SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 7. [NEW SERIES.] | NEW YORK, FEBRUARY 13, 1875. | [$3.20 per Annum, Postage prepaid.

THE EXCELSIOR UNIVERSAL WOOD WORKER.

It often happens, in manufacturing establishments, that even in the busy season, many expensive and valuable tools are allowed to stand idle because the peculiar kind of work, for which they may be exclusively adapted, is not for the time required. There is no doubt that large shops economize work by having, for every change of operation, a special tool, but the value of such apparatus is certainly enhanced if its construction be such that it can be devoted to other operations whenever the same may be desirable.

Such a machine is that represented in the annexed illustrations, the distinguishing name of which forms the above heading. Its operation is not new, and therefore not experimental; but the combination of several operations, and the form, shape, and adjustability of the different parts to make them answer one and all the purposes, are decidedly novel and useful. It is built by the well known firm of Bentel, Margedant & Co., manufacturers of woodworking machinery, of Hamilton, Ohio.

The sticker or molding operation is not intended for such heavy work as the large sized Universal Wood Worker, made by the same manufacturers and illustrated some time ago in this paper. The present machine has one sidehead only, but is, nevertheless, very strong, as the whole frame is cast in one piece, without joined or framed parts.

Fig. 1 shows the apparatus arranged for a molding machine. The table or platen consists of a large main support on which a side bracket is raised and lowered independently of any other adjustment of parts; also of two tables independently adjustable in a horizontal plane, all of which can be raised and lowered at either end of the machine, by means of a crank wrench, which engages two screws connected by corresponding gearing.

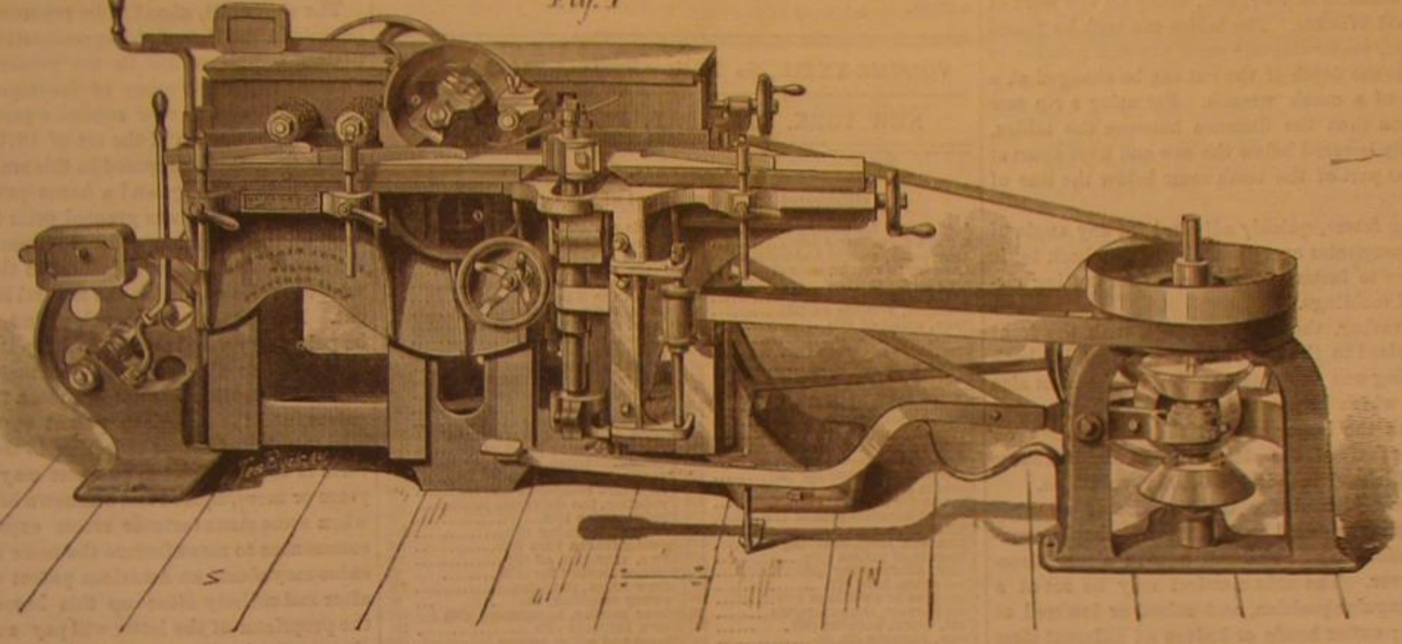
The illustration shows both tops at a common level. The larger one rests partly on the main support and on the side bracket. The smaller table is carried forwards to the projecting sidehead sufficiently to permit the free working of the same. The table may be brought forward, and the opening entirely closed if the sidehead is not needed; the machine will then operate as known under the name of a "single-head molder or sticker." The sidehead can be raised and lowered, moved in or out, set at any angle, and adjusted either way, keeping the angular position given. The upright countershaft of the sidehead, driven by strong friction gearing, enables the operator to start or stop the sidehead at will, while the material is moved forward by the feed rollers, and operated upon by the central cutter head. This gives an important advantage in planing material on the sides only, in the middle, or on one or both ends, substituting, in many cases, machine work for labor hitherto accomplished only by hand.

The feed rollers are of a peculiar construction; they remain perfectly parallel at any hight, or rise from the table, are strongly and simply geared and linked, and are so arranged that they press on the whole width of the material with even pressure.

The feed shafts, on which the teethed wheels are held by a nut, rest on strong sleeve sockets with long bearings, in which they can be slid back if not needed. The feed arrangement is held down by adjusting levers and weights. The hand lever on the end of the machine is used for starting or stopping the feed.

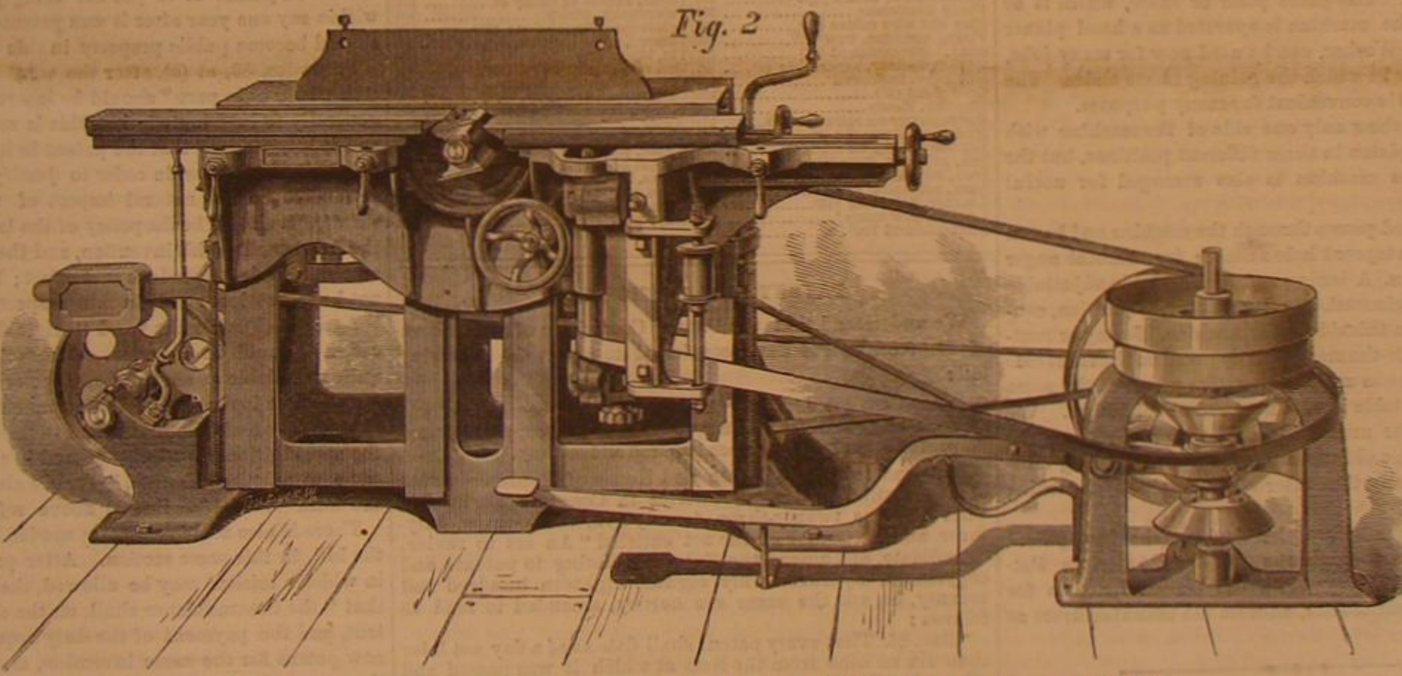
The weighted chip bonnet is adjustable to permit the use of long or short projecting molding cutters. The usual springs and spring holders, which are adjustable for their purpose, accompany the outfit. They can be let down on the sides of the tables, and may be advantageously used, at any altitude of the tables, for a large variety of work. The back top of the machine, visible in the engraving, serves in this position of

Fig. 1



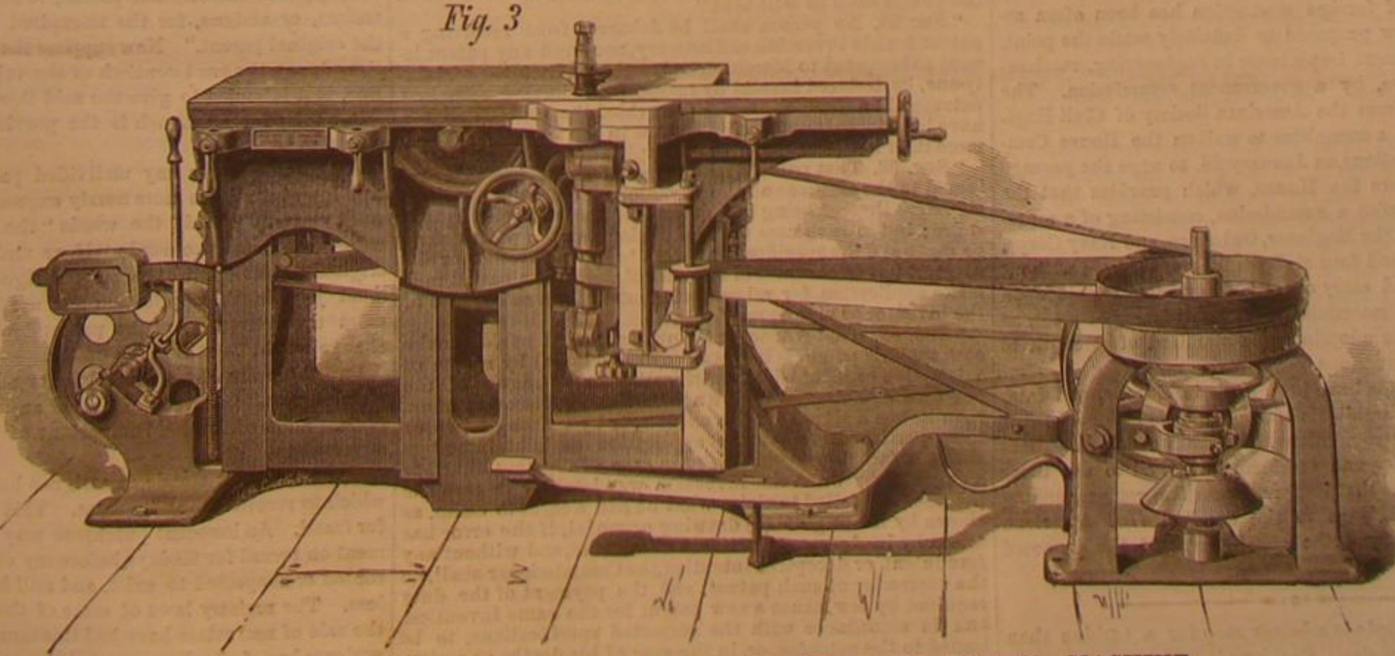
THE EXCELSIOR WOOD WORKER AS A MOLDING MACHINE.

Fig. 2



THE EXCELSIOR WOOD WORKER AS A HAND PLANING MACHINE.

Fig. 3



THE EXCELSIOR WOOD WORKER AS A SHAPING AND BORING MACHINE.

the machine as a commodious rest for short or long material before or after it is planed.

Fig. 2 shows the apparatus arranged as a hand planing machine, to which it can be changed quickly, and while the central cutter head is running.

The feed roller shafts are returned in their sleeves; the large table is slid back and the small one brought forward close to the cutting line of the cutter head. The main support is raised so that the front top, back of the cutter head, is on a level with the cutting line. The machine is then in position for planing material out of wind, squaring, beveling, cornering, chamfering, or tapering. The small front top may be raised or lowered for any desired thickness of cut. A fence or guide, which is adjustable to any desired angle, rests on the back top. By simple changes of the cutter heads, the adjusting of the tables to a common level with the cutting line of the cutter head, and the raising or lowering, parting or closing, of the front tables, all the different manipulations can be made, such as planing out of wind, beveling, cornering, tapering, mitering, rabbeting, jointing, panel raising on both sides at one operation, hand matching, rolling joints, gaining, plowing, circular, elliptical, and serpentine molding, rip and crosscut sawing, etc., doing all the work of the Universal Wood Worker. The tables can both be raised or lowered together, preserving the same position relative to each other; so that the depth of the cut can be changed at a moment by a turn of a crank wrench. For using a rip saw of larger dimension than the distance between the tables, the same are simply lowered below the saw and kept apart at the middle, so that part of the teeth come below the line of the tables.

A patent gaining frame, quickly adjusted for any angle of gain required, accompanies every machine. The back top is provided with holes to fasten the pattern on for cutting circular and elliptical moldings.

In the third engraving, the main support, with the front tables, is shown raised to the hight of the adjustable back top, thereby forming one large table; the sidehead is also raised to a hight which brings the smaller leather-covered pulley in line with the larger step of the cone pulley on the upright countershaft of the side head. This increases the speed of the sidehead mandrel to 5,000 revolutions.

The speed is now altered for the purpose of running smaller cutters as they are used on friezing and shaping machines, but the motion may be changed now in either direction by the foot lever. The side mandrel may be set at a perpendicular or angular position, and raised or lowered at will while running; cutter heads or knives of different sizes and shapes can be used and will operate in the same manner and for the same purpose as those of the best special friezing or shaping machine. The guide plate or fence, which is so very useful when the machine is operated as a hand planer or Universal Wood Worker, can be used now for many jobs, as well as the groove in which the gaining frame slides. The gaining frame itself is convenient for many purposes.

The illustrations show only one side of the machine with the stickerhead or platen in three different positions, but the opposite side of the machine is also arranged for useful work.

The center mandrel passes through the machine and has on the projecting end a tapered hole suitable for machine auger bits or chuck shanks. A boring and routing table adjustable in perpendicular, horizontal, angular, and rotary position, constitutes the outfit on this side of the machine. Boring or routing may be done while the machine is operated on the front side so that two persons can use the operative power at the same time. The boring table is of a new and novel design. We are informed that the machine is sold with and without the boring arrangement, and is so arranged that the boring table can be put on at any time afterwards by simply fastening a few bolts.

The right to manufacture the device (the last patent on which was taken through the Scientific American Patent Agency, April 7, 1874) within the United States is for sale. For further particulars, address the manufacturers as above.

Comparative Tests of Building Materials.

The superiority of American steels and irons to similar grades of metals of foreign production has been often asserted; and it is now proposed to definitely settle the point, which is of the utmost importance in engineering, mechanics, and agriculture, by a government commission. The suggestion comes from the American Society of Civil Engineers, who deputed a committee to wait on the House Committee on Appropriations, on January 26, to urge the passage of a bill, now before the House, which provides that the President shall appoint a commission, consisting of a representative each from the Engineer, Ordnance, and Navy Corps, the Coast Survey, and four civil engineers, to serve without pay, to institute and carry out such a system of tests upon American building materials, particularly iron and steel, as would result in the adoption of a standard of strength to govern future constructions.

Similar experiments have been made in Europe, and data, for the guidance of architects and for the use of local boards in framing building regulations, have been obtained. Hitherto our scientific men and artificers have had to use these results; but we hope that improved practice, comprehending the well known facts as to the excellence of American metals, will result from the appointment of the proposed commission.

Rock or swamp maple is a better step for a turbine than either *lignum vitæ* or elm. Cast iron is useless.

Scientific American.

MUNN & CO., Editors and Proprietors.

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

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

TERMS.

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

☞ By the new law, 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, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 187.. 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.

VOLUME XXXII., No 7. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, FEBRUARY 13, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

PATENT LAW AMENDMENTS.

We understand that the Patent Committee of the House of Representatives have concluded to report the following bill:

To amend the act entitled "An act to revise, consolidate, and amend the statutes relating to patents and copyrights," approved July eighth, eighteen hundred and seventy.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That sections twenty-three, twenty-five, thirty-three, fifty-three, and sixty-four of the act entitled "An act to revise, consolidate, and amend the statutes relating to patents and copyrights," approved July eighth, eighteen hundred and seventy, be, and the same are hereby, amended to read as follows:

"SEC. 23. That every patent shall date as of a day not later than six months from the time at which it was passed and allowed, and notice thereof was sent to the applicant, or his agent; and if the final fee shall not be paid sufficiently within that period to admit of the patent being prepared for issue, the patent shall be withheld."

"SEC. 25. No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent issued subsequent to March second, eighteen hundred and sixty-one, be declared invalid by reason of its having been first patented in a foreign country; provided the same shall not have been introduced into public use in the United States for more than two years prior to the application."

"SEC. 33. That patents may be granted and issued or reissued to the assignee of the inventor or discoverer, the assignment thereof being first entered of record in the Patent Office; but in such case the application for the patent shall be made and the specification sworn to by the inventor or discoverer, but an assignee of the entire interest in a patent may make application for reissue without the aid or consent of the inventor or discoverer."

"SEC. 53. That whenever the owner of a patent shall make oath that his patent is inoperative or invalid (a) by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he has a right to claim as new, or by reason of two or more parties having made application as joint inventors when, in fact, they were not, or in case of a patent issued to a single party when the invention was joint, or in case the patentee has failed to claim what he had a right to claim, as shown by his original (b) drawing or model, if the error has arisen by inadvertence, accident or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent, and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specifications, to be issued to the patentee, or, in the case of his death, or assignment of the whole or any undivided part (c) of the original patent, to his executors, administrators, or assigns, for the unexpired part of the term of the original patent (d), the surrender of which shall take effect upon the issue of the amended patent; and the Commissioner may, in his discretion cause several patents to be issued for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued letters patent. And the specification and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. And the patent so reissued, together with the corrected specification, shall have the effect and operation in law, on the trial of all actions for causes thereafter arising, as though the same had been originally filed in such corrected form; but no new matter shall be introduced in the application, nor, in case of a machine patent, shall the model or drawings be amended, except each by the other."

"SEC. 64. That upon the receipt of such application, and the payment of the duty required by law, the Commissioner shall cause to be published in the Patent Office *Official Gazette*, and in such other papers published in the section of the country most interested adversely to the extension of the patent as he may deem proper, for at least sixty days prior to the day set for hearing the case, a notice of such application, and of the time and place when and where the same will be considered, that any person may appear and show case why the extension should not be granted.'

The above bill, about to be reported by the committee on patents in the House of Representatives, contains several important improvements in the present statute, but falls far short of correcting many of the imperfections of the latter. Some of these will now receive a passing notice

The 25th section of the act of 1870 needs further amendments than those proposed in this amendatory act. He who holds both a foreign and a home patent is now obliged, if the foreign patent was granted prior to the House patent, to keep up the former in order to preserve the latter.

There would be less objection to this if the home patent were to expire only with the natural life of the foreign patent. But in case of a French patent, a hundred francs must be paid every year in order to keep it in existence. A failure to make this payment—no matter for what reason, or whether intentional or not—causes a forfeiture of the French patent, and the American patent expires with it, as the law now stands. Another objection to the section in its present form is that the foreign patentee may allow it to run for ten years or more, unused and unknown in the United States; and when some manufacturer erects expensive works here and commences to manufacture the same thing, the foreign patentee may obtain an American patent within two years thereafter and entirely close up this home manufactory, unless the proprietor of the latter will pay such an exorbitant royalty as may be demanded of him.

The law should require the holder of a foreign patent to take out a patent or to put the thing patented in use here within say one year after it was patented abroad, or the same should become public property in this country.

In section 53, at (a), after the word "invalid," the words "in whole or in part" should be inserted. The law is now generally so interpreted; but this is sometimes controverted and it is contended that the patent in its original shape must be wholly worthless, in order to justify a reissue: and such seems to be the natural import of the language of the statute. It should be the policy of the law to give an inventor the full benefit of his invention, and the Office usually strains a point in order to produce that effect; but the matter should not be left at loose ends in this respect.

Again, at (b), after the word "original," the word "specification" should be inserted. The original specification is quite as reliable as are the drawings or the model in indicating the true invention, and often much more so. But as the section now reads, both here and in lines 62 and 63 of the bill, the specification is entirely ignored in this connection. The same word "specification" should also be inserted before the word "model" in line 62 above referred to.

There is also some correction needed in or about line 46 of the bill, in this same section. After providing for the cases in which a reissue may be allowed, the bill goes on to state that "the Commissioner shall, on the surrender of such patent, and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specification, to be issued to the patentee, or, in case of his death or assignment of the whole or *any undivided part* of the original patent, to his executors, administrators, or assigns, for the unexpired part of the term of the original patent." Now suppose the patentee to have assigned, say the one twentieth of the original patent to John Doe, is it intended to give the said Doe the sole right to obtain a reissue? But such is the provision of the bill as it now stands.

If the words "or any undivided part" were erased, the true intent would be more nearly expressed. But if, after the word "patent" at (d), the words "the surrender of which" were erased, and the words "if an undivided interest in the original patent shall have been assigned, all the assignees must join in the application for a reissue. And in all cases the surrender of the patent" were substituted, the change would be still much better.

But there are some amendments not noticed in the bill which are quite as much needed as any of those which it contains. Some of the most important of these will be briefly adverted to.

As the law now stands, an assignee has ninety days within which to record his assignment. This holds the door open for fraud. An innocent purchaser may have had his assignment on record for 89 days before any other assignment is recorded or suspected to exist, and still he may find it worthless. The registry laws of some of the States in relation to the sale of real estate have had this same provision. But experience has fully demonstrated the superiority of the rule that the first deed on record shall hold the property. It may work hardship in some cases, but it incites to vigilance, and is, on the whole, vastly preferable. The same would doubtless be the case in relation to the assignment of patents.

But licenses are by the present law not required to be recorded at all. After the most thorough care and vigilance, the purchaser of a patent may find that scores of licences to make, use, and sell the thing patented in every portion of the United States have left the property, for which he has paid his money, comparatively worthless. This ought not to be so. A license should be recorded just the same as an assignment or a deed.

But there is another evil, which, although less in magnitude, is just as palpable and should not be overlooked. The 48th section of the act of 1870 summarily abolishes the appeal from the Commissioner to the courts in interference cases. There is reason to believe that this was the result of accident or mistake. Interference cases above all others should be subject to such appeals. The inquiries involved are just as intricate, and the questions of law and fact call into requisition as high an order of legal acumen, as those which tax to their utmost capacity the most experienced and clearsighted minds that are to be found on the bench of any court in the republic. And yet, by the law as it now stands, these questions are to be decided, without any right of appeal, by a Commissioner who is wholly inexperienced in such matters, who has never read a chapter of Kent or Blackstone, and who is wholly ignorant of the great legal maxims which underlie all sound judgment in matters of that nature. Such an arrangement is outrageously improper, and should be changed at once.

We shall make only one further suggestion in this connection. After a decision by the Board of Examiners-in-Chief, we see no reason why the dissatisfied party should be obliged to appeal in all cases to the Commissioner before he can make his appeal to the Supreme Court of the District, especially in interference cases. If such a case is appealed from the Board of Examiners-in-Chief, it rarely if ever fails to be taken eventually to the court. It would save much trouble and some expense if the dissatisfied party were permitted at his option to appeal directly to the court. A change in section 48, which would make it read as follows, would accomplish the entire purpose above suggested.

"Section 48. *And be it further enacted* that, if such party is dissatisfied with the decision of the Commissioner, he may appeal to the Supreme Court of the District of Columbia sitting in *banco*. Or the dissatisfied party may at his option appeal directly from the decision of the Examiners-in-Chief to the said Supreme Court without first having appealed to the Commissioner of Patents."

CAN ANTS TALK?

No one has studied the habits of "our six-legged rivals" without becoming impressed by their ability to communicate with each other, and the wide range of intelligence which they seem to be able to convey. Information of common danger is quickly spread throughout colonies numbering many thousands, the news being brought by perhaps one or two spies. Hitherto their mode of communication has been a mystery, the most plausible hypothesis being that it was by a sort of fencing with their antennæ. Thus an ant returning from a foraging expedition meets another outward bound. They stop, strike antennæ together a few times, then proceed, No. 1 to the nest, No. 2 setting off on a new course and going straight to the place where No. 1 found her load. It would now appear that the striking of antennæ is merely a sort of salutation, as two neighbors might shake hands, while conversation goes on by other means. At any rate, according to the report of Professor Landois to the Natural History Society of Prussian Rhineland, they are provided with a sounding apparatus resembling that of the sand wasp. To have implies to use; and though its pitch is generally inaudible to human ears, its range of tone may be ample for a fully developed language. We say "generally inaudible," notwithstanding Professor Landois' belief that it is always so, having more than once noticed a faint strident, hissing sound proceeding from columns of large ants when annoyed. The next thing in order is an apparatus for making inaudible sounds audible, as invisible rays are made luminous; then some enterprising student may give us a comparative grammar of formic idioms

THE SEWING MACHINE.

The Committee on Patents of the House of Representatives has recently reported adversely to the application for the extension of the A. B. Wilson sewing machine feed motion patent. As we have previously explained, this patent has been controlled by a coalition of manufacturers, namely, the Wheeler & Wilson, Grover & Baker, Wilcox & Gibbs, Singer, and the two Howe companies, who have made it the means of exacting immense royalties from smaller makers, and thus of distancing all competition, while at the same time of amassing colossal profits from their own large sales. The patent has already been once extended, and this second extension, had it been granted, would have continued the monopoly for a further period of seven years, during which time a score of millions would probably have been added to its already vast wealth. As it is, the invention now becomes public property, and is free to all users. The onerous royalty is thus obviated, the door opened widely for a healthy competition, and the diminution in price of the sewing machine probably to the extent of fifty per cent, will doubtless soon follow.

The history of a successful invention of this kind furnishes a suggestive commentary upon the wisdom of the principles which underlie our system of patent laws. Of these, the ultimate object is, solely and purely, benefit to the community, not the mere securing of a monopoly to the inventor. But as is exemplified in the instance in point, although the proprietors of this valuable right have been allowed to exercise a species of tyranny for several years, and to exact from the public large sums, still the object has been not to afford means for them to get rich, but to induce them to improve and develop the invention. Spurred on by immense gains, those reaping the harvest have accomplished this development. More than that, they have evolved a new and lucrative industry. Ample opportunity has been afforded them for all this; and now Congress, in declining to continue the same privilege, asserts that the benefits to the public will not be so great in so doing as will be secured by removing the restrictions. Certainly the reward obtained during the period of the monopoly by its owners has been enormous, but it is utterly inconsiderable beside the profits which will now accrue to the public.

In brief, for twenty-one years we have submitted to great exactions, but in so doing we were investing sums to secure the prosperity of our descendants. By allowing a few to become wealthy over a couple of decades, we have induced them to develop a great industry which will prove a source of income to millions in years to come.

