send for Pamphlet and
Sample of work.
Improved Solid Steel Cutters for
all kinds of Variety Moulders
made to order, and warranted
by the
B. C. MACHINERY CO.,
Battle Creek, Mich.

Todd & Rafferty Machine Co.
MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine, Lowe's
Patent Tubular and Flue Boilers, Plain Slide Valve Sta-
tionary, Hoisting, and Portable Engines, Boilers of all
kinds, Steam Pumps, Mill Gearing, Shafting, &c., Silk,
Tow Ovens, Bagging, Rope, Flax, and Hemp Machinery.
Agents for the New Haven Manufacturing Co.'s Machin-
ist's Tools, for Judson's Governors and Stop Valves,
Sturtevant Blowers, and Differential Pulley-Block.
WAREHOUSES, 33 LIBERTY STREET, NEW YORK.
WORKS, PATERSON, NEW JERSEY.

Niagara
Steam Pump Works
ESTABLISHED 1825.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

**BOGARDUS' PATENT UNIVERSAL ECCEN-
TRIC MILLS**—For grinding Bones, Ores, Sand, Old
Crucibles, Fire Clay, Gunpowder, Oil Cake, Seed, Corn,
Cotton and Cob, Tobacco, Snuff, Sugar, Salts, Roots,
Spices, Coffee, Coconut, Flaxseed, Asbestos, Mica,
etc., and whatever cannot be ground by other mills.
Also for Paints, Printers' Inks, Paste Blacking, etc.
JOHN W. THOMSON, successor to JAMES BOGAR-
DUS, corner of White and Elm Sts., New York.

HOW TO MAKE SPIRAL SPRINGS. By
Joshua Rose. With three engravings of the tools,
which are easily made, and complete practical directions
for working, including Hardening and Tempering. Price
10 cents. Contained in SCIENTIFIC AMERICAN SUPPLE-
MENT No. 20. To be had at this office and at all News
Stores throughout the country.

WROUGHT
IRON
BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.
The attention of Engineers and Architects is called
to our improved Wrought-Iron Beams and Girders (pat-
ented), in which the compound welds between the stem
and flanges, which have proved so objectionable in the old
mode of manufacturing, are entirely avoided. We are pre-
pared to furnish all sizes at terms as favorable as can be
obtained elsewhere. For descriptive lithograph, address
Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

PERFECT NEWSPAPER FILE.

*The Koch Patent File, for preserving newspapers,
magazines, and pamphlets, has been recently improved
and price reduced. Subscribers to the SCIENTIFIC AME-
RICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be
supplied for the low price of \$1.50 by mail, or \$1.35 at the
office of this paper. Heavy board sides; inscription
"SCIENTIFIC AMERICAN," in gilt. Necessary for
every one who wishes to preserve the paper.

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

HASKELL'S THREE CYLINDER PUMP—
Hand or Power. Cheaper than a Steam Pump.
Will outwear a Rotary Pump—do more work, with less
power, than any other pump. Not liable to get out of
order. Any blacksmith can repair it. Adapted to any
kind of hard work. Send for Circular.
CHASE MACHINE COMPANY, Boston, Mass.

SEND FOR CIRCULARS OF ONLY CHOICE
3d hand Engines and Boilers, Portable and Station-
ary, also of Pumps, Tubing, Castings, Iron Pipe, &c., to
JAMES M. BINGHAM.
Successor to BINGHAM & RICH, Oil City, Pa.

Diamond Solid Emery Wheels.

Prices—4x6, \$1.25; 6x8, \$2.25; 8x12, \$5.50; 10x12, \$12.50;
12x12, \$16.00; 20x22, \$19.50; 24x24, \$42. All other sizes at pro-
portionate prices. Fast cutting, free from glazing, they are
the best Solid Emery Wheels. Give diam. of holes
in your order for wheels. Emery Grinders unequalled by
any in the world. Address AMERICAN TWIST DRILL
CO., Woonsocket, R. I.



H.W. JOHNS' PATENT
ASBESTOS
MATERIALS.
Asbestos Roofing, with the Improved White Asbestos
Fire Proof Coating, for steep or flat Roofs in all climates.
Asbestos Root Coating, for old Leaky Roofs.
Asbestos Cement, for repairing Leaks on Roofs.
Asbestos Root Paint, for Tin Roofs, Ironwork, &c.
Asbestos Paints—all colors—for structural purposes.
Asbestos Fire Proof Coating, for wood work, &c.
Asbestos Steam Pipe and Boiler Coverings.
Asbestos Steam Packing, flat and round, all sizes.
Sheathing Felt, Vermin-Proof Lining, &c.
These articles are ready for use, and can be easily ap-
plied by any one. Send for Pamphlets, Price Lists, &c.
H. W. JOHNS, 87 Maiden Lane, N. Y.,
Patentee and Manufacturer. Established 1855.

NOYE'S
Mill Furnishing Works
are the largest in the United States. They make Burr
Millstones, Portable Mills, Smut Machines, Packers, Mill
Picks, Water Wheels, Pulleys and Gearing, specially
adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.



W. C. DUYCKINCK,
IMPORTER, MANUFACTURER, AND DEALER IN
**Railway, Machinists', and En-
gineers' Supplies.**
50 and 52 JOHN STREET,
P. O. Box 4101. NEW YORK.

Diamonds & Carbon
shaped or Crude, furnished and set for Boring Rocks,
Dressing Mill Burrs, Emery Wheels, Grindstones, Hard-
ened Steel, Calculator Rollers, and for Sawing, Turning, or
Working Stone and other hard substances; also Glaziers'
Diamonds. J. DICKINSON, 64 Nassau St., New York.

THE HEALD & SISCO
Patent Centrifugal Pumps.
VERTICAL & HORIZONTAL.
First Premiums at New Orleans, Cincinnati, and New
York. "Medal of Special Award."
American Institute, 1872.
Perfect satisfaction guaranteed. The cheapest, simplest,
strongest, most efficient and popular Pump in use, for
emptying Dry-docks, Coffers, dams, etc., and for use in
Paper Mills, Tanneries, and Factories. STEAM PUMPS
very low, for Wrecking, Dredging, Irrigating, etc. Illus-
trated pamphlet, free. Nearly 1,000 references to actual
customers. 31 pages first class testimony. Address
HEALD, SISCO & CO., Baldwinsville, N. Y.

HOUSTON
TURBINE
WATERWHEEL
IMPORTANT IMPROVEMENTS!
SEND FOR NEW CIRCULAR.
MERRILL & HOUSTON
IRON WORKS.
BELOIT, WISCONSIN.

WHIPPLE'S
Patent Door Knob.
Awarded a Bronze Medal at the American Institute Fair
for 1874. The Judge says: "We consider this method of
fastening DOOR KNOBS a great improvement over any-
thing yet invented for the purpose, as it obviates the use
of side screws and washers, and can be regulated to suit
any thickness of Doors." Send for Circular.
THE PARKER & WHIPPLE COMPANY,
West Meriden, Conn., or 97 Chambers St., N. Y.

Machinists' Tools.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

Do Your Own Printing!
\$3 Press for cards, labels, envelopes, etc.
Larger size for larger work.
Business Men do their printing and advertis-
ing, save money and increase trade. Pleasure and
profit in Amateur Printing. The Girls or
Boys can get great fun and make money fast at
it. Send two stamps for full cata-
logue of presses, type, etc., to the Manufacturers,
KELSEY & CO., Meriden, Conn.

**VELOCIPED CARRIAGES, OF LIGHT CON-
struction, fast speed. Worked by hand cranks;**
also by foot treadles. Illustrated in SCIENTIFIC AME-
RICAN SUPPLEMENT No. 8. To be had at this office
and of all news agents. Price 10 cents.

EAGLE FOOT LATHES,
With Scroll and Circular Saw Attach-
ments, Slide Rest, Tools, &c.; also Small
Engine Lathes, Metal Hand Planers, &c.
Neatest designs, superior finish. Low
Prices. Our new Catalogue describes
these and every tool necessary for the Am-
ateur or Artisan. Send for it.
WM. L. CHASE & CO.,
96 & 97 Liberty St. New York.

The Tanite Co.,
STROUDSBURG, PA.
EMERY WHEELS & GRINDERS

SCREW PROPELLERS, THEIR SHAFTS AND
FITTINGS. By Hamilton W. Pendred, M. E. An
able treatise, showing the present practice, its advan-
tages and defects. With 25 figures. Price 10 cents. Con-
tained in No. 4 of SCIENTIFIC AMERICAN SUPPLE-
MENT. To be had at this office, and of all news agents.

PORTLAND CEMENT

For Walks, Cisterns, Foundations, Stables, Cellars,
Bridges, Reservoirs, Breweries, etc.
Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St., New York

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
I. B. PIERCE, Sec'y.

FOREIGN PATENTS
AND
THE CENTENNIAL.

There is no doubt that our Centennial Exposition will
attract to our shores multitudes of representative people
from all parts of the world, and they will take home with
them many of our best improvements to introduce into
their own manufactures.

An unusual opportunity will be offered for selling to
these people such foreign patents as have been secured on
good American inventions in the respective countries
from which these visitors come.

At the reduced prices for which patents are obtained
abroad, our people will lose a chance not likely to occur
again, if they do not avail themselves of the opportunity
of securing their inventions in foreign countries at once
so as to have their patents ready to negotiate during the
coming summer.

For cost of patents in the different countries and the
conditions on which they are granted, send for pamphlet
containing full information.

Address **MUNN & CO.,**
31 Park Row, New York.
BRANCH OFFICE, cor. F and 7th Sts.,
Washington, D. C.



PROSPECTUS
OF THE
SCIENTIFIC AMERICAN,
FOR 1876.

THE MOST POPULAR SCIENTIFIC PAPER
IN THE WORLD.

THIRTY-FIRST YEAR.

VOLUME XXXIV.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN
beg to announce that on the first day of January,
1876, a new volume commenced. It will continue
to be the aim of the publishers to render the con-
tents of the new volume more attractive and use-
ful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pur-
suits should think of doing without the SCIENTIFIC
AMERICAN. Every number contains from
six to ten engravings of new machines and inven-
tions which cannot be found in any other publica-
tion.

The SCIENTIFIC AMERICAN is devoted to the
interests of Popular Science, the Mechanic Arts,
Manufactures, Inventions, Agriculture, Commerce
and the industrial pursuits generally; and it is val-
uable and instructive not only in the Workshop
and Manufactory, but also in the Household, the
Library, and the Reading Room. Each volume
contains hundreds of Notes, Receipts, and Sug-
gestions and Advice, by Practical Writers, for Work-
ing Men and Employers, in all the various arts.

TERMS OF SUBSCRIPTION—POSTAGE
PAID BY US.

One copy Scientific American, one year... \$3.20
One copy Scientific American, six months... 1.60
One copy Scientific American, three months... 1.00
One copy Scientific American and one copy
Scientific American Supplement, both
for one year, post-paid... 7.00

The Scientific American Supplement

A weekly paper, uniform in size with the SCIENTIFIC
AMERICAN, but a distinct publication. It
contains working drawings of engineering works,
and elaborate treatises on every branch of Science
and Mechanics, by eminent writers, at home and
abroad. An illustrated cover protects the hand-
somer printed sheets. Price, \$5.00 per annum.
Single copies 10 cents.

Remit by postal order, draft, or express.
Address all letters and make all Post Office or-
ders and drafts payable to

MUNN & CO.,
37 PARK ROW, NEW YORK

The "Scientific American" is printed with
CHAS. ENEU JOHNSON & CO.'S GIN. Tenth and
Lombard-sts., Philadelphia, and 59 Gold-st., New-York

Wm. Charles *6.50*

SCIENTIFIC AMERICAN

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

Vol. XXXIV. - No. 26.
[NEW SERIES.]

NEW YORK, JUNE 24, 1876.

\$3.20 per Annum.
[POSTAGE PREPAID.]



THE HORTICULTURAL HALL, CENTENNIAL EXPOSITION PHILADELPHIA.-(See page 404.)

Much, however, of the opposition to inventors and the patented devices arises from the misconceived idea that the patent laws are intended solely for the benefit of inventors. Now, as we have repeatedly explained, such is not the case. True, they hold out an inducement which has for its object to make people invent; but that inducement is monopoly closely limited in point of time, and during the existence of which the inventor develops his idea. Consequently, at the end of the protected period, the invention becomes public property in its improved and not in its crude form. Therefore it is obvious that to denounce the patent system is merely to denounce that which insures great benefits to every one, at an absurdly small cost. For the means whereby the patent laws are enforced, the fact is undeniable that, in this sad period of official corruption, the Patent Office stands forth pure and unblemished. Instead of its appropriations being exceeded, as is the case in some departments of the government, it has a balance of nearly \$900,000 to its credit in the United States Treasury.

ury. Its expenses last year were \$459,730 for salaries, and \$63,216 for miscellaneous matters; and seven and a half times more work was done than in 1865. Had the salary and expense account kept pace with the work, the expense in 1865 would have been over \$3,000,000.

A DANGEROUS NEIGHBOR.

Mr. Hardenbergh, of New Jersey, has recently introduced a resolution into the House of Representatives to remove the powder magazine, now located on Ellis Island in New York Harbor, on the ground that an explosion of the powder there stored would destroy or seriously damage an immense number of buildings in New York and Jersey City. Ellis Island is used as a storehouse for powder for vessels of war, and no ship is allowed to come up to the navy yard until the contents of her magazine have been discharged. At the present time about one hundred and thirty tons of powder are stored on the island, some of which is old and not up to the full standard of strength.

Authorities differ greatly as to the elastic force exerted by powder at the moment of its explosion. Robin estimates it at 1,000 times the pressure of the atmosphere, or 15,000 lbs. per square inch. Rumford, on the other hand, placed it as high as 54,470 times atmospheric pressure. Other experimenters vary between these extremes. We take, as our present rough calculation, Robin's estimate, because of the possible deterioration of the powder; 130 tons of the explosive occupies about 4,900 cubic feet, or would form a pile of 17 feet cube. On each square inch of surface of atmosphere bounding this mass, supposing the latter to be suddenly rendered gaseous, there would therefore be, as above noted, a pressure of 15,000 lbs., or a total pressure of nearly 4,000,000,000 lbs. As the vibrations due to this sudden pressure radiate equally in all directions, like those of light and heat, it necessarily follows that the intensity of the force diminished in proportion as the circle of its radiation increases in diameter. Taking the direct distance from Ellis Island to New York City as one mile, an explosion on the former, by the time it reached the nearest walls, would be distributed over 172,846,080 square feet of surface, and therefore the mechanical effect of the shock on the houses first attained would be some 22 lbs. to the square foot of surface. This is equivalent to the wind pressure of a heavy storm traveling at the rate of 65 miles per hour; but in lieu of being a continuous blast, as in the case of a tornado, there would be a sudden shock, due to the condensation of the wave of air generated in the explosion, followed by a reflex and weaker shock due to the rarefaction of the wave, followed by other and shorter vibrations. The result, therefore, would be a jar like that of an earthquake.

Such would be the probable effect did the whole quantity of powder, as above stated, explode at once; but this is not at all likely. Confined as the explosive is in barrels and copper tanks, the blowing-up of a few receptacles would scatter others, and these would either be thrown into the water, as the island is quite small, or might be exploded separately, thus producing a series of light and inconsiderable shocks.

Reducing the result first quoted one half, to allow for powder scattered and unexploded, we still have a mechanical effect of 11 lbs. to the foot on buildings a mile distant, equivalent to the simultaneous explosion of 65 tons of powder. That amount is very nearly the same as blew up at Erith, near London, England, in 1864, the effects of which were at the time carefully noted; so that from the record of these we can obtain an approximate idea of the results in the vicinity of New York. A circle swept from Ellis Island with the radius of one mile includes only a small part of Jersey City, and an even less area of New York; the first and most disastrous effects would therefore be felt by the shipping in the harbor, and probably few buildings would be left standing in the included city portions. The mechanical intensity of the shock varying inversely as the square of the distance from the center, it follows that, by the time the concussion reached the City Hall in New York, its force would be reduced to less than 3 lbs. per square foot of surface. This would be sufficient to overthrow steeples and probably all of the exceptionally high buildings included in the area. At a corresponding distance from the Erith explosion, the earth heaved and trembled, men were thrown violently out of bed, not a door nor a pane of glass was left whole, and walls were cracked and shaken. Even the more substantial buildings in lower New York would also be badly jarred, owing to the duration of the shock, which, despite its comparatively low pressure, would be (because of the quantity of powder) of long duration. In general, it may be concluded that a complete rebuilding of all New York below the City Hall would become necessary.

At four miles, windows and doors would be smashed, ceilings thrown down, and weak structures injured. The concussion would be violently felt as far up the Hudson as Tarrytown, and the report would be heard at Poughkeepsie, and possibly at Philadelphia. The report of the Erith explosion was heard 94 miles away, a greater distance than that which separates New York from the Centennial buildings. Every church within a radius of 25 miles of Ellis Island would suffer from cracked walls and windows; and if the disaster occurred at night, every gaslight in the cities of New York, Jersey City, and Brooklyn would be extinguished.

The loss of life due to falling buildings would probably be great. People in the streets in the lower part of the city would be thrown down, and many probably rendered deaf. Far less extensive explosions have overthrown houses and ripped off their shoes, a curious result of the inertia due to the differing specific gravities of the animal and the metal. It is likely that not a bird within fifteen miles radius would

survive. The iron water mains in the part of the city below the City Hall would also be ruptured, as that effect has followed less extensive explosions.

These results are based on merely theoretical considerations, and on the presumption that a simultaneous explosion of 65 tons at least would occur. They are of course subject to modifications of circumstances, but are not without the limits of possibility. Thus they will suffice to show the error of allowing so large a quantity of gunpowder to be stored so near to a populous district. If some magazine reasonably near the navy yard is of paramount necessity, there are other situations in the lower part of New York Bay which might be used without incurring anything like the danger; and the peril might still further be lessened by dividing the amount stored, and isolating the portions so that the blowing-up of one part could not determine the explosion of the rest.

THE CENTENNIAL EXPOSITION.

Unless the reader is specially interested in agricultural matters, and therefore has an object in deferring visiting the Centennial until the autumn, when the displays of live stock and fall products will take place, we advise him to make his pilgrimage to Philadelphia now. Nearly everything is in order, and the finishing touches are being pushed forward with great rapidity. No such crowds are present at this time as will be toward the close of the six months; and when the magnificent distance, which is to be traversed merely to pass through the various aisles and from building to building, some twenty-five miles in all, is realized, it will be perceived that sight seeing on such a gigantic scale during hot weather will savor strongly of hard work. To those who are able to spend some time in Philadelphia and so view the Exposition leisurely, the heated term will be of minor inconvenience; but others, whose holiday is limited, will find their enjoyment greatly increased if they will take advantage of the moderate weather of the present month.

For the benefit of the latter, a few hints as to how best to see the display in the shortest time may prove serviceable. The mistake of most people is trying to see too much in too short a time; and this is attended with very disagreeable results. When the mind is on the stretch, the body is not nearly so sensitive to fatigue; and consequently the visitor may never feel that he has overtaxed himself until after the day's work is over, when he will be admonished of the fact by illness, which may incapacitate him for the following day; a serious matter when one's time is limited. Still it is by no means impossible to get a good general idea of the show in two or three days; and this period, we have no doubt, will comprise all that can be afforded by the majority of people coming from a distance to Philadelphia.

As every visitor will naturally prefer to plan his own visit, it is superfluous to offer suggestions for a programme here. Still, we may point out that to hurry is but to waste time, and that the few days will be most agreeably spent if the first be quietly devoted to such parts of the Exposition as it is intended to study, while the mind is fresh and unwearied. Then the subsequent observation of objects to which no particular thought is given becomes a kind of relaxation. It will save much time to procure a good map, giving the names of localities.

THE WOMAN'S PAVILION.

Perhaps the most interesting object—if we may be so ungallant as to use the word—in the woman's edifice is the lady engineer. We do not recollect ever having seen a woman manage a steam engine before; but if Miss Allison may be taken as an example, there is no doubt but that the fair sex is quite competent for the duty. In fact, the lady herself suggests very truly that there is a good field for woman's work in taking charge of the thousands of small motors used in minor manufacturing operation. She thinks that an engine is not half so hard to manage as a baby, and most, of her sex at least, will agree with her. Miss Allison has regularly studied engineering and science, and runs the machine entrusted to her in a manner which elicits general admiration. We wish we could speak as highly of the rest of the woman's display in general; but it must be considered, as a whole, to be disappointing. Still, there are many excellent articles in it which will well repay a visit to the building. Queen Victoria sends a beautifully spun napkin, her own work, and some spirited etchings which give some pleasant glimpses of home life in the royal family. The English princesses contribute some really fine specimens of embroidery. This handiwork of royal fingers silently preaches a lesson of industry which, to judge from the conversation of those who gather about the cases, is invariably heeded. No doubt, however, her Majesty would find a world of amusement, could she overhear, as we did, certain naïve remarks of the rural damsels, whose impression appears to be that queens do nothing but wear gold crowns and sit on thrones.

If we were asked as to the prevailing characteristic in all the woman's work exhibited, we should unhesitatingly say: patience. And that quality is shown in as high a degree in the embroideries and, to the masculine mind, incomprehensibly intricate patchwork as in the elaborate productions of the Japanese artists in the celebrated collection of bronzes, in the Main Building. If patience always yielded beauty, then our woman's work would be transcendent. But it does not; and therefore while we may recognize the deft persevering fingers, in the innumerable worsted pictures, hair chains, feather and shell ornaments, and marvelous pieces of knitting, let us not be asked to call them beautiful. We will make one exception (we dare say there are others which we do not recall) of a quilt: a wonderful quilt, intricate and yet artistic. Fifteen hundred rosebuds, in each of which

there are nine hundred stitches, are embroidered on white and rose-colored satin. No wonder it took eighteen months to complete.

