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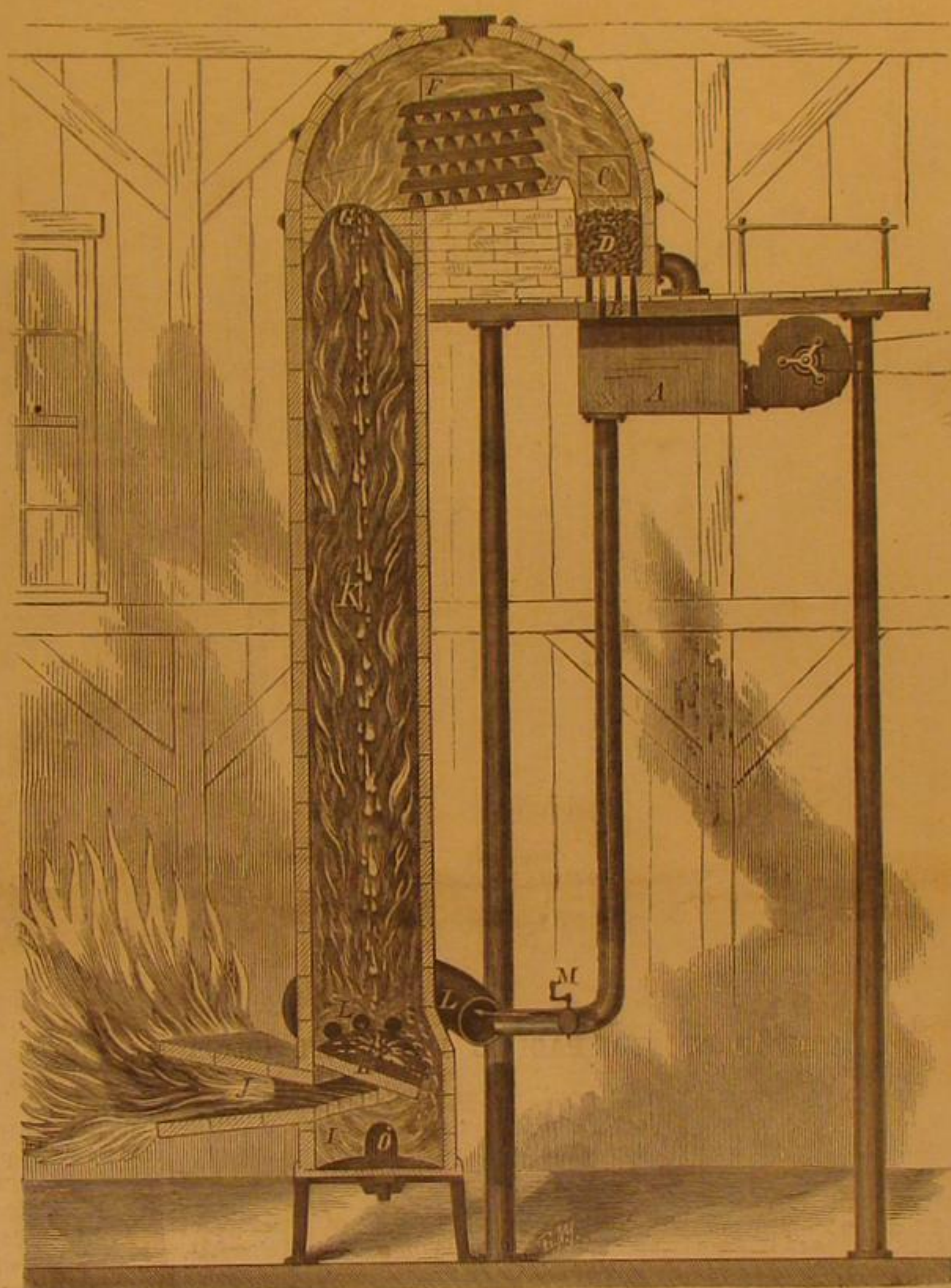
The Peters Process of Manufacturing Steel from Pig Iron.

One of the fields in which great advancement has been made, and in which a great many are still earnestly striving to make improvements, is that of the production of refined iron and steel by new processes which do not involve the necessity of puddling by manual labor, as is the old practice.

The annexed engraving represents a vertical section of a furnace for decarburizing and desulphurizing iron in the manufacture of cast steel for rails, car wheels, guns, etc., it being a modification of the reverberatory and cupola furnaces combined. The blast enters the air chamber, A, under the scaffold, and passing upward through tweers, B, to the fuel—either anthracite or bituminous—which is supplied through the small door, C, into the fire-box, D, passes from thence to the dome of the furnace, the flame playing upon the pig iron which is piled upon the bed or hearth, E, and which is introduced through the large door, F. The vertical part of the furnace is contracted at the top, G, so as to retard the exit of the flame at that point, and the product of combustion passes down on to the platform, H, which may be supported from the bottom or from projecting brick from the sides. The platform, H, is composed of fire-brick or any incombustible material; and the products of combustion then pass on into and through the reservoir, I, and finally escape at J. The reservoir, I, having thus attained, after a time, intense heat, is now ready to receive the molten iron as it falls in globules, K, from the top of the furnace or stack, through the flame and on to the platform, H, previously described. The concussion causes them to burst upon the platform, liberating all the free carbon and all the gas or sulphur contained therein, and thereby increasing the density of the metal. A blast through the tweers, L, is caused to play upon the iron, while thus in a finely divided state, similar in form to scales. This supply of oxygen brought in contact with the particles of iron completely decarburizes it and also frees it from any remaining sulphur or other impurities. Also the unconsumed carbon from the fuel above is supplied with oxygen at this point, and consumed, producing intense heat. It will be observed that each particle of iron is, without coming in contact with the fuel exposed to the flame and blast, and undergoes a self-puddling process by falling from a hight of fifteen feet or more. Manganese and charcoal are placed in the reservoir, I, for the purpose of a final fluxing and recarburizing, as may be desired.