PROSPECTS FOR 1875.

We are gratified to be able to state that the subscriptions to the SCIENTIFIC AMERICAN, for the new year of 1875, are pouring in from all directions as they have never done before. We are now printing, every week, 50,000 copies of our journal, which is undoubtedly more than the combined circulation of all other papers of its kind published in the world.

We hope our friends who have not yet renewed, and all who are engaged in the formation of clubs, will send along their names as rapidly as possible. To prevent the loss of back numbers by those whose remittances are a little tardy, we electrotype each issue and preserve the plates, whereby we are enabled to print new editions of any numbers that may be required.

We recommend persons to patronize their local periodical dealers, when equally convenient for them, in preference to the mail. By receiving the paper weekly from the counter or by carrier, the objectionable creases in the paper, necessitated by the folding for the mail, are avoided; besides, it is commendable to patronize home enterprizes in every thing.

We have the most gratifying assurances from all parts of the country that, notwithstanding the hard times among some of our industrial classes, the demand for scientific and mechanical information is increasing. Our subscription books, since the new year, demonstrate this fact.

SCIENCE RECORD FOR 1875.

We have much pleasure in announcing the issue of the volume for the current year, which we believe will, on examination, be found fully equal in merit to any of the preceding books of the series. The SCIENCE RECORD for 1875 contains about 600 pages, and such is the wide scope and variety of contents that the index alone fills some ten closely printed pages. The index of references is also extensive, designating nearly one hundred and fifty scientific publications that have been more or less consulted in the compilation of the work.

In the department of Chemistry and Metallurgy, which covers nearly sixty-eight pages, we have accounts of all the leading improvements, discoveries, and suggestions in these important branches, made public during the year just closed. All who are interested in either of these departments of Science, or who desire to be concisely informed as to the latest progress therein, will find the records to be of value.

The department of Technology, occupying nearly one hundred and fifty pages, contains a very large amount of new and useful information, illustrated by a variety of engravings. The new alloys, new recipes, and new processes in the various arts, here collected and condensed, are of great value, and probably not attainable in any other one work. Among the illustrated articles is the latest form of machinery for the artificial manufacture of ice: also the methods and apparatus used in gathering natural ice. Here we find described the many uses of paraffin, new methods for the ornamentation of metals, nickel plating, iron welding, new imitations of silver and other precious metals, directions for the practice of several new and simple arts, photographic improvements, waterproofing of paper, manufacture of carbonic acid, solvents for rubber, protection and ornamenting of iron, preparation of bronzes, uses of mica, production of artificial leather, artificial manufacture of precious stones, tempering of steels, and a multitude of other subjects, all useful, interesting, and desirable for reference.

Under the head of Electricity, Light, Heat, and Sound, covering fifty pages, we have descriptions and engravings of recent telegraphic apparatus, new electric motors, new machines for producing the electric light, several forms of new batteries, an engraving of the apparatus used for the new artificial light called the Bicarbon Light, said to be equal to the oxyhydrogen but cheaper and superior, better also than the electric or magnesium light. An electrical barometer, a simple little instrument, worked by electricity drawn from belts in machine shops, is represented, and a great number of other improvements and new suggestions.

The department of Mechanics and Engineering, occupying nearly one hundred pages, embraces a great variety of articles of special interest to the mechanic and engineer. The latest improvements in ships are here given, with engravings. The Bessemer steamer is illustrated, also the Castalia twin ship. Diagrams of the most recent ordnance are given There is a chapter on the propulsion of cars and vehicles by springs, with engravings. The latest railway improvements and structures are shown, and among them the new car of Giffard, of injector fame, which moves without oscillation.

The departments of Rural Economy, Botany, Horticulture, Agriculture, etc., are full and interesting. The latest egg hatching machine is illustrated; so are the habits and form of the Colorado potato beetle, etc.

Under Materia Medica, Therapeutics, Hygiene, we have a large amount of new and important information, from the most reliable sources, profitable to every reader.

Pisciculture is an interesting department, containing engravings of the most recent methods for hatching and cultivating fish, with descriptions. The farming of fish is rapidly growing in importance, and there is evidence of more profit, with less labor, to be made from the streams that flow through the land than from the adjoining land itself.

The department of Natural History and Zöology will be found especially interesting, as the amount of new information acquired during the past year, from various expeditions, is large and important.

In the department of Geography, the past year has been prolific of new and interesting information. A series of views of the remarkable cañons of the Colorado is given, which convey an idea of the astonishing natural formations that exist in our West.

Astronomy is full of useful interest; some of the results of the Transit of Venus observations are given, together with a mass of new and valuable matter.

The department of Biography is illustrated with the portraits of several eminent men of science, and will be found unusually interesting.

Taken altogether, the SCIENCE RECORD for 1875 is a book of unrivalled importance and value. All who desire to have before them, in condensed form, the year's progress in Science should possess a copy. Sent by mail, prepaid. Price $2.50. Published by Munn & Co., office of the SCIENTIFIC AMERICAN, New York.

AN ANCIENT METRIC SYSTEM.

The library of Asshurbanipal, King of Assyria, found during Mr. Layard's excavations at Nineveh, shows that Science had made no little progress in Asia twenty-five hundred years ago. This curious library consisted of flat, square tablets of baked clay, having on each side a page of closely written cuneiform cursive letters, which had been impressed on the clay while it was yet moist. The great majority of these tablets are now in the British Museum, and have been found to contain the remains of an immense grammatical encyclopædia. There are also fragments of many mathematical and astronomical treatises, with catalogues of observations, tables, calculations of eclipses of the moon, and observations of solar eclipses, the earliest of which occurred nearly a thousand years before the beginning of the Christian era. There are also fragments of law books and legal records, books of chronology, manuals of history, accounts of Assyrian and other divinities, collections of hymns in the style of the Psalms of David, a geographical encyclopædia, works on natural history containing lists of plants and animals, of timber trees employed in building and furnishing, of stones fit for architecture and sculpture, etc. Perhaps the most interesting of all these lists is a classified catalogue of every species of animals known to the Assyrians, showing a scientific nomenclature similar in principle to that of Linnæus. Opposite the common name of each animal is placed a scientific and ideographic name, composed of two parts, a family name and a characteristic epithet denoting the species.

A still more remarkable indication of the scientific advancement of the ancient Assyrians appears in their system of weights and measures, in which, as in the French system, all the units of surface, capacity, and weight were derived from one typical linear unit. The basis of the system was the cubit (equal to 20·67 inches). This was divided into sixty parts, corresponding with the minutes of the degree. The cubit, multiplied by 360, the number of degrees in the circle, produced the stade, the unit for large distances. The fundamental unit for areas was the square foot, the square of a measure bearing to the cubit the relation of 3 to 5, or 12·4 inches of our measure. The cube of the foot was the metreta, the standard of all measures of capacity; and the weight of a cubic foot of water gave the talent, the fundamental unit of weight; the sexagesimal division of the talent gave, first the mina (=510·83 grains), and second, the drachma (=8·51 grains).

The sexagesimal system was employed throughout their mathematics, the unit being invariably multiplied or divided by sixty, the result again by sixty, and so on to infinity. "This, it is very evident," observes Lenormant, "was the result of a wise combination of a very practical character, intended to combine the advantages of the two systems of dividing unity that have been in dispute at all times and among all nations—the decimal and the duodecimal." We still follow this Chaldæo-Assyrian system in the divisions of the circle and in our divisions of time.

Water glass deserves more extended household usage. Mixed with paint or whitewash it gives increased durability and a fine gloss, it is an excellent fireproof cement, and when dry is also waterproof. It is a good adhesive mucilage for mending china, glass, or wood, and made into a wash is the best coating for brick vaults.

Dr. GUTTCEIT recommends rubbing warts, night and morning, with a moistened piece of muriate of ammonia. They soften and dwindle away, leaving no such white mark as follows their dispersion with lunar caustic.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER IX.

Continued from page 68.

THE PASSENGER STATIONS.

With the exception of that in the viaduct, described in our last article, all the stations are beneath the street level. The first of these underground landings occurs in the beam tunnel, midway between 58th and 59th streets. It consists of two waiting rooms and two landings, one of each for each side tunnel, placed immediately beneath one of the rectangular openings of the central tunnel. The platforms are 150 feet long, 12 feet broad, and 3 feet 6 inches above railroad grade. Along its entire length the outside rubble retaining wall of the tunnel is removed and set back 11 feet nearer the house line, its place being supplied by a row of cast iron columns 10 inches in diameter at the base of the shaft, 10 feet 6 inches high, and of ½ inch metal. They are placed 11 feet 9 inches apart and 8 feet from the inner edge of the platform. About the center of the platform the retaining wall is again interrupted for a distance of 59 feet, and set back 20 feet nearer the house line, thus forming a recess 20 feet by 59 feet, which contains the waiting room, ticket office, water closet and vaults. The waiting room is 36 feet long, 10 feet wide and 11 feet 6 inches high. From the north end of this room rise iron steps which lead to the sidewalk. These steps are 8 feet broad, have iron frames and rises, with wooden treads, and are divided down the center by an iron railing 3 feet high, which also extends from the foot of the stairs to the ticket office, thus separating the flight into two flights, one to be used by passengers ascending from the station to the street, and the other by those descending. At the exit on the sidewalk, these steps are covered by a neat wooden house 8 feet x 12 feet, and lighted by patent lights placed in the roof. The general style of this house is shown in Fig. 6, page 338, volume XXXI

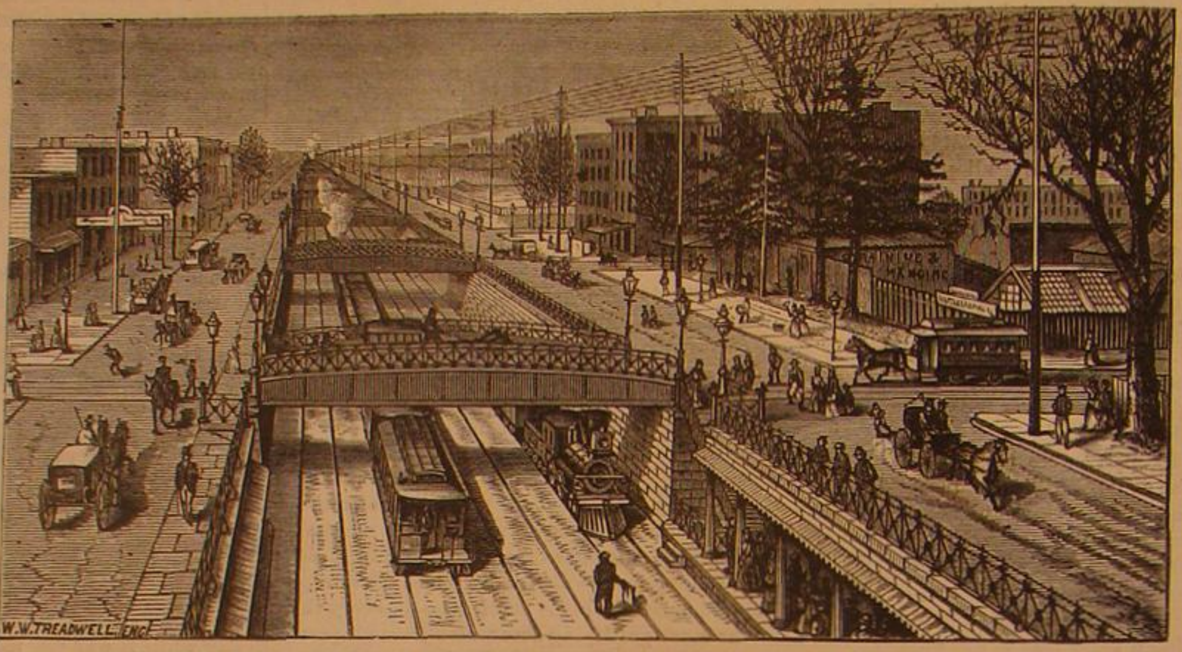


Fig 22.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—PASSENGER STATION AT 125th ST.—THE HARLEM OPEN CUT AND CROSS STREET BRIDGES.

The roof of the station, like that of the tunnel, is composed of H iron beams and turned arches between them. Along the top of the iron columns run the two girders previously described; along the retaining wall which bounds the platform is placed one H beam, and upon the 20 inch brick walls, which form the inner walls of the waiting room and stairway, rest two more girders. Upon these are placed transversely the H beams similar to those used in roofing of the beam tunnel, and between them the brick arches.

The lighting of the station is derived from eleven patent lights, 3 feet in diameter, placed in the sidewalk immediately over the waiting room, from the lights placed in the roof of the house covering the stairs, and from the rectangular opening in the roof of the central tunnel. The ventilation is also largely derived from this latter opening, but also through the ventilators in the side of the house over the stairs.

The station at 72d street is precisely similar to that at 59th street, and needs no description. The station at 86th street is illustrated in elevation in Fig. 23. It differs essentially from those just described. There are two stations, one for each of the two side tunnels; but unlike the 59th street station, they are placed on the inner side of the small tunnel, or the side nearest the central tunnel, and do not have a waiting room. They consist really of a covered platform, 172 feet long, 13 feet 8 inches wide, and 3 feet 10 inches above the railroad bed.

Along the inner side, and separating the side from the center tunnel, runs a rubble wall, 4 feet thick, with vertical faces and lined on the side of the platform with brick. Three feet six inches from the inner edge of the landing is a long row of cast iron columns, 10 inches in diameter at the base, 11 feet 4½ inches high, and of ⅜ inch metal. These columns support two 15-inch heavy girders placed side by side, their flanges touching. Upon these rest the roof beams and turned brick arches.

At the south end of these platforms is the ticket office. A flight of four steps leads from the street to the platform on which this ticket office stands; and from this landing go off, to the east and west, two other flights which lead to a platform below the street grade, and from these latter landings a final flight, at right angles to the latter, leads to the platform beside the track.

At the north end of each platform is a small waiting room 35 feet by 8 feet.

The last station on the road is between 125th and 126th streets, in the open cut and upon the west side of the track. Its general appearance is well shown in Fig. 22, which also shows in perspective the open cut through Harlem and the various bridges at the street crossings. In plan, this station consists of a platform, 164 feet in length, 8 feet in width, 2 feet 10 inches above railroad grade and composed of a layer, 12 inches thick, of broken stone covered with 4 inches concrete and 12 inches hard finish. The platform is covered over its entire length by a corrugated iron roof, resting upon 9-inch heavy beams supported upon 15-inch heavy girders, which in turn rest upon cast iron columns, of the same kind as those used in the other stations, placed 12 feet apart and 4 feet from the edge of the platform. These columns rest upon cap stones 8 inches thick and 2 feet square.

At the south or 125th street end of the platform are the waiting room, ticket office, vaults, etc., occupying a recess 53 feet by 10 feet. These rooms are covered by 15-inch heavy beams and 8 inch turned brick arches. The stairs from the platform to the street are also at the south end, are 5 feet wide with yellow pine steps and cast iron risers and strings, supported by 9-inch heavy beams.

Weight and Height of Americans.

According to a recent work of Mr. B. A. Gould, Actuary to the United States Sanitary Commission, in which some very interesting figures relative to soldiers in the last war are given, it appears that the American nation, instead of being degenerate and inferior to the European race in point of physical perfection, is far the reverse. The figures adduced show that "the tallest men were from Michigan, Illinois, and Wisconsin; the next tallest, New England, New York, New Jersey; and the shortest from Scotland, England, Germany." In weight, the men of Kentucky and Tennessee were the heaviest, averaging 150 pounds; England, Scotland, France, Belgium, all between 138 and 139 pounds. The ratio of weight to stature gave in pounds to the inch: Ohio and Western States, 2·185; New England, 2·121; England and Scotland, 2·118; Germany, 2·168.

A Layer of Hydrogen above our Atmosphere.

In a paper read before the Manchester Literary and Philosophical Society, Henry H. Howorth observes: "It is clear that, if under certain conditions hydrogen be an exception to the general law of the diffusion of gases, and follows rather the more general law of gravitation, it will exist in a stratum above the atmosphere and beyond the reach of direct observation. In his experiment upon the occlusion of gases, Mr. Graham examined several aerolites, and found that, under the air pump, they parted with a very large quantity of occluded hydrogen. If, as is probable, the gas was occluded by the aerolites when at a red heat, and this red heat was coincident with their passage through that layer of the upper atmosphere in which the phenomena of shooting stars and of the aurora occur, it seems more than probable that this stream is a layer of hydrogen. This is confirmed by what we know of the spectrum of certain auroras, which resembles those of the zodiacal light and the solar corona. The spectrum of the corona has been the most attentively studied, and Janssen, perhaps the greatest authority on it, speaks most confidently about its distinguishing feature being the hydrogen lines, while a special line, which characterizes both its spectrum and that of aurora, and which is different to that of any terrestrial substance, is considered by Father Secchi to be an abnormal hydrogen line. Dr. Dalton long ago argued, as Mr. Baxendell has reminded Mr. Howorth, that the peculiar features of the aurora could best be explained by the hypothecation of a stratum of some peculiar gas above the atmosphere. A gas of a 'ferruginous nature' is the expression of Dr. Dalton. Now hydrogen, in the higher chemistry, is not only classed among the metals, but Faraday and others have shown that in its relation to magnetism it is nearly allied to iron, so that a stratum of hydrogen above the air would seem to exactly answer Dr. Dalton's postulate. If it should exist, the earth would resemble the sun in one remarkable feature, for we now know that the sun is girdled with an immense layer of hydrogen. Lastly, he would add that the heterogeneous texture of the gaseous nebula, like the great nebula in Orion, seems to argue that the law of the equal diffusion of gases does not prevail there."

Singular Mathematical Fact.

Any number of figures you may wish to multiply by 5 will give the same result if divided by 2—a much quicker operation; but you must remember to annex a cipher to the answer, whenever there is no remainder, and when there is a remainder, whatever it may be, annex a 5 to the answer Multiply 464 by 5 and the answer will be 2,320; dividing the same number by 2 and you have 232, and, as there is no remainder, you add a cipher. Now take 357, and multiply by 5; there is 1,785. Divide the same number by 2, and you have 178 and a remainder; you therefore place a 5 at the end of the line, and the result is again 1,785.

Wicks of Kerosene Lamps.

The unsatisfactory light frequently given by kerosene lamps is often due to the wick. The filtering of several quarts of oil through a wick, which stops every particle of dust in it, must necessarily gradually obstruct the pores of the wick. Consequently although a wick may be long enough to last some time, its conducting power may be so impaired that a good light cannot be obtained.

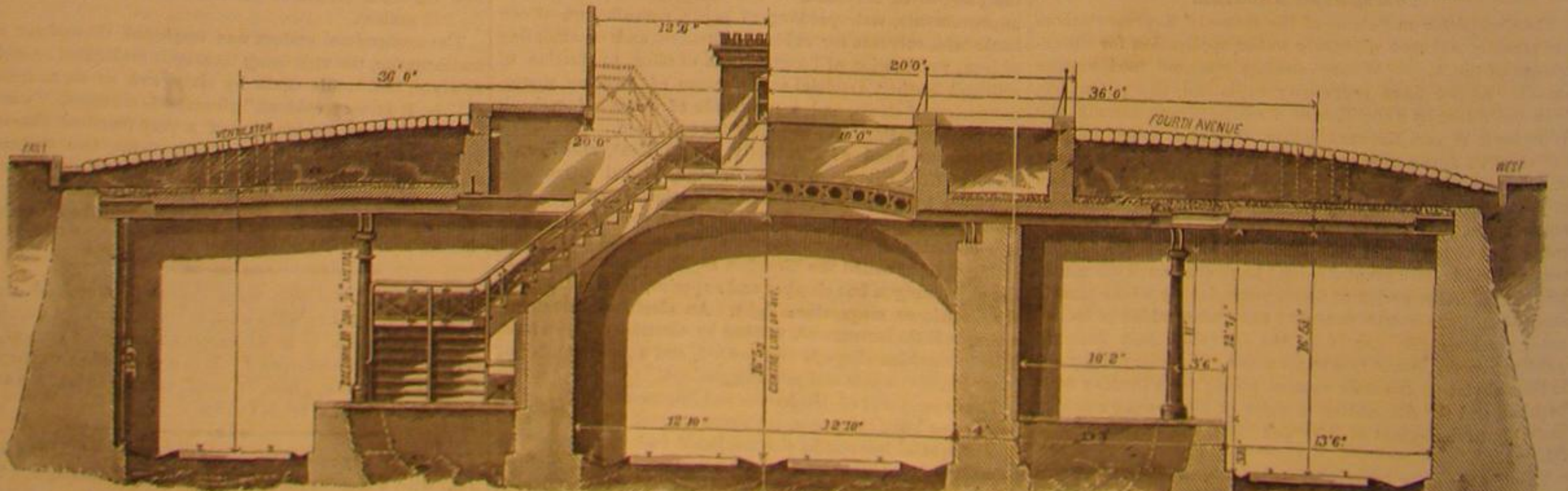


Fig. 23.—THE UNDERGROUND RAILWAY NEW YORK CITY—THE 86th STREET PASSENGER STATION.

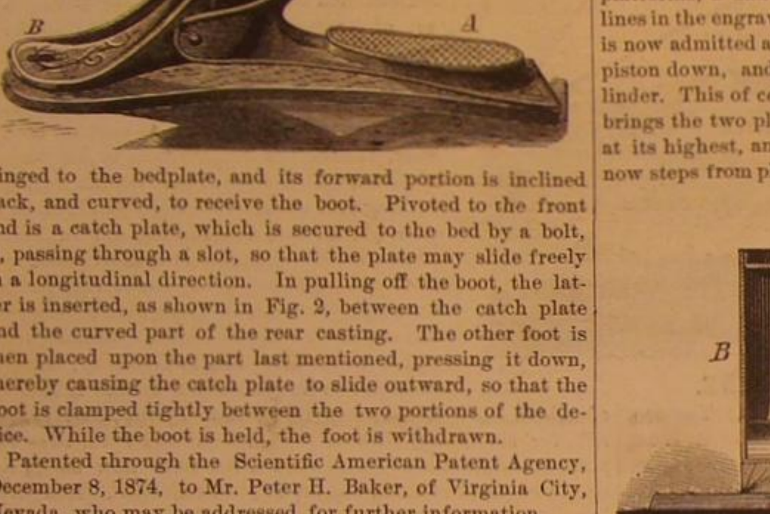
BAKER'S IMPROVED BOOTJACK.

The simple and powerful bootjack, represented in the annexed engraving, will doubtless find a ready welcome from all who expect to experience countless struggles with well soaked boots during the wet weather of the next few months. It will be noted that the device takes a firm grasp, not merely of the heel, which is liable suddenly to come off, causing the operator to sit down with more celerity than grace, but of the entire counter, tightly holding the same until the foot is extricated.

The rear portion, Fig. 1, consists of a casting, A, which is

Fig. 1

Fig. 2



hinged to the bedplate, and its forward portion is inclined back, and curved, to receive the boot. Pivoted to the front end is a catch plate, which is secured to the bed by a bolt, B, passing through a slot, so that the plate may slide freely in a longitudinal direction. In pulling off the boot, the latter is inserted, as shown in Fig. 2, between the catch plate and the curved part of the rear casting. The other foot is then placed upon the part last mentioned, pressing it down, thereby causing the catch plate to slide outward, so that the boot is clamped tightly between the two portions of the device. While the boot is held, the foot is withdrawn.

Patented through the Scientific American Patent Agency, December 8, 1874, to Mr. Peter H. Baker, of Virginia City, Nevada, who may be addressed for further information.

Private Pisciculture.

Mr. Seth Green, the well known pisciculturist, states that he has invented a new method for transporting and hatching nearly all kinds of fish eggs, by which spawn can be carried for one hundred and thirty days journey, and can be hatched in any room in the house. One million eggs, it is also said, can be hatched by using a pail of water daily.

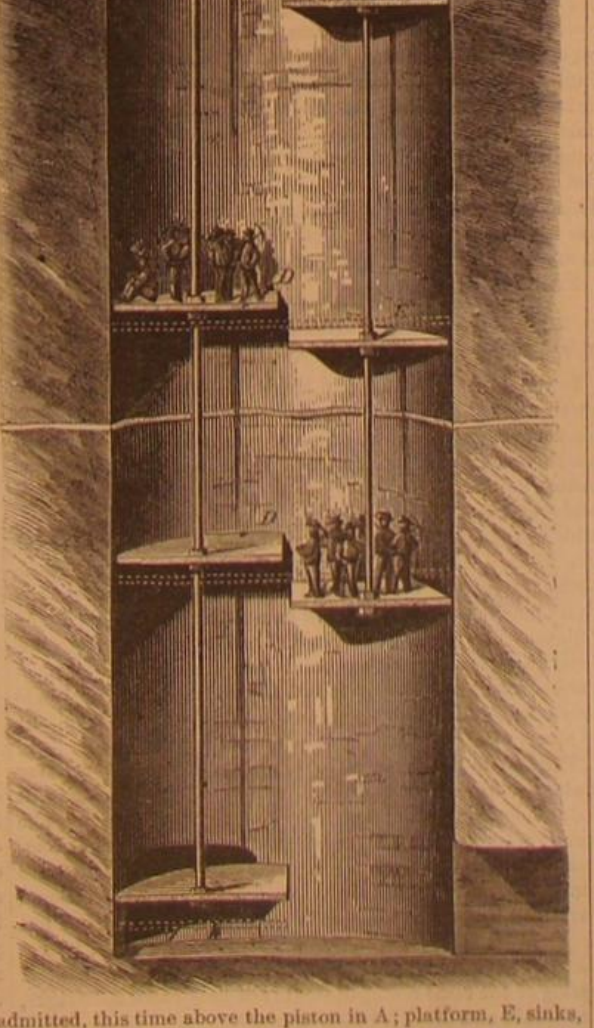
We believe that fish culture by private parties can be rendered a lucrative source of income, provided it is followed with the same care as is exercised in the raising of poultry or any other live stock. Hundreds of farmers have streams and ponds on their lands now of no value save perhaps as watering places for cattle in pasture, and yielding a few worthless perch and catfish, perhaps an occasional trout or pickerel. If Mr. Green has solved the most difficult part of the problem, namely, the successful transportation of the eggs, the mode of stocking of waters and the rearing of the fish are not difficult subjects of which to acquire an adequate knowledge. One species of fish in particular, which is little known, will, we think, prove especially remunerative, and for this reason we commend it to notice. We mean the land-locked salmon, which is a distinct species of the fish, though so closely resembling the ocean salmon as to suggest the idea that, at some remote period, a quantity of the latter fish, being by a convulsion of Nature barred from returning to the sea, had propagated in their land-locked quarters and eventually developed into a separate variety. The habits of the land-locked and ocean salmon are closely similar. The young fry of the former seem to remain in the fast water before going down to their ocean, the deep still water of the pond or lake, about the same time as those of the *salmo salar*. The average size of the fish is about one and a half pounds, though it has been captured weighing as high as eight pounds. It requires running aerated water with access to still pools. As a table fish, the land-locked salmon is said to be superior to its ocean relative; and as game it is reported to be unequaled, rising to the fly from running water even in the hottest summer days.

Steam and Water Power.