Leaving out fancy work, woman's labor is but poorly represented. There are few inventions, where there might be many. We notice some dish washers and a life-preserving mattress, which, it is said, is to be officially tested, and there is a fine collection of medicines prepared and put up by fair hands. The best woman's work is in the other buildings, and those who are inclined to belittle her part in industrial labor may see the evidences of her skill in the superb coloring of the famous Doulton pottery and in the wonderful Gobelin tapestry—there is one gem of this needle work in the Art Gallery, which only near inspection distinguishes from a painting; in the intricate meshes of the Belgian point lace, in the nice shading and coloring of the German cotton velvets, in the manufacture of the delicate Swedish silver work, in the Italian mosaics, in the decoration of the fragile Bohemian glass. And this is only the beginning. In Agricultural Hall are wines of all kinds prepared by woman, in Memorial Hall her finest works of pictorial art are displayed; and in among the buzzing machinery, she is tending looms spinning raw silk into thread, making and putting together the intricate mechanism of watches, and converting coarse leather and cloth into the daintiest of shoes. The severest criticism that can be made on the Woman's Pavilion is that its contents show woman's amusements, not her work.

THE BOATS.

The Exposition is notably rich in nautical objects, and in models especially. Every class of vessel can be found, from the full-rigged sloop of war, in the navy department, down to the fishing smacks, which Massachusetts contributes in a collection of probably five hundred. There is a model of the old frigate Constitution, and of a lightship, the latter complete in every part. An ingenious Yankee has rigged a chicken bone with a set of sails, and only close inspection shows the curious conceit. The famous Merriman dress, in which Captain Boyton swam the English channel, is also exhibited. Foreign visitors are displaying much interest in the ice yacht, a superb full-rigged specimen of that vessel, with her sails set, being prominently located in

MACHINERY HALL.

In this building, work has rapidly been carried forward. The immense Krupp 61-ton gun is now in position, and several industrial operations, intended to be exhibited in progress, are fairly under way. In the French section, toilet soap manufactory is in full blast; near by, an immense press is striking off American flags on continuous webs of cloth; an india rubber factory prepares and purifies the crude material. A set of workmen are busily engaged in making cocoanut sugarplums. Two paper mills are also hard at work; the Coventry silk loom is weaving silk book-marks in wonderful rapidity; and the great Walter press, at certain hours, strikes off its thousands of the New York Times.

THE ORIENTAL CAFES.

have recently all opened, and are by no means the least interesting part of the general display. One is Turkish, and all its attendants are genuine Mohamedans. Here one may have delicious coffee made in the Turkish fashion (that is, in a kind of paste with water, and boiled thick), rose conserves, any number of curious sirups, and real Turkish tobacco in a real Turkish pipe. Prices are cheap; for \$1, a taste of almost all the Turkish delicacies can be had. The Tunis café is conducted on curious principles. It involves a touch of the harem. It is not so large as the Turkish building, nor so ornate in its style. An individual, posted outside the door after the fashion of itinerant showman, yells at you to enter. You pay 25 cents to a person supposed to be an Arab, although he looks more like a German, and are served with a cup of muddy coffee, and permitted to stare at five musicians. One torments a venerable violin, another bangs a pair of cymbals, the third has a nondescript instrument resembling a lute, and the remainder, a woman and a small boy, drum with their fingers on kettledrums. The music is painful to an advanced degree; and the woman occasionally intensifies the discomfort of the deluded visitor by dancing, if a variety of postures deserves that title. Altogether the show is not uninteresting; but one experience will probably satisfy the most curious of visitors.

Another curious building is devoted to the sale of Hungarian wine. The attendants are dressed in the national Magyar costume. Wines of excellent quality may be tasted in moderation, at quite low prices.

THE AQUARIA.

Professor Frederick Mather is busily preparing the aquaria in Agricultural Hall. The display is to be made in thirty-five large tanks, one of which is 23 feet long by 7 wide, and 4 feet deep. The collection is not yet complete, but will be in a short time. The British Commission has despatched a large tank to Bermuda, to obtain angel sharks and other curious fish. Later in the season, when trout and salmon begin to spawn, the hatching process will be illustrated. Several specimens of forcing apparatus are already on exhibition. There is a tank filled with terrapin; and in one aquarium are gathered hundreds of small specimens of California salmon, which have been artificially hatched. We shall allude to this very interesting portion of the Exposition in detail hereafter.

The most active prolongers of youth are wholesome food, pure air, regular habits, and plenty of exercise for both mind and body. With these, added to a contented disposition and a good temper, Father Time may be long defied.

MECHANICAL HORSE GROOMING.

The benefits of machine grooming are twofold: first the removal of dirt, and, second, the keeping the pores of the skin open. The former only deals with the hair, giving to the animal a clean, shining coat; the latter promotes the health, thereby enabling horses to do more work, and milch cows to yield a larger quantity of finer milk. In both cases the difference is more in favor of machine grooming than some may perhaps imagine. Under a general practice of machine grooming, there would be less scurf and dirt to remove, so that the work would be done in half the time.

The engraving represents the groomer, invented by Messrs. Newton, of High Holborn, London, England. The winch handle projects from a fly wheel, around the periphery of which an endless gut band passes over a small pulley below. The framing of the machine is bolted to the floor. The three arms shown at different angles are tubes, each having a rotary spindle in it. These are connected to the spindle of the pulley already referred to by miter gear at each articulation, of a circular instead of a conical form, so that the spindles are actuated, whether at an angle or in a straight line. The brush is on the end of the spindle in the tube arm, held in the hand of the operator. The weight, with cord over the pulley, counterbalances the arms, thereby relieving the hand of the operator. The three arms bend in any direction; and by connection with the spindle of the pulley, they have also a rotary motion, enabling the operator to apply the brush to every part of the body, as back, belly, sides, and out and inside of the legs, and so forth. When the operator, holding the brush, turns the spindle of the pulley in the direction in which it is rotating, it is in favor of the person at the winch; but when he turns it the opposite way, it is the reverse. The machine is not more difficult to work than a chaff cutter, turnip pulper, or cake breaker. The brush may be taken off, and a polisher, consisting of a cylinder about the same size as the brush, composed of disks of thick felt material, put on.

IMPROVED BARN DOOR FASTENING.

We illustrate herewith a simple device for holding barn doors open. It works automatically, is composed of but two castings, has no springs, and, in short, is decidedly better than the hook and staple commonly used for the purpose. It consists of a strong hook peculiarly shaped, pivoted in a stand, which is attached by screws to the side of the barn. When not engaged, the hook stands as shown in the horizontal view, Fig. 2. The door, in swinging open, first strikes the beveled nose, A, pushes it back, and then meets the rear curved arm, B. As the latter is carried back, as shown in the dotted lines, Fig. 2, the nose, A, is once more carried forward and caused to engage the edge of the door, as exhibited in Fig. 1. There is a stop in the base to prevent the



hook from swinging back too far to be opened by the door.

Patented through the Scientific American Patent Agency, May 2, 1876, by Mr. Perry A. Peer. Agents wanted. For particulars address Mr. H. P. Kauffer, Kalamazoo, Mich.

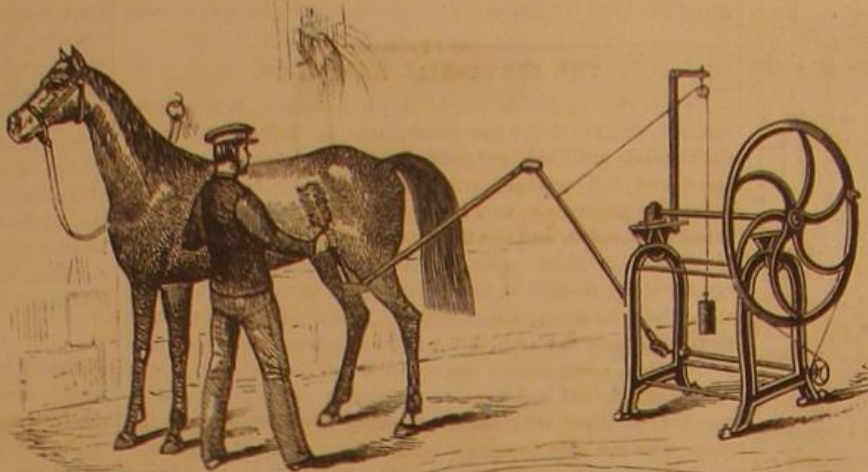
Cheap Foreign Postage.

It may not be generally known that American postal cards may be sent for an additional one cent stamp to the following countries: Netherlands, Moldavia, Newfoundland, Norway, Poland, Portugal, Roumania, Russia, Servia, Spain, Sweden, Switzerland, Austria, Belgium, Denmark, Egypt, Germany, Great Britain and Ireland, Greece, Greenland, Holland, France, Italy, Turkey, Montenegro, and Wallachia. It will be seen that persons can communicate with their friends in many parts of the world for two cents.

Engravings and Advertising.

Experience shows that the illustration of inventions by engravings is one of the best means ever devised for the introduction of inventions and the sale of patents. As a means for the circulation of such illustrations, nothing can compare in value with the SCIENTIFIC AMERICAN. Every engraving published therein goes before probably not less than one hundred and fifty thousand persons.

All good business men, before spending their money on advertising, are in the habit of inquiring about the character and extent of circulation enjoyed by the journal that solicits their patronage. In this respect the publishers of the SCIENTIFIC AMERICAN challenge the closest scrutiny; the

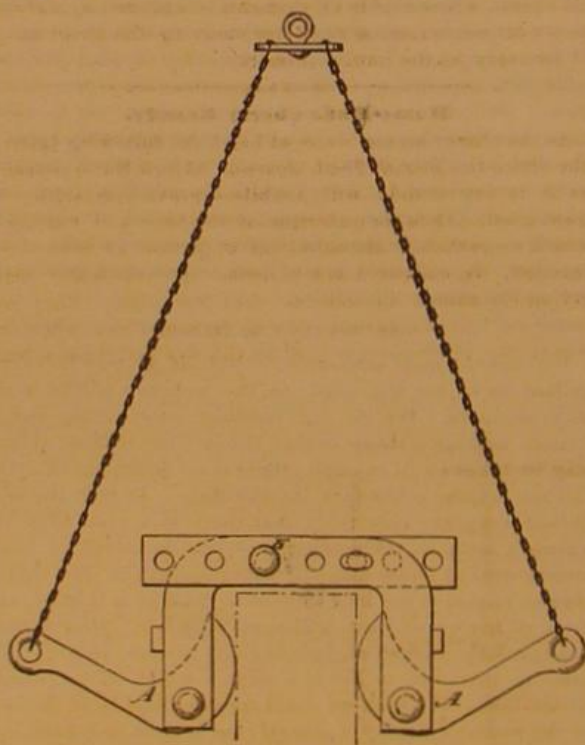
**MECHANICAL HORSE GROOMER.**

facts will show that their terms are much lower than those of any other journal of the same class in proportion to the extent of circulation.

Parties who desire to have their machines illustrated can address the undersigned, who are also prepared to send artists to make sketches of manufacturing establishments, with a view to their publication in the SCIENTIFIC AMERICAN. address MUNN & Co., 37 Park Row, New York city.

A NEW STONE LIFTER.

This is a simple and ingenious device, patented through



the Scientific American Patent Agency, April 25, 1876, by Mr. Sidney E. Shepard, of Mineral Point, Wis. It consists of a pair of eccentric lever gripping jaws, A, which are pivoted in a frame formed of two parts, as shown in the engraving. These parts are adjustable along each other, and may be secured by pins, E, to shift the jaws nearer together or further apart in order to adapt them for different sized stones. The arms of the jaws are connected by chains to an eye plate, and to the latter the hoisting rope is attached. The device will prove useful to builders and in stone quarries.

Another Chinese Giant.

Land and Water says that the last newspaper from the East inform us that a Chinese giant of extraordinary height has been discovered. His name is Chin ki Tsu; he is nearly 7 feet 4 inches high, and weighs 297 lbs.; he is 37 years old, and a native of Shantung Province. He is taller by 2 1/2 inches than Chang, and is believed to be the tallest Chinaman ever on exhibition. He is now on his way to the Centennial at Philadelphia, in charge of an Italian showman. He was picked up in Chefoo, where he worked as a coolie, and has an enormous appetite. On his way down to Hong Kong he was allowed fourteen bowls of rice and vegetables to each meal, and he ate it all without complaining.

PROFESSOR E. T. Quimby, of Dartmouth College, N. H., writes to state that J. D. L.'s solution of the Pythagorean problem was published more than 25 years ago, in Professor Alpheus Crosby's work on geometry.

Exhibition of the Applications of Electricity.

The exhibition is to take place in the Palais de l'Industrie in the Champs Elysées, and is announced to open on the 14th of July, and to close at the end of November. As in the case of the Maritime Exhibition held last year, and of that of Brussels, which is to open in June, exhibitors will have to pay for the space they occupy. The amount of interest which will be excited by such an exhibition may be best estimated by reference to the subjects of the eighteen groups which form the programme. The first group is retrospective, including as far as possible the apparatus of all the early discoverers. The second is devoted to laboratory apparatus, and static and dynamic electricity. The third group includes batteries, piles, and generators of all kinds. The fourth is devoted to electro-magnetism and its converse. The fifth group comprises the entire field of electric telegraphy. Others are devoted to electric horology, to the applications of electricity to railway trains, signals, etc.; to electric motors of all kinds; electric lighting, with its applications to photography; electro-chemistry, electro-metallurgy, synthesis, and analysis; electro-galvanic applications to the fine arts; electrotypy and electro-engraving; medical electricity; lightning conductors, and other apparatus connected with atmospheric electricity; the applications of electricity to military and naval purposes; electric toys and curiosities; and lastly, a collection of all the works that can be obtained upon electricity and its applications, whether French or foreign, with an analytical catalogue. The subject is a large one, and capable of interesting illustrations.

The proposal has been supported by the government; and the letters of the ministers of war, of the marine, finance, public instruction, and public works have recently appeared in print: The ministers of war and of the marine have authorized the officers of the army and navy to lend their aid, and have themselves named several officers of both services, and the other ministers have offered similar assistance.

Comte Hallez d'Arros, with whom the scheme originated, has formed a numerous and powerful committee of organization, including many of the best known men of science, engineers, and others in France, for instance MM. Edmond Becquerel, Bréguet, Dalloz, Dumoulin, De la Gournerie, Drs. Lionville, Lœury, Marié-Davy, Tessie du Motay, a large proportion of the members being engaged in the practical applications of electricity.

A SIMPLE KEROSENE-TESTING DEVICE.

Mr. H. E. Mead, of New York city, contributes the annexed illustration of a simple method, devised by himself, for testing kerosene oil with such ordinary appliances as are sure to exist in or about every dwelling. The extensive use of kerosene makes it important that people should understand how to avoid the numerous dangerous compounds sold as illuminating oils under high-sounding names.

This apparatus consists of a common tin pan of water, set upon bricks at a sufficient height to allow of a lighted lamp being inserted beneath. In the pan is floated a patty pan con-



taining a tablespoonful or two of the oil to be tested. A thermometer is also placed in the water. The indications of this instrument are noted as the water becomes gradually heated by the lamp, and from time to time an ignited match is applied to the oil. It is safe to advise the prompt throwing of the entire supply of oil into the sink in case a flash occurs below 100°. It is as dangerous as gunpowder. It is also a safe rule not to purchase oil which flashes below 110°, and it should be further understood that the greater the heat the material will endure without flashing, above 110°, the greater is the proportional increase in its safety.

NEWSPAPER and other publishers will be supplied with electrotypes of the Centennial Buildings and most of the other engravings which appear in the SCIENTIFIC AMERICAN and SUPPLEMENT, on very cheap terms. For prices address the publishers, and indicate at the same time what engravings are desired, and the date of the issue in which they appeared.

NEW SMOKE-BURNING GRATE.

M. Jordan, of Augsburg, Germany, has recently devised the new smoke-burning grate illustrated in the annexed engraving. Instead of placing fresh coal directly on the fire, it is shoveled upon an exterior plate, *a*, in order that it may previously undergo a kind of dry distillation. From the plate, *a*, the fuel passes to a front grate, *b*, the inner part of which is inclined at an angle of 20°. From *b* the coal falls upon another plate, *c*, situated on a level with the main grate, and being inclined rearwardly upward at an angle of 7°. The aperture between the front grate and plate, *c*, is closed by hinged doors, which are preserved from over-heating by the unconsumed fuel in their rear, so that they may be easily opened and closed by hand.

In its journey from plate, *a*, to plate, *c*, the fuel disengages the greater part of its gaseous elements; and the latter, mixed with the air which penetrates the front grate, *b*, pass to the flame in the main grate, *f*, and are there completely consumed. The management of the main grate is effected through the doors, *d*, but one of which is opened at a time, so as not to cool the fire. The apparatus is said to be easily worked, and the fireman is not subjected to the radiant heat from the furnace.

Roquefort Cheese.

Probably few of our readers know what this very odorous cheese is made from. Its consumption has lately increased, says the *London Grocer*, in an enormous proportion. China itself, it appears, comes in for no mean part in consumption. France, of course, eats more Roquefort than any other nation; and England is acquiring a taste for it. The ewe's milk, from which it is made, is carefully preserved for the special manufacturing of Roquefort; 250,000 ewes furnish this milk, which is poured into large earthen basins, and slightly heated; it is then placed in molds under a slice of decayed bread, which promotes the formation of greenish tints after which the cheeses are salted and piled up in cellars, where they are left for several months before they are edible; and even then it takes the American people some time to acquire the taste necessary for their proper appreciation.

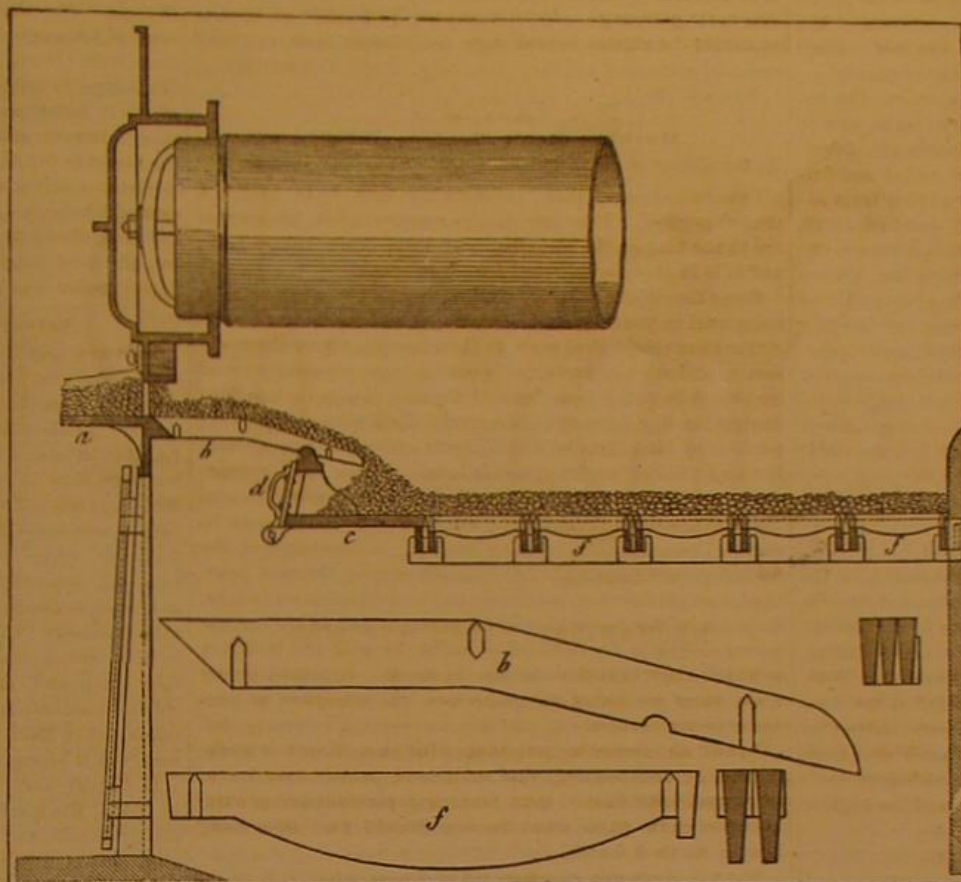
THE PLETHYSMOGRAPH.

Dr. A. Mosso, of Turin, says *La Nature*, from which we extract the annexed engraving, has devised a new method for measuring the movements of the blood vessels, which is destined to acquire very extended usage in physiological investigation and in clinical medicine. It consists in encircling with a rubber ring, *A*, any member of the body, as for instance the forearm, and inserting it in a glass cylinder, *B*, which is filled with tepid water. By means of a special apparatus is measured the quantity of water admitted or expelled through the opening, *F*, in said cylinder, by the contraction or dilation of the volume of the member. The cylinder rests on a plank, *E*, which is suspended by cords from the ceiling so as to prevent the involuntary movements of the body causing any motion of the arm in its receptacle.

In order to measure the water, the opening, *F*, communicates by a pipe with glass tube, *G*, which, bent at right angles, descends to the level, *a b*. A small test tube, *M*, suitably graduated, is suspended from a double pulley, *L*, and is equilibrated by the counterweight, *N*, to which is attached a pen which marks on an endless band of paper (not shown), caused to unroll before it by clockwork or other suitable mechanism. The test tube is so suspended that the pipe, *G*, is exactly in its axis. Supposing now that the vase, *P*, placed below the test tube, is filled with water, and that the vessels of the forearm dilate, increasing the volume of the member, a proportional quantity of water will then be expelled from cylinder, *B*, and will pass into the test tube, *M*. The latter will then sink in the vase beneath, and so will displace, in its turn, a quantity of liquid exactly equal to that which it has received. The counterweight, *N*, will of course rise, and obviously a contraction in volume of the arm will produce just the reverse result. In order that the pressure in the cylinder, *B*, may be constant, it is necessary that the water level in *M* shall always be in the plane, *a b*, of the liquid in the vase, *P*. To avoid displacements of these levels, a mixture of alcohol and water, of less density than water alone, is used in the vase. With this precaution the test tube may fill and empty, rise and descend, without its variation in weight causing any disturbance of the levels, the cylinder pressure thus remaining invariable.