According to Mr. Batchelder's book, in 1863, where he quotes Montgomery on cotton, at Lowell or Lawrence, the interest, at six per cent, on the purchase of a mill power, and of land for the mill, will average about $15 per horse power per annum. The rent for water power, also, in cases where the mills are not owners of the water power, would appear to be from $300 to $500 per annum, per mill power of 62½ horses net, showing a rate, per horse power, of $5 to $8.33⅓ only. In Holyoke, the price is about the same. At Manayunk, Philadelphia, the rent of water power and land used to be (1863 about $60 per horse power per annum. I am not aware that the price has been diminished. To these rents should be added a comparatively small expense for labor, oiling, etc., and for repairs. It is obvious that Lowell and Lawrence, and a few places equally well situated, have, after deducting the value of land for the mill, advantages in water power which do not form, however, an average for the United States. I understand that no water companies, with such profitable terms for mills as that of Lowell, are now formed, although, in 1863, it was considered that, such is the superabundance of water power in New England and other parts of the country, it could be obtained in situations favorable for manufacturing for half the cost at Lowell. The reason, or at least one reason, is that the labor required in preparing the water power has increased, as the cost of using steam power has diminished. Another, probably, is that the cost of freight is so much higher, that this and other considerations of a like nature are of more moment, in selecting the site for a mill, than the advantage of water.—*H. Gastrell.*

THE BELGIAN MODE OF LOWERING MINERS IN SHAFTS.

Mr. J. W. Cole, of the Tanite Company, of Stroudsburg, Pa., sends us, from Brussels, Belgium, the following interesting account of his recent visit to the collieries of the *Sociétés des Charbonnages de Mariemont et Bascoup.* These large corporations own an area of some 500 square miles of coal fields, and employ 9,000 men, producing, from fourteen mines, 7,000 tuns per day. The apparatus for lowering and elevating the miners to and from their work is very ingenious, and of especial advantage where a large number of men are to be transported. Its operation will be understood from the annexed engraving, in which A and B are two steam cylinders, connected by the pipe, C, and containing water in the spaces below the pistons. The latter are attached to platforms, D and E. The parts being as shown by the full lines in the engraving, a miner steps upon platform, D. Steam is now admitted above the piston in cylinder, B, forcing said piston down, and hence driving the water into the other cylinder. This of course raises platform, E, and, as is evident, brings the two platforms on a level, when the piston in A is at its highest, and that in B at its lowest point. The miner now steps from platform, D, to platform, E. Steam is again



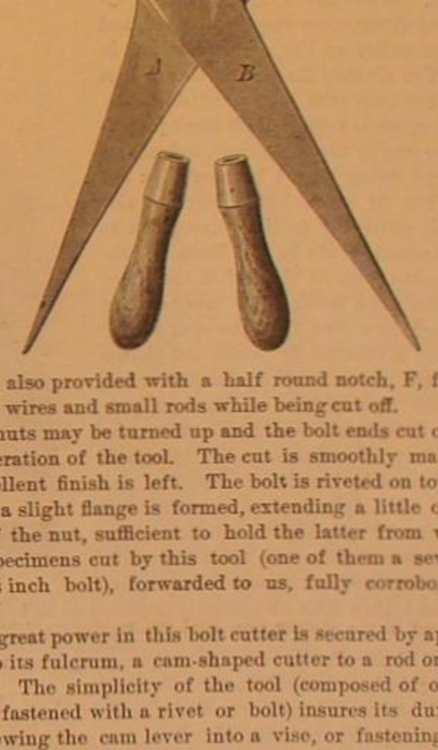
admitted, this time above the piston in A; platform, E, sinks, and eventually comes on a level with a third platform, D', secured below platform, D. This operation is continued, the workmen entering at the top and stepping from one platform to another until the bottom is reached.

The societies own 14 locomotives and 123 stationary engines; the boilers for the latter are so arranged that no fire door can be opened without closing the flue, thus avoiding the evil effects of a cold air draft.

COMBINED WRENCH AND BOLT CUTTER.

The expensive and cumbersome bolt cutters heretofore provided for blacksmiths and carriage trimmers led Mr. P. Broadbooks, of Batavia, N. Y., to invent a simpler and more effective tool for his own shop; for this he obtained letters patent, dated March 18, 1873. Recent improvements have added to the value of the invention, the moderate cost of which makes it a feature of interest to every mechanic having occasion for its use.

The engraving represents a side view, and shows the manner in which the tool is applied. A and B represent lever handles, pivoted at C. On the lever, B, is found a cam-shaped head, beveled so as to form a cutting edge on the inner side, which operates (with the head, D, of the opposite lever) like a pair of shears. The head, D, is formed with a deep notch or recess, so that it will fit on a nut, and may be used for turning the same like an ordinary wrench. This recess has an offset, E, for turning smaller nuts, and supporting them while the bolt is being cut off by the cam head. The wrench



head is also provided with a half round notch, F, for supporting wires and small rods while being cut off.

The nuts may be turned up and the bolt ends cut off with one operation of the tool. The cut is smoothly made, and an excellent finish is left. The bolt is riveted on top of the nut, as a slight flange is formed, extending a little over the edge of the nut, sufficient to hold the latter from working off. Specimens cut by this tool (one of them a seven sixteenths inch bolt), forwarded to us, fully corroborate the above.

The great power in this bolt cutter is secured by applying, close to its fulcrum, a cam-shaped cutter to a rod or bolt to be cut. The simplicity of the tool (composed of only two pieces, fastened with a rivet or bolt) insures its durability. By screwing the cam lever into a vise, or fastening it into the bench, the other lever can be operated so as to cut bolts, rods, or wires with great ease and rapidity. By removing the handles, as shown in the engraving, the shanks, A and B, form a serviceable pair of large compasses.

This wrench and bolt cutter, and one of the bolt cutters in the Broadbook system of compound tools (already illustrated in the SCIENTIFIC AMERICAN), will enable a person to reach, and cut easily, any bolt in any part of a vehicle, and the two tools together cost less than one of the bolt cutters now in common use.

Arrangements will be made with manufacturers to make this combined wrench and bolt cutter on royalty. For full particulars address Broadbooks & Co., Batavia, N. Y.

THE ANTHRACITE COAL HARVEST OF 1874.—The total quantity of anthracite coal mined in Pennsylvania, in 1874, was twenty-one millions six hundred thousand tuns, or over five hundred and sixty millions of cubic feet. Placed in one mass, this would form a solid wall one hundred feet high, one hundred feet wide, and nearly eleven miles in length.

If a shaft springs in running, the trouble lies probably in either a too small diameter of the shaft for its weight and velocity, a set of unbalanced pulleys, or an unequal strain on either side by the belts.

Correspondence.

Animal Suicides.

To the Editor of the Scientific American:

A few weeks ago I saw in your paper an account of a scorpion stinging himself to death while being burnt with a sun glass. He did not intend to commit suicide; it was a mere accident on his part. I lived in Brazil for several months, and I have seen more than a dozen sting themselves to death. I used to take a straw or small stick, and lay it across their backs and hold them down with considerable force; and they would turn their tails over and feel very carefully for the straw, and then draw back and strike at it; and often the sting would strike the straw and split it, and so enter the body.

I have taken an iron ring, about 4 or 5 inches across, and heated it black hot and put it over them; and when they began to feel uncomfortable, they would strike all around with their tails. But I never knew one to sting himself. At one time I enclosed two of them within a hot ring; and when they began to feel the heat, they went at each other with their stings, and in a short time they were both dead.

Lynn, Mass. S. A. T.

A New Form of Flying Machine.

To the Editor of the Scientific American:

Screw propulsion is the principle upon which will, probably, be accomplished the great problem of aerial navigation. The plan here proposed is a modification of the device presented by W. D. G., in a recent issue of the SCIENTIFIC AMERICAN. The horizontal driving shaft is attached below the spar, above which the wing propellers revolve in opposite directions. This shaft is rotated by means of cranks actuated by the machinery below, and is connected with the wings by means of bevel gearing. The wing spar is arranged to rotate partially around its own axis, the driving shaft moving with it. The wing propeller shafts may thus be worked vertically, or inclined forward at any angle desired. To rise vertically in the air, the wing propeller shafts are set in a perpendicular position; when a forward motion is required, they are inclined forward. At right angles to the wing spar is a fore and aft spar, and a sail is attached to these after the manner of a kite. Below, about where the string would be attached in the ordinary kite, is suspended a bag of ballast whose position can be shifted at pleasure by means of the lines passing upwards through the bottom of the car. By slackening the forward line and hauling taut the aft line, the inclination of the kite may be increased as circumstances may require. This ballast may be a part of the cargo or the baggage of passengers. When the wings get out of order or need oiling, they may be stopped, and the stern propeller on the car below put in motion. The air ship then sails like a kite when the boy runs with it on a still day.

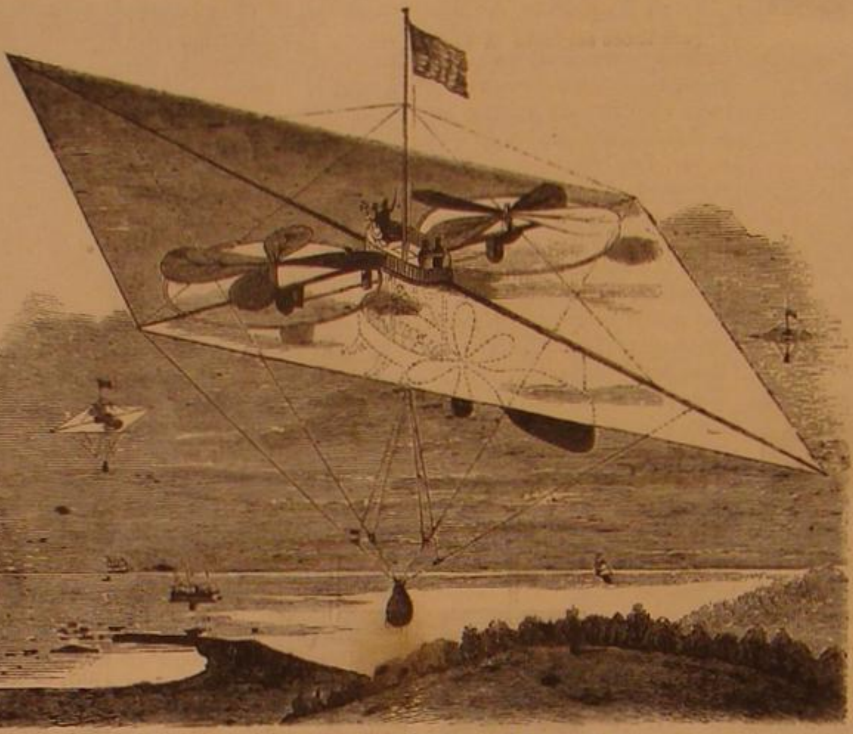
If great speed is required, all three propellers may be run at the same time, the shafts of the wings being placed horizontally: the ship will then fly onward at a level, or rise or descend, according to the slope given to the kite by means of the ballast lines. Working in a socket joint at the end of the stern propeller shaft is a rudder, the other end of which swings by a cord from the spar above. The steering is effected by ropes, not shown in the illustration, attached to the rudder and passed to the deck of the car through pulleys on the wing spar. On approaching the earth, the bag of ballast touches first; and at this elevation, by keeping its wings in gentle motion, our ship may remain suspended until transfers of passengers and mails are effected, or preparations are made for landing. If an accident should happen to the machinery, the ballast may be instantly adjusted so as to bring the kite to float level, in which position the contrivance becomes a capital parachute. The passengers may then repair to the upper deck and calmly await the result.

Increased power and greater security may be obtained by having two propellers on each side of the car, arranged along the wing spar, and so connected that either or both sets may be run. A greater number of fore and aft spars may also be introduced, crossing at the center of the car, like the three sticks of a kite. The rudder might be attached to the rear extremity of the fore and aft spar, in which position it would exercise greater power and render the flight of the ship more steady; it might have a horizontal as well as a vertical wing, and be capable of a vertical as well as a horizontal movement, performing in this way precisely the functions of the tail of a bird.

The great and only obstacle to the successful accomplishment of the problem of aerial navigation is the weight attendant upon motive powers now in use. But even with steam machinery, by using concentrated fuels, the above device would seem practicable. The inclined plane or kite principle is that applied by birds after acquiring momentum by flapping their wings. In this case, the propelling power is continuous, and great velocities might be attained, amply sufficient, no doubt, to dispense entirely with all downward action of the propellers after once starting.

The day cannot be far distant when the inventive genius of the nineteenth century will accomplish a mode of locomotion practised with so much ease by such vast numbers of the animal kingdom. The time may yet come when the present ways of travel will be regarded as we now do the old fashioned 'pike and stage coach; and nations will be brought into such easy, rapid, frequent, and intimate commercial and social connection as to result in a grand unity in language, law, and government on earth. WM. W. BLACKFORD.

New Orleans, La.



BLACKFORD'S FLYING MACHINE.

The Universal Jointed Propeller.

To the Editor of the Scientific American:

In your issue of November 28, I notice a communication from Lieut. F. M. Barber, U. S. Navy, together with an engraving representing a universal joint in the shaft of a propeller, which he claims as his invention, but states that he has no patent, and perhaps some one may get an idea by seeing it.

Mr. Barber, in his praise of the boat to which he has applied it, is correct, as, from my experience and knowledge of its operation on several vessels, I find it absolutely essential in many respects for the security of sea-going and other vessels, apart from its intrinsic value as a means of rapid manœuvering.

I have taken out patents in the United States, Great Britain, France, Belgium, and Canada.

Washington, D. C. JAMES L. CATHCART.

REMARKS BY THE EDITOR.—Several patents have been granted for different means of making the connection between the driving shaft and the propeller, so that the latter could be used for steering purposes. The idea of connecting the propeller with the driving shaft by means of a Hooke or universal joint is quite old, and was shown in an old English patent, the date of which we have forgotten, but it can be found in Bourne's "Treatise on Propellers."

Burning Chimneys.

To the Editor of the Scientific American:

Probably the most prolific cause of fires in houses, especially in the country, is the burning of chimneys. Of the dozen or so of fires I have witnessed, at least one third are known to have been caused by sparks from burning chimneys falling upon the roof. To prevent the burning of chimneys is an easy matter. The soot in the chimney cannot burn, except as the fire of the stove is communicated to it through the pipe. If the pipe, therefore, be kept clean and free from soot, and the damper in the stove always closed, the chimney will never burn out. To free the pipe of soot, take the stove handle or any convenient implement, and rap the pipe smartly on all sides from top to bottom. The soot will fall into the stove and be harmlessly consumed, or it can be removed in the usual way.

If there be a horizontal pipe, this should be taken down twice a year and thoroughly cleaned. Or if the pipe be only a few feet in length, and the arrangements will admit of it, provide the horizontal pipe with a permanent scraper, as follows: To the end of a stout wire, a few inches longer than the pipe, attach a small segment of a disk of sheet iron, at right angles to the wire. Remove the elbow, and thrust the scraper into the pipe. Pass the other end of the wire through a hole punched in the elbow, loop the end of the wire for a handle, and replace the elbow. After first rapping the pipe, the soot can all be drawn out and let fall into the stove. This arrangement I adopted six years ago, and my chimney has not burned out during that time. I clean my pipe thus, as often as once a fortnight during cold weather.

Franklin, N. Y. J. H. P.

Steam Boiler Explosions.

To the Editor of the Scientific American:

In your issue of January 16, Mr. R. D. Williams attempts to account for the destruction resulting from steam boiler explosions; and although he brings an array of figures to support his theory, I think he is wrong when he assumes that (because a boiler is not torn to pieces when it gives way under a cold water test) it is not the bursting pressure, under steam, which produces the fragments, but that, at the instant of the explosion, a large amount of water heated to a temperature above the natural boiling point is converted into steam, and that alone tears the boiler and causes the destruction which follows. He seems to forget that there is very little elasticity in cold water and a great deal in steam; the former, at the enormous pressure of 15,000 lbs. to the square inch, is only compressed $\frac{1}{20}$ of its volume, while a very large volume of steam can be confined in a very small space.

The opening of a seam or breaking of a rivet relieves water pressure, because, there being so little elasticity, it soon finds its volume; but it is not so with steam. The same rupture would relieve but a comparatively small fraction of the pressure exerted in producing it, and the pressure continues exerting its force upon the broken or fractional part until the whole pressure is relieved and the steam has acquired its full volume. A wooden wedge driven into a cast iron pipe would produce a slight fracture; but a steel spring of the same strength would not only cause a fracture, but would also break it into fragments.

I do not deny, positively, that the conversion of water into steam at the instant of explosion does not lend force, for such a thing is perhaps possible, but I think hardly probable. I do contend, however, that steam of sufficient pressure to rupture a boiler is also sufficient to cause the destruction of life and property which follows explosions.

If Mr. Williams wishes to test the correctness of his theory, let him take an empty boiler that will burst at a pressure of 100 lbs., and connect it by a steam pipe with another boiler, and force dry steam into it until an explosion occurs. In my opinion he will find as many fragments and as much destruction as if the boiler contained the usual amount of water.

I am glad to see the cause of boiler explosions discussed in the columns of the SCIENTIFIC AMERICAN, and are convinced that the interchange of thought on the subject will eventually lead to a solution of this difficult and important problem.

Washington, D. C. C.

Brass vs. Phosphor Bronze for Rolling Mill Uses.

To the Editor of the Scientific American:

I have read in your issue of January 16 an article on phosphor bronze, by a correspondent in this place. Previous to reading it, I was laboring under the impression that it was a superior composition for journal boxes and rolling mill brasses; but on comparing the results of the trials given by your correspondent, with similar work done on brass bearings, my former opinion of phosphor bronze has been changed considerably. The trials made with the bronze brasses were made in a single turn mill, located on the bank of the Monongahela river, a few hundred yards above the mill where some trials were made of which I give you the results.

The water supply of both mills is taken from the same source; and as a matter of course, when the bronze bearings were getting gritty, muddy water, the brass ones were getting the same. The following is the actual work done in the regular way, not by trial bearings. We have no ten inch mill, so I will give you the particulars of a sixteen inch bar mill, for merchant iron. A set of brasses usually run a year in the roughing and finishing, and it is customary to put in new ones every time the mill is stopped to line up and repair, which is done generally in July or August of each year, though the brasses may be but partly worn. This train runs double turns, making over twenty-two millions of revolutions per annum, and turning out in that time about sixty thousand tuns of finished iron. An eight inch train, the driving shaft of which carries two large speed pulleys and a nine foot fly wheel, has journals six inches in diameter and twelve long; it has brass boxes in pillow blocks, the first set of which was put in when the mill was built, and they ran for six years, double turns, equivalent to twelve years of single turns. The second set have now been in some two years or more, and are in good condition. Roughing roll brasses usually run one year as bottom roll brasses, and are then changed to top roll brasses, where they do duty for one year longer. In the finishing rolls (same train) the roller has only had three sets of brasses since the mill has been built (over eight years). These brasses have carried the journals, which revolve over fifty million times in a working year, and turn out about five thousand tuns of finished iron in that time. We also run a thirty-five tun rotary squeezer, cast from the same patterns and fitted by the same parties as the one mentioned by your correspondent. The one under which this most "severe test of all" on a bronze plate was made turns about eleven revolutions per minute, and squeezes puddle balls for nineteen furnaces, single turns. Our squeezer runs sixteen revolutions and does the work for twenty-eight puddling furnaces, double turns, or nearly three times the work, turning out sixty-five tuns of blooms per day of two turns; and under the upright shaft of this squeezer, the builders put a chilled plate of cast iron; and after fifteen months of steady running, as above mentioned, it shows no perceptible wear. I am therefore unable to see where this severe test comes in. The brasses we use are made from ingot copper and pure block tin, in proportion of seven of copper to one of tin. I cannot give its tensile strength, ductility, etc., data which may be very desirable to wire drawers, brass rollers, rivet makers, etc., but which are of no value in determining the value of a composition for journal brasses; but I will guarantee that, if honestly made as above, they will give satisfaction as to durability, and will run smooth and cool, and cost some eight or nine cents per lb. less than bronze. The senior proprietor of this mill, an excellent mechanic, live, progressive, and full of ideas, brought up in a mill, knows the requirements of rolling mill brasses probably as well as any man in this country; and in order to have the best of the kind that could be produced, he has all his brasses made on the premises, for his own use only out of the best materials that can be procured; hence the extraordinary duty performed by the brasses in his mill. He also adopted a plan of preventing the cinder which gets in between the neck of the rolls; and as it is proved to be a good plan for muck mill brasses, I give it for the benefit of your readers: Bore grooves out of the bearings, $1\frac{1}{4}$ inches wide and $\frac{1}{4}$ inch deep and $1\frac{1}{2}$ inches apart, put them at an angle of 45° with the face of the brass, and fill up said grooves with soft Babbitt metal. Then when cinder or iron gets in, it will travel but a short distance before it reaches the soft metal, and the motion of the roll will imbed it therein so that it cannot protrude and score the neck, as it would were it to stick in the brass.

Another useful plan, adopted by him and now coming into general use, is a mode of preventing screws from getting tight in their nuts. The plan is to plane a key wa or groove in the screw, ¼ inch wide, the full length of the screw and down to the bottom of the threads; and it will act like a tap and scrape all the hard, gummy grease out of the nut and always keep it clean and working free. It is a very simple matter, but saves a great deal of time and vexation.

Pittsburgh, Pa. T. J. B.

To the Editor of the Scientific American:

A letter in your paper of January 16 on phosphor bronze bearings for rolling mill journals, giving the results of three trial bearings, is, I think, fatal to the use of that alloy for the above mentioned purpose, as a much cheaper and more durable bearing can be and is obtained by the use of cast iron lined with Babbitt metal. Under the vertical or central shaft of a rotary squeezers a chilled cast iron plate is used, costing a few cents per pound and giving universal satisfaction, as most mill owners can testify. I am of the opinion that if phosphor bronze were put to a fair test, it would be equal to the best alloy of copper and tin, but for good durable bearings, I think nothing can beat the ones I have mentioned. MACHINIST.

Pittsburgh, Pa.

How to Learn Color Tests for Temper.

Says Mr. J. Richards: "Procure eight piece of cast steel, about 2 inches long by 1 inch wide and ⅜ of an inch thick; heat them to a high red heat, and drop them into a salt bath. Leave one without tempering, to show the white shade of extreme hardness, and grind off and polish one side of each of the remaining seven pieces. Then give them to an experienced tool maker to be drawn to seven various shades of temper, ranging from the white piece to the dark blue color of soft steel. On the backs of these pieces paste labels, describing the technical name of the shades and the general uses to which tools of corresponding hardness are adapted. This will form an interesting collection of specimens, and accustom the eye to the various tints, which will, after some experience, be instantly recognized when seen separately."

PRACTICAL MECHANISM.

NUMBER XVII.

BY JOSHUA ROSE.

MOVEMENT OF THE PISTON AND THE CRANK.

Let us now place upon the valve a maximum of steam lap, and we shall find an entirely new element under consideration. It is that, although steam lap to a certain amount gives us a more free exhaust, beyond that amount it cramps the exhaust by closing the exhaust port of the cylinder. Suppose, for instance, we give the valve, of the engine upon which we have been experimenting, seven eighths of steam lap (instead of three eighths, as formerly). We shall find that, at one part of the stroke, the valve, after having opened the exhaust port full, will commence to close the cylinder exhaust port, so that, while the steam port (being used as an exhaust port) is full open, the exhaust port of the cylinder is as shown in Fig. 54 (the valve seat face at D being left wider

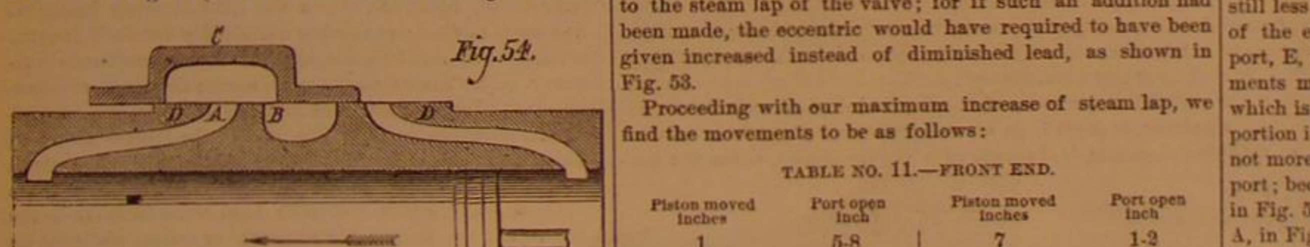


Fig. 54.

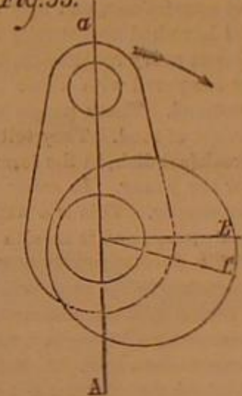
than before, to prevent the steam from blowing through to the exhaust port, as it would do if the face, D, were only as wide as the bridge between the steam and exhaust ports, as in our former experiments), A being the steam port operating as an exhaust port and full open; whereas the exhaust port, B, of the cylinder, is closed to such a degree as to cramp the exhaust to the extent of the difference in width of opening between the ports, A and B. We have, however, already decided that the exhaust opening should never be less (during any part of the exhaust) than one half the full width of the steam port; hence it follows that the maximum of steam lap should in all cases be such an amount as will leave an exhaust opening, at all times, at both the ports, A and B, Fig. 54, equal to one half of the full width of the port, A; and it also follows that the limit to which a valve may be made to work expansively is defined or governed by the width of opening which it will leave at B.

We will now place the engine upon which we have experimented under conditions to work to a maximum of expansion, giving to the valve seven eighths inch of steam lap on each side, by increasing the valve travel to three and nine sixteenths inches, and lengthening the eccentric rod one eighth inch (which will be necessary for the increased travel).

Having effected these alterations and moved the engine round a revolution, the first thing to attract our attention is that the front steam port is not left full open by the valve at any part of the stroke, making it appear that the eccentric rod is either too long or that the valve is not properly set; that neither of these defects exists is proved by the fact that the valve lead is equal at each end of the stroke while our valve travel is sufficient to fully open both ports (provided the valve movement were regular); for the width of the steam port, seven eighths, added to the steam lap, seven eighths, amounts to one and three fourths inches, which, multiplied by two, is three and a half; whereas, our travel is three and nine sixteenths inches, or one sixteenth more than would appear to be actually necessary. The valve travels over and beyond the back port to the amount of the deficiency of the opening of the front port added to the one sixteenth inch of increase of travel, and this irregularity of movement is ir remediable in all valves having a maximum of steam lap; so that, if the lead be made equal at each end of the stroke, the front port never opens (as a steam port) to its full width. The irregularity is not, however, a very serious defect, since it does not affect the port unfavorably as an exhaust port, and since the port is, of itself, wider than it would require to be if used as a steam port only, and is, therefore, open sufficiently for the admission of the steam. It will naturally occur to the mind that this defect could be remedied by increasing the valve travel; but were recourse had to this expedient, it would cause the valve, when in the position shown in Fig. 54, to leave the opening, at B, still less; and we must, therefore, leave the valve travel as it is, bearing in mind that an increase of valve travel, while advantageous, as we have already shown, to a valve having a small amount of steam lap, is inadmissible, except it be to a very small degree, in one having a maximum of such lap.

The causes which effect partial closure of the front port are those set forth in Fig. 53 and its accompanying explanation. We have given the valve three fourths of an inch more travel than it had in our former experiment; and the effects of this increase are experienced more in one part of the valve travel than in another, as already explained. We have also increased the lap of the valve, and have had, as a natural consequence, to increase the lead of the eccentric so as to get the same amount of lead on the valve as we had in our previous experiment (that is, one sixty-fourth of an inch); for an increase in the amount of the steam lap on a valve necessitates an increased amount of lead of the eccentric (to get an equal amount of lead on the valve) and therefore a greater irregularity in the movement of the valve. The lead of an eccentric (which gives us the lead of the valve) is the amount to which it is set so that its throw line stands in advance (in the direction in which the engine is to run) of a line at right angles to the center line of the crank, as shown in Fig. 55, A A being the center of the line crank; B a line at right angles to A A; C the throw line of the eccentric; and the distance from C to B, at the periphery of the eccentric, the lead of the eccentric, the arrow denoting the direction in which the engine is to run.

Fig. 55.



In a former experiment, we found that increasing the throw of the eccentric, and hence the travel of the valve, rendered it necessary to diminish the lead of the eccentric, and therefore tended to diminish the irregularity of the valve movement. The reason, in that case, was that no addition had been made to the steam lap of the valve; for if such an addition had been made, the eccentric would have required to have been given increased instead of diminished lead, as shown in Fig. 53.

Proceeding with our maximum increase of steam lap, we find the movements to be as follows:

TABLE NO. 11.—FRONT END.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	7	1-2
2	3-4	8	5-16
3	13-16	9 1-4	closed, and expansion begins
4	13-16		
5	3-4 full	11 3-8	closed, but expansion ends
6	11-16		
		12	exhaust port open full

TABLE NO. 12.—BACK END.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	13-16	6	5-8
2	7-8	7	7-16
3	7-8	8 5-8	closed, and expansion begins
4	7-8		
5	3-4	11	closed, but expansion ends
		12	exhaust port open full

We find here that the steam in the back end commenced to work expansively three quarters of an inch earlier in the stroke than that in the front end of the cylinder, and that it was used expansively during two and five eighths inches of the stroke instead of two and one eighth, as in the front stroke; and furthermore, that the steam in the back end commenced to exhaust when the piston had moved eleven and one eighth inches of its stroke, leaving it to travel the other seven eighths of an inch without any pressure behind it; while the steam in the front end commenced to exhaust when the piston had moved eleven and three eighths inches of the stroke, leaving it to travel the other five eighths without any steam pressure behind it.

Such are the irregularities due to the employment of a maximum of steam lap and its accompanying lead of eccentric, the greatest defect of them all being that the exhaust port opens too early in the stroke, and thus the engine loses a large part of the effectiveness of the steam. It is the variation of the exhaust port opening after the piston has commenced its return stroke (which does not, therefore, appear in the previous tables) that prevents us (as before stated) from adding any more steam lap to the valve, as is shown in the following tables of the exhaust openings:

TABLE NO. 13.—EXHAUST AT THE FRONT END.

Piston moved inches	Port A, Fig. 54, open inch	Port B, Fig. 54, open inch
11 3-4	3-8	1 3-4
12	7-8	1 3-8
Return stroke		
1	7-8	5-8
2	7-8	1-2
3	7-8	1-2
4	7-8	9-16
5	7-8	11-16
6	7-8	7-8
7	7-8	1
8	7-8	1 5-16
[illegible]	3-4	1 5-8
1[illegible]	3-8	1 3 4
1[illegible]	closed	

[illegible]LE NO. 14.—EXHAUST AT THE BACK END.

[illegible]	Port A, Fig 54, open inch	Port B, Fig. 54, open inch
11 [illegible]	7-16	1 3-4
12	7-8	1 7-16
1	7-8	7-8 barely
2	7-8	11-16
3	7-8	5-8 full
4	7-8	11-16
5	7-8	3-4
6	7-8	13-16
7	7-8	15-16
8	7-8	1 1-8
9	7-8	1 3-8
10	5-8	1 11-16
11	3-16 full	1 3-4
11 1-4	closed	

We here find that the exhaust opening, during the early part of the stroke, that is, from the first to the fifth inch of piston movement, was less at B than it was at A, in Fig. 54, and was, at one part of each stroke, but little more than one half the full width of A, and therefore as small as is compatible with an exhaust sufficiently free for a fast running engine. We have, in point of fact, by the partial closure of B, filched from the exhaust opening to enable us to use the steam more expansively; and in the case of a very fast running engine, we have rather lost than gained by the operation. In locomotives (the piston travel being very fast) sufficient steam lap is employed to leave the opening at B equal, at all parts of the stroke, to the full width of the steam ports.

It has been already remarked that lap on the exhaust side of the valve is sometimes employed to prevent the steam from exhausting too early in the stroke; and that, whatever the amount of such lap, it cramps to a like amount the exhaust opening. How then, it will naturally be asked, can exhaust lap be employed at all, since the opening at B is already as small as admissible, and such lap would make it still less? This leads us to the consideration of the width of the exhaust port of the cylinder, that is to say, of the port, E, in Fig. 47. We have in all our previous experiments made this port twice the width of the steam port, which is the proportion generally employed; and which proportion is ample, providing that the amount of steam lap is not more than three quarters that of the width of the steam port; because, up to that amount, the exhaust opening at B, in Fig. 54, will, at all parts of the stroke, be equal to that at A, in Fig. 54, while beyond that amount it will be, as shown, less than at A.

The width of the cylinder exhaust port may be, if the valve have little or no steam lap, even less than twice the width of the steam port; for instance, the port, E (Fig. 47), has been in all our experiments one and three fourths of an inch wide, the steam ports being seven eighths of an inch wide; but the valve having no steam lap, the port, E, may be made one and one half inches wide only, in which case (the bridges and steam ports remaining unaltered in width) the valve would require to have a narrower exhaust port, and would hence be to that amount narrower in its total width, thus reducing the area of its back face, upon which the steam acts to press it to its seat, and hence reducing the friction upon its face and the power required to move it.

Finishing Microscopic Slides.

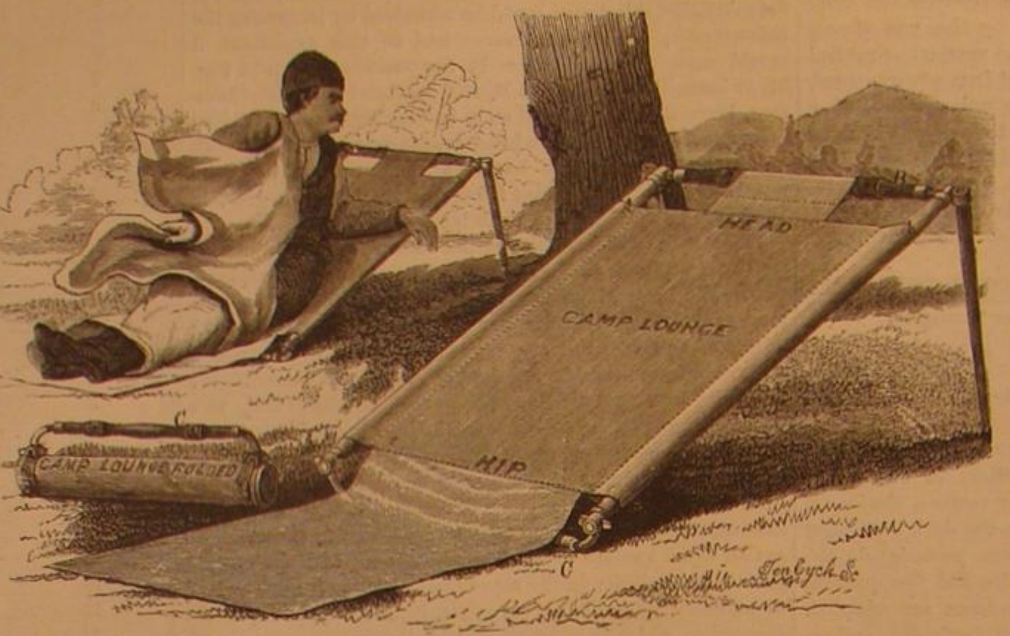
The object and a moderate quantity of balsam are covered with thin glass in the usual way, and, if the object is small, held down with a spring clip to prevent displacement. The slide is then boiled either over a spirit lamp or, better still, over an ordinary microscopic lamp. Vapor of turpentine is freely given off, which, as the slide cools, contracts, drawing under the superfluous balsam, which should be kept round the glass cover with a needle. When cool, the balsam may be chipped off with a knife, and the slide finished in the usual way. The cover can never be displaced, as is too often the case where the slide is not boiled. A little practice will tell when the boiling has gone far enough, as, if continued too long, the bubbles formed during the process will not disappear, and the slide will be spoiled.

IN the article on balloons, page 64, current volume, in 1st example: For 5,026·5 pounds, substitute 5,026·5 feet. Section (*c*) of the rule: For buoyant effect, substitute square of the buoyant effect. Formula at end of article:

$x = \frac{2a}{b-}\left[\frac{8a^3}{b^3}\right.$, etc., should read $x = \frac{2a}{b} + \left[\frac{8a^3}{b^3}\right.$, etc.

IMPROVED CAMP LOUNGE.

Parties intending to camp out during next summer, hunters, lumbermen, and, in brief, all who, either for pleasure or necessity, sleep in the open air, will find in the device herewith illustrated a light, compact, and comfortable couch. It is composed of but few parts, which may be taken apart and folded into very small space, so as to be carried in a small valise, or in the hand, or even in a deep overcoat pocket. The invention is simply a piece of canvas which, when stretched on a frame, presents the appearance represented in the engraving. There are two side sticks, A, which are jointed in the middle so as to be folded in smaller space, and two girths, B and C, which form the transverse portions of the frame. Girth, B, forming the head, is straight, and into its extremities the shanks of the double ferrules are screwed with right and left hand threads. The inner pair of ferrules receive the ends of the side sticks. The shanks of the ferrules of girth, C, are arched so as to raise the hip of the person reclining a short distance above the ground. Said shanks are also provided with right and left hand screws, so that, by turning both girths, the width of the frame may be expanded at pleasure.



A NEW CAMP LOUNGE.

In putting the couch together, the side sticks are inserted through the side hems, and the head girth through an additional head piece. The foot girth rests upon the ground. The girths are then turned to proper width and the canvas stretched tightly. In order to support the couch at a suitable incline, two sticks are inserted in the outer ferrules of the double ferrules on girth, B, said ferrules being formed at right angles to those in which the side sticks are inserted. The holes shown in the girths are for the insertion of sticks in case levers are needed for turning the girths. A loose piece of canvas is provided, secured to the main portion, and which rests upon the ground beneath the lower portion of the body and feet of the occupant. The small compass and convenient shape into which the device can be folded, is shown on the left of the illustration .It is not absolutely necessary to carry any of the wooden portions of the couch, except the girths, B and C, as the side and supporting sticks may easily be cut from the forest when needed.

The device is a substitute for the india rubber, woolen, and other blankets usually carried to spread upon the ground. It may also be pitched upon uneven ground, securing a comfortable resting place; any desirable elevation of the head may be obtained by driving the sticks more or less into the soil. It, besides, furnishes a softer bed, and raises the body of the occupant above the surface, an advantage of great sanitary importance.

Patented through the Scientific American Patent Agency, January 12, 1875. For further particulars address The Camp Lounge Company, Troy, N. Y., who will forward one to any address for $4.

IMPROVED GRATE BAR.

We illustrate a novel grate bar, by Mr. C. Toope, of this city, and patented to him January 12, 1875. The inventor has had many years' experience as a practical engineer and iron molder. In the present device he has utilized his experience to produce a bar which, while having the greatest amount of air surface, will still retain the necessary strength. The invention, it is claimed, cannot be injured by contraction or expansion. The lock on the sides, in the center of each bar, holds it securely in its place, and prevents it from falling in case the ends should be burned off. The lugs on its sides are about two inches apart, and intersect each other. These, together with the crossbars between the flanges, on the lower-side, prevent the bar from warping or twisting, and the flanges from widening or contracting. The bar is further claimed to be light, durable, and to give a large area of air surface, and, from its peculiar construction, to save from 25 to 40 per cent in weight, according to size, as compared with other bars now in use.

Fig. 1

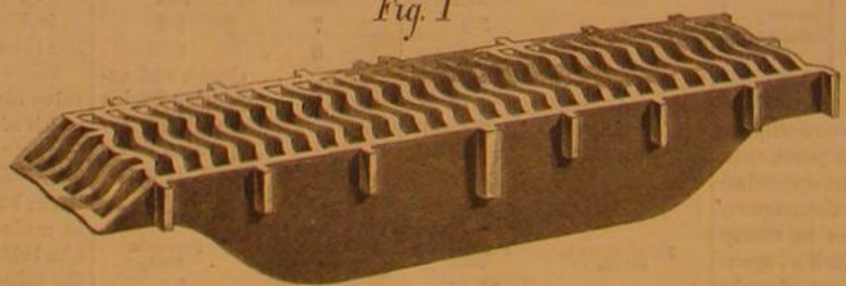
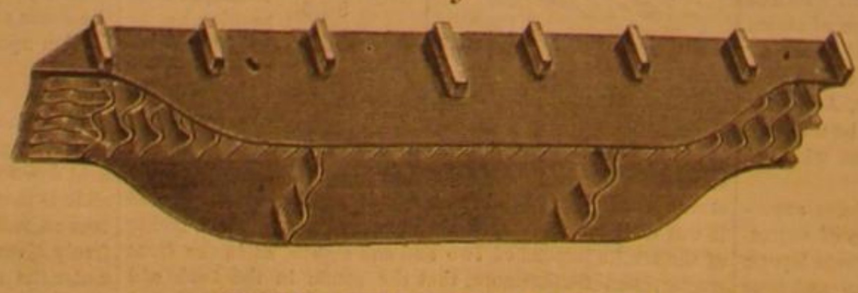


Fig. 2



TOOPE'S IMPROVED GRATE BAR.

The inventor is extensively engaged in the foundery business, with ample facilities for manufacturing, and proposes to furnish these bars either by the pound or square foot, at the ordinary price of castings, and much below the price usually charged by middlemen.

The engravings represent, respectively, the upper side, Fig. 1, and the lower side, Fig. 2. For further particulars address Charles Toope & Co., Lexington Iron Foundery, 88th street, near Fourth avenue, New York city.

Causes of the Decay of Teeth.

In a paper read before the American Dental Society of Europe, Dr. George W. Field says: "By analysis, healthy blood is found to contain a small percentage of inorganic matter, and we can but infer that it is there for a purpose, and that purpose the building up and supporting a perfect osseous system, and that it is from this source alone that the teeth can derive the materials essential to the proper development of their different parts. The blood, acting as medium to supply these materials, cannot manufacture them, but must be supplied most generously, and the food taken into the system must be the base for supplies. Then it follows that the food richest in phosphates is what we need. In the preparation of wheat flour the most valuable part is rejected—that which contains the very nutriment for the want of which we are losing our teeth. The animals fare better than we. The Scotch oatmeal is still richer in phosphates than wheat, be the latter ever so properly prepared; therefore, to substitute this for the fine wheat flour is what is essential if we wish to have such teeth as Nature designed we should. These are my convictions, and they are strengthened daily.

I have had opportunity to examine the mouths of people of almost every nationality, and I have found none that could be compared with those from the north of Ireland and of Scotland. These people make use of oatmeal as a principal article of food. They tell me that it is an almost universal breakfast dish, in the form of porridge, with milk, especially for the young. In many families it is served in cake form for supper. This is a national dish. All partake of it, old and young; and it is with the latter, during the period when all the developmental forces are active, that the system thus nourished is the most benefited. These people not only have a good dental development, but they are strong and healthy, possessing a strength and vigor of constitution almost unknown elsewhere. Acknowledge that Nature must find in the food the material out of which to build up a strong and vigorous constitution: how can we expect to have teeth other than of the delicate, fragile sort, easily acted upon by the deleterious agents present in the mouth, if we persist in withholding the very elements required for their proper nourishment and development?

We all know that, during the period of growth and development, if there is an unusual deficiency of the bone-producing elements, if, because of a severe illness, there is a suspension or a weakening of the assimilative power of the system, this temporary arrest of the developing process in growth leaves its ineffaceable mark, and nowhere so conspicuously as upon the teeth. This being the case, is it unreasonable to suppose that, given the ordinarily good health and activity of the developmental forces of children, and a generous supply of the proper bone food, we will have as a result a good dental development?"

Finny Musicians.

M. Dufossé has recently published a series of admirable researches, in which acoustic phenomena and fishes have been fully systematized and classified, certainly with very curious and striking results. He recognizes the fact that, out of 3,000 species of fishes, 52 are capable of producing sounds. Dr. Galton, in commenting upon the subject, adds that "there is every reason to believe that the majority of the sounds produced by fishes are not casual utterances, but are truly voluntary;" and he further states that, among such, "there is a most remarkable development of the organs of hearing, in all essential particulars correlative with the degree of perfection of the instrument."

M. Dufossé divides the phenomena into two classes. Under the first he places certain sounds which fishes emit when taken off the hook and pitched into a receptacle. These are evidently involuntary, and perhaps convulsive; and among them may be mentioned a croaking noise made by the tench, carp, loach, and other thick-lipped fish, when compelled suddenly to open the mouth. The sea horse also makes a peculiar, sharp sound, by means of a little bone loosely articulated to the gill covering.

The second class includes expressive noises; and it is in this category that the novel and interesting portions of the discoveries are met. Subdividing his subject, M. Dufossé first refers to expressive sounds of a stridulous or harsh nature. These are caused by friction of the pharyngeal bones in a species of mackerel. The noise is rough, short, and piercing; and both males and females are equally sonorous, especially in the hottest part of summer. A somewhat similar sound, though more resembling a grinding of the teeth, is made by the sun fish, and is due to friction of hard prominences in the jaws, playing the part of intermaxillary teeth.

Blowing sounds are included in the second subdivision, and are peculiar to the carp tribe. It appears that the fish has an air bladder, provided with a duct communicating with the gullet. Little valves in this duct can be opened or closed by the animal at pleasure, so as to control the escape of gases from the bladder, through which the blowing sound is produced.

The most important portion of the investigation is found in the second division of the second class, namely musical sounds. Their *timbre* is more or less sweet and soft, and never excites such sensations as are caused by grinding the teeth. They are subject also to an extraordinary degree of change, and their vibrations after being analyzed can be measured by appropriate instruments. They are generated by the air bladder, together with its muscles, the action of the latter being aided and intensified by the rest of the organs. The quality of the sounds is modified by the contraction of other muscles. The *maigre*, a fish found in shoals off the French coast, is cited as the most striking instance. The sounds emitted are notable principally for their length, having a mean of 24 seconds, and for their monotonous uniformity. The *timbre* varies very much, the most common being that of an ordinary reed organ or the reed of a clarionnet. Another *timbre* resembles that of the largest string of a violoncello, sometimes passing to that of a *bourdon* organ pipe. Some sounds, are, however, less sweet, and may have some likeness to the tone of a hurdygurdy or rattle; while others are clear and pure, resembling in their *timbre* those produced by a hautboy, harmonica, or accordeon. They have generally, however, a tendency to degenerate into a humming sound, either from an excess or from a want of intensity. M. Dufossé suggests that the song of the fabled sirens had its origin in the utterances of a shoal of *maigres*.

In his review of these investigations, which we find in the *Popular Science Review*, Dr. Galton mentions numerous other instances of musical fishes. In the harbor of Bombay there is a fish, resembling the ordinary perch, which makes long drawn musical notes like the dying cadence of an æolian harp; and in Ceylon two mollusks are found, called "creeping shells," which evolve similar sounds. The magoora, a fish found in the lake at Colombo, makes a grunt when disturbed under water, and Darwin mentions a kind of *silurus*, met with in the Panama river, which also produces a grating noise, distinctly audible when the fish is submerged.

Dr. Galton says, in concluding, that "as the sounds generally excel in frequency and intensity at the breeding season, it will not be unreasonable to regard them—granting, as we do, that the chirp of the cricket and the croak of the frog is each in its way an alluring serenade—as nuptial hymns, or, to use language ascribed to Plutarch, as "deafening epithalamia."

In plugging screw holes in finished work, glue only the edge of the plug; put no glue in the hole. Pass a sponge of hot water over brad holes, and, when dry, sandpaper and paint. The putty in the latter case, after the wood is swelled, will not meet the brad head.

REMARKABLE BIRDS.

Our latest English advices report that many additions of interest and importance have recently been made to the Zöological Society's collection in Regent's Park, London. Among these are some specimens of a bustard, which is common in the Cape settlement, South Africa, and is known scientifically as the *eupodotus kori;* and we publish herewith an engraving of two of them, selected from the pages of *The Field.*

Burchell, in his "Travels in the Interior of South Africa," gives an account of this bustard, which he found on the borders of the Orange River. He says it is there known as the *wilde paauw*, or peacock, and is much esteemed for food, sometimes growing enormously fat, and increasing to a weight which a man can only carry with difficulty. In the Sichuana language, he tells us, the bird is called *kori*, from which its present scientific appellation has been derived.

In the Cape Colony, where it is migratory, arriving from the interior in greater or lesser numbers according to the drought, it is called the *gom paauw*, and is pretty generally distributed in the open plains dotted with mimosa jungle in the northern and eastern parts of the colony. It is a noble bird, and, when seen stalking about in its proper haunts, says Mr. E. L. Layard, "affords a sight to a hunter's eye never to be forgotten."

Andersson states that the kori bustard is found throughout the year in Damaraland and Great Namaqua Land, and is common as far as Ondonga; but is partially migratory. He never saw one weighing more than thirty pounds; but was assured on good authority that, in some parts of the Free States and the Transvaal districts, individuals are sometimes shot weighing from sixty to seventy pounds. This statement, however, must be accepted with reservation. The spread of wings is 8 feet 4 inches. Its flight is heavy, but nevertheless rapid, and at night, says Anderson, when changing its feeding ground, it may be seen flying at a great hight. It feeds on insects and berries, and is very partial to the sweet gummy exudations of the low mimosa thorn, so abundant in Damaraland. This, no doubt, is the origin of its Cape name, "gom paauw," although Andersson, who refers to this propensity, does not give the local name for the bird; while Mr. Layard, who mentions the name in his "Birds of South Africa," says nothing about the bird feeding on gum. He states, however, that it is never found far from the mimosa jungle that skirts the rivers.

In addition to the food above mentioned, the kori will eat reptiles, and can swallow a lizard or snake of considerable size. A female bird of this species, which was shot by Mr. Layard and a friend, disgorged the largest chameleon they had ever seen, and the crop contained in addition a mass of small snakes and locusts.

The three smaller figures in the background, in the act of "showing off," are Australian bustards, of which remarkable species we published illustrations and descriptions on page 162, volume XXVIII. Mr. Bartlett, the superintendent of the Zöological Gardens, has reason to believe that this curious display, which takes place in the pairing season, is different with each species.

Diphtheria.

Dr. George Johnson, senior physician to King's College Hospital, England, gives an interesting paper in the London *Lancet* on this subject, from which we derive the following:

"I propose in the present communication to discuss some important practical questions relating to the etiology, the pathology, and the treatment of diphtheria.

There are practitioners who, believing that diphtheria is a specific contagious disease, maintain that defective drainage and filth have little or no influence in its causation, while others, denying its contagiousness, assert that its origin and spread may always be explained by its insanitary conditions. I believe that both classes of negationists are in error. I have no doubt that the disease, though not highly contagious, is communicable from the sick to the healthy, and I have as little doubt that it is often caused by filthy emanations from sewers and cesspools, and this, too, when it is in the highest degree improbable that any specific poison can have been introduced from without into the decomposing stuff that has excited the disease. In proof of the contagiousness of diphtheria, the following, amongst a multitude of similar cases, may be set forth:

M. Valleix, a colleague of Trousseau, while examining the throat of a patient, received into his mouth a small quantity of saliva spurted out by the patient in coughing. Next day, on one of his tonsils there was a pellicular deposit, and some hours later both tonsils of the uvula were covered by false membrane; the disease made rapid progress, and in forty-eight hours he died. Another of Trousseau's provincial colleagues was performing tracheotomy in a case of diphtheritic croup, when he applied his mouth to the wound to suck blood from the trachea. He thus inoculated himself, and died in forty-eight hours. [Several other similar examples are then cited, also cases where the disease was apparently communicated to persons visiting or living in the apartments of the diphtheria patient.]

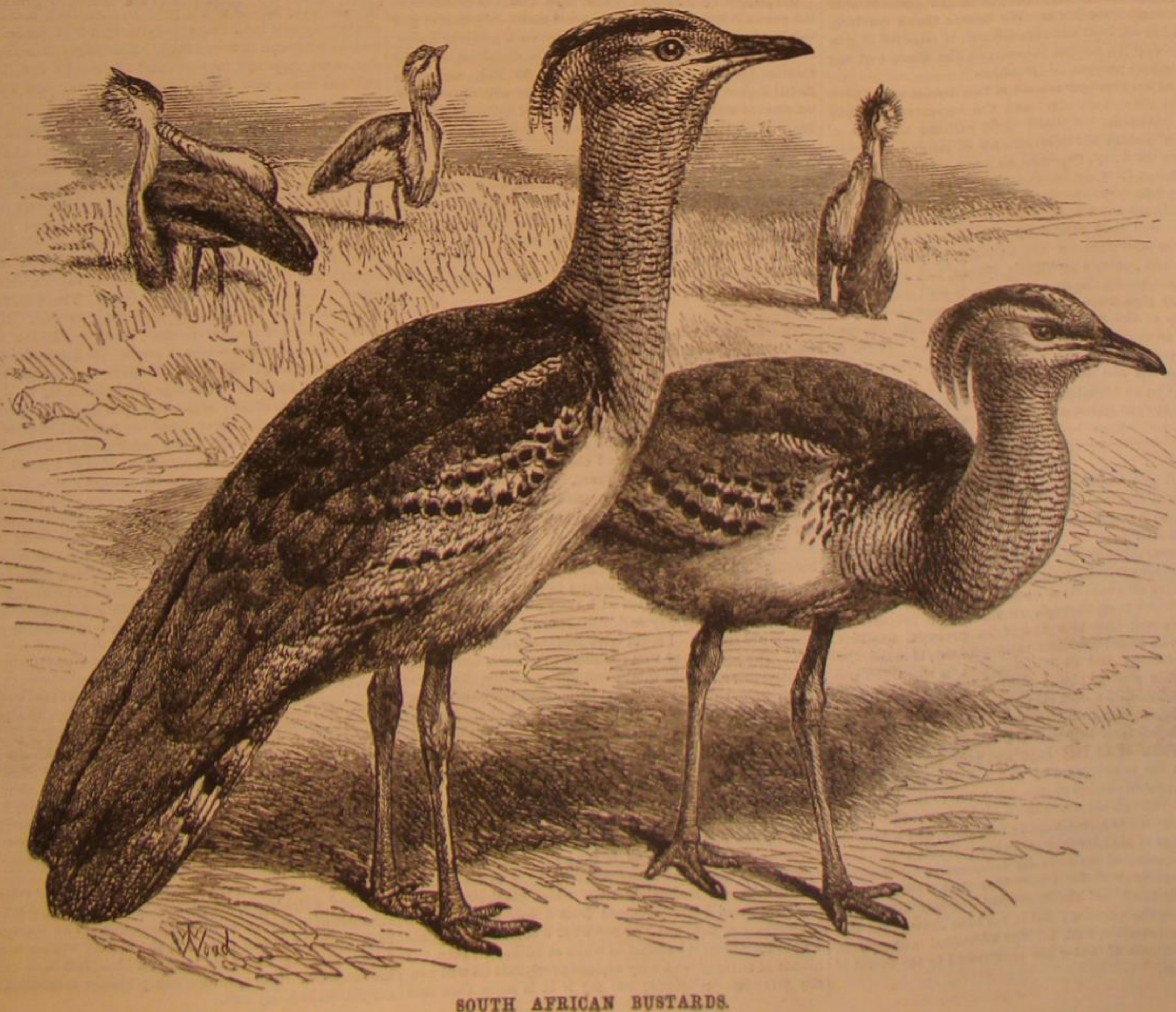
I believe that all the cases which I have cited are examples of the diphtheritic infection being conveyed either through the air or more directly by the actual contact of the morbid secretions with the tissues of the recipient. To oppose to positive evidence of this kind such negative statements as that, in numberless instances, medical attendants and nurses have come into close contact with diphtheritic patients, without taking the disease, appears to me a vain and frivolous objection. Diphtheria is not a highly contagious disease. In the scale of infectiousness it stands far below scarlet fever, for instance, and there is reason to believe that the susceptibility to disease differs almost infinitely in different persons; but a medical attendant who entirely ignores the contagiousness of the malady is likely to neglect reasonable and necessary precautions to protect himself and others from the risk of infection.