By using two plethysmographs, Dr. Mosso has obtained pen traces representing the varying volumes of the forearms, the pulse of the carotid, and, in general, valuable physiological data leading to the demonstration of the most important phenomena of the blood vessels. He has been able to

make researches on the causes of sleep and the action of substances which favor or hinder the same. One curious result noted is that all the minor emotions translate themselves into modification of the state of the blood vessels. The mere entry of a person, interesting to the individual whose arm was being experimented upon, produced a diminution of volume in the member of from 0.25 to 0.75 cubic inch. The work of the brain, during the solution of any difficult problem, is said also to be always accompanied by a contraction of the vessels, proportionate to the effort of thought and to the cerebral activity. Dr. Mosso, says our contemporary,



JORDAN'S SMOKE-BURNING GRATE.

has opened a new field in experimental therapeutics, in giving us a most convenient method for studying the direct action of remedies on the human economy

Home-Made Cherry Brandy.

As the cherry season is now at hand, the following description, from the *British Trade Journal*, of how Swiss peasants make cherry brandy will doubtless prove interesting to those possessing large quantities of the fruit and desiring a possibly profitable utilization for a portion of their crop. The soft red-stalked black cherries are principally used, and are gathered as soon as they are ripe. They are preserved in open barrels during fermentation, when the fermenting cherries rise just to the top and form a com-

acquires a bitter taste, which is the result of the fermentation of the kernels of the cherry stones. This bitter taste is considered of such importance that in some places the cherry stones are specially taken out and pressed, and the results are then infused into the pure liquor.

Distillation among the peasants is effected by means of copper kettles, which have big hollow handles and one or two vapor-diverting pipes. The kettles, in consequence of the rise of the fermenting product, are never quite filled. They are very slowly heated, as their contents easily catch fire, and the brandy possesses the best taste when it has been gradually drawn off at a medium temperature. This process in the preparation of the *Kirschwasser*, as it is called, is managed by professional distillers. The cooling apparatus is generally nothing more than a stone or wooden reservoir into which the icy waters of a spring continually flow, and through which run one or more pipes (communicating with the still) in an oblique direction from top to bottom. Great care is taken that the distilled liquor is well cooled, as otherwise its quality very perceptibly suffers. That portion which runs over—the so-called precipitate—is carefully collected and poured back into the kettle in order to prevent the ether, of which it is partly composed, from concentrating in any one portion of the cherry brandy before the entire mass is properly boiled: perhaps also to prevent the cherry brandy from accumulating verdigris. When, towards the end of the process, the fluid is not found to possess the necessary strength—a *satur quo* which practised distillers can easily detect by the manner in which the atmospheric bubbles rise to the top when shaken—it is specially drawn off and mixed with the next cask. In large distilleries the process is conducted by steam.

Setting Flower Cuttings.

A practical florist gives the following directions for setting cuttings: A healthy plant should be selected, and strong-looking woody pieces cut off: these, with a blossom on the end, rarely fail.

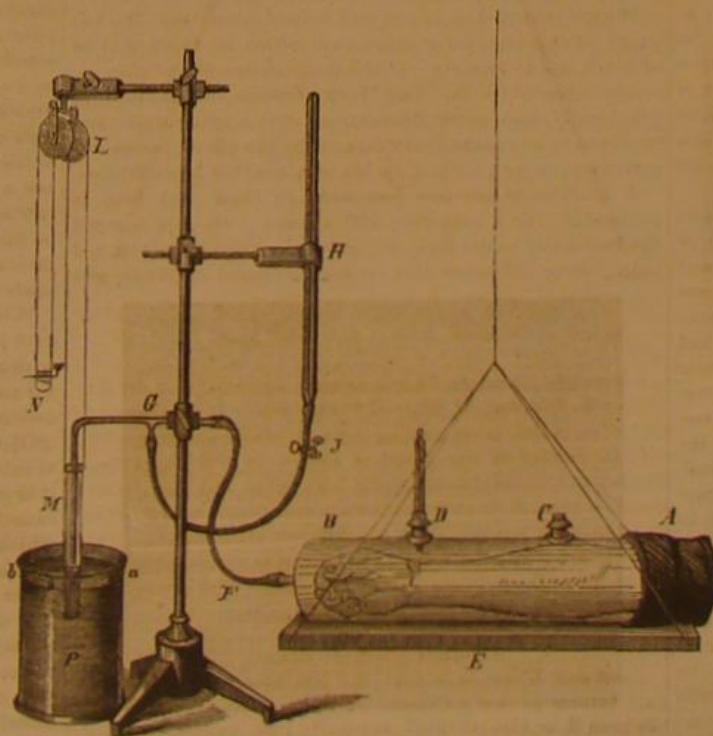
Trim off the large leaves and put them in water for a few hours or a day. Cuttings of ivy (*tradescantia*), wandering jew, canary bird flower (*tropeolum peregrinum*), and olean der, should be started in water and kept in water, in the shade, until a little root appears. Each cutting should have a good sized pot, or several cuttings can be put in a wooden box. The best soil for amateurs to use is half good earth and half white sand, well mixed; water well and keep in the shade, but not in damp, until the cuttings have taken, then give full sun. Transplanting geraniums requires skill. An amateur should use pots and keep the geraniums in them, sinking the pots in summer; and if the earth is not rich, they can be watered with fertilizers in winter. A five inch pot will do for a geranium for a year.

The Pictet Ice Machine.

Anhydrous sulphurous acid, SO_2 , is liquid under the atmospheric pressure at a temperature of 14° Fah., and does not give a pressure exceeding four atmospheres for a temperature of 95° Fah. It has no action on metals, or on grease, is not combustible, and at the same time is not expensive. A new ice machine has been devised by M. Raoul Pictet, to produce cold by using anhydrous sulphurous acid.

The experiment which has given the best results, for a type of machine capable of manufacturing 550 lbs. of ice per hour, may be described as follows:

A tubular cylindrical copper boiler, 6 feet 6½ inches long by 13½ inches diameter, is traversed longitudinally by 150 tubes of 1½ inch diameter, which are welded at their extremities to each end of the boiler or refrigerator. The vessel is placed horizontally in a large sheet iron vat containing one hundred boxes of 5½ gallons of water. An anti-freezing liquid (salt water) is constantly driven into the interior of the refrigerator by means of a screw. This liquid cools to about 19.5° Fah. for ordinary working, and in returning washes against the sides of the box in which is the water to be frozen. In the reserved space between the refrigerator tubes, the liquid sulphurous acid is evaporated, and its vapors are drawn by a force and suction pump, which compresses them in the condenser. This condenser is a tubular boiler identical with the refrigerator, with this exception, that



THE PLETHYSMOGRAPH.

paratively thick covering over the cherry liquor, as soon as fermentation has ceased, they sink again to the bottom, and are entirely covered by the liquor. The carbonic acid gas usually escapes with violent precipitation. When the weather is warm, this stormy flight ceases after a few days, but only very gradually; and then, if the manufacturer does not wish to enter into the process of distillation immediately, the cask is hermetically closed. As a rule, distillation is postponed to the winter, not, however, for want of time, but principally because in the meanwhile the cherry brandy

a current of ordinary water continually passes and repasses through the interior of the tubes to carry off the heat produced by the change from a gaseous to a liquid state of the sulphurous acid by the work of compression. A tube, with a stopcock regulated by hand once for all, allows the liquid sulphurous acid to return to the refrigerator to be again volatilized. The anhydrous sulphurous acid has the exceptionally advantageous property of being an excellent lubricator, so that the solid metallic piston working in the cylinder of the forcing pump does not need oiling. Thus introduction

of foreign matter into the apparatus becomes impossible. The force necessary for manufacturing 550 lbs. of ice per hour is at the outside 7 horse power. A temperature of 19.5° Fah. in the bath is more than sufficient for obtaining in the boxes a rapid and entirely economical freezing. The cost of making ice by this process is estimated at \$2 per ton.

THE CENTENNIAL HORTICULTURAL BUILDING.

On the front page of this issue we publish an engraving of the interior of Horticultural Hall, a building which will be, to many visitors, the most attractive section of the Exhibition. The lightness and airiness of the structure and the beauty and variety of its contents, added to the fact that all their attractiveness is the work of Nature, will certainly secure a large share of the attention of many visitors. The noble palms shown in our engraving, are, many of them, new to this country; and there is, in nearly every department of floriculture and arboriculture, a good selection of native and foreign species. One hundred species are forwarded from Jamaica alone, all of them rare and interesting, many of which have never been in this country. The ferns indigenous to the United States also number one hundred varieties. Moreover, the following interesting and valuable plants will be shown, growing in the soil, and blossoming and bearing fruit: Ginger, pimento or allspice, nutmeg, alligator pear, bamboo, sarsaparilla, Liberian coffee, yam, cashew nut, *Ligustrum citra*, teak, Indian or China grass, betel nut, tea. Also, specimens of the pawpaw, mamme apple, mango, black pepper, indigo, breadfruit, and naseberry. A few beautiful specimens of the orchid may also be found in the west wing of this building.

Illustrations of the Centennial.

We give on our front page an elegant illustration of the interior of Horticultural Hall, for which we are indebted to *Harper's Weekly*. We will take this occasion to say that the picture of the Woman's Pavilion and New Jersey building, given in our number for June 3, were also from that journal, credit for which was inadvertently omitted at the time of publication. The arrangements of the Messrs. Harper for the illustration of the Exhibition have been made on a most extensive scale, regardless of cost, and the numbers of their popular weekly teem with artistic productions of the highest merit.

Correspondence.

The Extraction of Gold.

To the Editor of the Scientific American:

The variety of the elementary bodies found in ores of the precious metals renders it extremely difficult to furnish any single formula that will in all cases meet the requirement of the metallurgist; but a large class of placer gold and auriferous ores will admit of treatment by the following process, which may, by slight alteration, be made to suit others.

Gold is generally found in Nature accompanied by other metals; and those are often in combination with other elementary bodies, such as sulphur and tellurium, in variable proportions. These are subject to decomposition by the action of oxygen, or water, or carbon; in the change, sulphuretted hydrogen is generated, and perhaps a union with sulphur and carbon is effected. The former is readily absorbed by gold, communicating to it a negative quality as regards mercury, forming what is called unamalgamable or rusty gold. The ordinary amalgamating process takes up a large part of the coarse gold. This favorable condition is due to its greater specific gravity, which favors superficial cleaning by the attrition received, while it presents less surface of the gold to chemical action. The finer particles escape amalgamation.

A quantitative analysis of the tailings at any of the quartz mills or placer washings will determine the difference of the assay value and the amount obtained by the mills; and the difference between the two estimates will excite some surprise. To obviate some of the inconveniences above mentioned has long been desirable, and resort has been had to other methods of treatment. Smelting, one of the most perfect processes for the reduction of metals, is unfortunately one of the most costly, and therefore cannot be employed in case of poor ores. The next in importance is the chlorination process, the invention of the celebrated metallurgist Plattner, of Freiburg, Germany. This process presents advantages of economy which have caused it to be adopted in California and elsewhere; yet unfortunately it entails certain conditions, difficult to comply with in many cases, which greatly impair its value. It is necessary that the ore should be free from most of the base metals and earthy bases. The weak attraction for oxygen and want of stability of the former, and the absorption of chlorine by the latter, will defeat the object in view. Under the most favorable conditions, very great skill and attention are necessary to insure success. To avoid the cost of smelting, and the restrictions narrowing the sphere of usefulness of the chlorination process, the following process has been devised:

The auriferous sulphides or fine sulphurets are roasted in the ordinary reverberatory or other furnaces, under the conditions commonly employed. The sulphurous vapors arising are passed through a broad-based chimney, partially filled with ore, rock, or coke, of egg size or thereabouts, resting upon a grating. A small stream of water is introduced and allowed to impinge on the top, and will percolate through the whole mass. The water arrives at the bottom highly charged with sulphurous acid from the ascending vapors; this acid may be converted into sulphuric by the use

of hyponitric acid in a similar chimney arrangement. After roasting, the ore may consist of sulphate, sulphide, and oxide of iron, copper, etc. If the roasted ore is treated to a warm solution of dilute sulphuric acid, as above mentioned, there will result the following reaction: $\text{FeS} + \text{H}_2\text{O}, \text{SO}_2 = \text{HS} + \text{FeO SO}_2$. The sulphuretted hydrogen passes off as vapor; the iron sulphate and other soluble salts, if present, may be leached out. The insoluble salts remaining with the gold exert no action in separation by mercury. The addition of a little caustic lime at end of the process, excluding it as much as possible from atmospheric influence, will give rise to the formation of the hydrated protoxide of iron, a powerful deoxidizer, which acts by keeping both mercury and gold clean and active.

JOHN TENBRIDGE.

Newark, N. J.

Working Men's Reading Rooms.

To the Editor of the Scientific American:

I am happy to see that the working men have in you a true champion. They are to the country what his staples are to the farmer, to be relied on when other things fail; and it is in their behalf that I wish to speak.

Some time since I saw a reading room for working men suggested in your paper, and some of the towns in this vicinity have established such, to their benefit. Now there are many, perhaps hundreds, of working men, especially those employed in watch factories and the like, whose occupations during the day demand such a strain upon the eyesight that reading by lamplight is both difficult and injurious. There is also a class of working men whom my plan is more especially intended to help, namely, those whose limited education has not given them tastes which are calculated more to elevate character than to make money. A mechanic of the humbler class spends his life so much among the real, practical, and prosaic that, unless he has a very spiritual nature, he is apt to become coarse in his perceptions; and if he has no natural taste for instructive books, he will not be likely to acquire one in following his business. In almost every town, there are ladies and gentlemen who can spare at least one evening in the week, and who have enough literary talent to fill an interesting programme for an audience of working men, giving readings and addresses, which may be interspersed with music, thus making a pleasant and profitable evening for those who otherwise would find time hang heavily on their hands.

Many a workman who has yet to know what it is to receive wages that do not necessitate the strictest economy feels a pardonable hesitation in taking his family to any kind of meeting where broadcloth and velvet abound, and where people look askance at his worn clothes and hardened hands; but the entertainment I suggest would be his and his alone, and he and his fellow workers could meet thereat without restraint.

This suggestion is respectfully offered, not in opposition to that of the SCIENTIFIC AMERICAN, but to meet a want which that, in some instances, would not entirely cover. These ideas are, of course, subject to modifications; but I feel sure that such an institution, organized in any manufacturing town, would not be long in existence without a marked change for the better.

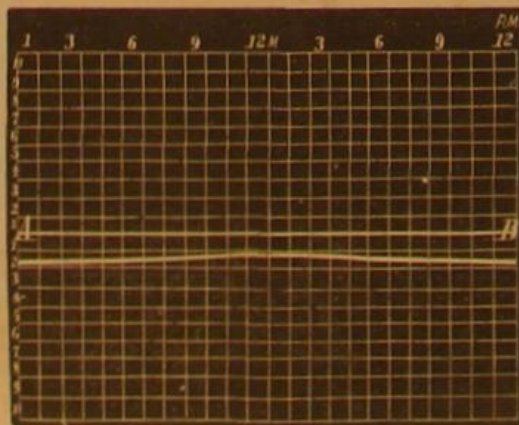
M. P. P.

Rockton, Ill.

HOME-MADE PROBABILITIES.

We are indebted to an old and valued subscriber, Dr. Leving, of this city, for a suggestion which we think will be of much use to farmers. It is a modification of the plan recently adopted by the New York *Tribune*, for exhibiting, graphically, barometric fluctuations over a given time; and its object is to enable every farmer, by the aid of barometer and thermometer, to cast up his own weather probabilities.

A blackboard, say two feet wide by three feet long, is preferable, but a barn door will answer. On this is ruled the horizontal center line, AB, in the engraving, say in red paint; above and below this are ten horizontal divisions, and



the board is also divided vertically into twenty hour sections, numbered to represent the hours as shown. The red line marks a barometric height of 30 inches, and the other horizontal lines tenths of inches above and below. It is evident that on this the course of barometric variation can be indicated by an irregular line. For example, our engraving shows that at 12 P. M. the instrument registered 29.82, 12 hours later it had risen to 29.88, then it declined to 29.84. The board thus prepared is hung at any convenient place, near the barometer; and at noon or at any other time, whoever may pass it has only to glance at the clock or his watch, look at the barometer, and carry on the line to mark the indication with a bit of chalk. Then in the evening, say, if the farmer is desirous of knowing whether the weather will be fine on the morrow, he merely glances at the board, and the

direction of the line tells the story. Being only a chalk mark, the line is rubbed out and made over every day. By observing the weather following changes of barometer, the farmer can soon learn to interpret the indications. As a general rule, however, says the *Tribune*, when the curved line is above the line of mean pressure and varies but little, fair weather may be relied upon; but if there are sudden and excessive fluctuations, a northeasterly storm is likely to follow. The time of its approach is indicated by the frequency of the fluctuations, its violence by the excess of the movement. When the curve is below the line of mean pressure, uncertain weather, mainly from the southward, with increased temperature, will follow. A descent of the curved line from above to below the line (30) evinces a tendency from good to bad weather; while an ascent, from below to above it, points as unmistakably to pleasant weather, which may, however, not be of long continuance. The diagram is the measure for all storms likely to occur. The proportional distance above and below the central line marks the excess of changes. As temperature corresponding to barometric indications is also an aid to predicting the weather, a second board might be constructed to mark changes in the thermometer, and hung beside the one already described.

Solvay's Ammonia Soda Process.

This new method of making soda ash from common salt seems likely to prove as great a success in practice as it is remarkable in theory. In technology revolutions take place slowly. Although this process was exhibited at the Vienna Exhibition and attracted a great deal of attention there, it has been slow in coming into practical use. Professor A. W. Hofmann did not hesitate then to prophesy for it a brilliant future, but some details of the operation were not yet perfect, and, while capitalists hesitated to risk on a thing so new, old manufacturers fought it as their direst foe. The operation depends on a principle discovered a long time previous, namely: that bicarbonate of ammonia is able, under certain circumstances, to decompose the much more permanent compound, chloride of sodium, the result being chloride of ammonium and bicarbonate of soda. A patent was taken out in 1838, in England, for making soda ash in this way, but it seems not to have come into practical use.

E. Solvay took out several patents abroad, the first being in 1863. His method, we understand, as now employed, is nearly as follows: In one tank a saturated solution of common salt is first prepared, and then slightly diluted with water until it stands at 67° or 70°. This solution is then filtered and run into a second tank, and ammonia gas forced up through the brine in small bubbles, which are rapidly absorbed. When the brine has become saturated with ammonia gas and its density falls to 16°, it flows automatically into the third tank, first, however, passing through a worm placed in cold water to cool it. This third vessel, called the absorber, is the most important part of the apparatus, for it is here that the carbonic acid is admitted, which seems to first to combine with the ammonia to form a bicarbonate of ammonia, then, gaining fresh power, it attacks the chloride of sodium, driving out the acid and combining with the base. The operation may be represented thus: $(\text{NH}_4)\text{HCO}_3 + \text{NaCl} = \text{NH}_4\text{Cl} + \text{NaHCO}_3$. The absorber is a cylinder 37 to 53 feet high, provided with numerous perforated, convex, horizontal partitions, or false bottoms, with teeth-like openings around the edge. The absorber is filled with liquid and carbonic acid forced in at the bottom under 1½ to 2 atmospheres of pressure; and ascending, it comes into intimate contact with the liquid. The bicarbonate of soda collects as a crust on the false bottom. The liquor is frequently drawn off, and the absorber filled with water to dissolve the soda salt, which can then be evaporated in vacuo and the excess of carbonic acid driven off and caught in receivers for use a second time. The carbonate of soda resulting from calcining this bicarbonate is quite pure if the salt employed be pure, and is at all events free from sulphur, an ever-present and unavoidable contamination of crude soda ash made by the Leblanc process.

What becomes of the waste products? The chief by-product is, of course, chloride of ammonia, which by treatment with an alkali is decomposed, and the ammonia gas liberated for use over and over again. If quicklime be employed to decompose the sal ammoniac, the operation is as follows: $2\text{NH}_4\text{Cl} + \text{CaO}, \text{H}_2\text{O} = \text{CaCl}_2 + 2\text{NH}_3 + 2\text{H}_2\text{O}$. The chloride of calcium thus obtained being an article of very little value, it is preferable to decompose the sal ammoniac by means of caustic magnesia, thus obtaining a chloride of magnesia, which can in turn be decomposed very readily by the action of steam into caustic magnesia and hydrochloric acid, the latter a valuable commercial article, the former for use again.

It will be seen that there is no waste, every product being utilized; and the question of practicability rests chiefly on the one question: Is bicarbonate of ammonia able to decompose all, or very nearly all, the chloride of sodium in the brine? Ordinarily, no; but under pressure and by a proper adjustment of conditions it seems to have become possible, else the success of the process reported abroad could not have been attained.

Moths.

This is the period when moths begin to fly, and those who have not packed away winter garments and furs should lose no time in doing so. Beat the articles thoroughly, and expose them to bright sunlight and air for several hours. Seal them up in tight paper cases, or put them away in close trunks, with plenty of gum camphor, pepper, tobacco, chips of Russia leather, or cedar dust.

A GOOD cheap paint for rough woodwork is made of melted pitch 6 lbs., linseed oil 1 pint, brick dust 1 lb.

PORCELAIN AND POTTERY.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY PROFESSOR CHARLES F. CHANDLER, OF COLUMBIA COLLEGE, NEW YORK CITY.

The object of the present lecture is a brief description of the potter's art in its various branches. The word pottery, which is of Latin origin, is frequently replaced by ceramics, a word derived from the Greek, and having a more comprehensive meaning. The material used in this art is chiefly clay, a hydrated silicate of alumina; and the product differs from glass partly in composition and partly in the mode of preparation. Glass is readily fusible, and can be worked only in a fused condition. Pottery, on the contrary, receives its final form before the fire is applied, and it is then baked only to harden it.