When a case of diphtheria occurs in a house without evidence of importation from without, still more when several cases occur together or in quick succession, there will be good reason to suspect that sewers, cesspools, or contaminated water may be the source of the disease. My belief is that, in a very large proportion of cases, there is as close a relation between diphtheria and insanitary conditions as exists between typhoid fever and similar insanitary conditions; and I scarcely need say that, if this be so, the general recognition of the fact is of the greatest importance with reference to the adoption of preventive measures. There is reason to believe that much more harm would result from ignorance of the filth origin of diphtheria than from practically ignoring its infectiousness.

Many instances have come to my knowledge in which fetid fæcal emanations have appeared to be the direct cause of diphtheria.

One case was of a family consisting of a lady, her husband, four children, and three servants. The house is drained into a cesspool about twenty yards distant. The accumulation of many months was emptied one day while the wind was blowing towards the house from the cesspool, and a very offensive smell reached the house. Three days afterwards all the four children became feverish and complained of sore throat; the tonsils were seen to be inflamed and covered with yellowish white patches. In a few days two of the servants were attacked, one rather severely, and, lastly, the lady. Her tonsils were inflamed and covered by false membrane. The only member of the family who escaped was the husband, who was away from home all day, and one servant.'

In another case the family consisted of the father and mother, seven children, and three servants. 'On going up the garden to the house, my nose was assailed by a horrible stink, and, seeing some men at work close to the house, I stopped to see what they were doing. I found that they had ripped open a drain running in front of the house within ten



SOUTH AFRICAN BUSTARDS.

yards of it, and they had opened a cesspool into which the drain flowed. I found the mother, five of the children, and two of the servants suffering from sore throat.' Mr. Bateman says:—'I am at the present time (January, 1874) attending at another house where a young lady and the parlor maid are suffering from severe sore throat with the usual patches. A cesspool had been opened a few days before quite close to the house. I feel quite certain that all these cases were caused by the sewage filth, and in particular by that portion of it which, floating in the atmosphere, was respired by the persons affected Many other cases were cited.

It appears to me to be a matter of almost absolute certainty that the foul cesspool was the primary source of all these cases.

My friend Mr. Salter, of Tolleshunt D'Arcy, in Essex, who has had a large experience of diphtheria, writes to me that he has 'had unquestionably a great many cases of diphtheria whose origin can be distinctly traced to sewage poison, either gaseous or liquid,' and he gives me some particulars of an outbreak in one family, four children and a nurse having been attacked in quick succession, which he attributes to the percolation of sewage into the well which supplied the family with water.

I look upon the occurrence of an indigenous case of diphtheria in a house as an indication of the necessity for a most rigid inquiry into the condition of the drainage and the water supply. At the beginning of the present year, a gentleman living in one of the best houses in Queen's Gate asked me to see his butler, whom I found suffering from a severe attack of diphtheria. The basement of the house looked the perfection of cleanliness, but I advised that a sanitary engineer should be called in to inspect the premises. The result was the discovery of an untrapped sink pipe near the butler's sleeping room.

It is notorious that, in the houses of some of the most exalted and wealthy, and in open country districts, the sanitary defects which originate such diseases as diphtheria and typhoid fever are almost as common as in the meanest cottages and in the most crowded cities; but it is obvious that overcrowding in the small rooms and cottages inhabited by the lower classes must greatly increase the danger arising from other insanitary conditions.

In opposition to the doctrine which I am now advocating, it is sometimes stated with perfect truth that diphtheria never visits some houses which are dirty within and without, and which are surrounded by every form of abominable filth. The reply to this is that no one believes that any and every kind of foul emanation from decomposing organic matter will suffice to cause diphtheria. As every black powder containing charcoal is not the explosive compound which we call gunpowder, so every fetid gas escaping from a drain or a cesssool is not laden with the perilous stuff which will excite diphtheria. We believe that a combination of conditions, local and atmospheric, is required to generate or develop the morbid poison, and the absence of any one of these may prevent its formation."

In view of the great prevalence of this disease at the present time in New York city, and the extensive mortality therefrom resulting, we would again call the attention of our Board of Health to the importance of issuing an order, without further delay, requiring all house owners to make a pipe connection from the house drain to the kitchen chimney. As we have heretofore shown, by this simple expedient, costing probably not more than ten dollars for each house, the sewage gas will then escape up chimney, and not find its way into the apartments of the building, to poison the atmosphere, and generate diphtheria, typhus, and other malignent diseases among the occupants. It is well known that the ordinary pipe traps do not prevent, except in part, the backing up of the foul sewage gases. The only effectual remedy is an open escape pipe into the chimney. If the escape pipe connects with the kitchen chimney, which is all the time, winter and summer, kept warm by a fire, there will always be an attending column of air to assist in carrying off the sewage gases, and, to some extent, render them innocuous.

Water.

The sixth and concluding lecture of the course on chemistry by Dr. Frankland, F.R.S., to working men in connection with the Royal School of Mines, was delivered lately. Subject: Water.

The lecturer said: People usually imagine that they know all about water perfectly well, but, in truth, we are very far from knowing all about it; a whole course of lectures would not be sufficient to go through all the known properties of water. We will look at a few of its principal qualities: First, as to its color; doubtless you would say, if asked, that water is colorless, and so it appears to be when you look only at a thin stratum; but looked at in a stratum of sufficient depth, it will be seen that water has its own peculiar color—a bluish green tint. This we show by passing a ray of white light from the electrical lamp through a horizontal tube, which is 15 feet long and half filled with pure water from the laboratory, and you see the light, passing through the air in the top of the tube on to the screen, is white; that through the water has a bluish green tint. This layer corresponds to a reservoir 7½ feet deep, and a stratum of pure water of that depth would give this color.

Another quality of water is its comparative incompressibility; it was doubted for a very long time whether it was compressible at all, and the celebrated Florence experiment did not settle the question; but it has been shown that it is slightly compressible, that, for one additional atmosphere, 1,000,000 volumes of water are compressed to the extent of 51·3 volumes.

Again, the specific heat of water is greater than that of any other substance we know; that is to say, a certain weight of water contains more heat than an equal weight of any other substance; and this greatly influences the climate of islands and countries lying near the sea. Thus, in the hot summer months, when the land gets strongly heated, the water absorbs the rays of the sun, but its temperature rises much more slowly, and thus it moderates the heat of the land; whereas in winter the reverse takes place: the land parts with its heat readily and becomes cold, while the water gives out a much greater quantity of heat in falling through a similar number of degrees. For this reason the climates of islands are more uniform, and subject to less extremes than those of inland countries. The heat given out by 1 lb. of water in cooling 1° would raise 1 lb. of air 4°; or 1 cubic inch of water in losing 1° of heat warms 3,076 cubic inches of air 4°. On this account, too, our east winds, blowing over large surfaces of land which has but low specific heat, are so much colder than our west winds which come to us over water. Water, too, has a high latent heat, and this, too, has an important bearing in the condition of water as it exists in Nature. Thus, 3 cubic feet of water at the temperature of 32° Fah. gives out, when it becomes converted into ice, a quantity of heat equal to that given out by the burning of a bushel of coal.

Further, water expands on freezing, and the coating of ice thus formed on the surface has a tendency to prevent large masses of water from being entirely frozen. Sometimes we hear of ground ice, or ice formed on the beds of rivers; and the lecturer, who was in Switzerland last winter, noticed that in all the rivers there this ground ice was formed. It admitted of a very simple explanation. Owing to the curious property of this maximum density of water, in still water the ice will be formed on the surface, as before explained; but in these Alpine streams the whole mass of water is kept agitated and mixed up, and consequently keeps throughout of a uniform temperature. Thus we may have the whole body of water uniformly cooled down to 32° Fah., and ice will then form as readily at the bottom as at the top; in fact, more readily, for it is easily proved that ice forms (and the same is the case with other liquids as well as water, in crystalizing) most readily in contact with rough surfaces, and therefore forms first in contact with the stones on the bed of the river; and when once formed there it goes on increasing. If water be perfectly still, it may be cooled down several degrees below 32° Fah. without freezing; and people have sometimes been surprised to find the water in the jugs in their rooms in a morning, which was quite liquid when they took up the jug, freeze as they attempted to pour it out. Being perfectly quiescent, it had cooled below 32° without freezing, but froze as soon as it was moved.

One of the properties of water most useful to chemists is the power it has of dissolving a great many substances; and this is of great commercial value, since such gases as hydrochloric acid gas and ammonia gas can be dissolved, and the solution become marketable articles. At 59° Fah., and under 29·921 inches pressure, 1 volume of water will dissolve 780 volumes of ammonia gas, or 450 volumes of hydrochloric acid gas. With regard to solids, it is found that, as a rule, they are more soluble in hot than in cold water (common salt is equally soluble at all temperatures). Hence, if water at a high temperature be saturated with them, as it cools they will be deposited, and it is found that they assume in deposition definite geometrical forms; these are called crystals. (Beautiful crystalization effects were then shown on the screen by means of the electric lamp and solar microscope, the crystalization of red prussiate of potash being exceedingly beautiful and interesting.)

LONDON WATER.

The above remarks apply to pure water, but we never meet with pure water in Nature: all natural waters contain more or less dissolved matter; the difference is only one of degree. We may divide the water we meet with around us into (1) drinkable or potable water; (2) mineral water; (3) polluted water, so fouled, by the drainage of towns or the refuse of manufactories, that it is no longer fit for domestic use. As the result of researches and observations carried on during the last fifteen or twenty years, it has been asserted that water is one of the most ready means of transmission of germs of epidemic diseases, for example, water contaminated with the excrementitious matter of persons infected with those diseases. Many people will not believe the thing to be true, because the idea is so horrible; but it is nevertheless the case. People in large towns are constantly in the habit of drinking water which is contaminated with their own excrementitious matters, and in this way such diseases as typhoid fever and cholera are spread. I could give instance after instance of this. The presence of these matters in water is not so easy to detect as you might think; and unfortunately, the waters so contaminated taste somewhat better than the pure waters, and people often prefer them, being unaware of the cause of their preference There are means for testing the purity or impurity of your water I will mention one or two simple ones: Get a solution of nitrate of silver or lunar caustic (buy the crystals at the chemist's, and dissolve them in distilled or rain water). Here are three specimens of water, to each of which I will add a few drops of this solution of nitrate of silver The first is distilled water, and you see it remains perfectly clear. The second is the ordinary Thames water, supplied by the Grand Junction Company to this building; here we have a moderately large white precipitate. The third specimen I have obtained from a notorious pump in Bloomsbury square, and you see what a copious precipitate we get from that; it becomes as white as milk. If, then, the nitrate of silver gives a very copious precipitate (it will usually give some precipitate; but say if it is more than that Thames water gave) beware of drinking the water. It may be fit to drink, but the probability is that it is contaminated with those noxious matters. There is no wonder that our third specimen gave such a precipitate (and all the shallow wells of London are as bad), for the water in them is nothing more than the soakage from the cesspools and similar places in the neighborhood. And yet people in the neighborhood constantly drink it, and often prefer it to that supplied by the companies, especially in summer, when it is cooler than the vapid warm water from the taps. Some parts of London are supplied with water from deep wells sunk into the chalk. Now, if you subject that water to the next test I will mention, you will see its superiority. Take a tumblerful of water, let a beam of sunlight from a slit in a shutter pass through it, and observe the path of the light in the water. Here we have two specimens of water; the first from the pipes of this building, that is, Thames water, the other the deep well water. On sending a beam from the electric lamp through both of them, we see at once that the path of the beam in the first reveals itself as a broad and very marked band of light, while in the second the path of the beam is almost invisible. That is to say, there is nothing like so much suspended matter in the latter specimen as in the former, although the Thames water is as clear as sand filters can filter it; but there is no filter so efficient as the soaking through several hundred feet of chalk.

Henry Highton.

Rev. Henry Highton, a gentleman long and well known in scientific, telegraphic, and scholastic circles, died recently in England. As a scientific man he is associated with various discoveries in connection with electrical telegraphy, for which he more than once received a medal from the Society of Arts. He took out his first patent as early as July, 1844, for a telegraph worked by static electricity and a chemical recorder. In 1846 he invented his well known gold leaf telegraph, which, however, was never practically used. A small strip of gold leaf inserted in a glass tube was made to form part of the line circuit, and it was placed between the poles of a large permanent magnet. Whenever the line currents passed through the gold leaf, it was instantly moved to the right or left, according to the direction of the current. Its delicacy is so great that efforts have been recently made to introduce it upon our long cable circuits. In 1848 he took out a patent, with his brother Edward, for a new form of needle telegraph, and various other modifications; and in 1850 the British Electric Telegraph Company was formed for the express purpose of working and bringing into more general use the inventions of Messrs. H. and E. Highton. He recently (1872–3) introduced a new form of battery, and has been engaged in perfecting a mode of working long submarine cables by means of his gold leaf receiver, and a new electromagnetic induction apparatus, by which the sensitiveness of telegraph instruments is considerably increased. He also, some years ago, invented and perfected a new kind of artificial stone, now largely used for paving and building purposes.

Stoppage of Carriers in Pneumatic Tubes.

Although this accident is exceedingly rare, yet the possibility of its happening at all necessitates the discovery of a ready means for localizing the position of the arrested carrier. The method hitherto employed has not given good results. It is to apply to the mouth of the pneumatic tube a receptacle full of compressed air of a known pressure, which is allowed to enter the tube. The resultant pressure in the receptacle and the tube, as far as the arrested carrier, furnishes datum to estimate the carrier's distance. The distances so measured have not been approximately correct. M. Ch. Bontemps adopts another method, based on the law of the propagation of sound waves in pipes. He fits to the mouth of the pneumatic tube a kind of drum, an instrument furnished with an elastic membrane whose inflations or depressions are automatically registered upon a revolving cylinder A diapason likewise traces, upon the same cylinder, seconds and fractions of a second. The under part of the membrane is set in motion by an explosion, say that of a pistol. The blow raises the membrane, and its upward motion is at once registered. The wave speeds onwards along the tube with a speed of 363 yards a second, and strikes against the obstacle; thence it is reflected back to the membrane, and a second motion is registered. It now only remains to calculate the exact time between the two registers, representing twice the time the wave takes to traverse the distance from the tube's mouth to the obstacle. This arrangement is said to be so exact that the possible error does not exceed 2 meters, or 6½ feet.

Cheap Telegraphy.

Competition is the life of business; and where that business is conducted by people of experience and ability, the public are the gainers.

The Atlantic and Pacific Telegraph Company now loom up as competitors with the Western Union Telegraph Company. General Eckert, an experienced telegrapher and manager, long connected with the Western Union, has taken the presidency of the Atlantic and Pacific. A lively competition is expected, and telegraphing, in some directions at least, is likely to be done at reduced prices.

DR. DEMARQUAY, of the Hospice Dubois, recently removed a lipoma weighing 3,200 grammes, about 7 lbs., from the shoulder of a woman aged seventy-three. The tumor had been twenty years in existence, and the old woman used to wear it in a bag, and carry it on her shoulders as a soldier his knapsack. The operation was perfectly successful, and the patient is doing well.

DECISIONS OF THE COURTS.

United States Circuit Court.---Eastern District of Michigan.

RUBBER DENTAL PLATE PATENT.—THE GOODYEAR DENTAL VULCANITE COMPANY *et al. vs.* GEORGE WILLIS.

This was a bill in equity filed against the defendant, a dentist, for infringement of reissued letters patent No. 1,904, granted to The Dental Vulcanite Company, assignee of John A. Cummings, for "Improvement in Artificial Gums and Palates." The claim in the patent is for "the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described."

Cummings filed his caveat May 14, 1852. Applied for a patent April 12, 1855. This application was rejected May 19, 1855, and again rejected August 14, 1855, and again rejected by the Commissioner of Patents February 6, 1856. In 1859 a motion was made before the Commissioner for a rehearing, or for an appeal to the Board of Examiners, which motion was denied. On March 20, 1864, a renewed application was filed. On April 7, 1863, the Patent Office wrote to Cummings acknowledging that injustice had been done in the former rejection, and the patent was thereupon allowed, and was issued on June 7, 1864. There was evidence that tended to show poverty on the part of the inventor and efforts by him to raise money to prosecute his application during these periods. The invention went into public use about 1859.

EMMONS, J.:

In ordinary circumstances the condition of judicial opinion in reference to all the points involved in the record would render unnecessary their discussion upon principle; and in a case where such rulings have been so numerous, and directly upon the points, and so elaborate in argument, it is unusual to do more than refer to them generally, as settling the points in issue. Such, however, is the exceptional feeling and excitement existing in the minds of the numerous defendants in suits brought on this patent in this and adjoining districts, resulting, we believe, from the want of knowledge on their part of the real history of previous litigations, and the character and number of opinions which have been already pronounced, that it is deemed a duty by my brethren and myself to reproduce that which we are well aware is already familiar to the bench and bar. * We think the learned counsel for the defendant much underrated the effect which it is our duty to give to judgments pronounced by co-ordinate courts, where precisely the same points are brought in litigation before us. *

The following decisions, noticed, we think, in the order in which they were made, every one of them upon records precisely like that before us, or less favorable to the complainants, decide (most of them with much fullness of argument) every point necessary to authorize a decree for complainants. In 3 Fisher, 87, Dental Vulcanite Company *vs.* Wetherbee, before Justice Clifford, in 1868, the bill was filed to restrain an infringement of the patent now before us. The defendant there, as here, insisted that the patent was invalid because it did not embrace that which was the subject of a patent. That if it did, it was void for want of novelty, and that Cummings was not the inventor. That if he invented he abandoned it. That there was a forfeiture of his rights, if any he had, under the statute, because he suffered it to go into use more than two years before he applied for his patent. That the reissue was void, because not warranted by the original patent. The cause was argued by counsel as eminent as any in the nation. Justice Clifford, after taking much time for deliberation, in a painstaking judgment, overruled every objection taken by the defense. Goodyear Dental Vulcanite Company *vs.* Gardner was a similar case before the learned Justice, in 1868, and the same defense, among others, was substantially taken. The application for a preliminary injunction was argued by B. F. Curtis and Causten Browne, for complainants, and B. F. Thurston and S. D. Law and John A. Foster for defendants. It is seldom that more professional ability is brought to the discussion of a similar application. Justice Clifford again, in his judgment, sustained the patent and overruled all the objections to it. (See pamph. rep. of case.) This case was subsequently brought to final hearing on pleadings and proofs, and in 4 Fisher, 224, will be found the opinion of Justice Clifford rendered in favor of complainants after much deliberation, leave having been expressly given the respondents to reargue the questions of law and fact presented in the Wetherbee case. We will note, in connection with this case in the Supreme Court, the imputations cast upon it by the defense, observing here only that there is no accusation of impropriety in the case, before or at the time of the motion for interlocutory injunction. In 5 Patent Office *Gazette*, p. 585, Goodyear Dental Vulcanite Company *vs.* Smith, the same defenses were in evidence as in the case now before us, the records being identical, with the exception of a small amount of additional testimony on the part of the defense in this case, of so little importance that it was not noticed at the bar by either side.

The cause was argued at great length by able counsel before Judge Shepley, who rendered an elaborate judgment in favor of complainants. In 6 Patent Office *Gazette*, p. 154, Goodyear Dental Vulcanite Company *vs.* Root, the same questions were presented to Justice Hunt, sitting in the northern district of New York, who, after argument, again sustained the patent. Subsequently, in suits by the same complainants against Charles S. Stockton and Frank A. Cummings, argument was had by the same counsel on the same record as in the Smith case, before Judge Nixon, in the district of New Jersey, who again sustained the patent at September term, 1874. A decree in favor of complainants against William H. Gates was granted at October term, 1874, on the same record as in the Smith case, before Judges McKennan and Cadwalader, in the eastern district of Pennsylvania.

The case of Goodyear Dental Vulcanite Company *vs.* Gardner, *ante*, was appealed to the Supreme Court, and every ruling necessary for the support of the judgment in the court below affirmed by that tribunal. The effect of this judgment, as an authority here, is earnestly assailed, because the court, before the opinion was actually delivered, although judgment had been rendered, dismissed the appeal. We do not see, in the reasons for this dismissal, anything which decreases the obligation on our part to follow the rule of law necessarily involved in the judgment. *

This series of decisions, without one in conflict with them, presents conditions in which it is our undoubted duty to apply the principle which makes the judgments of co-ordinate courts obligatory where they have been upon the same points and the same subject matter.

As we have already intimated, ordinarily we should terminate our consideration of this case here. A matter so often and so authoritatively decided would not be discussed, upon principle, did we not believe that a brief reference to the reasons upon which these adjudications rest would be locally beneficial. *

Various reasons are then set forth concluding as follows:

To negative the idea that Cummings, by his delay in the prosecution of his claim, intended to abandon it the complainants have put into the record voluminous proofs showing a continuous and persistent assertion of his right and intention to maintain it. The testimony shows numerous and fruitless attempts to procure assistance to defray the expenses of his application by offering shares of the patent, if obtained, and otherwise, and in the latter periods of his delay such a degree of ill health, poverty, and general depression on his part, as shows good reason why he did not prosecute more vigorously his application. The facts do not warrant, nor was the argument pressed, that there was fatal delay prior to 1859. At that time, Cummings had become insolvent, and his health seriously impaired by chronic diseases, which ultimately terminated his life. The testimony leaves no room for doubt that after this period he wholly ceased to furnish any considerable part of the support of his family. His wife's small separate property was first mortgaged and then sold, to procure what is proved to be the small and sometimes too scanty expenditure upon which they lived. The praiseworthy efforts of his wife as the keeper of a boarding house, the pawning of her few personal ornaments, and her general care and support of a diseased and dispirited husband, present a picture as affecting as it is demonstrative of Cumming's inability, from sheer poverty, to prosecute his application. The only diligence of which, in his physical and pecuniary condition, he was capable, he manifested by such a constant reiteration of his rights as showed that the idea, in the words of some of the witnesses, "had taken complete possession of his mind," and incapacitated him for all other business. His offer of portions of the future patent were frequently repeated during the whole period till 1854, when, after its partial use by the profession had demonstrated its utility, for the first time his proposition was accepted, the means obtained, and the patent procured. His history and condition during this entire time exclude the idea that he intended to abandon his claim. The *prima facie* evidence of a contrary intention, springing from the fact that he did make the last application, is not overcome by the evidence *aliunde*, but is proven to be consonant with the real intention of the inventor.

There is one most remarkable feature in several of the discussions of this subject before other tribunals, and which with great emphasis presented itself to this. We do not refer to it to censure counsel in the present cause, as those of equal eminence have elsewhere, in the presence of excited defendants, made similar denunciations. That Goodyear should have a patent for vulcanite, and compel dentists to pay a royalty for using it, and that Cummings should procure a patent for a dental plate made of that same substance, and compel them also to pay a tribute for its use, is treated as an astounding novelty and an atrocious fraud. The accident that subsequent transfers have lodged the present patent in the same hands which held that of Goodyear, presents to the unprofessional mind, unacquainted with the wholly distinct character of the two rights, plausible grounds for this unfounded criticism. A large share of the strong feeling and the strong conviction that injustice has been done the dental profession has sprung from what seems to us a wholly unjustifiable perversion of the most familiar truisms in patent law. It is but the simple—the every day recurring—case where one patentee employs the invention of a prior one. In such instances, it must be true that he who uses the manufacture or article which involves both must pay a royalty to each inventor. Cummings' invention neither authorized him nor any one else to use the invention of Goodyear, nor could the latter make these dental plates with his material without the consent of Cummings or his grantees. When Goodyear's patent expired he and his associates had just as much right to become the assignees of Cummings as any other citizen. The accidental circumstance that the same man issued licenses first under one patent and then under the other is unimportant and even trivial. Such instances in this department of business are very frequent, and the union of such interests, instead of being injurious, is beneficial to the public, not only from the economy, but the convenience of procuring licenses. Self-evident as all this is to the legal profession and to those dealing in this species of property, an impolitic and much-to-be-regretted impression has been created, in the minds of the dental profession, that they have been wronged and actually oppressed by what has been termed "the mercenary marriage or illicit connection of these two rights." It would seem too evident to require additional illustration that the rights under this patent, and the obligations of those who use it, are in no way changed in the slightest degree by the immaterial fact that Goodyear once had a patent for vulcanite that has now expired. *Its* use is free alike to the dentists and these complainants. The one charges and the other pays neither more nor less than if vulcanite was a natural substance common as ordinary clay. It is the real value of Cummings' invention alone which is sold, and which they purchase or not, as they please, being free to use *vulcanite* without any royalty whatever, for any purpose not involving his invention.

Our purpose in thus referring to a few of the reasons which induce us to decide this case in favor of the complainants upon principle, irrespective of the prior adjudications, has been to suggest to the numerous other defendants having like cases pending what we believe to be the uselessness of additional argument before subordinate tribunals. If this patent is to be held invalid after so many judgments sustaining its validity, we are clearly of the opinion that it should be done by the court of last resort. The interests of the numerous defendants now litigating in the circuits would be far better promoted by an early appeal to the Supreme Court than in wasting so much time and money by the creation of numerous similar records, and paying for repeated arguments before co-ordinate courts. We do not think they can be effective there without a violation of the well-established and necessary principle to which we referred in the outset, which renders authoritative upon us the long list of adjudications elsewhere rendered.

Decree for complainants.

An appeal from this decision has been taken to the Supreme Court of the United States.

(*Benjamin F. Lee*, for complainants.
John F. Follett and Calvin C. Burt, for defendant.

Recent American and Foreign Patents.

Improved Violin.

Josiah H. Payne, Garner, Miss.—This is a violin provided with string-fastening devices at the base of the neck and openings corresponding therewith through the top and bottom of the rim, for the passage of the strings. By this arrangement, the tail piece or apron, to which the ends of the strings have heretofore been attached, is dispensed with, and the tone of the instrument is greatly improved.

Improved Device for Protecting Horses' Tails.

Franklin E. Howard, Geneseo, N. Y.—This invention consists in a bag formed of leather, cloth, or other material impervious to mud, the same being slitted to form lapping edges, and adapt it to be readily applied or removed from the tail, a useful device at this season of the year. It saves much time to the coachman, and preserves the hair of the tail.

Improved Boiler Tube Expander.

William S. Sharpneck, Onawa City, Iowa.—This invention consists in an expander adapted to all sized tubes made in longitudinal sections, the outer surface of which is turned to various diameters distinct from each other, each gradation being provided with a collar for forming the bead inside the head of the boiler.

Improved Stove Pipe Elbow.

Samuel Smith, Brooklyn, E. D., N. Y.—This invention consists in holding the connected parts of an elbow pipe together by straps, forming a part of and extending from one and riveted to the other.

Improved Plow.

Thomas Canty, Kaufman, Tex.—Several deep notches are cut in the upper edge of the share, and to tongues thus formed curved parallel and flat strips are attached. Thus said plates form continuations of the share, over which the soil glides with a minimum amount of friction. The means of supporting the rear ends of the strips is a brace having arms. Thus all the mold board strips are supported and held rigidly in position, so as to resist lateral and downward pressure.

Improved Railway Switch.