When the molten mass of the earth became solidified, the outer crust was composed chiefly of silicious rocks, such as granite. Granite is composed of three different substances: quartz, which is almost pure silica; felspar, a silicate of alumina and potassa; and mica, a silicate of lime and alumina. After a time the high temperature prevailing on the earth's surface decreased, moisture was precipitated, oceans were formed. These oceans were acid, containing hydrochloric acid, by which the rocky crust was attacked and decomposed. The disintegration of the silicious rocks is still going on, though only on a much reduced scale, and the products of their disintegration maintain the fertility of our soil. The felspar and mica are thus converted into clay, in which the quartz remains imbedded, the whole retaining the original shape of the parent granite until it is washed away by the action of water. Then the heavier and coarser particles of quartz are deposited near by as sand, while the finely suspended clay is carried to some distance into quiet water, where it has leisure to settle. By further chemical action the clay may then be cemented together to form slates and shales, and the sand to form different kinds of sandstone.

Clay is found nearly everywhere on the surface of the earth. It is valuable to us on account of its plasticity, by virtue of which it may be easily molded, rolled in sheets, and worked like dough, and because it may be baked together to form a solid, compact mass. In its pure state it has the disadvantage of shrinking considerably in the baking, and other substances must be added to counteract this tendency. Sometimes the proper mixture is found ready made in Nature. The purest of all clays is known as kaolin, china clay, or porcelain clay. It is indeed perfectly pure and white, and was formerly found only in China. For this reason the manufacture of porcelain was so long impossible in Europe. Clay containing carbonate of lime is called loam, and, colored with oxide of iron, ochre. Other names are potter's clay, brick clay, marl, etc.

The ware manufactured by the potter varies with the nature of the clay and of the substances added to it. We may classify it under the heads of porcelain, stoneware, and earthenware.

Porcelain is dense, hard, and compact; it emits a ringing sound on being struck, cannot be scratched, and is more or less translucent when held up to the light. When broken, the fracture shows no porosity, and it does not cleave to the tongue. There are three varieties: the hard or real porcelain, in which the glazing is of the same material as the body of the ware, differing only in proportions; the soft or tender French porcelain formerly made at Sèvres, which is not a true porcelain but a semi-fused glass-like substance; and the English soft porcelain, which is made with the addition of phosphate of lime or bone ashes to render it more fusible.

Stoneware, in its more common forms, is dark, more or less imperfect, partially fused, and covered with a thin glaze. The characteristic of earthenware is its porosity; it is not fused at all.

True porcelain came originally from China and Japan. Its manufacture, according to their traditions, extends back to the remotest antiquity. It was found there by travelers as early as 2,000 years ago. For a time the secret was lost; but about 485 B. C. it was recovered. The first attempt to imitate it in Europe was made in 1695, when they succeeded in making the tender porcelain at Sèvres. In 1703, true porcelain was invented in Germany. Böttger, a Berlin apothecary, somehow acquired the reputation of possessing the secret of making gold. So valuable a person could not be suffered to remain at large by a needy government, so he was kept in confinement and provided with all the materials he asked for. His gold making proved a failure, but he succeeded in producing a red stoneware having the properties of porcelain; and in 1709, when kaolin was found at Schneeberg, he at last produced the true white porcelain and became the first director of the works at Meissen. A history of the early potters and their hardships would be very interesting, if the time permitted. Take, as an example, the case of the Frenchman Palissy, who had sacrificed all he had in his endeavors to make the kind of ware known as *faïence*; and when on the point of succeeding, he made firewood of his furniture and tore up the floor of his room to keep up the heat of his kiln.

After a time the secret of the art leaked out; works were established in Berlin in 1751, and in Nymphenberg, Bavaria, in 1755; and in 1765 they gave up making soft porcelain at Sèvres, and began the manufacture of the true hard variety.

If kaolin alone were used, it would shrink considerably in the baking, and would furnish a very porous product. To prevent excessive shrinkage, quartz is added, while felspar is used to fill up the pores. The kaolin is first washed by suspending it in water, allowing the coarse particles to settle in the first tank, then drawing off to a second, and so on, until the deposit is of the requisite fineness. This process

is called elutriation. In the next place, the felspar and quartz are calcined, dropped red hot into water to disintegrate them, and passed through a crushing mill. Fineness of the product is essential to success. Then all the materials are mixed up wet, in a rotating apparatus containing a number of knives. As the mixture would settle unevenly if allowed to stand, it is run into a number of flat bags placed between boards, and the water is readily filtered off. By allowing the mass thus obtained to stand some time before working, it becomes more mellow and plastic.

The process of shaping the plastic mass was illustrated on the platform by a professional potter, who made a number of objects on the potter's wheel, an horizontal disk of wood rotated by means of a larger horizontal metallic disk placed on the same axis and kicked by the foot. Another plan is to mix up the material with water to the consistence of cream and pour it into plaster of Paris molds, a number of which were exhibited. The plaster absorbs the water, and then the very fragile vessels of clay may be taken out and completely dried previous to baking. They require a temperature rather higher than a bright red heat. For this purpose large kilns, two or three stories high, are constructed, the rooms of which are large enough to walk about in. This is necessary, because the greatest care is required to avoid breaking the unbaked vessels, or green ware, as it is called. For the best quality, each object is separately placed on an infusible mold or seegar of the same shape. For inferior articles one seegar is made to serve for many objects, which are then kept apart by little bits of clay. Hence we often see two or three little defects in the glazing. When the vessels are baked, they come out as biscuit ware, which is compact and strong enough to bear handling.

They are next glazed by means of the same mixture with the addition of more felspar, which renders it more fusible. The vessels are dipped into the mixture, dried, and put back into the furnace, first taking care to remove all the glazing mixture from the bottom to prevent their being cemented to the seggars. The decorations are painted on with metallic oxides ground up with oil of turpentine, oil of lavender, or a solution of gum, and burnt in by placing in a small muffle furnace. Chromium produces a green, cobalt a blue, and gold a purple color.

Specimens of porcelain from different works were exhibited, the American specimens being from the Union Works at Greenpoint. The latter were made more durable than ornamental, to suit the demand, though some were quite as thin and delicate as Berlin ware. Samples of artificial teeth of porcelain, purely an American enterprise, were also shown.

Stoneware is made from certain natural clays which contain the constituents of the porcelain mixture, but are more or less colored. It is thinly glazed by means of lime, soda, or potassa fluxes. Ordinary salt is often used for this purpose.

Granite ware is an English and American combination of stoneware clay and the porcelain mixture, for ordinary table china. To conceal the natural color, an opaque glaze of borax, lime, and oxide of tin is laid on. Instead of being decorated by the artist's brush, the design is printed on paper, stuck on, and burnt in. This ware is sometimes tinted blue with oxide of cobalt, or buff with oxide of iron.

Earthenware is merely baked without fusing, hence it is very porous and well suited for flower pots and water coolers for warm countries. The red color is due to oxide of iron. Some earthenware is glazed with oxide of lead; but this should never be used, as the glazing is poisonous. Acids readily attack it. It is easily recognized by its very glassy appearance.

Formerly the most famous pottery was the *faïence* (originally from Faenza, Italy) and majolica (from Majorca), which consist of a cream-colored, porous earthenware covered with a thick glaze.

The lecturer concluded by exhibiting a large number of screen pictures, representing the manufacture of porcelain among the Chinese, the Egyptians, and the moderns, together with some of their choicest productions. C. F. K.

Useful Recipes for the Shop, the Household, and the Farm.

An excellent process for coloring gold is based on the use of the following materials: Nitrate of potassa 6 ozs., common salt 3 ozs., sulphate of zinc 3 ozs., alum 3 ozs. These are reduced to powder and allowed to dissolve slowly in the color pot over a fire that can easily be regulated. The mixture should be well stirred with an iron rod; and as it dissolves it will rise, when the work must be at once suspended in it and kept in continual motion until the liquid is about to sink down in the pot. The objects are then taken out and immersed in clean muriatic acid pickle, which will remove the adhering color. The color in the pot will rise again after the withdrawal of the work, and this opportunity may be taken advantage of for a fresh dip.

The following four recipes for dyeing goods at home are contributed to *Inter-Ocean*:

For orange on cotton goods, take 1 oz. bichromate of potash, 2 ozs. sugar of lead; dissolve in soft water enough to cover the goods, put in goods, simmer a few minutes, rinse in cold water, and dry. For blue, for 10 lbs. of goods, dissolve 10 ozs. copperas in water to cover the goods, put the goods in soak 4 hours; heat soft water boiling hot, and put in 6 ozs. prussiate of potash; put in the goods; let remain half an hour; air a few minutes, then add more prussiate of potash; put in the goods, let remain a short time; air again, and add 4 oz. oil of vitriol; put goods back; let them remain 3 minutes, stirring them, then rinse in cold water. If wanted very light, do not allow the goods to remain in the dye after

adding the vitriol but a moment; the shade can be made darker or lighter by the time it is left in the last time.

Permanent green on cottons: First color blue; then dissolve 5 ozs. sugar of lead in 4 gallons of water. Dissolve in another vessel 4 ozs. bichromate of potash in 4 gallons soft water. Dip the goods first in the lead water a few minutes, then in the potash water; wring out dry; afterwards rinse in cold water. If you wish a dark green, first dye a dark blue; if light green, a light blue.

Permanent yellow and orange: For 5 lbs. goods, 7 ozs. sugar of lead, in which dip the goods 5 minutes. Make a new dye with 4 ozs. bichromate of potash; allow the goods to remain about 10 minutes, or until the color suits. For orange pass it through strong lime water.

Durable brown for 5 lbs. goods: Two ozs. copperas (or alum) in sufficient water to wet the goods. One pound japonica dissolved in water. Take as much weak lye as will wet the goods well (or 8 ozs. bichromate of potash—this is more expensive, but no better); put in the japonica water; dip the cloth first in the copperas water, then in the japonica water, having it hot. Care must be taken to use a weak lye; if it be too strong, the color will be too dark.

We call the following practical suggestions relative to hop growing from the report of a meeting of the Hop Growers' Union, at Clinton, N. Y.: Hops should be planted on well drained high ground. Land which has been in cultivation at least one year is better than sward land. The hills should be made seven or eight feet apart. Inasmuch as an early start and vigorous growth the first year insures vigor during the second year, it is well to plant as early as possible. Make the holes with a hop bar and plant five pieces of root in each. Do not cut off the first year's growth if the vines spread inconveniently, but wind them about the stake. Always cover the hills with manure before the ground freezes. The vines should be tied as soon as they will reach the poles. Do not begin to pick too early; when fit to gather the seeds will be hard and brown. All hops should be picked within a period of eight days. Farm manure is preferable to prepared fertilizers.

A good and simple furniture polish consists of a little Castile soap scraped into a pint of warm water. Add three tablespoonfuls of sweet oil; heat, and apply while hot.

Ceilings that look very rough and manifest a tendency to peel should be gone over with a solution of 1 oz. alum to 1 quart water. This will remove the superfluous lime and render the ceiling white.

The green outer husks of walnuts contain a yellow brown and remarkably fast dye, which is well suited for dyeing woolen or cotton materials, staining wood, etc. Wool thus dyed requires no mordant, is very soft to handle, and not like that dyed with vitriol. The shades of color obtained are from bright to dark brown. The husks may be simply kept dried till used, or packed moist in tubs, by which means their coloring power is further increased.

During recent experiments on fireproofing materials at Vienna, the following mixtures of salts were successfully employed: To 20 parts by weight of water add 3 of borax and 2½ of sulphate of magnesia. This forms an insoluble borate of magnesia, which surrounds and impregnates the threads or fibers to which it is applied, and renders either the development of gases or the spread of flame very difficult. To 1 part liquid sal ammoniac, add 2 parts sulphate of lime. A single coating of this acts as an excellent preservative for wood structures against burning. Old roofing soaked with tar and oil failed to catch fire after being impregnated with this mixture.

A new waterproofing compound for fabrics is made as follows: In 14 parts of water, heated to 180° Fah., dissolve 10½ lbs. gelatin and 21 lbs. castor oil soap. Then add 10½ lbs. gum lac, shaking the liquid until the last is completely dissolved. Remove from the fire, and add in small quantities 21 lbs. powdered alum until the alum dissolves. This forms an insoluble alumina soap, closely incorporated with the gelatin and the gum lac. Apply with a brush.

A cement suitable for joining metals to non-metallic substances is prepared by dissolving in boiling water 2½ lbs. glue and 2 ozs. gum ammoniac, adding in small quantities about 2 ozs. sulphuric acid.

Exterminating Bedbugs.

Where all other means have failed to exterminate bedbugs, sulphurous acid gas has succeeded. Take everything out of the infested room, plug up all the windows tightly, close all chimneys, and empty about 1 oz. of powdered sulphur on a pan of hot coals, placed in the middle of the floor. Shut the doors and cover all cracks; let the sulphur burn as long as it will. Where the room is large, it is a good plan to fasten a bit of tin tube to the bottom of the pan, and to this connect enough small rubber pipe to lead out of the nearest door. By blowing into the end of the pipe with the bellows, the sulphur will be caused to burn more quickly by the draft created, and to give a denser smoke. After the sulphur has burned out, paint all the cracks in the floor and around the mop board with a strong solution of corrosive sublimate, and treat the furniture to the same before replacing it. We have seen a room frightfully infested completely freed by this plan.

To bleach leaves, mix 1 drachm chloride of lime with 1 pint water, and add sufficient acetic acid to liberate the chlorine. Steep the leaves about 10 minutes, and until they are whitened; remove them on a piece of paper, and wash in clean water.

C. T. S., of Rockland, Mass., claims that the nail-making machine, recently credited by us to the late Jacob Perkins, was the invention of Colonel Jesse Reed.

IMPROVED PORTABLE PHOTOGRAPHIC APPARATUS.

We illustrate herewith a new photographic apparatus of very simple construction and intended to enable persons having little or no knowledge of photography to succeed in producing good pictures. It is equally well suited for the professional artist as for the amateur, and its compact form renders it especially well adapted for out-of-door work. The manipulations required are purely mechanical and require no dexterity or skill. The dark room or tent is abolished, and there is little probability of clothes or hands being soiled with the chemicals.

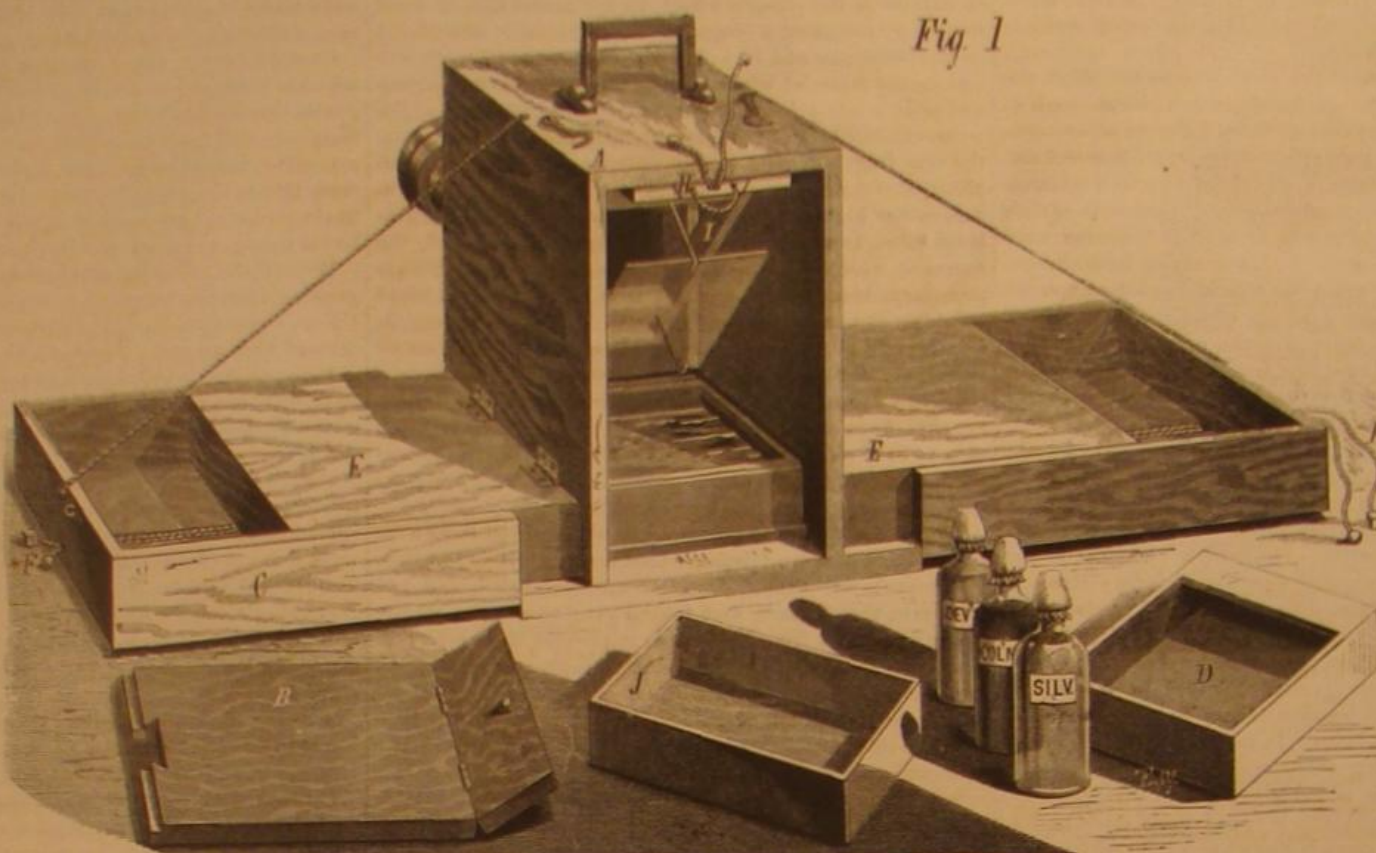
Fig. 1 represents the invention ready for use; the construction is depicted in the sections, Figs. 2 and 3. The central and main case, A, Fig. 3, is provided in front with the usual lens and cap, and in rear with a removable shutter shown detached at B, Fig. 1. To the bottom of the main case at each side are hinged side cases, C, which, when extended as shown in Fig. 1, are sustained by cords, and, when folded as in Fig. 3, are attached to the main portion by hooks and staples. Openings are made in the lower part of each side of the main casing, as shown in Fig. 3, to allow of inserting therein the trays, D, containing the developing and other solutions. Just above these openings are hinged boxes, E, which inclose the trays when the latter rest on the side cases, C. In this position the two boxes, with the central or main case, form the dark chamber. When the apparatus is folded, the boxes rest, as shown in Fig. 3, against the side walls of the main case. The trays, D, are made of sheet zinc, and are controlled from both sides of the apparatus by the strings, F, by which they are drawn at will from their position in the boxes, E, into the main chamber, or vice versa.

G, Fig. 2, is the focussing frame which slides by a dovetailed piece in guide strips. The sliding piece is graduated above so as to allow of the adjustment of the frame in any position in which it has formerly been set. A loop shown at H, Figs. 1 and 2, serves to move the frame as desired. Inside the latter is pivoted a swinging frame, I, Figs. 1 and 2, which supports projecting wire arms having hook ends to hold the ground glass or sensitized plate. This frame is held above by a suitable catch, which is released at will by one of the strings shown at the top of the case. A second string serves to raise and lower the frame, I, so that the plate may be dipped at will into the different solutions contained in the tray below (dotted lines, Fig. 2).

Besides the two trays in the side boxes there is an additional water tray, which is introduced into the main case through the lower hinged part of the rear shutter. There are also suitable boxes, J, Fig. 3, for storing the bottles of chemicals, etc. The mode of manipulation is as follows, the apparatus being arranged as in Fig. 1:

The focussing frame is drawn out and the ground glass inserted, and the whole pushed back until the catch engages. The frame is then adjusted until a clear image of the object

with the developing solution, and replaced. The collodionized glass plate is now inserted instead of the glass one, and the frame moved forward. The rear shutter is affixed in position. The swinging frame catch is next released; and the frame is gradually lowered into the silver solution, the tray containing which has previously been drawn into position. The plate is allowed to remain in this bath for about four minutes, to render it sensitive to light. It is then lifted out, and the frame carried forward until the click of the catch is heard. The focussing frame is now adjusted to the mark on the scale already observed, the lens cap is removed, and



BRICE'S PORTABLE PHOTOGRAPHIC APPARATUS.

exposure takes place. The tray with the silver solution being returned to the box, the developing solution is drawn into position, and the glass plate is lowered into this for about ninety seconds. At the expiration of this period it is removed; and the water bath being introduced through the rear shut-

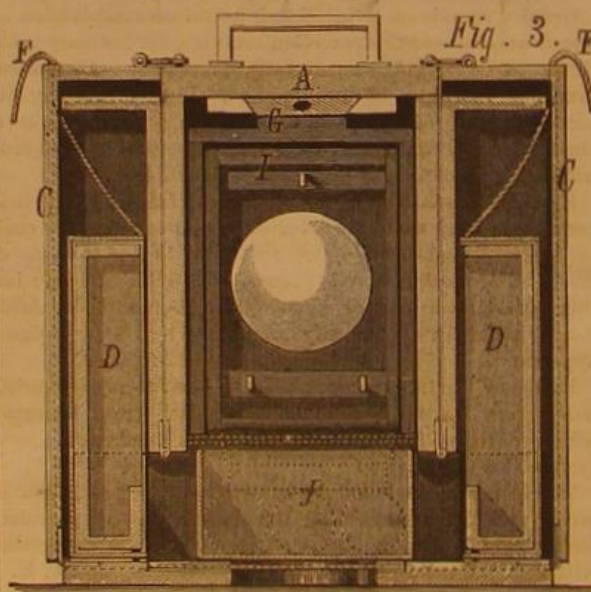
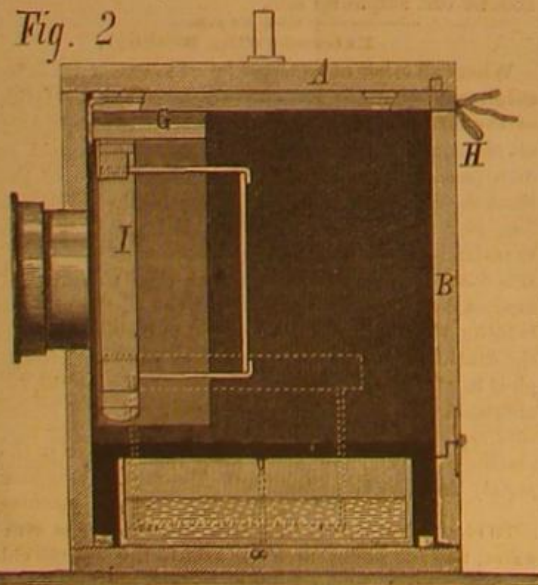


Fig. 2



is obtained on the glass, when the figure marked on the slide piece scale is noted. One of the side trays is next drawn into the main case and filled with the silver solution from one of the bottles shown. This tray being returned to its first position, the other tray is similarly drawn forward, filled

ter, the plate is finally lowered and washed. Nothing further remains to be done but the usual finishing treatment.

Patented in the United States, Great Britain, France, and Belgium through the Scientific American Patent Agency. For further particulars address the inventor, Wm. A. Brice, care of R. Clifford Poulter, 4a Middle Temple Lane, London, E. C., England.

A Long Gas Pipe.

There was, says the *American Manufacturer*, a very interesting and conclusive experiment made with the use of the 3-inch pipes of the Columbia Conduit Company, before they were in use for the transportation of oil, by connecting them with a small gas well at Millerstown. From the time the gas was turned in to the time it ignited at Hammerville, Allegheny county, 32 miles from the well, was 22 minutes; of course it was impeded by the air, which had to be forced out of the whole 32 miles of pipe in that time. The amount discharged was at the rate of 161,000 feet per 24 hours, the noise or roar of the discharge alarming the people living in the vicinity, with no perceptible difference in the flame between the discharge end of the pipe and at the well. The pressure at the discharge was 49 lbs., and at the well 55 lbs., a difference of only 6 lbs. per inch after the connection with the well. This, of course, is not in conformity with the theories and demonstrations of scientists, but the experiment was conducted under the care of two experienced engineers, namely, J. H. McElroy, of Pittsburgh Gas Company, and R.

Young, of Allegheny Gas Company, and the facts can be relied upon. It looks as though some facts would have to be changed, or some tables and books on pneumatics and hydraulics will have to be revised.

SIX 100-TON GUNS.

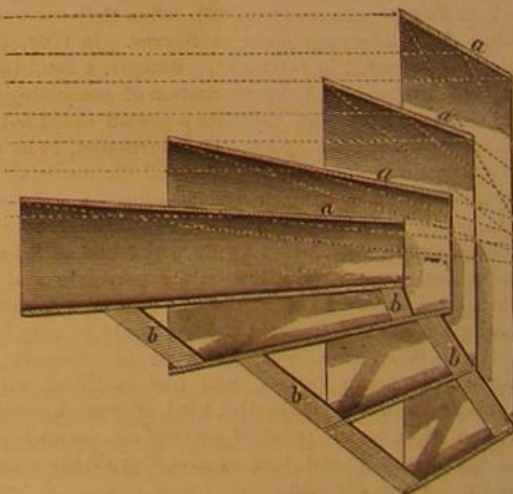
Sir W. G. Armstrong & Co., of the Elswick Ordnance Works, Newcastle-on-Tyne, are constructing six 100-ton guns for the Italian navy. They will be muzzle-loaders, and will consist of 19 distinct pieces, bound together by the process usually adopted at the Elswick works. The barrel

of each gun will be constructed of two lengths of steel, each length being about 16 feet, so that the total length of the barrel will be over 30 feet. The breech end of the barrel will be 29 inches in diameter, and the muzzle end 25.39 inches. Special machinery has been applied to the manufacture of the guns. The process of boring the barrels, which are made of welded steel, is one of great difficulty and delicacy. The first bore put through the solid steel was 9 inches, the second 12 inches, and the third 15½ inches diameter. The center tube will be bound by 15 different coils, on the principle introduced by Sir W. G. Armstrong, and the trunnion pieces will be no less than 6½ feet in diameter. There is no machinery now existing strong enough to deliver such guns, and hence Sir W. G. Armstrong &

Co. have for some time past been constructing a crane to lift them in and out of the ships in which they will be fought. This crane is capable of lifting 160 tons, and its platform revolves upon a line roller frame of 43 feet diameter. It stands upon a masonry and concrete pedestal 20 feet high and 50 feet in diameter, the outer wall of which is made to carry the path in which the line roller ring runs; while the center is hollow and serves as a house for the boiler and the pump supplying the water pressure for working the crane. The process of lifting is achieved by an inverted hydraulic press hung in gimbals, on a new system devised by Mr. Rendal. Motion is imparted to the crane by an hydraulic rotary engine. The foundations for the crane are being laid in the arsenal of Spezzia, where it will be a fixture.

ANOTHER INVENTOR OF THE BALESTRIERI REFLECTOR.

We took occasion, recently, in describing the new lantern alleged to be the invention of Professor Balestrieri, of Naples, to point out that substantially the same device had already been patented by American inventors in this country in 1871. We are now indebted to an old and valued correspondent, Mr. David Shive, of Allentown, Pa., for reminding us that he devised the same apparatus a year previous to the date of the patent above referred to, and used it for concentrating the sun's rays in order to melt refractory sub-



stances. Mr. Shive refers us to our own files, and we find that in 1870 we published the annexed illustration, which the reader will see is almost precisely similar to the Balestrieri invention. Mr. Shive's idea of using the apparatus for heat, and that covered by the 1871 patent, for employing it as a locomotive head light, seem to include all of Professor Balestrieri's applications. So this appears to be an instance of double re-invention.

THE CONTENTS OF A COD'S STOMACH.

Mr. Frank Buckland publishes in *Land and Water* the remarkable engraving herewith reproduced. The curious subject is a mass of horsehair and string, the fibers of which are matted and intertwined well together by means of no less than ten fish hooks. All these are small hooks except two; these, as can be seen by the engraving, are much larger. It is a remarkable thing that the points of all these hooks are turned upwards. He cannot quite account for the presence of so many hooks in the stomach of this cod, except that the cod who owned the stomach had somehow or another managed to get hold of haddocks or whiting caught on hooks, and in whose bodies the hooks still remained. The flesh of the whittings or haddocks had been entirely digested by the juices of the cod's stomach; the horsehair and metal of the hooks, however, resisted its action. That whiting and haddock have frequently hooks left in them is well known to all those who have the care of seals. Sea fish hooks are very cheap; and the fishermen, rather than take the trouble to extract the hook from the fish's mouth, very frequently cut off the "snood" or line to which the fish is attached, and let the hook remain in situ. The seal swallows the fish, hook and all, the hook gets entangled in the poor seal's intestines, and of course proves fatal.

"The cod is what is generally called a voracious fish. I have now in my museum," says Mr. Buckland, "a portion of a tallow candle, about seven inches long, also a pair of sailor's mitts, both taken from a cod's stomach."

THE MYGALES—DOOR BUILDING SPIDERS.

In the *Paris Jardin des Plantes*, says *La Nature*, there is a curious spider belonging to the mygale species, and commonly known as avicular, owing to the supposition that the insect finds its prey in small birds. Like all spiders, this curious creature has eight eyes. Its mandibles are armed with sharp teeth, and its feet have retractile claws, resembling those of a cat. The cephalo-thorax is of a velvety black with an olive luster; the abdomen and feet are covered with long reddish hair. Its length is about three inches and its breadth seven inches. Only the larger members of the species attack birds, as they overcome their victims by sheer strength and not by poisonous injection; for although they possess venomous capabilities, the quantity of venom is not sufficient to affect large prey. Their favorite food is crickets and insects of large size, which they capture at night, lying torpid during daytime.

The most curious member of the species is a mygale indigenous to Corsica, a light brown spider which lies in tubes dug in clay banks. These passages run in a straight line for two thirds of their length, and then become slightly oblique at their inner extremity. A close examination of these remarkable habitations proves the existence in the spider of an instinct wonderful in its minuteness. The tubes are vaulted from end to end with a hard mortar, and this in turn is lined with a soft, silky web. Before, however, covering his walls with their finest hangings, the spider fastens up a coarse fabric, and on this, as a foundation, the more delicate material is secured. Then he begins the construction of his door, in which operation it would seem that almost reasoning faculties are employed. At a hasty glance, the cover appears to be merely a little disk of mortar lined within with web, hinged to one side of the aperture so as to open outward, and supported by a prolongation of the lining mortar. Close examination, however, shows the door to be far from carelessly constructed. Although scarcely one tenth of an inch thick, it is constructed of upwards of thirty alternate layers of web and mortar, each layer being imbedded in another, like a series of cups.

The web layers are extended to form the hinge, so that the latter is stronger in proportion to the thickness of the door. On scrutinizing the edges of the latter, it further appears that they are beveled obliquely inwards, and that a corresponding bevel exists in the orifice of the passage. The use of this arrangement is obvious; for were the edges of the door straight, the hinge would be the only barrier to breaking in the cover from outside, and its delicate material would quickly yield before a strong attack. With the beveled edges, it is, of course, impossible to force the door inwards. In order to hide his dwelling, the mygale covers his door with rough clay so that it cannot be distinguished from the adjacent soil, while the asperities allow him to open it easily in making a sudden retreat. Once in his den, however, it would be supposed that he would be powerless before an

enemy knowing enough to force open his door in the proper direction. But the mygale provides for that contingency, and, being unable to make a lock for his portal, converts himself into that necessary means of security.

The interior of the cover, instead of being perfectly smooth, is pierced with, perhaps, thirty deep holes; and most of these are located just where a lock would be placed, that is, opposite to a hinge. When the spider finds himself besieged, he pokes his claws into these holes and fastens his sharp mandibles into the walls of his dwelling. Then, contracting



FISH HOOKS AND LINES FOUND IN A COD'S STOMACH.

his body, he pulls his door tightly shut, and so defies the assaults of his enemies.

During the day the mygale closes his portal, but at night he opens it slightly, and watches; should a fly or cricket come within proper distance, he leaps out, the prey is grasped, and the spider is back again in his den, with the door shut, before hardly a fraction of a second can elapse.

It is said that only the females build and occupy these marvelous nests, since males have never been found in them. The lords of the spider creation have no fixed habitation, but live under stones and in crevices of trees, and prowl around in search of their precarious existence. It is probable that they meet the fate of all bachelor spiders, to whom matrimony is death; for it is a peculiarity of the arachnid bride to devour her loving helpmate at the earliest possible moment, and unceremoniously to throw the shell of his used-up carcass out of her nest, when she cleans house in preparation for a new husband.



DOOR-BUILDING SPIDERS.

The mygale carries its eggs inclosed in a closely woven cocoon of white silk, forming two rounded pieces, united at their border.

Happy Accidents.

It is a fact, patent to every one conversant with the progress of inventions, that the most useful discoveries are generally the result of accident. These columns have borne witness to a great number of individual cases of this kind. In the May number of *Chambers' Journal*, a writer says:

Seldom do men sit down with a steady resolve, a determined purpose, to discover some new principle or invent some new process. When they do so, there is a lurking idea of the kind of thing they want, a dim perception of the direction in which success may most reasonably be sought. Generally speaking, something is concerned which, for want of a better term, we call accident. An appearance presents itself, or an effect is produced, which the observer neither designed or expected: an accident, certainly, so far as he is personally concerned. It may be a manifestation, until then

unknown, of some natural force or property; or it may be an action of one substance on another, susceptible of useful practical application. This is, briefly expressed, the distinction between a discovery and an invention. But the important point to notice is that the value of the accident depends on the kind of man or kind of mind, by whom or by which it is first observed. If the soil is not sufficiently prepared, the seed will not grow. Thousands of men had seen light reflected from distant windows, and variations in the light according to the angle of reflection; but a well prepared mind, on one occasion, suddenly drew from this phenomenon an idea which established the beautiful science of the polarization of light. It is pleasant to read of the manner in which shrewd minds have turned an accidental observation to practical advantage.

The reflecting apparatus for lighthouses arose out of a wager, if the facts are correctly recorded. Somewhat more than a century ago, some one in Liverpool offered to wager that he would read the small print of a newspaper by the light of a farthing candle placed ten yards or thirty feet distant. The wager being accepted, he coated the inside of a wooden board with pieces of looking glass, forming a rough substitute for a concave mirror; placing a small lighted candle in front of this mirror, the rays of light were reflected, and converged to a focus ten yards on the other side of the candle, and the light at that focus was sufficient to enable the expert member to read a newspaper. An observant practical man was present. The idea flashed

upon him that, if the light of a farthing candle could in this way be thrown out to a distance, the light of a large lamp could similarly be projected to a mile or miles away. The idea grew into form, and resulted in the invention of the reflecting apparatus for lighthouses.

One day, Lundyfoot, a snuff manufacturer, was drying some snuff. Through a little neglect, the snuff was allowed to be overheated, till it became charred. Noticing the pungent character of the snuff, and how it tickled the nose, and knowing that some men like to have the nose tickled more than others, he resolved to try whether high-dried snuff could be brought into favor. It not only did so, but proved a source of wealth to him.

The writer has seen a piece of calico being printed at one of the great Manchester establishments, become a little displaced. The effect was very singular. The diagonal repetition of the pattern produced a forked lightning effect, of a kind which a designer would not have been likely to hit upon. The master printer suggested the engraving of a design in which the forked lightning effect should be utilized. It proved to be one of the most successful patterns ever introduced by the firm.

One of the producing causes of prosperity of the Staffordshire pottery manufacture was the discovery of a cheap durable glaze. The discovery was due purely to accident. At Stanley Farm, a few miles from Burslem, a maid servant was one day heating a strong solution of common salt, to be used in curing pork. During her absence from the kitchen, the liquid boiled over. Being in an unglazed earthen vessel, the solution, spreading over the outside, produced a chemical action which she little understood, and which did not compensate her for the scolding she received. Some of the elements of the liquid combined with some of those of the highly heated brown clay surface to produce a vitreous coating or enamel, which did not peel off when the vessel was cold. The humble brown ware vessel acquired historical celebrity.

A Burslem potter, learning what had taken place, saw that glazed ware might possibly hit the taste of the public; he introduced the system of glazing by means of common salt, a system at once cheap, easy, and durable; and England has made many a million pounds sterling by the accidental discovery.

When maidens are doing their hair, an important element of daily duty in many a household, they may perhaps be gratified in learning that this process led accidentally to a very useful invention. Joshua Heilman, engaged in the cotton manufacture at Mulhouse, in Alsace, was long meditating on the possibility of inventing a combing machine for long-staple cotton. Brooding over the matter, he watched his daughters combing their hair, and noticed how they drew the long tresses between their fingers, alternately with drawing the comb through them. The thought struck him that, if he could successfully imitate by a machine this twofold action, so as to comb out the long fibers of cotton, and drive back the shorter by reversing the action of the comb, his long-sought object would be pretty nearly attained.

Armed with this new idea, he set to work with renewed cheerfulness, and invented a beautiful machine, which enabled him to comb cheap cotton into moderately fine yarn.

In 1720, a potter named Astbury was journeying on horseback from Staffordshire to London. Stopping awhile at Dunstable, he obtained assistance in regard to a weakness in the in the eyes of his horse. The hostler at the inn, making use of such bits of veterinary knowledge as he possessed, took a piece of flint, calcined it in the fire, pulverized it, and blew some of the powder into the horse's eyes. The change produced in the flint, by burning from a black stone to a white powder, struck Astbury with a new idea. Would it be possible to produce white flint ware, harder and more durable than white ware made wholly of clay? He collected a small stock of flints from the chalk hills of Dunstable, and took them back with him to Staffordshire. The result more than realized his expectations; powder of calcined flint, mixed with pipe clay, produced a most excellent ware, and established a new branch of the potter's art that took firm root in Staffordshire.

Railway from Boston to the Summit of Mount Washington.

It is expected that the extension of the branch of the Boston, Concord, and Montreal Railroad, from the Fabian House to the base of Mount Washington, a distance of about seven miles, there connecting directly with the Mount Washington Railway, extending to the summit, will be completed and opened for public travel by the first of July, at which time passengers by this line from Boston can reach the base of Mount Washington without change of cars, and thence, by direct transfer to the cars of the Mount Washington Railway, reach the summit, making the entire distance by steam power. Passengers will thus be enabled to take their breakfast at Boston and their supper on the summit of Mount Washington at the usual hours of the same day, and without fatigue or the annoyance of change.

The Fast Train Across the Continent.

This remarkable enterprise ended triumphantly on Sunday, June 4, the train reaching San Francisco at 9:23 A. M. The total time from Jersey City to San Francisco was 83 hours 34 minutes, being 4 hours 26 minutes less than the schedule time, 88 hours. At 9:52, on June 4, the passengers alighted in the court of the Palace hotel, dusty and travel-worn, but in good health and spirits. Engine No. 49 brought the train through from Ogden, with the assistance of an additional engine in crossing the Sierras. The time from Ogden to San Francisco was 23 hours and 52 minutes. The actual average running time from Ogden to Oakland wharf was 41½ miles per hour. Considerable trouble was experienced on the Central Pacific from the wearing out of the brake shoes on the Pennsylvania cars; and in the mountains the Central Pacific Company put on two of their own coaches to brake the train. There was no accident of any kind throughout the trip. Shortly after arrival breakfast was served, to which prominent citizens, army and navy officers, representatives of the press and the theatrical profession, railroad officials, and the Mayor of the city were invited.

A salute of thirteen guns was fired from the roof of the Palace hotel on the arrival of the train at the wharf. The remainder of the day was devoted to needed rest. The excursionists were serenaded in the evening.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From April 25 to May 22, 1876, inclusive.

ARTIFICIAL STONE.—W. H. Smith, Philadelphia, Pa.
ATOMIZER.—T. J. Holmes, Boston, Mass.
AXLE.—G. W. W. Mittlemore, Jamestown, Wis.
BLIND ROLLER.—S. Hartshorn, New York city.
BOILER FLUE CLEANER.—A. Winkler, Rye, N. Y.
BOOKBINDING.—A. Hoyt, Brooklyn, N. Y., et al.
BOTTLE STOPPER, ETC.—N. Thompson (of Brooklyn, N. Y.), London, Eng.
BRICK MACHINE.—W. L. Grigg, Chicago, Ill.
CAR FAKE INDICATOR.—M. Runkel, Golden Square, London, England.
CALENDAR, ETC.—M. H. Paddock, East Clarkson, N. Y.
CAPSTAN.—J. H. David, Damaris-Cotta, Me.
CASTOR.—L. P. Lawrence, Port Morris, N. J.
CHARGING GAS RETORTS.—J. F. Rice, Louisiana, Mo.
CLEANING SHIPS' BOTTOMS.—J. C. Seymour, New York city.
COFFEE POT.—G. W. Hubbard, Windsor, Vt.
CONDENSING EXHAUST STEAM.—J. F. Field, Brooklyn, N. Y.
CUTTING MEAT.—W. H. Goodchild, New York city, et al.
ELECTRO-MAGNETIC ENGINE.—L. Bastet, New York city.
EXTRACTING JUICES.—L. F. G. Bouscaren, Cincinnati, O.
FOLDING TENT, ETC.—F. A. Guthrie, Addison, O.
FORK, ETC.—Brown Brothers Co., Waterbury, Conn.
FOUNTAIN LAMP.—H. H. Webb, Brooklyn, N. Y.
GAFF FASTENING.—J. H. David, Damaris-Cotta, Me.
GAS EXTINGUISHER.—V. N. Taylor et al., Springfield, Mass.
GLOVE FASTENING, ETC.—F. G. Farnham, Hanley, Pa.
HAND STAMP.—G. K. Cooke, New York city.
HARVESTING MACHINE.—S. Johnston, Brockport, N. Y.
HYDRAULIC DREDGE, ETC.—W. H. Newton, Chicago, Ill.
IRONING MACHINE.—T. S. Wiles et al., Albany, N. Y.
KITCHEN SAFE.—G. W. Bollenbacher, Bloomington, Ind.
KNITTING MACHINE, ETC.—C. J. Appleton, Elizabeth, N. J.
MAKING PAPER PULP.—J. W. Dixon, West Manayunk, Pa.
MAKING TEA, ETC.—J. Miller, Hiram's, N. Y.
PAPER-CUTTING MACHINE.—J. Vanhorn et al., Brooklyn, N. Y.
PIS.—H. M. Jenkins et al., New York city.
PISTON PACKING, ETC.—J. T. Wright et al., Dayton, Ohio.
PREVENTING FALLS IN SKATING.—J. T. Parlow (of N. Y.), London, Eng.
PRINTER'S GALLEY.—J. F. Hannan, New York city.
PROJECTILE.—N. Ward, Washington, D. C.
PROPELLER.—F. H. B. Babbe, Antioch, Cal.
RAILWAY, ETC.—R. Stone, Vandalia, N. Y.
RAILWAY SWITCH AND SIGNAL.—D. Rousseau et al., New York city.
SACK-SEWING MACHINE.—J. S. Hall, Monterey, Cal.
SASH FASTENER.—N. Thompson (of Brooklyn, N. Y.), London, England.
SASH FASTENER.—W. A. Hopkins, New York city.
SBEW, ETC.—C. D. Rogers, Providence, R. I.
SBEW, ETC.—E. A. Leland, New York city.
SELF-CLOSING VALVE.—E. W. Lippert, Cincinnati, O., et al.