John D. Murchison and William T. Haney, Taylorsville, Ga.—This invention consists of pivoted switch rails, which are set by a longitudinal crank rod connected therewith, and by pivoted lever rods and elbow levers, operated by curved upright levers at both sides, and at suitable distances from each end of the switch rails, to be struck by a laterally adjustable bar at the head block of the locomotive.

Improved Locomotives and Cars.

Henry Handyside, London, England.—This invention relates to certain peculiar construction and arrangements of locomotive engines and apparatus to be applied thereto, and to the carriages or wagons of a train, whereby the safe and easy ascent of trains up steep inclines is accomplished, and their passage round sharp curves is facilitated. The locomotive engine is coupled to the train or other load to be hauled up an incline, by a rope or chain, which is wound on a drum mounted in the framing of the engine. The axis or shaft of this works horizontally in bearings in the main framing, and is driven or rotated direct or by gearing, as found most convenient, from a separate pair of cylinders, distinct from the usual cylinders which drive the locomotive in ordinary cases. These separate cylinders may be secured to any convenient part of the locomotive and they transmit a rotary motion to the shaft of the hauling drum by connecting rods coupled to cranks secured to the ends of the hauling drum shaft, or coupled to the shaft of separate or intermediate gearing. The drum or windlass barrel is loose upon its shaft, and is coupled therewith, when required for hauling purposes, by means of a sliding clutch, provided with projections or teeth, by preference inclined or beveled off at the back, which teeth engage into corresponding holes or recesses in the end of the drum. A clutch lever is provided for throwing the hauling drum into or out of action, as required. On arriving at the foot of a steep incline, the engineer will release the hauling drum on the engine, and will, without stopping the engine, run it up the grade to any desired distance. On stopping the engine, struts immediately come into action and maintain the engine firmly in its place. The hauling drum is now started by throwing the clutch into gear therewith (the rope or chain having been paid out as the engine ascended), and the entire train, or any part of the train, is hauled up by the sole power of the cylinders which work the winding drum. The struts on the train act to prevent any retrograde motion thereof, when required, or in case of an accident to the hauling apparatus; they also allow the engine to start again without the train to take another length of the incline, and so on until the complete ascent of the incline has been effected, the train being hauled up by the engine by the aid of the winding drum. On level sections, or on comparatively light grades, the locomotive acts precisely as an ordinary locomotive engine.

Improved Butter Worker.

Jonas Lindbeck, Andrew J. Lindbeck, and John E. Lindbeck, Bishop Hill, Ill., assignors to themselves and Andrew Jacobson, same place.—To the inner surface of a cylinder are secured rows of teeth, which are made diamond-shaped in their cross section, and are placed in an inclined position. To a shaft, rotated within the cylinder, are attached teeth, which are also made diamond-shaped in their cross section, but are inclined in the opposite direction, and are arranged spirally upon the shaft. In the top of the cylinder is placed a hopper for the convenient insertion of the butter. As the butter is fed into the hopper, it is thoroughly worked and mixed by the teeth, and at the same time carried forward to the other end of the box, and is forced out through a hole in said end. As the butter escapes from the hole, it passes over two or more rollers pivoted to a chamber, the lower side of which inclines back, and projects beneath the end of the box to serve as a channel to conduct the brine into a spout.

Improved Clothes Washer.

Ezra Crowell, Belfast, N. Y.—This invention is an improvement in the class of washing machines or devices consisting, chiefly, of a hollow sheet metal cylinder and a plunger reciprocating therein. The improvement relates to constructing the cylinder with vents on the side near the top, and connecting them, by means of an exterior tube, hood, or casing, to allow escape of air and water past the side of the piston.

Improved Device for Lifting and Moving Railroad Cars.

Benjamin F. Phelps, Kansas City, Mo.—The object of this invention is to provide means for conveniently lifting and moving railroad cars and other heavy bodies; and it consists of a lever, to which is attached a movable fulcrum, and also a roller and push bar. The push bar is forked to go over the end of the lever, and has an adjustable dog on its end, by means of which it is attached to the angle of a car. By means of a self-adjusting fulcrum pawl, the lever may be applied by either lifting or bearing down, as may be desired.

Improved Hanger for Plant Shelves.

William Higgs, Washington Mills, N. Y.—This invention consists in a shelf hanger, made of a single piece of wire, bent into the general form of a right-angled triangle, with a prong formed of its end or ends at the lower end of its perpendicular, and a loop formed at the upper end of its perpendicular.

Improved Scissors for Use with Sewing Machines.

Sarah L. Fawcett, New York city.—This invention comprises a pair of scissors with a sharp cutting hook to free the cotton from the rotating hook of a sewing machine, and a pulling hook for drawing the cotton from under the needle. The contrivance is particularly adapted for the Willcox & Gibbs sewing machine, and all machines which use the rotating hook.

Improved Combined Cultivator and Seeder.

Matthew Green, Walker Station, Mo.—The pinion of the seed-dropping device is thrown in and out of gear with the wheel, and applied to a shaft which passes into the seed receptacle along the bottom thereof, and is provided with a screw thread inside of the box or receptacle. A slide has a perforation with a flexible spring surrounding the same, being of a diameter corresponding to that of the screw end of the shaft, so that the latter feeds, by the rotation imparted by the gear wheel, the seed taken up by the spiral flange of the screw to the seed-conveying tube.

Improved Steam Rock Drill.

Joseph C. Githens, New York city.—The essential features of this invention consist in mechanism which causes the piston to turn as it moves upward, and allow it to move downward without turning. Other devices force said piston and disk together and apart by steam, for holding and releasing the guide rod as the piston moves up and down.

Improved Fruit Dryer.

William S. Plummer, San Francisco, Cal.—This invention relates to a fruit dryer in which the racks for holding the fruit pans or plates are made to revolve and carry the fruit around a horizontal course through a heated chamber and back to the place of starting, when the dried fruit is replaced by green, making a continuous process. The invention consists of a peculiar construction of the circular chamber, partly of stationary walls and partly of revolving walls, also of contrivances for heating the chamber economically by hot air and steam.

Improved Horse Power Well Boring Machine.

Matthew Steward, Napoleon, Ohio.—This is a horizontal master wheel, which gears internally with a vertical countershaft that drives the horizontal windlass to hoist the auger. The shaft also gears with a hollow horizontal wheel for turning the auger, and is connected with it by two friction rollers on the wall of the eye of the wheel, against which vertical bars parallel to the shaft and attached to it by arms bear, so as to allow the auger to descend freely, and with but little friction, at the same time that it is revolving. The platform for the attendant of the auger is built over the master wheel, and the whole machine is contained within the compass of the sweep to which the horse is attached.

Improved Machine for Barking Wood.

Orson W. Clark, Appleton, Wis.—The cutter has a roller guide on each side of it, one being to gage the wood for the depth it is required to be cut, while the latter is merely to assist the former by acting on the dressed portion of the wood after it passes from the former, and to hold it altogether after the end escapes. These gage rollers are each mounted in the end of a rocking support, and can be shifted toward and from the axis of the cutter. The nut for feeding the frame along is made in two parts, which are pivoted together and connected by a rocking link, so that when one of the parts of the nut is pressed on the screw, the other part will also be closed on the screw by the same means, through the medium of the said rocking link. When the handle is let go, the spring throws open both jaws and disconnects the frame from the screw, so that it can be instantly shoved back to the place of beginning, after each piece is barked.

Improved Soda Water Cock.

Henry Fraser, Pictou, Canada.—Upon the top of the cock is a deep ring flange, having a screw thread cut in its inner surface to receive a screw formed upon the upper part of the cock. In the lower end of the screw are circular recesses to receive the ends of the plug, the handle of which passes out through the flange. By this construction, the upper part will always be held squarely in place, and thus will not be exposed to any unequal pressure.

Improved Biscuit Board.

Aaron P. Forman, Canton, Miss., assignor to William B. Stinson, same place.—In using the machine, the dough is placed in the central compartment of a hopper, and is drawn through between rollers by their revolution. The dough falls from the rollers. It falls upon a bottom board, from which it is removed and again placed in the hopper, and the operation is continued until the dough has been sufficiently worked.

Improved Folding Table.

Nicholas S. Tiemann, New York city, assignor to John A. Tiemann, of same place.—The invention consists of a combination of jointed braces and connecting bars, jointed legs, and a jointed table top, in such a manner that the legs are caused to fold and unfold, and assume their proper position in each condition by the top when it is folded and unfolded, thus affording a simple folding table.

Improved Machine for Making Fence Pickets.

Isaac Levy, Ellaville, Fla.—The invention is an improvement in the class of machines wherein revolving and vertically adjustable cutter heads are employed for dressing the heads of the pickets. The improvement relates particularly to the construction of the sliding or reciprocating table and an attachment thereof, for supporting and clamping pickets of different lengths. A bar is adjustable up and down the carriage, toward and from the cutters, by slotted side pieces and clamping bolts.

Improved Weather Strip.

William O. Chamberlain, Battle Ground, Ind.—The invention consists in a weather strip for doors, formed of two zinc strips, having their adjacent edges rolled to interlock with and turn upon each other. The free edge of the zinc is secured to a strip of wood. A spiral spring is attached to a stationary wooden strip, and its other end is secured to the wooden strip above mentioned. The elasticity of the spring, when the strip is free, raises the same and supports it, so that it will pass over the threshold without touching, when the door is swinging open and shut. A small wheel is pivoted to the side post in such a position that, when the door is swinging shut, the face of the said wheel will strike the wooden strip and force its free edge downward, so as, when the door is closed, to be in close contact with the sill.

Improved Lubricator.

Morris Evans, Erie, Pa.—The lubricator is connected by a separate pipe with the steam space of boiler, and is so arranged that the lubricator therein is thereby thrown in a continuous stream into the steam chest and cylinder, and the quantity of the stream easily controlled by the regulating steam cock.

Improved Plow.

Hugh D. Smith, Richmond, Va.—By suitable construction, the beam may be moved up or down upon its standard, a cleat keeping it always parallel with its former position.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

W. F. M. will find directions for making cement for mending rubber garments on p. 203, vol. 30.—L. F. P. will find a recipe for lard oil on p. 283, vol. 30. Furniture polish is described on p. 315, vol. 30. Cutting glass is detailed on p. 331, vol. 30.—C. W. will find a recipe for wood filling on p. 347, vol. 31.—J. W. will find recipes for black and red ink on pp. 203, vol. 29, and 200, vol. 30.—S. S. can make a polishing starch by the recipe given on p. 203, vol. 31.—T. H. D. S. can make a T square by following the directions on p. 165, vol. 30.

(1) J. A. McI. asks: How can I make Britannia metal? A. Melt together 8 ozs. shruff or dross brass, 2 lbs. regulus of antimony, and 10 lbs. tin.

(2) C. A. D. asks: What is wire-drawn steam? A. Steam which has its pressure reduced by the resistance of passages.

(3) D. W. G. asks: What can I use to coat the inside of a small brass tube with, that will effectually resist the action of vinegar and spirituous liquors? A. We have seen it recommended in similar cases to use tannate of gelatin.

(4) N. H. V. asks: Does the volatile fluid sulphide of carbon contain carbon in solution? A. From 1 oz. bisulphide of carbon, 404·21 grains sulphur and 75·79 grains carbon may be obtained; yet the carbon cannot be said to be in solution, but in chemical combination with the sulphur. So also with all the compounds containing carbon. Carbon, in its free state, is insoluble in acids or alkalies.

(5) S. E. A. asks: 1. At what temperature does platinum fuse? A. Experiments made by Dr. Deville give the fusing point of platinum to be between 2600° Fah. and 2696° Fah. 2. At what temperature will a compound of silver with one third platinum fuse? A. Direct experiment is your only resource to find the melting point of your alloy.

(6) J. H. A. asks: 1. Will oil in which steel is hardened lose its hardening property? A. Yes. It must be kept up by a supply of melted resin stirred into the oil when warm. 2. Which is the best oil for steel? A. Pure Straits whale or sperm oil. Be sure that it is free from any mixture of mineral oils.—J. E. E., of Pa.

(7) W. W. says: I separated some fine powder from hard coal ashes which are wasted. Is it useful for anything? A. Such ashes have been used for cleaning tin ware for a long time with satisfaction, still it is doubtful whether ashes could be used in this way at present with pecuniary profit as a commercial undertaking.

(8) C. E. P. asks: What process does carbon undergo in order to form it into crucibles? A. Black lead crucibles are made of two parts of graphite and one of fire clay, mixed with water into a paste, pressed in molds, and well dried. Graphite or plumbago is an allotropic form of carbon. It is also used in the manufacture of lead pencils.

(9) A. E. S. asks: 1. How can I fix lard so that it will remain in a soft or liquid state in cold weather? A. Try mixing the lard with a small quantity of kerosene oil, which may be deodorized by digesting for a short time on chloride of lime. 2. Would it be safe to mix it with alcohol for burning in a lamp? A. We would not recommend alcohol as a solvent in this case.

(10) F. F. V. says: On p. 304, vol. 31, is a paragraph on the crystallization of tin. Could this be so arranged as to do away with the platinum capsule? A. Any metallic vessel not attacked by the solution, or one made of carbon, will answer the purpose as well.

What impurities does sheet zinc commonly contain, and how may they be removed, so as to leave it comparatively pure? A. Commercial zinc contains a small quantity of lead, iron, and of a peculiar carbonaceous matter, besides (occasionally) traces of arsenic and of copper. The best method of obtaining the metal in a state of purity consists in transmitting sulphuretted hydrogen gas through a slightly acidulated solution of sulphate of zinc, filtering from any precipitate that may be found, (and after boiling the solution, in order to expel the sulphuretted hydrogen) precipitating the zinc in the form of carbonate by the addition of carbonate of soda. The carbonate when ignited is converted into the oxide of zinc, which must be distilled in a porcelain retort with charcoal prepared from loaf sugar.

What is block tin, and how may it be reduced to pure tin? A. Block tin is a name given to the metal to distinguish it from tin plate (sheet iron superficially covered with tin). The tin which is imported from Banca and several other places is almost chemically pure. English tin usually contains small quantities of arsenic, iron, copper, and lead, and often traces of gold. When required in a state of perfect purity, the metal may be obtained by means of voltaic action. For this purpose a concentrated solution of tin in hydrochloric acid is placed in a beaker, and water is cautiously poured in without disturbing the dense solution below. If a bar of tin be plunged into the liquid, beautiful prismatic crystals of pure tin are gradually deposited upon the bar, at the point of junction between the metallic solution and the water.

(11) H. K. G. asks: I have on hand 15 or 20 barrels cider, which I wish to make vinegar of. It is nearly 3 years old, but will not become sour, though it is no longer sweet. How can I make this sour? A. Try the following plan: Put some of the cider in a clean cask and add to it some vinegar containing abundance of mother of vinegar; after some days, if the acetic fermentation has taken place and the souring is going on, add another portion of the cider, and at similar intervals a third and a fourth. When the whole has become vinegar, take out as much as is equal to the vinegar first put in, and replace by fresh cider, and so proceed. The casks should never be but partly full; good exposure to air is necessary, and the temperature should be kept up to 86° Fah.

(12) B. says: I have made a glass prism, to contain bisulphide of carbon. What kind of cement will do for the joints, that will not injure the transparency of the fluid? A. Obtain a quantity of pure white shellac, which dissolve in alcohol. Evaporate until of the consistence of a thick paste. Moderately heat the ends of the glass plates to be joined, and immediately apply the shellac paste, and allow to set until perfectly hard. By this means a joint is obtained, which perfectly resists the action of the liquid, and, if ordinary care be taken of it, will remain perfectly tight for a very long time. This recipe is kindly furnished by Wale & Co., instrument makers to the Stevens Institute.

(13) A. B. C. asks: 1. There has been a controversy between us as to whether the use of bituminous coal as fuel in dwelling houses is attended with any injurious effects to the interior decorations, gilded work, etc. Is this so? A. When the coals contain sulphur compounds, the liberation of sulphurous gases has a still more injurious effect than the deposit of soot mentioned below. But it must be remembered that these pernicious consequences are dependent upon the escape of the products of combustion; and if bituminous coals are used, this escape should be properly guarded against. 2. What relation does English cannel coal bear to the bituminous coals of this country? A. The striking difference between the cannel and the bituminous coal is that the former contains a very much larger amount of volatile combustible matter. The English cannel coal has 66 per cent of this volatile matter, the Breckenridge from 56 to 72 per cent, the Pittsburgh bituminous has but 33 per cent. In burning there is a corresponding formation of thick sooty flame, and a likelihood, in cases where this combustion of the gases and soot is not perfect, of a deposit of soot.

(14) A. J. H. asks: 1. Will cast iron stills do for distilling spirits? A. Such stills have not been used for this purpose. Some more heat would be required for a cast iron than a copper still, and the iron would rust to some extent. But it would be safe to try such a still. 2. Will a lead worm do? A. It would be better to use a tin-lined lead pipe for the worm, since liquids running through lead pipes sometimes form lead salts which are poisonous. In fact worms of block tin are used in chemical laboratories, where it is desired to distil with the greatest freedom from impurities. There would be a tendency in the tin-lined lead pipe worm to sag with the heat, on account of the metal not being as stiff as copper; but this can be prevented by properly supporting the different parts of the worm.

(15) G. McI. asks: How is chlorate of potash made? A. Chlorate of potash may be economically obtained by exposing to a current of chlorine gas a mixture, in a slightly damp state, of 69 parts carbonate of potash, and 168 parts of caustic lime, previously reduced to the state of hydrate; chlorate of potash, carbonate of lime, and chloride of calcium are formed; boiling water dissolves both the chloride of calcium and chlorate of potash. The two salts are easily separated by crystallization, as the chlorate requires 16 parts of cold water for its solution, and the chloride is soluble to almost any extent. We would not recommend one, destitute of experience in such matters, to undertake its manufacture.

1. In making the calcium light, what kind of lime is used? A. The best results may be obtained with quicklime, freshly burned, free from sand, and perfectly dry. 2. How often can the same piece of lime be used, the piece being 2 inches by ¾ of an inch thick? A. It cannot be used for more than a few hours, for the reason that, from the intense heat that it is subjected to, it becomes disintegrated and partially vaporized.

(16) J. S. S. asks: 1. Is there any mode of constructing a bearing so as to dispense with brasses, when the journal or pivot has a travel back and forth of about 90°, the work or pressure being constant, and from 1,000 to 3,000 lbs., according to the size of machine? A. You can use such a box as you suggest, if you make it with ample bearing surface, and provide it with sufficient means of lubrication. Secure the thimble in position. 2. Are friction and wear greater where the journal makes an entire turn than where the travel is back and forth? A. The power required to overcome friction is ordinarily greater in the latter case, on account of the constant stopping and starting incident to the reciprocating motion. 3. I want to use a toggle lever attached to the connecting rod of an engine (revolutions 200 per minute). There is a journal or pivot at each end of toggle lever, and brasses will not work well. Can I, for 3,000 lbs. pressure, use a 2 inch steel pivot working in a casehardened iron thimble fitted in each end of toggle lever? Should the thimble be free in its hole in end of lever, or should it be shrunk in while the lever is hot?

(17) C. S. M. asks: I want to raise water by a hydraulic ram from the foot of the hill, on which my house stands, to the cistern in the attic, a vertical distance of 90 feet. I have a steady but small spring with a fall of 20 feet. How many gallons must be discharged from the spring through the best approved ram to raise one gallon into the cistern? A. See article on hydraulic rams, p. 259, vol. 31.

(18) G. W. S. asks: What is the difference between the Griffiths and the Hirsch propellers? A. The blades of the two screws are differently shaped, and in the Hirsch propeller the pitch expands from hub to periphery as well as in the direction of the axis.

(19) C. W. S. asks: We have a cross cut saw hanging up in the shop. On some days the strokes of the hammer will create a greater effect upon the saw than usual. It sounds as if some person had struck it a light blow with a mallet, the sound being clear and distinct. The quicker the strokes while driving a nail, the greater the effect. Has the purity of the atmosphere anything to do with this? A. We think not.

(20) F. C. S. says: 1. We are somewhat bothered in sawing frozen pine logs with a 56 inch circular saw. She will run all right in any other kind of wood. What is the reason of this? A. What is known as sapling pine, when frozen, is about as difficult timber to saw as can be found. The extreme points of the teeth must be wider than the plate of the saw, and very sharp, with the under side wider than the upper part of the tooth, so as to present a very sharp cutting edge to the timber. 2. Does it take a different kind of saw for sawing frozen pine? A. When timber is frozen, it generally requires less set in the saw than when it is not frozen.

(21) T. C. W. says: I melted 1 lb. each resin and pitch together in an iron vessel; then, while hot, I poured the contents of the vessel into a wooden mold in the shape of a brick; but I found, after the mixture got cold and hard, that I could not get it out of the mold; it adhered to the wood. Please to tell me how to construct a mold so that the substance will readily come out when cold. A. Try covering the surface of the mold with a thick coating of plumbago.

(22) A. V. P. says: There was in December, for some days, a very bright star visible in the east just before sunrise, very nearly over the sun, I think, rising a few minutes after six, or about one hour and twenty minutes before the sun, and visible until a few minutes after the sun rose to the naked eye. This morning it looked four times as large as a star of the first magnitude, owing possibly to the fine condition of the air. What star is it? A. Venus. 2. About two weeks ago we were astonished at the unusual brightness of a star rising in the E., or a little S. of E., just before 9 P. M. It rivalled Venus at her brightest, and its light flashed in our field glass, fairly lighting it up. After getting up into the heavens, it lost much of its brightness, and since then it has not been half so conspicuous. What is it? A. Sirius.

(23) C. N. G. asks: 1. What is the size of the largest telescopic lens now in use? A. There are now completed two similar Clark equatorials, 26½ inches clear aperture, and 26 feet focus. The crown lens is double convex, of equal curvature on each side, 13 feet radius. The flint lens is 12 feet 8 inches radius on the concave side, nearly flat on the other. 2. What is its value? A. $50,000. 3. Can lenses be made any size? A. The largest disks now obtainable are 30 inches in diameter, price $10,000 per pair. Two 30 inch achromatics and a silvered glass reflector of 6 feet 6 inches aperture are now being made in Europe. 4. Can large ones be made as rapidly in proportion to their size as small ones? A. No.

(24) J. C. says: 1. We learn that the moon by her attraction produces the tides, and that attraction is in inverse proportion to distance (less distance, more force). When the tide is 72 feet high, moon's attraction is increased and earth's attraction decreased. Why does not the water continue to rise and go to the moon? A. Because the earth is nearest. 2. Why does the earth turn on its axis? A. Because the primeval nebula rotated as it condensed.

(25) C. M. asks: 1. In your issue of November 7, in answer to A. H., who asks how to prepare the glass for a camera, you say that lead-faced chucks are cast of the proper curvature, and the lever is held upon the chuck by a wooden handle attached with pitch, while sand and water are applied. Would not hard-tempered steel answer the same purpose as lead chucks? A. No; brass or iron grinders follow the roughing out. 2. Are microscopic objectives ground in the same manner, that is, with lead-faced chucks? A. Microscope lenses are roughed out on a lathe with a steel tool dipped in turpentine, or a diamond pinched into a copper rod, then ground in one of a pair of brass chucks alternately with the chuck of opposite curvature.

(26) W. P. & Co. ask: Is it practicable to discharge water from a centrifugal pump eight feet below the surface of the water? The discharge pipe is 22 inches diameter, the pump making 220 revolutions per minute. The lift of the suction pipe is from 4 to 6 feet, and the pipe is 22 inches in diameter also. A. It can readily be done with a good pump.

(27) J. W. asks: What boiler, engine, and wheel are required to propel, at 12 miles per hour, a boat of 36 feet keel, 10 feet beam, 3 feet draft, and sharp bows? She was built for sails. A. Cylinder 7x9 inches, boiler 4 feet diameter, 6 feet high; propeller from 32 to 36 inches diameter with 4 feet pitch.

(28) G. H. B. asks: What would be the effect on the cables of the new Brooklyn bridge (when completed) of a fire under that part of it extending over the tops of buildings? A. It

would depend so much upon the attendant circumstances that we could not give a general answer, except to say that, if our fire department were to act as efficiently as it usually does, the cable would probably not be injured.

A course for a boat race is three miles long, measured on the shore of a river. At slack water a rower can row the distance in 20 minutes. How long would it take him to row over the same course with the current of 1½ miles an hour, and how long also against the same? A. See p. 202, vol. 31.

(29) G. E. M. says: 1. How many horse power would it take to run a dummy on a 20 inch gage railway, not over 30 feet grade to the mile, hauling weight 8,000 lbs. at a rate of not over 10 miles per hour? A. It would probably require 2 or 3 effective horse power. 2. What style of engine would be best? A. A pair of vertical engines would answer very well.

(30) J. C. W. asks: 1. What kind of stove is best adapted to the use of coke, and could the same be economically used in the place of anthracite coal at about half the price per ton? A. A stove with open grate would be the best. We scarcely think there would be any great economy in this arrangement; but if it proved efficient, you would have a very cheerful and healthy fire. 2. Would it do to mix coke and coal for use in an ordinary coal stove, a self-feeder? A. It seems to us that the action would be somewhat the same as if wood were mixed with the coal. We have never tried the experiment, however, which is the only way to settle the matter.

(31) O. W. R. says: I have an engine of 1 inch bore x 3 inches stroke. It makes 500 revolutions per minute, and cuts of at ¾ stroke. Fly-wheel is 1 foot in diameter and 1 inch wide, weighing 10 lbs. What power could I get by running it at a pressure of 50 lbs. per square inch? A. You might realize about ⅙ of a horse power. 2. What kind of a boiler should I use? A. A cylinder boiler would answer very well.

(32) R. H. S. says: I dissolved a three cent nickel coin in nitric acid: after filtering, I poured in a solution of soda of commerce, then added spirits of ammonia, and precipitation commenced. I washed with pure water, and had a green mass. What is it? A. You first formed a solution of nitrate of nickel and nitrate of copper. On adding the soda, you neutralized the nitric acid in excess of what was needed to convert the metals into nitrates. On adding ammonia (in case you added it in proper quantities) you threw down a greenish blue precipitate of a copper salt, together with a little hydrated oxide of nickel. If you had used potash, you could have effected the precipitation more perfectly. This residue cannot be used for plating.

(33) C. H. asks: What is the cheapest way of obtaining 1,000 cubic feet of oxygen? Perfect purity is not required. A. Oxygen may be obtained on a small scale very readily by simply heating in a close retort a mixture of 4 parts chlorate of potash and 1 part black oxide of manganese. If large quantities are desired, the continuous process of T. du Motay may be employed. The principle of this process resides in the fact that the manganates and permanganates of potash, soda, and baryta, the ferrates and chromates of the same bases, and in general all metallic oxides and acids which will form, with potassa, soda, or baryta, binary compounds capable of superoxidising, possess the property of yielding their oxygen, at a more or less elevated temperature, when they are submitted to the action of a current of steam. These bodies, thus deoxidized, also possess the property of reoxidizing themselves when they are exposed to a temperature more or less great. The atmosphere is therefore the constant source from which the oxygen is derived. The mode of operation is the following: One of the binary compounds just enumerated is placed in a distilling vessel, whether at the maximum or minimum state of oxidation. If the compound is in the latter condition, it is oxidized by means of a current of air mechanically drawn over it; if at the former stage, it is deoxidized by means of a current of steam. The oxygen and steam, on issuing from the mouth of the retort, pass together into a condenser, where the steam is separated by condensation, while the oxygen passes over into a gas holder, and is there collected. When all the utilizable oxygen has been disengaged by the steaming process, the action of superoxidation by means of the air current is recommenced. By this alternate process the oxygen is generated as long as may be required.