SIGNAL BUOY.—J. M. Courtenay, Cornwall, N. Y.
SOLVING PROBLEMS.—T. Hill, Portland, Me.
STARCHING FABRICS.—T. S. Wiles et al., Albany, N. Y.
STEAM COOKING VESSEL.—S. T. Goodwyn, New Orleans, La.
STEAM ENGINE.—G. McNaughten, Brooklyn, N. Y.
STEAM HAMMER.—P. B. Williams et al., Quincy, Ill.
STEERING PROPELLER.—F. G. Fowler, Bridgeport, Conn.
TELEGRAPHING SOUND.—E. Gray, Chicago, Ill.
THREADING SCREWS, ETC.—C. D. Rogers, Providence, R. I.
THREATING OIL REFUSE.—W. P. Jenney, New York city.
TRIMMING CARDS.—V. E. Manger, New York city.
TWISTING MACHINERY, ETC.—G. Fletcher et al., Providence, R. I.
UMBRELLA, ETC.—H. Palmieri, New York city.
WHEEL HARBOR, ETC.—S. H. Weston, Wisconsin, VI.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED VALVE-GRINDING MACHINE.

William T. De Luce, Chicago, Ill.—This is an improved device for holding a valve upon its center while grinding it in its seat, which shall be so constructed as to enable the valve to be ground without detaching it from the pipe.

IMPROVED RAILROAD SWITCH CHAIR.

Henry C. Fox and Joseph Hayward, St. Joseph, Mo.—This consists of the base and web supports of the rails, extended up to and so fitted under the overhanging sides of the rail head that they are supported against splitting off and hammering down.

IMPROVED WATER MOTOR.

Israel F. Good, Goodsville, assignor to himself and Hiram F. Seiger, Orefield, Pa.—This invention consists of a series of buckets attached to a corresponding series of arms, some of which are made to rise with their buckets empty to an elevated tank by the weight of other descending filled buckets. The empty buckets are filled at the tank, and, in turn, raise the others, the excess of the weight of the filled buckets being applied to the performance of work.

IMPROVED DEVICE FOR STARTING PENDULUM CLOCKS.

Ernest A. Lourdelet, Paris, France.—This consists in the application of an additional axis in any convenient position in the clock dial or its pedestal, which axis is squared at the end to receive a key or its equivalent. It also carries a lever arm whose extremity is made by partly rotating the axis to bear against the pendulum rod and set the latter oscillating.

IMPROVED LEATHER-PUNCHING MACHINE.

Alonzo C. Riecke and Martin D. Norris, Eldora, Iowa.—This is a contrivance or device for punching leather straps of all kinds, but more particularly bars for leather fly nets for horses. It is adapted for punching either by movable or stationary punches, and has a feed mechanism worked by a shaft fixed transversely under the bed, to be turned by hand or other means.

IMPROVED STRAIN EQUALIZER FOR PULLEY ROPES.

Samuel Woolston, Vincentown, N. J.—This is a device for equalizing the strain upon the ropes of a number of sets of pulleys used together for moving heavy masses. It is so constructed as to enable all the ropes, or one or more of them, to be operated at a time without affecting the equalization of the strain among all of said ropes.

IMPROVED PIPE TONGS.

George M. Curry, St. Petersburg, Pa.—Upon the forward end of the handle is formed a crosshead in which is formed a groove to receive a tenon formed on a curved and pivoted bar. The other end of the crosshead is concaved, and upon it is formed a tenon to enter a groove in the convex side of a pivoted semi-cylindrical jaw. Another jaw is similarly arranged on the inner side of the outer end of the hook first mentioned. The jaws have thus sufficient play to adjust themselves to the object to be grasped.

IMPROVED RELIEF APPARATUS FOR AIR COMPRESSORS.

William F. Tallman, Mineville, N. Y.—This consists of a weighted valve, in connection with the cylinder of an air compressor, to be raised by the air when the pressure exceeds a certain limit. There is a piston to which the air is admitted by said valve, and raised so as to stop the action of the receiving valves of the compressor, with which it is connected for that purpose. It thus prevents the increase of the pressure unduly. The weighted valve falls when the pressure of air diminishes and opens an escape for the air from the piston, which then falls and allows the valves of the compressor to act again. The relief apparatus may be made to work special valves on the compressor instead of the receiving valves.

IMPROVED PAINTER'S WHEEL HORSE.

Albert D. Osgood, Oneida, Ill.—This is an improved horse for painting the wheels of vehicles of all kinds without necessitating the removing of the wheels. It admits the adjusting of the wheel into any position, takes up little room, and facilitates the work. It consists of a base support or stand, with revolving upper part, and an adjustable hub, supporting top arm, and thimble.

IMPROVED ELEVATOR.

Alfred B. Darling, New York city.—The first part of this invention is a contrivance whereby ropes may be used instead of chains for gearing the elevator carriage with the retarder, which is employed to regulate the descent of the carriage. The ropes are claimed to be stronger, less noisy, and more easy in operation, and less wearing. The second part consists of the carriage connected to the hoisting drum by ropes, which wind off and on reversely to the accommodation of the hoisting ropes. The object is, first, to prevent the hoisting ropes from winding off faster than the carriage descends; and, second, to insure the descent of the carriage.

IMPROVED GANG PLANK.

George Malone, Memphis, Tenn.—This is a ladder of ropes and cross pieces, in combination with the stage plank of a steamer, in such manner that it can readily be removed for sliding freight on and off the boat, and is readily applied again to afford foothold for passengers. The said ladder is also applicable for a fire escape.

IMPROVED ADDING MACHINE.

David Carroll, Spring Creek, Pa.—The essential feature of this arrangement is a contrivance of a key for each of the figures of the nine digits, arranged for two to be worked by each finger of the left hand, and one by the thumb. Each key turns the unit wheel the number of figures that it stands for.

IMPROVED CHUCK FOR HOLDING METAL DRILLS.

William Frost, New Bedford, Mass.—This consists of a sliding jaw having a triangular notch and a couple of toothed jaws fixed to slide at right angles, and arranged in said notch. These are toothed, so that one meshes in the other, and have a spring between them, for opening them. All are arranged in a stock which is attached to the mandrel, and is so contrived that round, square, or other shapes, either taper or straight, may be held with like facility.

IMPROVED BLACKSMITH'S FORGING HAMMER.

John Koplin, Reed's Landing, Minn.—This is a new arrangement of apparatus whereby a sledge hammer is worked by a foot lever and springs.

IMPROVED WATCHMAKER'S LATHE.

Daniel M. Williams, Calvert, Tex.—This invention consists of a novel contrivance of a bed adjustable for varying the height of the bed relatively to the centers for different kinds of work; also of an adjusting tail stock, and an attachment for cutting gear wheels and pinions, all of which will be found illustrated on page 194, current volume.

IMPROVED PLAITING MACHINE.

Andrew J. Decker, Fond du Lac, Wis.—This consists of a series of removable needles in a couple of side pieces fixed in a base plate and perforated with numerous holes in a row, in which the needles can be readily put and removed. A clamping plate at one end of the apparatus is adapted for holding the cloth. The cloth is doubled around two or three or more of the wires for plaiting it, and the plaits are fastened by stretching it along the edges after being plaited. The wires are drawn out to release the plaits when completed.

IMPROVED PUMPING APPARATUS.

Wade Couts, Brownville, Neb.—This is a pumping apparatus so constructed that cattle may be made to water themselves. As the cattle step upon a treadle platform, their weight draws down a rope which, by suitable counterpoises, causes the pump to be operated.

IMPROVED LIFTING JACK.

John Y. Thurston, Medfield, Mass.—This consists of a sliding ratchet bar operated by a spring-bolt lever, and retained by a safety spring pawl.

IMPROVED SPARK ARRESTER.

Waldo H. Jordan, New York city.—This is an uninclosed conical annular cap, to cover both the mouth of the chimney and the mouth of the cinder receptacle which is made around the chimney. The interior is provided with a parabolic deflecting surface that begins at the center of the shell, curves upward and outward, then downward to the outer edge of the shell. When the products of combustion rise, they impinge upon said deflecting surface, which serves to turn the solid particles, sending them down into the receptacle which surrounds the chimney, while the smoke and gases pass laterally from the interior to the atmosphere.

IMPROVED PORTABLE SPRING POWER HAMMER.

Ray F. Livermore, Port Henry, N. Y.—This is a contrivance of a lever catch and tripping device, in combination with a hammer having a spring or springs for striking a powerful blow. The hammer may be easily handled by one man, and made to strike a powerful blow. It is designed for breaking large boulders of rock ores, iron, etc.

IMPROVED LIFTING JACK.

George G. Howe, Faribault, Minn.—This consists of legs pivoted to a top support, to which a lifting lever is fulcrumed. A ratchet and guard of the lever serves, in connection with a pivoted locking brace link of the outer leg, to retain the lever in hoisted position.

IMPROVED CAR COUPLING.

Jabez B. Meadley, Davenport, Iowa.—This is a contrivance of spring jaws for opening and receiving the link and securing it self-acting, together with a cam, chain, and crank, whereby the jaws can be opened from the top or side of the car.

IMPROVED HYDRANT.

John T. Davis, Washington, D. C.—This invention relates to an improvement in the construction of the casing of the hydrant and the construction of the valve mechanism with the plug of the service pipe, also to the provision of a stopcock within the casing, whereby the water may be conveniently shut off at the hydrant itself, and the valve mechanism readily removed, for repair or other purpose, and whereby other operations incident to keeping a hydrant in proper condition may be effected without the necessity of digging up the casing.

IMPROVED ROTARY ENGINE.

Josephus Moore, Mound Valley, Kansas.—This consists of a pair of cylinders, with pistons set opposite each other for one to take steam when the other is not taking it. Abutments slide out and in to let the pistons pass, and are worked by cam disks outside of the cylinders. Two sets of slide valves are provided, for running the engine either way, the valves being worked by eccentrics on the shaft, outside of the case. There are two sets of exhaust ports for use according to the way the engine runs, the valves of which are connected to the reversing valves, so as to shift simultaneously with them. The steamways are constructed in the form of a ring, and the pistons are in the form of a segment of a ring, and are attached to the edge of a disk keyed on the shaft, so as to be fitted with ordinary round piston packing.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED MAIL BAG.

John Boyle, New York city.—The object here is to construct the mail bags that are taken up by the catchers of mail cars in such a manner that they may be more easily and securely taken hold of by the catches without danger of being dropped. The invention consists of a mail bag made with a narrower and contracted throat at the middle part, and provided with a detachable protecting sleeve.

DEVICE FOR REMOVING WIRES FROM BOTTLE CORKS.

John Franz, Croton Falls, N. Y.—A crocheted brace arranged in a handle is placed around one side of the neck of the bottle and under the wires. A forked claw engages the wire at the top of the cork and pulls it off by pressing the handle down.

IMPROVED DENTAL PLUGGER.

Cassius M. Richmond and Alexander Warner, Jr., San Francisco, Cal.—The mallet is mounted by a spring on the upper end of a tubular stock adapted for receiving different tools. A cam mounted on a revolving shaft, arranged parallel to the stock, lifts the mallet, and the spring throws it back against the head of the tool to strike the blow. The frame in which the cam shaft runs is mounted on the tool stock, so that the latter has a little endwise motion in the frame for allowing the tool to reciprocate, and a spring in the stock, beneath the head of the latter and the frame, raises the tool after being forced down by the hammer. A joint in the frame of the cam shaft allows the cam to be adjusted so as to strike light or heavy blows, as required.

IMPROVED COMBINED GAS AND CHANDELIER.

George P. Clark, Newton, Mass.—This is a contrivance of oil burners, in the center portion of a gas chandelier. It will be found fully described and illustrated on page 371 of our current volume.

IMPROVED TWEER.

Thomas F. Witherbee, Port Henry, N. Y.—This consists of a partition in the water chamber between the inlet and outlet pipes, to compel the water for cooling the tweer to pass entirely around it.

IMPROVED SHOE.

John C. Weil, Baltimore, Md.—This consists of a secondary insole, held in position by tags of muslin secured between the outsole and insole, and pasted down. The idea is to make the shoe easier to wear and less heating to the foot.

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. R. H. Allen & Co., N. Y.

For Bolt Forging Machines and Power Hammers, address S. C. Forsyth & Co., Manchester, N. H.

For Sale—State and County Rights of Patent on a first class Wash Boiler. Works splendidly. Address Frank Mackill, Jonesboro', Union Co., Ill.

Pure Mineral Lubricating Oil, for oiling machinery or mixing with animal or vegetable oils to prevent spontaneous combustion. Geo. Allen, Franklin, Pa.

Wanted—Manufacturers of Isinglass Boxes to address B. Frank Weyman, Pittsburgh, Pa.

Steam Launch for Sale, 32 ft., new. Address Morgan's Steamboat Works, Noank, Conn.

The Ransom Syphon Condenser will save you 25 per cent of fuel, or give an equal increase of power. Apply to: T. Sault, Consulting Engineer, General Agent New Haven, Conn.

Leather and Rubber Belting, Packing and Hose. Greene, Tweed & Co., 18 Park Place, New York.

Patentees—desiring light articles manufactured in Steel, Gray or Malleable Iron, and Brass, address Welles Specialty Works, Chicago, Ill.

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

A Bargain—Steam Yacht, 30 ft., complete; also 4 h. p. Engine, propeller and shaft. Lock Box 140, Washington, D. C.

Wanted—Address of Makers of No. 1 Cider Mills. P. C. Homes, Waverley, Illinois.

Wanted—New or second hand Punch, to punch seven eighths plate, inch and quarter hole; or gang drill. J. & T. McGregor, Detroit, Mich.

Best Belt-Pulleys—A. B. Cook & Co., Erie, Pa.

Centennial Exhibition, Philadelphia.—Examine the Allen Governors, Machinery Hall, D. 9, Par. 71.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

For Sale—35 in. 16½ ft. Lathe, \$400; 23½ in. 22 ft. do., \$250; 20 in. 7 ft. Stover's do., \$215; 13½ in. 6½ ft. do., and chuck, \$125; 9 ft. Planer, \$350; 12 in. Slotter, \$330; Profiling Machine, 2 spindles, \$250. Shearman, 45 Cortlandt St. N. Y.

Rubber Hydrant Hose, Hose Pipes and Couplings, best quality. Send for Prices to Bailey, Farrell & Co., Pittsburgh, Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hall & Belden Co., Danbury, Ct.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 48 North Third St., Philadelphia, Pa.

Power & Foot Presses & all Fruit-can Tools. Feracut Wks., Bridgeton, N. J. & C. T. Mehy, Hall, Cent. I.

Johnson's Universal Lathe Chuck—Awarded the highest Premium by the Franklin Institute of Phila., for "Durability, Firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

Safety and Economy—Eclipse Sectional Steam Boiler. First Class references. Lambertville Iron Works, Lambertville, N. J.

Woman's Shoes—Patent for Sale, either whole or State Rights. Address C. Steckel, 199 Allen St., N. Y.

For Sale—24 in. x 24 ft. Lathe, with Chuck; two 13 in. Lathes; one 7 ft. x 24 in. Planer; two 8 in. Shapers. E. P. Bullard, 48 Beckman St., New York.

For the best Patent Self-Opening Gates for Carriages, in any Style of Wood or Iron, address Cotton & Co., Dayton, Ohio.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to ½ horse power. Agents wanted. Address with stamp, 1,113 Chestnut st., Philadelphia, Pa.

Walrus Leather and Walrus Leather Wheels for polishing. Greene, Tweed & Co., 18 Park Place, N. Y.

The French Files of Linet & Co. have the en- dorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 21 Platt St., New York.

Trade Marks in England.—By a recent amend- ment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information address Munn & Co., 57 Park Row, New York city.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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.

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

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 430 Grand Street, New York.

Spinning Rings of a Superior Quality.—Whit- navesville Spinning Ring Co., Whitnavesville, Mass.

Rotary Fire or Supply Pumps, belted, two styles built—One, plain, \$125; the other, with water-gate, safety valve, and air chamber, \$175. Capacity, 10 to 500 gals. per minute. M'F's, S. C. Forsyth & Co., Manchester, N. H.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

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

Temples and Oilcans, Draper, Hopedale, Mass.

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

Notes & Queries.

M. J. D. will find a description of wire rope transmission on p. 370, vol. 31.—C. F. S. will find directions for bleaching straw on p. 11, vol. 32.—W. H. C. is informed that lightning rods need not be insulated. See p. 144, vol. 31.—G. H. W. will find directions for staining wood black on p. 50, vol. 31.—A. A. H. can clean articles to be plated by following the directions on p. 187, vol. 31.—A. F. B. will find directions for kalsomining on p. 333, vol. 34.—T. E. S. will find directions for making manifold paper on p. 303, vol. 31.—D. C. W. will find directions for converting cider into vinegar on p. 122, vol. 31.—K. K. will find a description of the process of making artificial butter on p. 119, vol. 30.—E. D. will find, on p. 298, vol. 31, directions for cleaning and polishing brass instruments.—A. W. T. will find an answer to his question as to gases evolved from exploded gunpowder on the editorial pages of this issue.—L. D. will find a description of the ditching machine about which he inquires on p. 335, vol. 32.—J. K. B. will find a recipe for birdlime on p. 347, vol. 28.—G. C. P. Jr., will find a description of a means of testing for arsenic on p. 257, vol. 29.—W. F. can clean his bright steel work by the process described on p. 56, vol. 33.—W. H. P. will find directions for making rubber varnish for waterproofing on p. 274, vol. 32.—S. C. M. will find particulars of the lifting power of hydrogen on p. 74, vol. 30.—O. W. J. will find directions for galvanizing on p. 346, vol. 31.—G. E. will find directions for lacquering brass and bronze on p. 240, vol. 34.—R. R. P. will find directions for making a concrete floor on p. 185, vol. 31.—W. K. L. will find directions for tinning iron wire on p. 362, vol. 31.—W. E. J. can cleanse vessels that have had kerosene in them by the process detailed on p. 276, vol. 34.—J. W. F. will find a description of the long and short screwdriver mystery on p. 21, vol. 19.—C. M. C. should read our article on p. 170, vol. 32, on the volume and compression of gases.—A. N. will find a description of chromic cement on p. 395, vol. 34.—E. L. W. will find instructions for putting up a lightning rod on p. 144, vol. 31.—H. K. A. is informed that the diving rod is an imposition.—H. J. W. will find on p. 362, vol. 31, directions for tinning malleable iron castings.—J. H. S. will find on p. 164, vol. 30, an article on oil in boilers. As to zinc in boilers, see p. 36, vol. 32.—C. W. L. should calculate the horse power of his engine for himself. See p. 33, vol. 33.—C. L. B. can color billiard balls by following the directions on p. 362, vol. 30.—J. H. S. will find directions for putting up lightning rods on p. 144, vol. 31.—C. W. will find a recipe for durable whitewash on p. 133, vol. 34.—H. H. B. will find on p. 11, vol. 32, directions for bronzing gun barrels.—G. B. B., R. H., S. L. H., G. B., and many 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) J. W. D. asks: Is it possible to obtain lodestone in its natural state? A. Yes. Lodestone or magnetic oxide of iron (magnetite) is a mineral very widely diffused throughout the United States and Canada. It is found in immense quantities in the northern part of New York State, in the Adirondack region, and in Canada. 2. Has a lodestone more attractive power than a steel magnet? A. No; artificial magnets of iron and steel greatly surpass it in power.

(2) W. E. C. says: In your No. 22, current volume, A. McC. says there is an engine in his vicinity of 18 x 24 inches; it runs at 90 revolutions per minute with 60 lbs. steam, cut off at ¾ stroke, and is rated 50 horse power; and the company are dissatisfied at the amount of coal burned, namely, 1½ tons. An engine of this description (throttle wide open) with 60 lbs. boiler pressure, allowing 100 lbs. pressure in the cylinder, would show about 105 horse power, and a consumption of coal of 2½ lbs. per hour per horse power, which is a very good showing for a non-condensing engine, and better than the average. A. If such a result could be verified by experiment, A. McC. would have very good reason to be satisfied. Our remarks were based on his rating of the power.

(3) R. S. asks: Will a fly wheel running twice as fast as an engine, on countershaft, be any advantage over driving from main wheel of engine? A. Not necessarily.

(4) G. C. S. asks: How much steam space should there be in a boiler for an engine of 2 inches bore and 4 inches stroke, running at 400 revolutions per minute? A. It should be ¼ or ½ the water space.

(5) A. D. A. asks: How is a fog horn constructed for attachment to a steam whistle? A. It is usually a whistle with a sound trumpet attached.

(6) A. G. says: We have a dry house, 13 x 25 feet, which is properly provided with about 400 feet of one inch pipe, through which live steam from the boiler passes, and escapes through a cock outside the building. Although the house is nearly boiler tight, and has proper ventilation, we are not able to increase the heat above 170° or 180° Fah. We intend to superheat the steam by means of a coil of pipe in a stove. Will it be best to superheat the steam first, let it pass through the 400 feet pipe, and escape, or should we let the live steam pass through the 400 feet pipe, then superheat it outside the building, and introduce the superheated steam into the dry kiln? A. We would advise you to try a new plan. Heat the air in a separate chamber from that of the drying room by concentrating the pipes therein. Let the air from this hot chamber enter the drying room at the ceiling, and provide for its escape at the bottom, so as to secure a constant change and renewal thereof. Place a steam trap at the end of the heating pipe. Put full head of steam on to your

coils, and you will probably improve the drying capacity of your room without superheating. If you should try this plan, please communicate to us the result.

(7) W. T. P. asks: How many cups of Lockwood battery will it take to run a telegraph line two miles long, having 70 instruments of about 60 ohms resistance each? A. Twenty-five or thirty.

(8) P. & W. ask: 1. For an electric light apparatus, would 50 cups carbon battery, using a lamp made after the Dubosc pattern, answer? A. Yes. 2. Would the apparatus illuminate a distance of five blocks? A. Yes. 3. How large are the points used? A. Use ¾ inch square carbons. They come in lengths of 8 or 9 inches.

(9) W. M. J. asks: 1. Would a copper conductor 1½ inches wide, riveted to an iron bar of same width ¼ inch thick and spliced by bolting, allowing the ends to pass 6 or 8 inches, make a good conductor for a lightning rod? A. Yes; but it is better to use copper altogether, and too much care cannot be taken to insure good earth connection. 2. Would insulators be any benefit? A. No, on the contrary. 3. Would black paint affect the conducting power? A. No.

(10) F. E. H. asks: What is the best means of examining the electricity in a lightning rod, when a thunder cloud is passing over? A. Don't try any. You may find it very unsatisfactory work.

(11) I. M. asks: How is the power applied from the pendulum to the wheel work in an electric clock? I am a telegraph operator, and wish to attach one to my battery. A. An electro-magnet is placed in the electric clock and so arranged that each movement of the armature, acting on an escapement, pushes the hands forward. The circuit is made and broken at every swing of the pendulum of the regulating clock, the upper part of the pendulum being provided with the necessary attachments.

(12) H. B. H., of Havana, Cuba, asks: We are putting up a telegraph alarm, worked by Leclanché's battery, using double wire circuits. What proportion of cells to wire should we use? A. Use one cell for every 2 or 3 ohms of resistance in the circuit.

(13) W. H. S. asks: How is the varnish, used on plaster patterns, made? A. We believe paraffin is employed for this purpose.

(14) A. A. asks: What can I put into green ink, made with verdigris, to make it darker? A. Try a little sulphate of indigo.

(15) M. D. C. says: I am rendering tallow in a large oil cask by introducing open steam in the side of cask, near the bottom. I use 8 or 10 lbs. sulphuric acid to each 1,200 or 1,500 lbs. of rough suet. After settling over night, the greater part of the tallow rises to the top and is clear and good, but there is still considerable in the tank that is mixed with the fine particles of meat which has been cut by the acid. Can you help me? A. Digest the fatty matter for about 48 hours with very weak oil of vitriol. Transfer a quantity of this material (the solid) to the cask, and for every 10 lbs. material add 5 pints water and 3 ozs. sulphuric acid (specific gravity 1.845). Introduce a jet of steam and boil for some time. The liberated fatty matter as it floats on the surface may be drawn off; and after the addition of a little oil of vitriol to the residue remaining in the cask, a new charge of material may be introduced and the process repeated. The accumulated residue of animal matters and scrap may be used as a manure, or mixed with sawdust for a fuel.

(16) E. H. asks: What is the relative economy in fuel of the three different kinds of steam boilers, namely, the locomotive, the return tubular, and the upright tubular boilers, for portable engines? A. So far as we know, the difference in economy of the various styles is not very great, if all are proportioned and set equally well.

(17) W. O. P. says: 1. Other things being equal, which will give the best result for a propeller, a double engine of three horse power in each, or a single engine of six horse power? A. The single engine. 2. What size should the boat and screw be to make ten miles per hour, with six horse power? A. Boat 30 to 32 feet in length. Propeller 2 feet in diameter and 3 feet pitch.

(18) E. W. asks: Will a cylinder 1½ inches in diameter, of 3 inches stroke, propel a boat 16 feet long, of 5 feet beam? A. No. The engine is scarcely large enough.

(19) The Brethren, of Reutlingen, Württemberg, say: We want to bend strips of oak or beech lumber 1½ inches square to a circle of 18 inches diameter, for chair work. We have cut the strips of green lumber and steamed them for different lengths of time; but as soon as we tried to bend them, they break right off. How can we do it, under what pressure of steam, and how long has the lumber to be in the box? A. A low pressure of steam only is necessary; and where the bending is excessive, the operations must be gradually conducted, clamping the wood, and exposing it to the action of steam for several hours each time. It is also necessary to use a very good quality of material.

(20) M. & Co. say: The escape of steam from our engine goes into our brick stack. Is there any danger of the steam injuring the mortar between the bricks, and eventually throwing the chimney down? A. Steam frequently has thus acted under the circumstances stated.

(21) J. S. says: How thick a wire rope and what size of solid round iron do I want to stand the falling weight of drilling tools, the largest weighing about 5,500 lbs.? A. We advise you to address your query to a manufacturer. We could not answer it without knowing more particulars.

(22) J. B. E. asks: 1. What will be the difference in pulling 2 screw tugs, each with a 20 x 24 inches cylinder and 7½ feet wheel, drawing 8½ feet water, or a tug with double cylinders 20 x 24 inches, wheel 9½ feet, drawing 10½ feet water? A. The data are insufficient to enable us to answer this question. In any case, we could only obtain a rough approximation by calculation. 2. I have a tug, cylinder 20 x 24 inches with independent cut-off, working the cut-off on half and full stroke on link. The engine pounds. Is it caused by the lead? A. The pounding may be due to various causes, to improper arrangement of valve motion, lack of adjustment of working parts, or improper fitting of crosshead or crank pin brasses.

(23) J. J. M. says: I have an engine with one pair of cylinders, 6 inches by 8 inches stroke, running at 100 revolutions per minute with 40 lbs. steam in boiler. I wish to condense the exhaust steam in a surface condenser. Please tell me how many square feet I need. A. About 60 square feet will be quite enough.

(24) H. L. B. asks: Will the air contained in an air chamber on a pipe over a faucet escape with the water after a time? Will air remain in an air chamber under a heavy pressure of water, if the water is kept in a state of rest? A. The air absorbed by the water, under heavy pressure; but in the first case mentioned, the air chamber frequently receives supplies of air from the water.

(25) F. N. asks: 1. Should a chimney be wider inside at the top than the bottom, and if so, why? A. We do not know of any good reason for this mode of construction. 2. Should the inside diameter be equal throughout? A. As the products of combustion grow cooler as they ascend, and occupy less volume, the chimney could be gradually contracted from the bottom to the top, without serious loss of efficiency.

(26) J. D. D. says: 1. I propose to build a steamboat with a keel 112 feet, beam 17 feet, of good model, with side wheels 15 feet in diameter, with paddles 4 feet long x 12 inches wide. Draft, when loaded, is 30 inches. I shall use a locomotive boiler, 14 feet long by 4 feet diameter, with a firebox 42 x 48 inches, having 60 tubes 2½ inches in diameter, and 10 feet long, which I propose to set in a brick arch, burning wood, with fire under the barrel instead of in the firebox, and returning through the firebox and tubes and over the top of boiler. Would there be any objections to setting the boiler in this manner? A. Its efficiency would be somewhat diminished. 2. My engine cylinder (oscillating) is 13 inches x 40 stroke, using steam at 75 lbs. and cutting off at ¼ or ½ stroke. Is the cylinder large enough for the boat? A. Yes. 3. Will the boiler make steam enough to drive the engine at 50 revolutions per minute? A. No, not more than 25 or 30. 4. How much slip will the wheels have? A. About 15 or 20 per cent. 5. Are the wheels of proper proportion for the hull? A. They will answer very well.

(27) W. G. H. says: 1. I have made a small engine, size of cylinder is 1½ by 2½ inches, running at 300 revolutions per minute. Would a locomotive boiler of the following dimensions generate sufficient steam to run it? Length of firebox 7 inches, height of firebox 6 inches, width of firebox 6 inches, diameter of waist 6 inches, number of tubes 3, diameter of tubes 2 inches, length of tubes 11 inches. A. The boiler is rather small. 2. What pressure would the above stand, if made of ¾ inch copper? A. The safe working pressure would be from 60 to 70 lbs. per square inch.

(28) L. P. S. asks: Has there been any plan for a governor devised on the principle of the gyroscope? A. There have been a number of governors devised on that principle. So far as we know, they have not come into extensive use. One was proposed for the Bessemer channel steamer.

(29) L. R. asks: How can I clean dirty oil from the drip pans under hangers? A. Filter it through plugs of cotton wool.

COMMUNICATIONS RECEIVED.

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

On Lighting Lamps by Electricity. By W. H. Z.
On a Perpetual Motion. By W. J.
On Flying Machines. By M. K.
On Nitrogen. By E. A. H.
On the Bedbug. By —.

Also inquiries and answers from the following: D. H. E., A. B., E. J. P., W. M. C., J. H. P., A. B., G. F., O. P. D., L. H. E., F. F., D. G. W., G. D.

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.

Inquiries 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: "Whose is the best washing machine, run by steam power? Who sells corrugated iron? Who sells machines for beveling the edges of straw boards, etc.?" 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,

May 23, 1876,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

A complete copy of any patent in the annexed list, including both the 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.

Alarm, burglar, compressed, L. Mekarski.....	177,296
Alarm, burglar, S. H. Harrington.....	177,607
Alarm, burglar, F. A. Lane.....	177,727
Bag, grain, H. Redden.....	177,749
Bale tie, J. F. Briggs.....	177,693
Bale ties, cotton, J. McMurtry.....	177,630, 177,631
Basket, grain, G. Amsden.....	177,728
Bath tub, back support, F. F. W. Eisenmann.....	177,700
Beds, hinge for, T. Q. Hall.....	177,711
Bird cage, J. D. Helms.....	177,715
Bird cage hooks, Osborn & Drayton (r).....	7,133, 2,134
Blasting powder, J. H. Dolde.....	177,819
Boat, life, J. F. Cosgrove.....	177,694
Roller, cast iron sectional, J. W. Hard.....	177,635
Roller, domestic, J. McConnell.....	177,734
Roller, sectional steam, W. P. Skiffington.....	177,757
Roller, steam, G. H. Corliss.....	177,692
Roller, steam, S. Smith.....	177,700
Roller, wash, E. M. Mallett.....	177,730
Rolt and chain, door, W. R. M. Adams.....	177,674
Boot and shoe, S. F. Pray.....	177,660
Boot heels, burnishing, R. C. Lambart.....	177,736
Boot, waterproof, H. D. Osgood.....	177,636
Boot tree, J. H. Sampson.....	177,723
Boots, screw rolling machine for, C. Tyson.....	177,772
Bread machine, W. P. Jones.....	177,849
Brick and tile machine, P. H. Kells.....	177,851
Brick machine, J. Bonshire.....	177,615
Brick machine, J. Denning.....	177,815
Buckle, belt, L. Earhart.....	177,822
Buckle fastening, R. Meyer (r).....	7,129
Burglar, A. M. Norton.....	177,742
Burial case, T. H. Daniels.....	177,812
Burial case, J. H. Murray.....	177,741
Burial case mold, T. E. Daniels.....	177,813
Burner for light house lamps, J. Funck.....	177,825
Burner, lamp, H. A. Chapin.....	177,618
Butter worker, M. Hutchinson.....	177,844
Button and stud, sleeve, E. Verpillier.....	177,899
Calendar, automatic, M. H. Paddock.....	177,879
Camp kit, M. A. Stephen.....	177,766
Can, A. R. Waller.....	177,902
Can spout cap, W. Collins.....	177,620
Car coupling, W. H. Farris.....	177,705
Car coupling, W. H. Keachle.....	177,722
Car coupling, C. H. Knowlton.....	177,648
Car heater and ventilator, E. S. Jensen.....	177,847
Car heater and ventilator, H. Maey.....	177,858
Car, street, L. Wood.....	177,672
Cars, driving fan blowers in, J. H. Wickes.....	177,907
Carpet stretcher and tack driver, J. M. Farrar.....	177,704
Carriage lifting frame, C. F. Haynes.....	177,638
Carriage top, G. E. Spare.....	177,763
Caster, furniture, G. B. Warren.....	177,935
Cattle, feeding salt to, Winterscheid et al.....	177,778
Chain, ornamental, J. L. Healey.....	177,834
Chair, B. Skoog.....	177,891
Chair, cradle, etc., combined, J. H. Leonard.....	177,855
Chair, rocking, M. Schrenkelsen.....	177,734
Cheese vat, Howe & Hill.....	177,719
Chimney tops, making fire, H. McMahon.....	177,735
Churn, A. L. Starkey.....	177,765
Cigarette machine, J. A. Marengo.....	177,732
Clasp for supporting garments, E. W. Philbrook.....	177,882
Clothes wringer, W. F. & H. L. Williams.....	177,919
Clothing seam, ornamental, J. H. Nichols.....	177,876
Coal, mining, P. Sheldon (r).....	2,135
Coal screen, wire loom for, C. P. Seltzinger.....	177,664
Coal scuttle, A. F. Burnett.....	177,617
Compass, mariner's, J. McNabb.....	177,869
Concertinas, etc., bellows for, L. T. Simon.....	177,896
Condenser for purifying grease, S. N. Hartwell.....	177,713
Condenser regulator, G. H. Corliss.....	177,907
Cooker, steam, W. F. Guernsey.....	177,828
Cooler, milk, G. Hofstatter.....	177,640
Coop, folding, J. O'Connor.....	177,878
Copy holder and galley stand, C. H. Brainard.....	177,691
Coughs, etc., remedy for, M. Battaglia.....	177,614
Currycombs, C. A. Hotchkiss.....	177,838, 177,839
Cradle, J. H. McLean.....	177,648
Culinary vessel, D. J. Esser.....	177,726
Cultivator, D. C. Tanner.....	177,666
Cultivator, wheel, E. M. & M. L. Kissell.....	177,803
Curled cord tightener, H. Besley.....	177,905
Desk, school, J. W. Childs (r).....	7,132
Desk, school, A. W. Hempleman.....	177,805
Digger, potato, C. Small.....	177,729
Ditching machine, Skinner & McClure.....	177,728
Doll head, C. Wiegand.....	177,777
Door hanger, S. H. & E. Y. Moore.....	177,484
Door, screen, J. Palm.....	177,607
Doweling machine, A. P. Merchant.....	177,802
Dryer, E. W. Bakewell (r).....	7,121
Ear muff, C. Sedgwick.....	177,725
Egg box, J. L. Stevens (r).....	7,131
Elevator, J. Meyer.....	177,979
Elevator, hydraulic, C. A. Chandler.....	177,618
Envelope, L. P. Hays.....	177,714
Evaporator, glyce, E. H. Gouge.....	177,927
Explosive compound, J. H. Dolde.....	177,918
Fabrics, molding, W. H. Hart, Jr.....	177,801
Fabrics, measuring packages, E. Morgan (r).....	7,123
Fare controller and indicator, L. Von Hoven.....	177,900
Faucet, A. Tomeska.....	177,898
Felt cloth, poncing, H. S. Richardson.....	177,602
Fence, portable, O. Thomas.....	177,897
Fence post, J. E. Phillips.....	177,638
Fence wire, L. B. Smith (r).....	7,136
Fence wire, barbed, C. H. Salisbury.....	177,732
Fire arm, breech loading, E. Hughes.....	177,442
Fire arm, breech loading, N. King.....	177,932
Fire arm, breech loading, J. C. Welles.....	177,935
Fire arm springs, attaching, W. A. Richardson.....	177,867
Fire kindler, D. B. Goewey.....	177,739
Fishing, spoon hook for, L. S. Hill.....	177,698
Floor cloth, making, Bulse & McKay.....	177,842
Flower basket, J. H. Meyer.....	177,653
Flue cleaner, A. Crosby (r).....	7,126
Fountain, nozzle or jet for, C. E. Foster.....	177,621

Fruit lifter, W. McCormick.....	177,868
Fuel artificial, F. Dixon.....	177,636
Furnace, hot air, D. Boyd.....	177,679
Furnace, hot air, W. H. Lotz.....	177,857
Gas, making, E. J. Jerzmanowski.....	177,721
Gas governor, R. H. Plass.....	177,745
Gas, making, J. S. Williams.....	177,909
Gas, making, E. J. Jerzmanowski.....	177,767
Gas, making, E. Stern.....	177,767
Gas regulator, J. R. Hall.....	177,634
Gate, farm, A. J. Grady.....	177,710
Generator, water coil steam, B. S. Benson.....	177,791
Globe and shade holder, hot air, L. E. Fish.....	177,824
Governor, steam, J. W. Clark.....	177,804
Grain binder, H. H. Bridenbath, Jr.....	177,616
Grain binder, Culbertson & Edgar.....	177,623
Grinding ring dress, E. S. Howland.....	177,718
Hammers, hanging for revolving, G. H. Pond.....	177,883
Harness, F. Reynolds.....	177,886
Harrow, A. Kehm.....	177,723
Harrow and cultivator, H. Butler.....	177,685
Harrow and field roller, M. Hutchins.....	177,723
Harrow and roller, J. Hartinger.....	177,689
Harvester, C. C. Bradley.....	177,644
Harvester, corn, S. S. Johnston.....	177,738
Harvester, corn, J. I. and W. J. Mettler.....	177,872
Harvester, corn, J. D. Miller.....	177,872
Hatchway, Hackett & Moessner.....	177,638
Hay carrier, E. L. Walker.....	177,901
Hay loader, J. W. & E. Small.....	177,898
Health lift, W. B. Blake.....	177,794
Heater, L. West.....	177,906
Hinge, J. K. Gillilan.....	177,708
Horse blanket, A. Crittenden.....	177,809
Horseshoe calk, G. M. L. McMillen.....	177,868
Horseshoe nails, finishing, E. Suckow.....	177,728
Hose goods, H. G. Hubbard.....	177,814
Hose pipe coupling, G. H. Buzzell.....	177,668
Hose pipe nozzle, R. Kendrick.....	177,646
Hydrant, T. Maguire.....	177,860
Ice cream freezer, D. J. Rogers.....	177,888
Ice creeper, C. Brodhead.....	177,797
Ice machine, A. J. S.....	177,845
Ice, making, B. Hoppenyan.....	177,717
Implement, combined, T. Davis.....	177,636
Indicator, current, B. W. Hoxie.....	177,840
Inkstand, S. Darling (r).....	7,127
Ironing apparatus, T. S. Wiles.....	177,908
Ironing board and table, J. A. Geraghty.....	177,707
Isinglass, obtaining, I. Stanwood.....	177,764
Key fastener, E. T. Jenkins.....	177,846
Kiln, brick, J. Bronkar.....	177,684
Knife, shoe, I. A. Dunham.....	177,627
Knitting machine, rotary, G. W. Cummings.....	177,695
Knob attachment, door, S. S. Niles.....	177,877
Lamp extinguisher, F. H. Furniss.....	177,631
Lamp support, W. Westlake.....	177,773
Lamp wick, W. Y. A. Boardman.....	177,796
Lamp wick trimmer, S. Naylor.....	177,875
Latch and lock, H. L. Arnold.....	177,611
Lathe, metal turning, S. W. Putnam, Jr.....	177,884
Leather rolling machine, J. Bright.....	177,682
Lignum, G. Bennet.....	177,790
Locks, securing, Cook & Heath.....	177,806
Loom picker, A. Holbrook.....	177,641
Loom take-up, T. W. Harrison.....	177,830
Lounge, camp, A. Tottingham.....	177,771
Match box, O. H. Hicks.....	177,887
Match box, S. E. Whitney.....	177,776
Measure, foot, F. B. Smith.....	177,762
Mechanical mechanical movement, H. Millinger.....	177,873
Meter, liquid, H. S. Maxim.....	177,733
Millstone dresser, A. DeFor.....	177,698
Mop wringer, D. Hoag.....	177,716
Nasal douche, Gassin, Gray & Gassin.....	177,692
Nut lock, Smith & Gill.....	177,665
Organs, tremolo for reed, O. H. Arno.....	177,610
Padlock, A. Delkescamp.....	177,814
Padlock, J. H. McWilliams (r).....	7,122
Paper bag machine, J. H. Balsley.....	177,787
Paper glove band, W. P. Vrooman.....	177,669
Paper jewelry, F. W. Seldewitz.....	177,899
Papers, producing safety, W. C. Sams.....	177,896
Pavement, concrete, A. Pelletier.....	177,744
Pavement, stone, A. Maginnis.....	177,809
Pawl, noiseless, E. Curtis.....	177,811
Pencil, adding, J. J. White.....	177,775
Pencil sharpener, G. P. Schneider.....	177,663
Photographs, negatives, retouching, F. Muravov.....	177,874
Photographic head rest, B. F. Adams.....	177,792
Pill machines, feeding, J. A. McFerran.....	177,867
Pill mold, J. A. McFerran.....	177,866
Pipe cutter, A. C. Wood.....	177,878
Planters, coverer for corn, C. G. Moremen.....	177,740
Plow, rotary, J. K. Underwood.....	177,666
Pocket book fasteners, L. Prahar.....	177,747
Portfolio, J. & C. Quenzer.....	177,748
Postage stamp, S. R. Dummer.....	177,821
Power, sand, S. H. Dimock.....	177,917
Press, J. B. J. Mignon.....	177,971
Price lists, holder for, S. Washburn, Jr.....	177,904
Printing press, C. B. Bottrell.....	177,908
Printing press, E. T. Dockum.....	177,699
Printing press, Woods & Tuttle (r).....	7,138
Pump, W. D. Trahern.....	177,697
Pump supply pipe, J. M. Bailey.....	177,612
Radiator air trap, G. W. Blake.....	177,793
Railway car trap, E. Blochman.....	177,795
Railway rail joint, C. F. Arnold.....	177,738
Railway switches, actuating, T. F. Corry.....	177,698
Rake, horse, J. H. Melick.....	177,870
Raker and cocker, hay, W. J. Mettler.....	177,787
Reaper and harvester, W. Clawwater.....	177,680
Register, etc., electric, H. Whittemore.....	177,661
Rein guard, check, C. B. Dickinson.....	177,816
Rein holder, C. Seike.....	177,736
Roller or pulley, J. J. McCormick.....	177,864
Sash cord fastener, J. Olitz.....	177,655
Saw frame, scroll, H. L. Pratt.....	177,639
Sawmills, conveying refuse from, W. Glue.....	177,928
Saw, scroll, H. J. Cordesman, Jr.....	177,621
Sawing machine, band, H. J. Cordesman, Jr.....	177,622
Sawing machine, drag, Clifford & Cory.....	177,619
Scales, platform, H. Estabrook.....	177,928
Screw-cutting machine, H. K. Jones.....	177,645
Screw driver, J. F. Kingwill.....	177,734
Screw tap, S. W. Martin.....	177,731
Screw, wood, R. J. Sams (r).....	7,124
Seeding machine, J. B. Birge.....	177,792
Separator, grain, C. & J. F. York.....	177,791
Separator, rotary grain, H. A. Barnard.....	177,789
Sewing machine, Applegate & Webb.....	177,784
Sewing machine, driving, S. F. Burdett.....	177,800
Sewing machine trimmer attachment, L. L. Barber.....	177,786
Shade support, T. F. McGann (r).....	7,128
Shingle, M. McComb.....	177,865
Shoe knife, I. A. Dunham.....	177,627
Shoelast, R. Taylor.....	177,769
Shutter opener, window, J. R. Day.....	177,697
Sieve, E. Stewart.....	177,894
Sieves, crimping wire for, C. P. Seltzinger (r).....	7,125

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 for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

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.