(34) J. A. H. says: We have heard lately considerable difference of opinion about the distance boilers should be set from the grates. Some parties claim that 6 feet is better than less; others say 3 or 4 feet. I am satisfied that there is economy in having plenty of space. Can you tell what would be the most economical distance to set a 60 inch shell, tubular boiler with 4 inch flues, 16 feet long? A. If by "from" you mean "above," we should say that for burning coal, with natural draft, it would probably be well to set the boiler not more than 30 inches above the grate, which would make 5 feet from center of boiler to surface of grate.

(35) R. K. asks: What is the best mode of setting steam boiler furnaces? Some claim that it is best to have a space of from 3 to 6 feet between the grates and boiler, and the same space for fire bed along the length of the boiler. A few of this class claim that it is not best to have a bridge wall, as they want the above space for the whole length of the fire bed. Others claim that from 12 to 18 inches space between boiler and grate is enough, with a bridge wall at back of grates. A. We do not believe that any authoritative rule can be given that will apply to all cases. From our observations, we should judge that both parties have good reasons for their opinions, since we have seen boilers set in both ways that did well. A bridge wall is generally convenient in working the fire. The most common practice in setting boilers is to place them from 1½ to 2½ feet above the grates.

(36) C. H. asks: I have several times noticed the chimneys of my kerosene lamps break without apparent cause. Sometimes they were being carried, at others they were on the table in a warm room. Can you tell me the reason for such constant breakage? A. We must class these occurrences with the unexplainable one of the vase that went into a thousand pieces just before the maid of all work was going to dust it.

(37) J. H. S. asks: What advantage is derived by running a main belt at 3,368 feet a minute, when the driven belt only requires 527 feet in the same time? What law governs it? A. The greater the speed of a belt, the less tension it requires to transmit the same power.

What is the expansion of steam pipe, when heated, per foot? A. Its length is about $\frac{1}{818}$ greater at 212° Fah. than at 32°.

(38) J. & H. ask: Does the use of coke in ordinary stoves, with cast iron or brick-lined fire pots, injure the stoves? A. Not unless you allow the iron to become unduly heated.

(39) H. C. W. asks: 1. Is the air in the air chamber of a hydraulic ram or force pump absorbed and carried off by the water? A. It is absorbed by the water to some extent. 2. If cast iron is used for such chambers, can it be rendered impervious to air by japanning or glazing, or any other means? A. An ordinary cast iron air chamber will answer well enough for most cases.

(40) I. F. asks: Is there any way by which printing ink may be removed from paper without materially injuring the same? The paper in question is heavy writing paper, and could bear a good deal of rubbing without tearing. A. We know of no better method than that of acting upon it with some solvent, such as turpentine or benzine.

(41) D. J. asks: What colors can I mix to make pearl gray paint? A. Any white pigment with a little blue black.

How can I separate gold from silver? A. The silver and gold may be parted by treating the alloy with very pure aquafortis. In order that this process should succeed, it is necessary that the silver should be as two or three to one of gold; also that the acid should be pure.

Is there any work on mixing of pig iron to produce the different grades of bar iron? A. Read Bauermann's "Treatise on the Metallurgy of Iron," or "The Practical Metal Worker," by O. Byrne.

(42) J. J. T. asks: Does a revolving body, such as the fly wheel of an engine or two weights revolving on arms, weigh as much when at rest as when in motion? A. Yes.

(43) J. W. asks: Can you tell me anything about the Keely motor of Philadelphia? I have seen scientific men, who have seen the power generated and run off, who say it is a fact and can be utilized. Have you seen it? Do you believe in it? Do you know anybody connected with it? Tell me all you know or think of it. A. The Keely humbug was shown up in our paper last year.

(44) W. P. asks: What is the best means of polishing leather? A. After the usual process of currying, the hide or skin, being rendered flexible and uniform, is conveyed to the shed or drying house, where the greasy substances are applied, which is called dubbing (daubing) or stuffing. The oil used for this purpose is prepared by boiling sheep or doe skins in cod oil. Before waxing, the leather is commonly colored by rubbing it with a brush dipped into a composition of oil and lampblack on the flesh side, till it is thoroughly black; it is then black sized with a brush or sponge, dried, tallowed with the proper cloth, and "slicked" upon the flesh side with a broad, smooth lump of glass, sized again with a sponge, and dried.

(45) P. R. S. asks: 1. What is the correct chemical formula of the double sulphate of nickel and ammonia? A. $Ni(NH^4)^2(SO^4)^2.6H^2O$, in the new system, or NiO,SO_3+NH^4O,SO_3+6HO in the old system. 2. Can I use cast zinc cylinders for Bunsen batteries, and how should I prepare them? A. Yes. First dip them in dilute sulphuric acid, and then rub them with mercury by means of a piece of flannel. You should experience no other trouble, if your connections are properly made. 3. Which are the right proportions of water and sulphuric acid for a Bunsen battery? A. One of acid to ten of water. 4. How can I obtain the nickel in a metallic state out of a mixture of it with nitric and sulphuric acids, most of it being sulphuric acid? A. On a small scale, the method of electrolysis will probably answer your purpose best.

(46) B. C. asks: How is cider made to effervesce? A. By bottling while the fermentation is still going on. In this case the carbonic acid gas generated in the process of fermentation is imprisoned in the liquid in the bottle, and escapes violently when, on drawing the cork, the pressure is removed. 2. What gives it the biting taste? A. It is due to the vegetable acids present—malic and acetic acids.

(47) P. I. says: I want a cheap vessel of 100 gallons capacity to boil a mixture, in containing 4 per cent of sulphuric acid, over an open fire. Is there anything cheaper than a copper tank? Will lead or nickel-plated iron do? A. For this purpose lead is out of the question, as it is a poor conductor of heat, and would speedily be burnt through. As to nickel, we have tried the experiment in the following manner and with results as stated below: First, a suitable vessel was coated on the interior with an even coating of nickel by galvanic action, filled with a solution containing 4 per cent of sulphuric acid, and gradually brought to the boiling point; in about half an hour (the solution being kept at about the same density by the addition of water from time to time) the nickel was found to be entirely dissolved. For your purpose we can recommend large porcelain-lined iron pots, which may readily be obtained, and at a much smaller cost than either of the above.

(48) A. F. O. says: 1. Is bichromatized glue insoluble in water? A. It is insoluble in water only after being exposed in thin films to the action of light. 2. Is it also as insoluble, in alcohol, as it was before the bichromate was added? A. Yes. 3. What proportions of glue and bichromate are used to produce the best result, and how should they be treated? A. Make a strong solution of isinglass in pure distilled water; for this purpose the water should be hot. Add to this as much bichromate of potash as it will dissolve; allow to stand. When cold, decant from the crystallized salt.

(49) J. McL. asks: How can I make ink for writing on zinc labels? A. Dissolve muriate of ammonia and crude sal ammoniac in strong vinegar.

(50) C. A. L. asks: How can I burnish silver plating? A. Use a tool of hardened cast steel or bloodstone.

(51) H. W. S. says: To find the radius when the length of chord and hight of arc are given: Let x=distance from center of circle to chord; then, by well known properties of right angled triangles, the value of x can be found, and x+hight of arch =radius. But I give a simpler rule. To the square of half the chord, add the square of the hight and divide the sum by twice the hight. This will give the radius, or $\frac{(\frac{1}{2}\text{chord})^2+h^2}{2h}=r$.

(52) R. L. DuB. says, in answer to several correspondents who ask as to burning sawdust: I erected a saw mill in New Jersey. The boiler was a return tubular, 14 feet 6 inches long and 54 inches in diameter, with 64 three inch tubes, and brick firebox 48x56x27 inches high; bridge wall was 7 inches at center, rounded to the sides of boiler. I had to use coal for a few weeks and lined the firebox down to ⅝ the above size. After making sufficient sawdust, I endeavored to run with that and slabs, and I found it hard to keep up steam enough to run an hour steadily. I experimented until I reached the following result: I made the firebox the original size, lowered the bridge wall 13 inches (keeping the same circle as before), lowered the paving in rear of firebox to a level with the grate bars, and obtained a barrel of furnace slag from 3 to 7 or 8 inches in size and 1 or 1½ inches thick, which I placed on the grate bars, about half covering them. I fired with wood; and when the slag got heated, I threw in the sawdust, which burned very well but smoked fearfully (clouds would arise from the smoke stack). I then introduced a 2 inch pipe, with about fifty ¼ inch holes, directly behind the bridge wall, leaving both ends of pipe open; after which, I never had a particle of trouble either in keeping up steam or in burning up the smoke. Not even in firing up did I ever see any smoke come out of the stack, which was 30 feet high and 32 inches square, enlarged near top and to the top to 36 inches inside measurement. I forgot to state that I covered the top of boiler with sheet iron, then laid brick on it, covering the interstices with sand. The sheet iron was to prevent the sand from wedging off the wall when the boiler expanded.

(53) V. M. J. says, in reply to J. C. W., who has small success in burning slack or fine soft coal: "From personal knowledge, I can say that neither unusually strong drafts, nor close bars, are necessary. We have a boiler 15 feet long by 4 feet 3 inches diameter with 51 four inch flues, connected with a stack 101 feet high, with a round 3 feet flue hole in it. Originally the boiler had common cast iron grate bars under it. Length of bars was about 4 feet, and the grate was 4 feet 8 inches wide. With this arrangement, ordinary lump coal was used; but owing to the quality of coal and the amount of steam required for power, it was very difficult to fire for 5 hours and keep clinkers off the bars; and at noon and night, it required hard and hot work to get the bars in good order. Three or four years ago, a change was made in the grate bars, substituting those now in, which are the same width as formerly, but 8 feet long, being more than half the length of boiler. The bars are made in short pieces, half the length in width, and supported by cross bars. The openings in bars are about ⅝ x 2½ inches, and the ribs of bars about ⅝ inches wide. Immediately inside of furnace doors, at end of boiler, is a shelf of fire brick, on line with grate bars, on which the fuel may be thrown. Also, at side of boiler and back end of grate bars are doors and similar arrangements, as at front of boiler. The doors are provided with dampers for regulating draft, both for furnace and ash pit. Damper in breech just at entrance to chimney, and boiler about 23 inches above the grate, complete the general arrangement. With this arrangement, common slack is used successfully, requiring less in quantity than coal formerly used, being much easier to fire, and with the great advantage of having the bars free from clinkers, from the draft not being so intense. Good judgment and experience in firing with this arrangement will insure the almost complete combustion of the smoke. The same kind of bars were put under a boiler which had a stack 65 feet high, with satisfactory results. The bars have been furnished in other cases, and wherever used will soon repay the expense of the change from the old style, on account of better combustion, and being able to use a cheap kind of coal.

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

J. E. C.—It consists of silica, which, under the microscope, appears as extremely small transparent grains. It may be used for polishing, or as a detergent (alone or along with rouge or saponaceous substances), or as a base for siliceous paints, or in soluble glass, or in glassware, glazes, etc.—T. S. C.—The specimen sent was found to consist of silica, silicate of alumina, carbonate of lime, carbonate of magnesia, oxide of iron, and sulphate of lime. It is a very poor conductor of heat, and would largely prevent the heat from passing to the water, and thus the iron would be overheated.—G. A. F.—A most careful analysis of this specimen was made, and revealed not a trace of nickel. Why did you form the opinion that it was an ore of iron and nickel?

(17) D. J. C. asks: Supposing a man is pulling a boat in smooth water in a dead calm, at the rate of a mile in 10 minutes, and to accomplish this he is compelled to pull thirty strokes per minute with a pulling force of 50 lbs. to each stroke. The oars are ten feet in length, weigh 10 lbs. each, the weight of the oar being equally distributed along its full length, so that you can balance it horizontally by holding it on your finger in the center of its length. The oars extend outside the rowlocks 7½ feet: the oarsman has to make the recover in ½ the time it takes to pull the stroke. What percentage of the pulling power is required to make the recover?—J. E. B. asks: How can pearl be dyed of various colors, using aniline?—H. P. asks: How can I imitate twist on a gun barrel?—E. B. L. asks: How can I make blacking for boot sole edges?—F. S. V. asks: How can I make soap for blowing bubbles that will last?—D. D. F. asks: Can any one give me some information as to the raising of hops, the distance apart, manner of cultivation, when to pick them, etc.?

COMMUNICATIONS RECEIVED.

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

On Rapid Transit in New York City. By G. R. N.
On the Motions of the Heavenly Bodies. By W. I. L.
On the Sun's Orbit. By J. H.
On the Epimethean Gods. By G. H.
On Oscillating Saloons on Steamers. By A. de B.
On Theories of Spiritualism. By S. C. F.
On the Highest Lakes. By C. R.
On Small Steam Engines. By G. F. S.
On Hollow Bolts. By J. B.
On Ornamenting Locomotives. By H. W. G.
On Diphtheria. By S. D. F.
On High Lakes. By H. R. S.
On Weights and Measures. By S. P. L.

Also enquiries and answers from the following:
N. B.—T. B. B.—W. W.—J. B. S.—W. J. B.—C. B. S. B.—W. C.—J. D. C.—M.—M. McC.—J. B. B.—H. P.

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 enquiries analogous to the following are sent: "Who makes machines for preparing peat for fuel? Who makes machines for shaping ax and broom handles? Who makes machinery for working flax fiber? Who sells plane guides? Who sells decalcomaine pictures? Who makes domestic gas machines? Whose is the best covering for steam pipes? What is the best preventive of boiler incrustation?" All such personal enquiries 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 January 12, 1875, AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Acid, liquid carbonic, H. Beins (r)	6,220
Air cooling apparatus, etc., E. E. Page	158,599
Bag fastener, J. Macphail	158,722
Bale tie, M. D. Copeland	158,683
Bale tie, J. W. Philp	158,733
Bandage winder, A. M. Cone	158,680
Bedstead, bureau, C. Brada	158,670
Bench vise, C. Burton	158,674
Bird cage attachment, G. Fleidner	158,696
Bird cage mat, O. Lindemann (r)	6,231
Blind slat adjuster, D. Aaron	158,562
Blind stop, J. Dougherty	158,690
Blind stop, A. T. Elford	158,634
Boiler for water heaters, W. Taylor	158,755
Boiler, sectional steam, J. F. Taylor	158,754
Boiler, water and steam indicator, W. L. Carman	158,675
Book rack, D. J. Stein	158,751
Books, rounding and backing, J. E. Coffin	158,679
Boot lasting, G. W. Copeland	158,682
Boot sole edges, trimming, R. F. Burns	158,569
Boot soles, imitation stitch on, Dunbrack & Vesey	158,633
Brick machine, W. E. Gard	158,584
Brick truck and stand, W. E. Gard	158,583
Brush, tooth, C. Bulkley	158,673
Burial case, G. Van Winkle	158,654
Burner, gas, A. Fulton	158,582
Burner, lamp, J. Gleason	158,700
Butter tub, J. G. Koehler	158,592
Button, shirt and collar, J. B. Carter	158,624
Can, oil, F. Lehr	158,721
Car coupling, J. Hardey	158,705
Car coupling, P. F. McClure	158,597
Car coupling, D. McCurdy	158,724
Car coupling, G. T. Perkins	158,731
Car coupling, A. Wonderly	158,663
Car door, freight, G. W. Phelon	158,732
Car platform, street, J. B. Slawson	158,749
Car replacer, R. D. Watson	158,656
Car starter, A. S. Gear	158,585
Car truck, J. A. Anderson	158,56[illegible]

Car truck, railway, J. Turner ... 158,780
Car wheel, W. J. Cochran ... 158,678
Carriage seat, extension, J. V. Randall ... 158,738
Carriage step, G. A. Keene (r) ... 6,229
Carriage and sleigh handle, Hawks and Hill ... 158,706
Cartridge shells, heading, S. W. Wood ... 158,614
Casting ingots, mold for, Foster & Lockwood ... 158,696
Chair foot rest, T. Head ... 158,637
Chimney guard, R. Priseman ... 158,602
Cigars, packing, S. Jacoby ... 158,714
Cistern top and filter, E. D. Stacey ... 158,605
Clock movement holder, W. H. Brickett ... 158,619
Clutch, machine, A. B. Bean (r) ... 6,215
Coal, etc., from hopper, feeding, J. B. Wilford ... 158,769
Coal, etc., loading, C. B. Bass ... 158,567
Column, iron, G. B. Davids ... 158,689
Conservatory, window, J. T. Crawford ... 158,686
Cooler and filter, water, A. H. Peterson ... 158,649
Cooler, milk, L. J. Roberts ... 158,603
Copying press waterproof pad, C. & J. G. Rowland 158,651
Corn sheller, L. B. Holt ... 158,711
Cuff, J. W. A. Cluett ... 158,627
Culinary vessel, G. R. Moore ... 158,598
Cultivator, R. S. Higgins ... 158,709
Cultivator, revolving, N. S. Wood ... 158,663
Cultivator, wheel, J. Stofford ... 158,752
Curtain fastening, Weller and Hopkins ... 158,658
Cylinders, lining for, E. Hill, Jr. ... 158,587
Dental handpiece, J. W. Gilbert ... 158,635
Digger, post hole, W. M. Ryan ... 158,609
Dish washer, W. N. Cosgrove ... 158,684
Ditching machine, H. H. Gray ... 158,701
Drawing rolls, clearer for, Gambrill & Sheridan ... 158,698
Dredger, G. Kuhn ... 158,717
Drill, rock, J. Hanrahan ... 158,704
Dryer, lumber, H. S. Taylor ... 158,753
Drying apparatus, W. J. Johnson ... 158,590
Elevator, L. L. Whitlock ... 158,613
Elevator grain, H. I., P. F., & E. D. Chase (r) 6,227, 6,228
Engine, compound, S. Archbold ... 158,666
Engine, hand fire, H. Numeyer ... 158,729
Engine, rotary, O. Adams ... 158,654
Engine, rotary, J. S. Fairfax ... 158,579
Engine, rotary, E. Frank ... 158,697
Engine, traction, W. C. Luce ... 158,595
Evaporator, centrifugal, Wendel and Florich ... 158,764
Excelsior, machine for making, J. G. Moore ... 158,647
Fabric, compound, G. V. Shepard ... 158,746
Fare registering device, J. A. Brown ... 158,568
Faucet, H. B. Leach ... 158,593
Fence, portable, J. W. Johnson ... 158,589
Fire arm sight, T. Dunstone ... 158,577
Flour bolt, D. T. Choat ... 158,626
Forms, turning irregular, B. H. Connor ... 158,629
Fruit picker, B. F. Price ... 158,736
Furnace and atomizer, hydrocarbon, R. D. Turner. 158,759
Furnace, boiler, E. P. Chancellor ... 158,625
Furnace grate bar, C. Toope ... 158,757
Fuse, electric, C. A. and I. S. Browne ... 158,672
Game apparatus, C. B. Wainwright ... 158,655
Gas governor, F. W. Wiesebrock ... 158,768
Gas regulator, F. W. Wiesebrock ... 158,767
Globe, E. E. Fitz ... 158,581
Grain cradle, J. W. Settle ... 158,745
Grain drill, J. King ... 158,716
Grain for starch, etc., treating, Adamson *et al.* (r) 6,226
Grain scourer, D. M. Richardson ... 158,740
Grass and bristles, etc., cutting, J. Pickering ... 158,650
Grate, J. B. Larkin ... 158,719
Grate, A. Richmond ... 158,741
Grate, J. D. Slichter ... 158,750
Hame fastener, O. M. Coburn ... 158,628
Harvesters, C. W. and W. W. Marsh (r) ... 6,223, 6,224
Harvester and thrasher, broom corn, E. C. Hinton 158,638
Harvesters, etc., wheel for, B. G. Turner ... 158,758
Heater, fire place, W. L. Phillips (r) ... 6,233
Heater, radiator, steam, C. C. Walworth ... 158,612
Heaters, boiler for water, W. Taylor ... 158,755
Hides and skins, unhairing, H. Mower ... 158,648
Hinge, D. W. Long ... 158,643
Hose, hydraulic, L. H. Downing ... 158,631
Hubs to axles, attaching, B. B. Howard ... 158,639
Hydrant, M. Burnett ... 158,622
Ingot mold, T. P. Moorwood ... 158,728
Ironing board and step ladder, I. L. Landis ... 158,718
Jack, lifting, J. Beers ... 158,615
Jar, covered, W. C. King (r) ... 6,222
Journal box, Deming and Wickes ... 158,575
Ladder, fire escape, Oberndorf and Frank ... 158,730
Lamp, traveler's, T. R. Almond ... 158,615
Lantern, J. Kintz (r) ... 6,230
Leather dressing machine, J. K. Tullis ... 158,761
Leather, manufacture of, C. J. Tinnerholm ... 158,608
Locking device for slide rests, M. J. Shimer ... 158,747
Locomotive variable exhaust, E. A. Hill ... 158,710
Loom picking mechanism, W. Stearns ... 158,606
Lubricating box, J. Whitaker ... 158,765
Medicine dropper, J. Barnes ... 158,564
Metal bending machine, E. A. Peck ... 158,600
Mill, shoe and die for stamping, W. Hainsworth ... 158,702
Mosquito bar frame, W. F. Howe ... 158,713
Musical instrument, brass, H. G. Lehnert ... 158,594
Nail driving machine, W. S. Watson ... 158,763
Pail, sectional dinner, C. H. Amann ... 158,616
Paper cylinders, drying, J. F. Jones ... 158,640
Paper pulp, manufacture of, J. F. Jones ... 158,641
Photometer balance, electrical, W. W. Goodwin. 158,636
Piles for beams, manufacture of, Z. S. Durfee ... 158,578
Pitman, T. E. Chandler ... 158,571
Pitman connection, L. H. Davis ... 158,690
Planing machine feed roller, Brown and Meyer ... 158,671
Planter, cotton seed, Miller and Reeves ... 158,727
Planter, hand potato, J. Sawyer ... 158,743
Plow, A. B. Farquhar ... 158,580
Plow, Prawl and Wample ... 158,735
Plow beam, C. Kimplen ... 158,642
Plow beam, metal, M. McDowell ... 158,725
Plow irons, roll for welding, W. M. Watson ... 158,657
Polishing wheel, elastic clamp, Bannister *et al.* ... 158,617
Press, screw, J. J. Crawford ... 158,695
Presser feet to bars, attaching, J. J. Schneider ... 158,544
Printing, letter press map, C. H. Waite ... 158,611
Privy vaults, cleaning, S. B. Scharf ... 158,748
Propeller, screw, E. B. Porter ... 158,734
Purifier, middlings, J. W. Wilson ... 158,771
Quilting frame, T. N. Wheeler ... 158,659
Radiator, automatic valve, J. Elder, Jr. ... 158,692
Railway rail joint fastening, P. McCarty ... 158,645
Rake, horse hay, F. Mast ... 158,723
Reflector and sight protector, M. H. Mendenhall ... 158,726
Refrigerator, S. H. Crump ... 158,687
Resawing machine, J. Gerhardt ... 158,699
Roller and seeding machine, J. H. Holland ... 158,712
Rolling metal, L. Thomas (r) ... 6,216
Running gear, J. Becker, Jr. ... 158,667
Saw gummer, S. L. Tibbals ... 158,756
Saw mill, H. D. Hall ... 158,703
Saw mill dog, W. M. Ferry ... 158,698
Seat support, spring, Hawley & Pearsall ... 158,705
Sewing machine, J. B. McCune ... 158,596
Sewing machine button hole cutter, I. S. Craig ... 158,57
Sewing machine presser roller, M. M. Barnes ... 158,565
Sewing machine tuck marker, J. Y. Detwiler *et al.* 158,576
Shoe nailing machine, P. H. Barstow ... 158,566
Shoe upper, J. L. Perry ... 158,601
Slate frame, S. B. Bushfield (r) ... 6,221
Soap, manufacture of, C. Lehmann ... 158,720
Spike, J. J. Adgate ... 158,665
Spoke tapering machine, P. Coon ... 158,681
Sponge cup, B. Brower ... 158,620
Sponge holder, Conradson & Forsell ... 158,573
Spool machine, G. E. Lyman ... 158,644
Stitch imitation and dividing, C. S. Dunbrack ... 158,682
Stone cutting machine, L. Dutertre ... 158,691
Stone, artificial, J. L. Rowland (r) ... 6,234
Stove, heating, G. Comstock ... 158,572
Stove, magazine cooking, W. B. Treadwell ... 158,623
Stove polish, etc., mixing, J. C. Wightman ... 158,660
Stove, reservoir cooking, G. G. Wolfe (r) .. 6,217, 6,218, 6,219
Straw cutter, J. K. O'Neil (r) ... 6,232
Table ware, covered, H. C. Wilcox ... 158,661
Telegraphic signal apparatus, J. M. Kates ... 158,715
Thills, coupling and uncoupling, F. P. Stone ... 158,607
Tile machine, Chandler & Taylor ... 158,570
Tobacco, plug, C. Siedler ... 158,604
Towel rack, J. A. Reynolds ... 158,739
Toy wind wheel, W. G. Fischer ... 158,694
Trap, fly, J. H. Bustis ... 158,623
Truck, hand, H. M. Underwood ... 158,610
Valve, balanced slide, W. Obenchain (r) ... 6,225
Valve gear, cut off, H. Bilgram ... 158,669
Vehicle spring bolster, H. Buck ... 158,621
Vehicle top joint, T. F. Darcy ... 158,688
Vehicle wheel hub, A. N. Price ... 158,737
Vessel, center board, C. Hemje ... 158,708
Vessels running on shore, preventing, E. D. Gird. 158,186
Vise, bench, C. Burton ... 158,674
Voting apparatus, H. W. Spratt ... 158,652
Wagon bolster, L. F. Whitman ... 158,766
Washing machine, J. S. Shrawder ... 158,748
Washing machine, H. G. Williams ... 158,770
Water closet, R. C. Clark ... 158,697
Water closet valve, E. Mills ... 158,646
Water pneumatic pressure, R. A. Chesebrough ... 158,676
Water wheel, S. N. Knight ... 158,591
Weather strip, W. T. Valentine ... 158,762
Windmill, S. D. Hopkins ... 158,588
Wrench, O. T. Bedell ... 158,668

DESIGNS PATENTED.

7,993.—Type.—D. W. Bruce, New York city.
7,994, 7,995.—Type.—J. Herriet, New York city.
7,996.—Cook Range.—N. S. Vedder, Troy, N. Y., *et al.*
7,997 to 7,999.—Stove.—N. S. Vedder, *et al.*, Troy, N. Y.
8,000.—Medal.—H. G. Brace, N. Y. city.
8,001.—Carpets.—H. F. Goetze, Boston, Mass.
8,002.—Organ Cases.—J. P. Lomas, New Haven, Conn.
8,003.—Carpets.—T. J. Stearns, Boston, Mass.
8,004.—Cook Stoves.—N. S. Vedder *et al.*, Troy, N. Y.
8,005, 8,006.—Stoves.—N. S. Vedder *et al.*, Troy, N. Y.
8,007.—Cassimere.—F. S. Bosworth, Providence, R. I.

TRADE MARKS REGISTERED.

2,159.—Cooking Stoves.—Bonnet & Co., Quincy, Ill.
2,160.—Baking Powder.—Hamilton & Co., Ft Wayne, Ind.
2,161.—Cigars.—S. Lowenthal & Co., Cincinnati, Ohio.
2,162, 2,163.—Pianofortes.—Arion Co., New York city.
2,164.—Nursing Bottles.—M. S. Burr & Co., Boston, Mass.
2,165, 2,166.—Silk Twist.—Copcutt & Co., Yonkers, N. Y.
2,167.—Medicines.—D. Dick & Co., New York city.
2,168.—Cook Stoves.—Fuller & Co., Troy, N. Y.
2,169.—Varnishes.—A. E. Hoppock & Co., Newark, N. J.
2,170.—Soap.—D. F. Packer, Mystic River, Conn.

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

CANADIAN PATENTS.

List of Patents Granted in Canada.

January 8 to January 18, 1874.

4,243.—J. G. Muller and W. Muller, Dayton, Montgomery county, Ohio, U. S. Improvements on apparatus for manufacturing illuminating gas, called "Muller's Gas Machine." Jan. 8, 1875.

4,244.—M. Bray, Boston, Suffolk county, Mass., U. S. A new rivet, called "Bray's Rivet." Jan. 8, 1875.

4,245.—J. Boyle, Toronto City, Ont. Improvements on machinery for molding iron, called "Boyle's Iron Molding Machine." Jan. 8, 1875.

4,246.—C. A. Shaw, Boston City, assignee of H. Halverson, Cambridge, Middlesex county, Mass., U. S. Improvements on lamp wicks, called "Halverson's Carbonized Lamp Wick." Jan. 9, 1875.

4,247.—L. Letourneau, Montreal, Canada. Améliorations aux appareils de securité des navires à vapeur et à voiles contre la mauvaise mer, pour les empecher de sombrer. "Ceinture Bauée, dite de Sauvetage des Navires." Jan. 9, 1875. Improvements in safety apparatus for ships and sailing vessels, to prevent sinking.

4,248.—J. L. Thomson and F. N. Davis, Beloit, Rock county, Wis., U. S. Improvements in the manufacture of paper barrels, called "Thomson's Paper Barrel." Jan. 9, 1875.

4,249.—E. Bussey, Troy, Rensselaer county, N. Y., U. S. Improvements in base burning stoves, called "Bussey's Base Burning Stove." Jan. 9, 1875.

4,250.—G. Williams, Toronto City, Ont. Improvements in friction pulley blocks for carrying wire rope, etc., called "Williams' Improved Semaphore Wire Rope Pulley." Jan. 9, 1875.

4,251.—E. W. Scoville and W. L. Scoville, Manlius, Onondaga county, N. Y., U. S. Improvements in door hangers, called "Scoville's Improved Door Hanger." Jan. 9, 1875.

4,252.—W. I. Jebb and L. F. Harvey, Buffalo, Erie county, N. Y., U. S. Improvements in station tickets, called "Harvey's Improved Station Ticket." Jan. 9, 1875.

4,253.—E. Caswell, L. Whitlock, and S. Scott, Lyons, Wayne county, N. Y., U. S. Improvements on machine for boring hubs, called "Caswell's Hub-Boring Machine." Jan. 14, 1875.

4,254.—S. T. Norman, Toronto City, Ont., assignee of R. D'Ary, same place. Mode of making galvanic electric body wear, consisting of insoles and belts and bands of different forms, called "D'Ary's Curative Galvanic Insoles, Belts, and Bands." Jan. 14, 1875.

4,255.—W. W. Wickes, Brooklyn, Kings county, N. Y., U. S., assignee of J. J. Bate, same place. Improvements on refrigerators, called "Bate's Improved Refrigerator." Jan. 14, 1875.

4,256.—J. L. Thomson and F. N. Davis, Beloit, Rock county, Wis., U. S. Improvements in paper barrels, called "Thomson's Paper Barrel." Jan. 14, 1875.

4,257.—W. M. Comey, Norfolk, Norfolk county, Mass., U. S. Improvements on games, called "Comey's Game of Conquete." Jan. 14, 1875.

4,258.—R. Patton, Montreal, P. Q., assignee of J. M. Maharg, Montreal. Improvements on steam traps, called "Patton's Steam Trap." Jan. 14, 1875.

4,259.—G. M. Bright and F. Barron, London, Eng., assignees of J. H. Banks, of 11 Lavender Road, Battersea, Surrey county, Eng. Improvements on the production of printing surfaces and of engraved metal surfaces applicable for other purposes, called "Banks' Improvements on the Production of Printing Surfaces and of Engraved Metal Surfaces, applicable for other purposes." Jan. 14, 1875.

4,260.—P. Burke, Toronto City, Ont. Improvements on gas carburetters, called "Burke's Improved Gas Carburetter." Jan. 14, 1875.

4,261.—P. B. Myers and S. Rough, Buchanan, Berrien county, Mich., U. S. Improvements on carpet stretchers, called "The Eureka Carpet Stretcher." Jan. 14, 1875.

4,262.—G. C. Thomas, New York city, N. Y., U. S. Improvements on retaining washers for lock nuts, called "Thomas' Lock Nut Washer." Jan. 14, 1875.

4,263.—E. N. Porter, Morrisville, Lamville county, Vt., U. S., assignee of E. E. Foster and M. B. Eaton, same place. Improvements on milk coolers, called "The Morrisville Milk Pan and Cooler." Jan. 14, 1875.

4,264.—A. B. Daniels, Franklin, Norfolk county, Mass., U. S. Improvements on games, called "Daniels' Game of Tourette." Jan. 14, 1875.

4,265.—W. A. Clarke, York Township, York county, Ont. Instrument for wrapping wire or cord on broken vehicle shafts or whiffletrees, fork handles, or any such like articles, called "Clarke's Wire and Cord Wrapper." Jan. 15, 1875.

4,266.—N. A. Menaur, Buffalo, Erie county, N. Y., U. S. Improvements on tea kettles, called "Menaur Tea Kettle." Jan. 15, 1875.

4,267.—F. B. A. Royer de la Bastie, Vilette, Department of Aisne, France. Process and furnace or apparatus for tempering and hardening flat and shaped glass, called "Royer de la Bastie's Process and Apparatus for Tempering Glass." Jan. 15, 1875.

4,268.—C. F. Lalonde, Montreal. Améliorations aux machines à separer les clous, viz., troquettes, rivets, crochets, etc., au sorter du bain d'etainage, "Machine a separer les vis, clous, broquettes, rivets, crochets, etc., au sorter du bain d'etainage." Improvements in machines for separating nails, screws, tacks, rivets, hooks, etc., when taken out of tin baths. Jan. 15, 1875.

4,269.—J. E. Townshend, Montreal, P. Q. Improvements in the cleansing, disinfecting, and preserving feathers, hair, wool, flocks, fiber, and all materials used for beds and upholstery, called "Townshend's Process." Jan. 15, 1875.

4,270.—J. E. Thompson, Stambridge, Missisquoi, P. Q. Improvements on steamers, called "Thompson's Perfected Steam Cooker." Jan. 15, 1875.

4,271.—Wm. West and T. West, Toronto City, Ont. Improvements on bedsteads, called "West's Combined Bookcase and Wardrobe Bedstead." Jan. 15, 1875.

4,272.—Jas. Goodwin, Lennoxville, Sherbrooke county, P. Q. Reissue of No. 3,377, on "Goodwin's Invalid Bedstead." Jan. 15, 1875.

4,273.—R. Whiting and J. Kyser, Cleveland, Ohio, U. S. Improvements on brace fasteners, called "Whiting's Brace Fastener." Jan. 15, 1875.

4,274.—J. Baker, Trenton, Hastings county, Ont. Extension of No. 223 on "Baker's Combined Hand Flour Scoop and Sifter." Jan. 15, 1875.

4,275.—L. J. Hewitt, Toronto City, Ont. Improvements in railroad car wheels, called "Hewitt's Improved Car Wheel." Jan. 15, 1875.

4,276.—G. D. Booth, Ottawa, Carleton county, Ont. Improvement on breech loading shot guns, called "Booth's Shot Gun Rifler, Adjustable and Convertible." Jan. 15, 1875.

4,277.—G. W. Otis, Lynn, Essex county, Mass. Improvements on lightning conductors. Attachments of head and ground plate for "Otis' Solid Cable Fluted Lightning Rod." Jan. 15, 1875.

4,278.—C. P. Crossman, West Warren, Worcester county, Mass., U. S., and E. J. Brown, Worcester, Worcester county. Improvements on salt boxes or casters, called "Crossman's Salt Box or Caster." Jan. 15, 1879.

4,279.—W. L. Phillips, New York city, N. Y., U. S. Improvements in stoves for heating and ventilating purposes, called "Phillips' Fire on the Hearth." Jan. 15, 1875.

4,280.—D. Conboy, Uxbridge, Ontario county, Ont. Improvements in vehicles for the conveyance of passengers, called "Conboy's Turn-Down Seat." Jan. 15, 1875.

4,281.—I. M. Rhodes, Hancock, Houghton county, Mich., U. S. Improvements on a fracture bed and apparatus, called "Rhodes' Fracture Bed and Apparatus." Jan. 18, 1875.

Advertisements.

Back Page - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents 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.

PERFECT
NEWSPAPER FILE.

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the Scientific American 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."

BAIRD'S BOOKS FOR PRACTICAL MEN.

My new, revised and enlarged Catalogue of PRACTICAL AND SCIENTIFIC BOOKS—96 pages, 8vo.—will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,
INDUSTRIAL PUBLISHER,
406 WALNUT STREET, Philadelphia, Pa.

BOOKS ON Steam and the Steam Engine.

☞ A Select List, with prices, sent free to any one furnishing his address.

HENRY CAREY BAIRD,
INDUSTRIAL PUBLISHER,
406 WALNUT STREET, Philadelphia

TANNERIES—NEW WAY OF BUILDING. SAVES half in running—better quality. Patent Rights for Sale. H. REED, Atlanta, Ga.

BOULT'S PATENT Reverse Motion Paneling, Variety Moulding, and Dovetailing Machine, cuts Panels of any design or style of Mould in the solid wood, with neatness and dispatch. Routes and grooves for windows—Stairs—Cars—Bridges, &c. Moulds fine bracket and general Scroll Work. It is a first Class Shaper and Moulder. Dovetails all kinds of Drawer and Joint Work with thick or thin stuff. Warranted Simple, Durable, and Efficient. Send for circula. and sample of work. Manufactured only by B. C. MACH'Y CO., Battle Creek, Mich

NEARLY 1,000 IN USE—BUFFALO PONY PLANERS. Will earn itself and pay expenses of running in eight days. Price from $100 and upwards each. Also, small Pony Planers and Matchers, and Planing Machine Knives. Recommended as superior and extra in quality. Circulars free. GEO. PARR, Manufacturer of Mechanic's Tools and Light Machinery Buffalo, N.Y.

Seeds and Bulbs.

ILLUSTRATED SPRING CATALOGUE FOR 1875

NOW READY

sent, with a specimen copy of **The American Garden**, a new Illustrated Journal of Garden Art, edited by James Hogg, on receipt of ten cents.
BEACH, SON & CO., Seedsmen, 76 Fulton St., Brooklyn, N. Y.

Machinery of Improved Styles for making SHINGLES HEADING, AND STAVES Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE AND HEADING SAWING MACHINE. For circulars address TREVOR & CO., Lockport, N. Y.

THE Shapley Engine,

Best and cheapest. **Compact. Simple, Durable, Economical.** Warranted first class in every respect. Send for Catalogue with testimonials.

Iron and Wood Working Machinery, New and Second-hand.
TULLY & WILDE, 20 Platt St., N. Y.

The Weekly Sun. A large, eight-page, independent, honest and fearless newspaper, of 56 broad columns. We aim to make the **Weekly Sun** the best family newspaper in the world. Try it. **$1.20** per year, postage paid. Address THE SUN, New York City.

STONE SAWING MACHINERY. MERRIMAN'S PATENT. ALSO, HAND AND STEAM DERRICKS & TRAVELLERS, THOMAS ROSS, RUTLAND, VT.

Steam Pumps

Will sell 100 at low prices. Send for circular and price list to Philadelphia Hydraulic Works, Evelina St., Phila., Pa.

WOODWORTH SURFACE PLANERS $125. Planers an d Matchers, $350. S.C. HILLS, 51 Courtland street, New York.

"EDEOGRAPHY." A new book on the art of Writing by Sound; a complete system of Phonetic Short Hand—the shortest, most simple, easy, and comprehensive, enabling any one, in a short time, to report trials, speeches, sermons, &c. The Lord's Prayer is written with forty-nine strokes of the pen, and 140 words per minute. The unemployed should learn this art. Price, by mail, 50 Cts. Agents wanted. Address T. W. EVANS & CO., 139 S. Seventh Street, Phila., Pa.

Useful and Rare Chemicals.

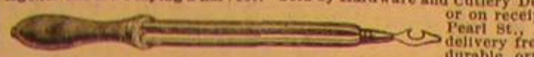
1. A cheap Mucilage, suitable for pasting Labels on Glass, Tin Cans, Wood, Iron and Stone.
2. The Soluble Glass Liquid and Jelly for Soap, Cement, Artificial Stone, Paint and Fireproofing Wood.
3. Hydrofluoric and White Acids, for Etching.
4. Nickel-Plating Materials, Salts, Anodes, Rouge, &c.
5. Glass Manufacturers' Articles, Manganese highest strength, Zaffre, Oxides of Cobalt, Uranium, Tin, Copper, Antimony, Bismuth, Nickel, Aluminum, Loadstone.
6. Marble and Glass Putty, Felspar, Fluorspar, finest Silex, Cryolite, Talc, Asbestos, Yellow Cadmium.

L. FEUCHTWANGER & CO., 180 FULTON ST., NEW YORK.

MACHINERY, NEW & SECOND-HAND. Send for Circular. CHAS. PLACE & CO., 103 Reade St., New York.

Knife Polisher, Can Opener Sharpener. Agents wanted Centennial Novelty Co. 631 N. 7th St. Phila. Pa. SAMPLE ONE DOZ. -FOR- 50 Cts. $1.00 | CIRCULARS FREE.

This imperfectly represents a recently patented household utensil which will soon be in general use. The few Agents out are reaping a harvest. Sold by Hardware and Cutlery Dealers and JEWELLERS, a proof of its Elegance or on receipt of only $1.50, The Radial Steel Co., No. 2 Pearl St., N. Y., P. O. Box 564, will make immediate delivery free of charge, to any address in the U. S., of durable, ornamental, handsomely plated RADIAL STEEL'



which Sharpens Knives by a touch, neatly Extracts Skewers, Cuts Cork Wire, and whose detachable handle contains, well! though you use its contents often, resist, if you can, a ☞ **"SMILE."**

FOR SALE.

	PRICE
Magic Lantern and 40 Slides	$ 50
Pair of Magic Lanterns and 40 Slides	$ 75
"Sciopticon" and 40 Slides	$ 60
Pair of Sciopticons and 50 Slides	$120
Oxy-Calcium Stereopticon for dissolving views—complete and 50 slides	$125

Magic Lanterns Wanted. Enclose stamp.
THEO. J. HARBACH, 809 Filbert St., Philadelphia, Pa.

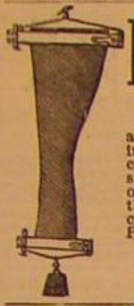
P. BLAISDELL & CO.,

Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills and other first-class Mechanic's Tools.

STEEL CASTINGS.

Solid and Homogeneous. Guaranteed tensile strength, 25 tuns to square inch. An invaluable substitute for expensive forgings, or for Cast Iron requiring great strength. Send for circular and price list to Mc HAFFIE STEEL CO., Evelina St., Philadelphia, Pa.

MASON'S PAT'T FRICTION CLUTCHES are manufactured by Volney W. Mason & Co., Providence, R. I. Agents, L. B. BROOKS, 60 Cliff street, New York; TAPLIN, RICE & CO., Akron, Ohio.



THE Pants' Stretcher.

(Over 20,000 IN USE.)

The only device that will effectually do away with knee forms and keep the Pants in proper shape. To be had in all first class gents' furnishing and fancy goods stores, tailors, stationers, etc. Parties ordering goods on collection or soliciting the agency must enclose their business card.

PRICES—	
Nickeled	$2.00
Japanned	1.75
Weights	.50

P. DEL VALLE HALSEY, 122 Church St., N. Y.

Thrilling Stories.

brilliant miscellaneous features, and pictorial embellishments unequalled every week in HEARTH AND HOME, the great illustrated weekly magazine. Price reduced to only $2.50 a year. Single copies, six cents. At news stands or by mail postage paid. Great inducements to agents and clubs. The Graphic Company, Publishers, 39—41 Park Place, 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 (patented), 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 prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address Carnegie, Kloman & Co., Union Iron Mills, Pittsburgh, Pa

BANKRUPT'S SALE OF HORIZONTAL and Vertical Steam Engines. Also new and second hand Machinist's Tools. Send for circular at THE YALE IRON WORKS, New Haven Conn.

$77 A WEEK to Male and Female Agents, in their locality. Costs NOTHING to try it. Particulars FREE. P. O. VICKERY & CO., Augusta, Me.

GLASS MOULDS, for Fruit Jars, Lamps Bottles, Ink Stands, etc., made by H. BROOKE 15 years COR. WHITE and CENTRE STS., N. Y. For any thing new in glass, you will require a mould (or die). ☞ PARTICULAR ATTENTION paid to MOULDS for INVENTORS. Send model or drawing; inclose stamp.

LE COUNT'S PATENT LATHE DOGS, both Steel and Iron; Iron and Steel Clamps, Expanding Mandrels, &c. Sold at wholesale prices during the hard times. Send for Illustrated List to C. W. LE COUNT, South Norwalk, Conn.

PATENT **Planing & Matching** and Molding Machines, Gray and Wood's Planers, Self-oiling Saw Arbors, and other wood-working machinery. S. A. WOOD'S MACHINE CO., 91 Liberty St., N. Y. / 67 Sudbury St., Boston. Send for Circulars, etc.

LUDLOW VALVES.

FRED. STONE & CO., 3 Park Place, New York.

The Beardic. A NEW DISCOVERY! A Chemical Triumph. Luxurious Whiskers or Moustaches produced in 21 days. A success in every instance. Price, 25 cents a Package. Address, LEE & CO., 526 Sixth Avenue, New York. Safe and sure.

WOOD-WORKING MACHINERY GENerally, Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Central, corner Union St., Worcester, Mass. WITHERBY RUGG & RICHARDSON.

Andrews' Patents.

Noiseless, Friction Grooved, or Geared Hoisters, suited to every want.
Safety Store Elevators. Prevent Accident, if Rope, Belt, and Engine Break.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS & BRO., 414 Water Street, New York.

PUNCHING AND DROP PRESSES. For the Best and Cheapest address THE STILES & PARKER PRESS CO., MIDDLETOWN, CONN

$60 TO $90 a week and expenses to all. Articles new, staple as flour. Samples free. C. M LININGTON & BRO., N. Y. or Chicago.

Free to Sewing Machine Agents.

The Wilson Reflector—An Illustrated Sewing Machine Journal, published monthly, devoted to the interest of Sewing Machines, and everything manufactured by Sewing Machines, Literature and General News. Eight pages and forty columns of choice miscellany and reading matter. WILSON SEWING MACHINE CO., PUBLISHERS. Subscription price FIFTEEN CENTS per annum, with an elegant chromo free, postage prepaid. FREE TO AGENTS and DEALERS in SEWING MACHINES and ATTACHMENTS. Address, WILSON'S REFLECTOR, CLEVELAND OHIO U. S. A.

BLAKE'S PATENT Stone and Ore Breaker

Crushes all hard and brittle substances to any required size. Also, any kind of STONE for ROADS and for CONCRETE, &c. Address BLAKE CRUSHER CO., New Haven, Conn.

AGENTS WANTED. Men or women. $34 a week. Proof furnished. Business pleasant and honorable with no risks. A 16 page circular and Valuable Samples free. ☞ A postal-card on which to send your address costs but one cent. Write at once to F. M. REED, 8TH ST., NEW YORK.

GEO. W. READ & CO.,

STEAM BAND SAW AND VENEER-CUTTING MILL,
186 to 200 LEWIS ST., foot 5th & 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.

OTIS' SAFETY HOISTING **Machinery.** OTIS, BROS. & CO No. 348 BROADWAY, NEW YORK.

IT WILL PAY

You to invest a few dollars in tickets in Public Library of Kentucky Concert and Drawing of

27th February

Positively no Postponement.

A Drawing on 27th, Or Money Refunded.

Whole Tickets $50. Halves $25. Tenth, or each Coupon $5. Eleven Whole Tickets, $500.

or Tickets, or information, address THO. E. BRAMLETTE, Agent and Manager, Louisville, Ky., or THOS. H. HAYS & Co., 609 Broadway, New York.

Public Library of Kentucky.

Death of Gov. Bramlette.—Action of the Trustees—A Successor Appointed—No More Postponements—Drawing Certain February 27th.

At a meeting of the Trustees of the Public Library of Kentucky, Jan. 16, 1875, it was resolved that C.M. Briggs, Esq., who under the late Hon. Tho. E. Bramlette was the real business manager of the gift concerts already given in aid of the Public Library of Kentucky, be and he is hereby authorized to take the place made vacant by the death of said Bramlette, in the management of the affairs of the fifth and last gift concert, and that the drawing announced for February 27, 1875, shall positively and unequivocally take place on that day without any further postponement or delay on any account whatever.

R. T. DURRETT, Pres.
JOHN S. CAIN, Secretary.

Hereafter all communications relating to the 5th Concert should be addressed to the undersigned, and I pledge myself that the drawing shall come off February 27th or that every dollar paid for tickets shall be returned.

C. M. BRIGGS, Agent and Manager, Room 4, Public Library Building, Louisville, Ky.

E. M. MAYO'S PATENT BOLT CUTTER. ☞ Send for Illustrated Circular, Cincinnati, Ohio.

Model Engines. Complete sets of Castings for making small Model Steam Engines 1½ in. bore, 3 in. stroke, price $4; ditto 2 in. bore, 4 in. stroke, price $10, same style as cut. Catalogue of Small Tools and Materials free. GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

Ladies at Home

And Men who have other business, wanted as agents. Novel plans, pleasant work, GOOD PAY. Send 3-cent stamp for particulars. THE GRAPHIC COMPANY, 39-41 Park Place, New York.

MAGNETS—Permanent Steel Magnets of any form or size, made to order by F. C. BEACH & CO., 263 Broadway, New York. Makers of the celebrated Tom Thumb and Miniature Telegraph Instruments.

PORTABLE STEAM ENGINES, COMBINing the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **1,000** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address THE J. C. HOADLEY CO., Lawrence, Mass.

MACHINERY.

IRON & WOOD WORKING MACHINERY OF EVERY DESCRIPTION.

Cold Rolled Shafting.

HANGERS, PULLEYS, COUPLINGS, BELTING, &c &c. Send for Illustrated Catalogue and Price List.
GEORGE PLACE & CO., 121 Chambers & 103 Reade Sts., N. Y. City

BEAUTIFUL DECALCOMANIA 10 or Transfer Pictures, with full instructions and 24 pp. catalogue, sent post-paid for 10 cents. 100 for 50 cts. They are Heads, Landscapes, Flowers, Autumn Leaves Animals, Birds, Insects, Grotesque and Comic Figures, &c. They can be easily transferred to any article so as to imitate the most beautiful painting. Also 5 beautiful Gem Chromos for 10 cents, 50 for 50 cents. Agents wanted. Address J. L. PATTEN & CO., 71 Pine St., New York.

☞ T. V. Carpenter, Advertising Agent. Address Box 773, New York city.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with books of instruction, manufactured and sold by THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated catalogue sent free on application.

STENCIL DIES For cutting business Stencils, all sizes. Also complete OUTFITS for Clothing Stencils and Key Checks, with which young men are making from $5 to $20 a day. Send for Catalogue and samples to S. M. SPENCER, 117 Hanover St., Boston, Mass.

7,000 IN USE BLAKE'S STEAM PUMPS FOR EVERY POSSIBLE DUTY GEO. F. BLAKE MFG CO. 79 & 81 LIBERTY ST. N.Y. CAUSEWAY & FRIEND STS. BOSTON. 50 CANAL ST. CHICAGO. SEND FOR ILLUSTRATED CATALOGUE.

Second Hand Engines and Boilers,

of all kinds and sizes, BOUGHT, SOLD & EXCHANGED Large stock always on hand. Send for circular to ROBERTS & KING, 119 Liberty St., New York

SHINGLE & BARREL MACHINERY EVART'S IMP. HEADING AND SHINGLE SAW, STAVE CUTTERS, JOINTERS, EQUALIZERS, AND HEADING TURNERS.
BAILEY GAUGE LATHE—For turning all kinds handles and Cabinet work. Simplest and best in use. We manufacture a full line of Wood and Iron Working Machinery, Steam Engines, &c. Address T. R. BAILEY & VAIL, Lockport, N. Y

The Toll-Gate! **Prize Picture** sent free! An ingenious gem! **50** objects to find! Address with stamp, E. C. ABBEY, Buffalo, N.Y.

55 SUCCESS BEYOND COMPETITION. 55 STATE FAIR FIRST PREMIUMS WITHIN MONTHS, awarded Nellis' Original Harpoon Horse Hay Fork. Also, manf's all kinds Agr'l Steels & Irons, tempered by Nellis' Process to suit all kinds of soil. Facts & merits in Pamphlets free. A. J. NELLIS & CO., Pittsburgh, Pa.

Trade Mark.

IMPORTANT FOR ALL LARGE CORPORATIONS AND MANUFACTURING CONCERNS.—**Buerk's Watchman's Time Detector**, capable of controlling, with the utmost accuracy, the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular.
J. E. BUERK, P. O. Box 1,057, Boston, Mass.
N. B.—This detector is covered by two U. S. Patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines Matching, Sash and Molding, Tenoning, Mortising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty Street, New York. 17

EAGLE FOOT LATHES, Small Engine Lathes, Hand Planers for metal—Slide Rests, Circular and Foot Scroll Saws—all of the neatest design and superior finish. Our catalogue describes every tool necessary to fit out the Artizan or Amateur, as well as the Boys for the Holidays. WM. L. CHASE & CO., 95 & 97 Liberty St., New York

Planing & Matching, Moulding, Re-sawing and Tenoning Machines. Scroll Saws and General Wood-Working Machinery. JOHN B. SCHENCK'S SONS { Matteawan, N. Y. / 118 Liberty St., N. Y. City. Send for Catalogue.

PROSPECTUS

OF THE

SCIENTIFIC AMERICAN, FOR 1875.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTIETH YEAR.

VOLUME XXXII.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the second day of January, 1875, 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.

By the new law, the postage must be paid in advance in New York, by the publishers; and the subscriber then receives the paper by mail free of charge.

TERMS.

One copy, one year (postage included)	$3.20
One copy, six months (postage included)	1.60
One copy, three months (postage included)	1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"	10.00
One copy of Scientific American for one year, and one copy of "Science Record" for 1874	5.50

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.

VALUE OF PATENTS,
And How to Obtain Them.

Practical Hints to Inventors.

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

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

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

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct

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

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & CO., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

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

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & CO., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Canadian Patents.

In order to apply for a patent in Canada, the applicant must furnish a working model, showing the operation of the improved parts; the model needs not to exceed eighteen inches on the longest side. Send the model, with a description of its merits, by express, or otherwise, to Munn & Co., 37 Park Row. Also remit to their order by draft, check, or postal order, the money to pay expenses, which are as follows: For a five years' patent, $75: for a ten years patent, $95; for a fifteen years' patent, $115. The five and ten years' patents are granted with privilege of extension to fifteen years.

Trademarks.

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

Design Patents.

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

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief, any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & CO., 37 Park Row, New York.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a 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. Address MUNN & CO., Patent Solicitors, 37 Park Row, New York.

MUNN & CO. will be happy to see inventors in person at their office, or to advise them by letter. In all cases they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice, address

MUNN & CO.,
PUBLISHERS SCIENTIFIC AMERICAN,
37 Park Row, New York.

OFFICE IN WASHINGTON—Corner F and 7th Streets, opposite Patent Office.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia and 59 Gold St., New York