A pamphlet containing the laws and full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.
BRANCH OFFICE—Corner F and 7th Streets, Washington, D. C.

FOREIGN PATENTS

AND

THE CENTENNIAL.

There is no doubt that our Centennial Exposition will attract to our shores multitudes of representative people from all parts of the world, and they will take home with them many of our best improvements to introduce into their own manufactures.

An unusual opportunity will be offered for selling to these people such foreign patents as have been secured on good American inventions in the respective countries from which these visitors come.

At the reduced prices for which patents are obtained abroad, our people will lose a chance not likely to occur again, if they do not avail themselves of the opportunity of securing their inventions in foreign countries at once so as to have their patents ready to negotiate during the coming summer.

For cost of patents in the different countries and the conditions on which they are granted, send for pamphlet containing full information.

Address
MUNN & CO.,
37 Park Row, New York.
BRANCH OFFICE, cor. F and 7th Sts.
Washington, D. C.



OF THE

SCIENTIFIC AMERICAN,

FOR 1876.

THE MOST POPULAR SCIENTIFIC PAPER
IN THE WORLD.

THIRTY-FIRST YEAR.

VOLUME XXXIV.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the first day of January, 1876, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room. Each volume contains hundreds of Notes, Receipts, and Suggestions and Advice, by Practical Writers, for Working Men and Employers, in all the various arts.

TERMS OF SUBSCRIPTION—POSTAGE
PAID BY US.

One copy Scientific American, one year.....\$3.20
One copy Scientific American, six months.....1.60
One copy Scientific American, three months.....1.00
One copy Scientific American and one copy Scientific American Supplement, both for one year, post-paid.....7.00

The Scientific American Supplement

A weekly paper, uniform in size with the SCIENTIFIC AMERICAN, but a distinct publication. It contains working drawings of engineering works, and elaborate treatises on every branch of Science and Mechanics, by eminent writers, at home and abroad. An illustrated cover protects the handsomely printed sheets. Price, \$5.00 per annum. Single copies 10 cents.

Remit by postal order, draft, or express.
Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.,
37 PARK ROW, NEW YORK



[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the
United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British

ILLUSTRATIONS.

	—Greenwich street and N. Ave.	207, 214	Astronomical notes..... 20, 88, 164,
	Railway, elevated, proposed London.....	214	Atlantic ferry, the..... 252, 253
Electrical experiments, Heco's.....	Railway rail joint, Mead's.....	22	Atoms, vortex, celebrated..... 252, 253
Electric apparatus for recording votes.....	Railway switch signal, Spay's.....	310	Automata, colored..... 252, 253
Electricity and organ building.....	Railway, underground, New York.....	207	Axle box metal..... 252, 253
Emery grinder, Sanford's.....	Rapid transit in New York city, city sketches of.....	215	Azale periods and glacial action..... 252, 253
Engine wheel, Harding's.....	Reflector, concentrating, Shilve's.....	406	
Engine, ammonia, Delaporte's.....	Refrigerator, air, Nørgaard's.....	52	B
Engine, compounded beam steam, Bagshaw's.....	Riveter and crane hydraulic, Tweddell's.....	226	Bacteria and nitrites in water..... 1
Engine, compression, Rider's.....	Riveting machine, steam, Pusey & Co.'s.....	412	Bacteria in perspiration..... 1
Engine, hydrocarbon.....	Roads, the Telford and Madock, Barlow & Co.'s.....	150	Baking powder..... (35)
Engine, semi-hydraulic, Hargison's.....	Rock-drill, hand, Barlow & Co.'s.....	148	Balloon ascent, and descent..... 2
Engines, automatic steam, Max-Im's.....	Roofs, iron, Lyman's.....	348	Balloon for paper..... 2
Engines, compressed air.....			Bankrupt, an English..... 2
Engraving and chasing machine.....			Bank vaults, can we protect them..... 1

Advertisements.

Back Page - \$1.00 a line.
Inside Page - 75 cents a line.
Engraving may head advertisements at the same rate
per line, by measurement, as the letter press. Ad-
vertisements must be received at publication office at
early as Friday morning to appear in next issue.

THE ALLEN GOVERNOR

Is fully warranted to be the best governor ever made for
all engines. It is simple in construction, not liable to get
out of repair, neat in appearance, noiseless, very power-
ful, very sensitive, will last a lifetime, will save fuel, will
save a large portion of the engineer's time, and is sold at
a reasonable price.

WORTH \$1,000.00 A YEAR.

PLAINVILLE MFG CO.,
PLAINVILLE, Conn., May 29, 1876.

S. B. ALLEN—I read an account of the "Allen Gover-
nor" in the SCIENTIFIC AMERICAN, and desire to tell you
what I think of it. Your governor was attached to our
large engine seven months ago. It has done more than
was claimed for it. It has saved about twenty per cent
of our coal, and added greatly to our power. We thought
a larger engine would be necessary to run our new machi-
nery, and had partly contracted for one, but now we have
plenty of power. The agent says you have saved us the
price of a new engine. I think your governor is worth a
thousand dollars a year to our Company. They would not
part with it for that sum. I have run an engine since
1848, and never saw a governor which will regulate a
steam engine like yours.

W. B. REYNOLDS, Engineer of Plainville Mfg Co.
We desire a good, responsible, first class firm of Engi-
neers or Machinists in every city where we are not rep-
resented, to sell these governors. Persons wanting gov-
ernors, or desiring to act as selling agents, may address
STILLMAN B. ALLEN, Boston, Mass.

All persons west of the Rocky Mountains will address
GODDARD & CO., Pacific Iron Works, San Francisco.

SCHLENKER'S
Stationary-Die and Revolving-Die
Bolt Cutters.

THE BEST AND CHEAPEST MADE.
HOWARD IRON WORKS,
Buffalo, N. Y.
Send for Catalogue.

Working Models
And Experimental Machinery, Metal or Wood, made to
order by
J. F. WERNER, 82 Center St., N. Y.

Baldwin Gear Cutter--For Sale,
CHEAP. Address W. E. LEWIS, Cleveland, Ohio.

FOOT LATHES--FOOT DRILL PRESSES.
H. L. SHEPARD, Cincinnati, O.

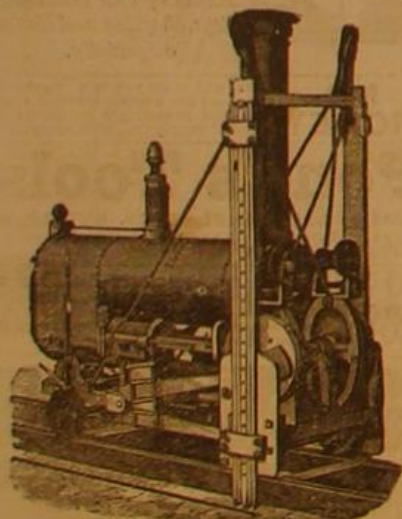
TUBULAR HEATING STOVE--Warms from
five to ten rooms. Greatest heater ever invented.
Patented May 2, 1876. Distant States for Sale. Drawings
and circulars sent free. TUBULAR STOVE CO.,
Clear Lake, Iowa.

FILES.

The very best in the United States are those of the old
and well-known
"WHEELER, MADDEN & CLEMSON"
brand. They may be had from dealers everywhere; or,
in large quantities, direct from the manufacturers.
MADDEN & COCKAYNE FILE CO.,
Send for Price-list. Middletown, N. Y.

STANDARD SCROLL BOOK, just out, has 200
designs and ideas invaluable to all Painters, etc.
Just the thing wanted, and must be seen to be appreci-
ated. Only \$1. Examine at any bookstore or painters'
supply store. Mailed post paid on receipt of price by
JESSE HANEY & CO., 119 Nassau St., N. Y.

Stone Channeling
OR
Quarrying Machine,



WARDWELL PATENT,
FOR CUTTING STONE INTO VARIOUS SIZES
AND DIMENSIONS IN ALL KINDS OF
QUARRIES.

STEAM STONE CUTTER CO., RUTLAND, VT.
SOLE PROPRIETORS AND MANUFACTURERS.

THE BEST
GOLD PENS

Are manufactured by JOHN HOLLAND, No. 19 West Fourth
St., Cincinnati. By a patent process he alloys pure gold so as
to make it as elastic as Damascus Steel. Prices as low as
the old style. Send for illustrated price list.

VELOCIPED CARRIAGES, OF LIGHT CON-
struction, fast speed. Worked by hand cranks;
also by foot treadles. Illustrated in SCIENTIFIC AME-
RICAN SUPPLEMENT No. 8. To be had at this office
and of all news agents. Price 10 cents.



ROOTS' FORCE BLAST BLOWER.
FIRST PREMIUM AWARDED
AT PARIS & VIENNA.
THOUSANDS IN USE BOTH
IN THIS COUNTRY & EUROPE.
SPEED ONLY 100 TO 250 REV. PER MIN.
SAVES HALF THE POWER USED BY FAN.
P. H. & F. M. ROOTS MFRS. CONNERSVILLE IND.
S. S. TOWNSEND 31 LIBERTY ST. N. Y. GENL AGT.

Todd & Rafferty Machine Co.

MANUFACTURERS OF

The celebrated Greene Variable Cut-Off Engine, Lowe's
Patent Tubular and Fine Boilers, Plain Side Valve Sta-
tionary, Hoisting, and Portable Engines, Boilers of all
kinds, Steam Pumps, Mill Gearing, Shafting, &c., Silk,
Tow, Oakum, Bagging, Rope, Flax, and Hemp Machinery,
Agents for the New Haven Manufacturing Co.'s Machi-
nists' Tools, for Judson's Governors and Stop Valves,
Sturtevant Blowers, and Differential Pulley-Blocks.
WAREHOUSES, 38 LIBERTY STREET, NEW YORK.
WORKS, PATERSON, NEW JERSEY.

DAMPER REGULATORS BEST AND LEVER
MURRILL & KEIZER, 44 Holliday St., Balt.

Old Colony Rivet Works,
34 Warren St., New York,
MANUFACTURERS OF

Hatchet Drills, Judson's Band Planing and
Shaping Machines, Hand Shears and Cut-
ters, Drilling Machines, Tire Upsetters,
and Portable Forges.

Send for Catalogue

NON-COMBUSTIBLE STEAM BOILER & PIPE

COVERING

WITH "AIR SPACE" IMPROVEMENT.
Saves 30 to 50 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St., N. Y.; 132 N. 2nd St., St. Louis, Mo.

To Roofers, Builders, & Property Owners.



A complete Roofing for \$3 per square, durable, econ-
omical, and fireproof. Send for Samples and Circulars.
E. H. MARTIN, General Roofing Materials,
P. O. Box 4784, 70 Maiden Lane
and 9 Liberty St., N. Y.

ROGERS' TANNATE OF SODA BOILER
SCALE PREVENTIVE.

JOS. G. ROGERS & CO., Madison, Ind.
Send for book on Boiler Incrustation.

GENUINE
CONCORD AXLES

The Standard--Best Stock--Finest Finish--
MANUFACTURED ONLY BY

D. ARTHUR BROWN & CO. Fisherville, N. H.

Niagara
Steam Pump Works

ESTABLISHED 1826.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

M. SELIG JUNIOR, & CO.,
Importers of American Machinery, Tools, Agricultural
Implements, Wholesale and Export Hardware and Ma-
chinery Merchants. Est'd 1866, 85 Queen Victoria St.,
LONDON, E. C., ENGLAND.

Portland and Keene's Cement.

From the best London Manufacturers. For sale by
JAMES BRAND, 85 Beekman St., New York.
A Practical Treatise on Cement furnished for 25 cents.

WROUGHT
IRON
BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.--
The attention of Engineers and Architects is called to
our Improved Wrought-Iron Beams and Girders (pat-
ented), in which the compound welds between the stem
and flanges, which have proved so objectionable in the old
mode of manufacturing, are entirely avoided. We are pre-
pared to furnish all sizes at terms as favorable as can be
obtained elsewhere. For descriptive lithograph, address
Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

PERFECT
NEWSPAPER FILE.

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

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

PORTLAND CEMENT

For Walks, Cisterns, Foundations, Stables, Cellars,
Bridges, Boats, etc. Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St. New York

MILLSTONE DIAMOND DRESSING MA-
CHINES. Simple, effective, and durable. Also,
diamond-pointed tools for dressing Emery Wheels, Grinding
stones, Chilled Iron, and Paper Calender Rolls, and other
mechanical purposes. Also, Diamond Tools, Saws, and
Drills made to order. J. DICKINSON, 61 Nassau St., N. Y.



The BEST MILLSTONE DRESSER--GRISCOM
& Co., Manufacturers and Patentees, Pottsville, Pa.

FOR THE LATEST IMPROVED
MACHINERY.

For Manufacturing SPOKES, HANDLES, AND HUBS,
Address J. GLEASON, cor. 3d & Diamond Sts., Phila.

H. W. JOHNS' PATENT
ASBESTOS
MATERIALS.

Asbestos Roofing, with the improved White Asbestos
Fire Proof Coating, for steep or flat Roofs in all climates.
Asbestos Roof Coating, for old Leaky Roofs.
Asbestos Cement, for repairing Leaks on Roofs.
Asbestos Roof Paint, for Tin Roofs, Ironwork, &c.
Asbestos Paints--all colors--for structural purposes.
Asbestos Fire Proof Coating, for wood work, &c.
Asbestos Steam Pipe and Boiler Coverings.
Asbestos Steam Packing, flat and round, all sizes.
Sheathing Felt, Vermin-Proof Lining, &c.
These articles are ready for use, and can be easily ap-
plied by any one. Send for Pamphlets, Price Lists, &c.
H. W. JOHNS, 87 Maiden Lane, N. Y.,
Patentee and Manufacturer. Established 1855.

Brayton Ready Motor.

It has no boiler, is safe, economical, started by any
one in one minute, occupies small space, and gives an
unsurpassed steady, reliable power. Address

Penna. Ready Motor Co.,
132 N. 3d St., Philadelphia, Pa.

NOYE'S
Mill Furnishing Works

are the largest in the United States. They make Burr
Millstones, Portable Mills, Smut Machines, Packers, Mill
Picks, Water Wheels, Pulleys and Gearing, specially
adapted to four mills. Send for Catalogue.

J. T. NOYE & SON, Buffalo, N. Y.

BOGARDUS' PATENT UNIVERSAL ECCEN-
TRIC MILLS--For grinding Bones, Ores, Sand, Old
Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn,
Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots,
Spices, Coffee, Coconut, Flaxseed, Asbestos, Mica,
etc., and whatever cannot be ground by other mills.
Also for Paints, Printers' Inks, Paste Blacking, etc.
JOHN W. THOMSON, successor to JAMES BOGAR-
DUS, corner of White and Elm Sts., New York.



WHIPPLE'S
Patent Door Knob.

Awarded a Bronze Medal at the American Institute Fair
for 1874. The Judge says: "We consider this method of
fastening DOOR KNOBS a great improvement over any-
thing yet invented for the purpose, as it obviates the use
of side screws and washers, and can be regulated to suit
any thickness of Doors." Send for Circular.
THE PAIKER & WHIPPLE COMPANY,
West Meriden, Conn., or 97 Chambers St., N. Y.

Machinists' Tools.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

Do Your Own Printing!

With \$3 Press for cards, labels, envelopes, etc.
Business Men do their printing and advertis-
ing, save money and increase trade. Pleasure and
profit in Amateur Printing. The Gift or
have great fun and make money fast at
printing. Send two stamps for full cata-
logue of presses, type, etc., to the Manufacturers,
KELLEY & CO., Meriden, Conn.

EAGLE FOOT LATHES.

With Scroll and Circular Saw Attach-
ments, Slide Rest, Tools, &c., also Small
Engine Lathes, Metal Hand Planers, &c.
Neatest designs, superior finish. Low
Prices. Our new Catalogue describes
these and every tool necessary for the Am-
ateur or Artisan. Send for it.
WM. L. CHASE & CO.,
36 & 37 Liberty St. New York.

The Tanite Co.,
STROUDSBURG, PA.
EMERY WHEELS & GRINDERS

CHICAGO OR WESTERN HEAD QUARTERS
for Tanite Co.'s Emery Wheels, Grinding
Machinery, &c. C. C. CHAMPLIN, 152 Lake St.
Tanite Wheels delivered free of freight in any part
of the West, on receipt of list price in advance.

SCREW PROPELLERS, THEIR SHAFTS AND
FITTINGS. By Hamilton W. Pender, M. E. An
able treatise, showing the present practice, its advan-
tages and defects. With 25 figures. Price 10 cents. Con-
tained in No. 4 of SCIENTIFIC AMERICAN SUPPLE-
MENT. To be had at this office, and of all news agents.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.

W. R. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

IMPORTANT FOR ALL CORPORATIONS AND
MAN'G. CONCERNS.--Buerk's Watchman's
Time Detector, capable of accurately controlling the
motion of a watchman or patrolman at the different sta-
tions of his beat. Send for circular.
J. E. BUEBK, P. O. Box 979, Boston, Mass.
N. B.--The suit against Imhäuser & Co., of New York,
was decided in my favor, June 19, 1874. Proceedings
have been commenced against Imhäuser & Co. for sell-
ing, contrary to the order of the Court, and especially the
clock with a series of springs in the cover, and marked
Pat'd Oct. 30, '74. Persons using these, or any other
clocks infringing on my Patent, will be dealt with accord-
ing to law.

PATENT
**COLD ROLLED
SHAFTING.**

The fact that this shafting has 75 per cent greater
strength, a finer finish, and is truer to gauge, than any
other in use, renders it undoubtedly the most economical.
We are also the sole manufacturers of the CELEBRATED
COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers,
etc., of the most approved styles. Price list mailed on
application to
JONES & LAUGHLINS,
Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa.
100 S. Canal Street, Chicago, Ill.
Stocks of this shafting in store and for sale by
FULLER, DANA, & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.
PIERCE & WHALING, Milwaukee, Wis.

An deutsche Erfinder.

Diese große und thätige Classe unserer Be-
obachtung machen wir besonders darauf
aufmerksam, daß unsere Firma durch ihre Ver-
bindung mit Washington und den europäischen
Hauptstädten, besondere Vortheile zur Erlan-
gung von in- und ausländischen Patenten
bietet.

Jeder Erfinder, gleichviel welcher Nationali-
tät angehört, ist durch die liberalen Patentge-
setze der Vereinigten Staaten zum Patentschutz
für Erfindungen berechtigt. Unsere Firma ist
bereit, gestützt auf 26jährige Erfahrung, deutsche
Erfinder jeder Zeit zu beraten und zu mäßigen
Breiten rasch und pünktlich Patente zu erlangen.

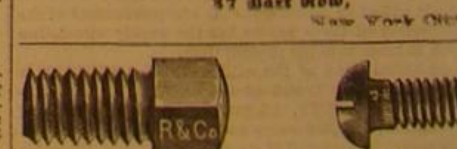
Die Deutsche Section ist in den Händen
fähiger deutscher Ingenieure, welche in der
Office persönlich mit Erfindern verkehren
werden.

Der "Scientific American" wird in seinen
Spalten die bedeutendsten Erfindungen be-
sprechen.

Korrespondenz erbeten und prompt beant-
wortet. Pamphlete in deutscher Sprache wer-
den auf Verlangen franco zugesandt.

Adresse:
Munn & Co.,
"Scientific American" Patent Agents
37 Nassau St., New York City.

REYNOLDS & CO.,
145 EAST ST., NEW HAVEN, CT.
MANUFACTURE



Iron and Steel Set Screws, Round, Square, and Hexagon
Head; Machine and Cap Screws; Piano, Knob, and Lock
Screws; Machine, Bridge, and Roof Bolts, Bolt Ends,
Blanks, Nuts, Washers, etc., of every description.
Send for Price List.

THE CENTENNIAL INTERNATIONAL EX-
HIBITION OF 1876.--The full History and Progress
of the Exhibition, maps of the grounds, engravings of
the buildings, news and accounts of all the most notable
objects, are given weekly in the SCIENTIFIC AME-
RICAN SUPPLEMENT. Terms, \$5 for the year; single co-
pies 10 cts. To be had at this office, and of all news agents.
All the back numbers, from the commencement on Jan-
uary 1, 1876, can be had. Those who desire to possess a
complete and splendid illustrated record of the Centen-
nial Exposition, should have the SCIENTIFIC AME-
RICAN SUPPLEMENT.

IRON BRIDGE BUILDING--A complete de-
scription, with dimensions, working drawings, and
perspectives of Girard Avenue Bridge, Philadelphia, Pa.
With foundations of piers. Ten engravings. Price 25
cents. Contained in Nos. 1, 2, and 3 of SCIENTIFIC
AMERICAN SUPPLEMENT, 10 cents per copy. To be
had at this office, and of all news agents.

The "Scientific American" is printed with
CHAS. KNEU JOHNSON & CO.'S SINK, Tenth and
Lombard-sts., Philadelphia, and 59 Gold-st., New-York