THE PETERS COMPOSITE DECARBURIZING AND DESULPHURIZING FURNACE.

By turning the blast off with the damper, M, in the lower tweers, L, all the advantages of the reverberatory furnace are secured, while purer and stronger iron is obtained for ordinary foundery purposes, where clean castings are essential, with the additional advantages of the puddling process. The escaping flame may be utilized by leading it under a boiler, or for other purposes. The opening at the top of the arch, N, is for letting off the smoke when starting the fire, and to be closed with a cover of fire brick while melting. The bottom of the reservoir, I, may be constructed with a drop bottom, like the ordinary cupola, for the purpose of repairs, etc. The metal is drawn off at O, into ingots. It will be seen that the area of the puddling platform, H, can be increased if desirable. If crucibles are used for pouring the metal, they can be heated to any degree by placing them in the flue at the escaping point, J, of the flame, by arranging a small door at that point in the side.

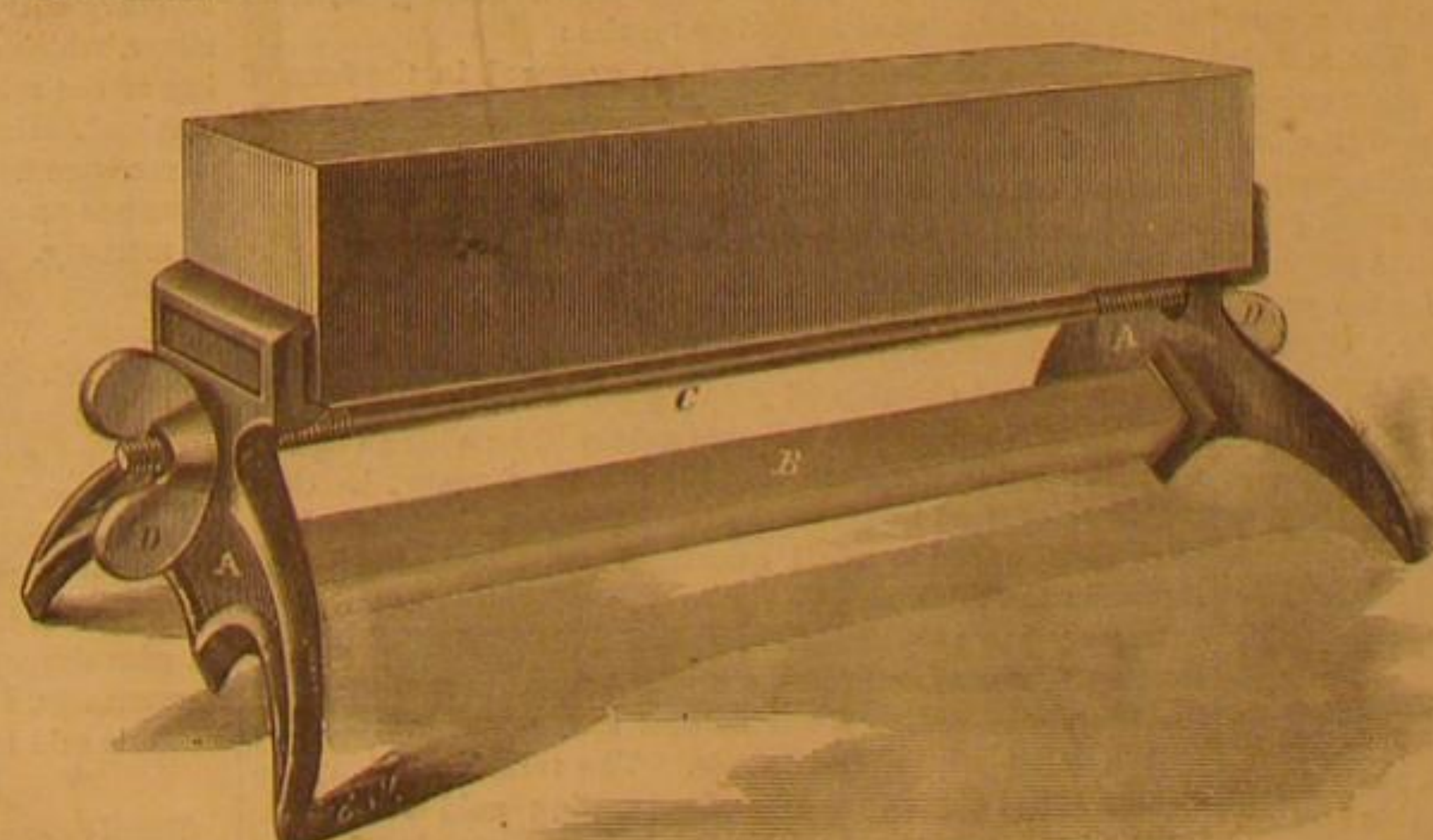
The inventor assures us that a very fine quality of steel can be produced by this method.

A striking feature is the cheapness of the required plant. The inventor estimates that he can put up a furnace that will melt and convert two tuns of metal per diem for $500, and one that will melt and convert five tuns twice a day for less than $3,000.

The inventor who is a practical iron master of long experience, would like to arrange with some capitalist to start and superintend the manufacture of steel by this process. The device was patented, through the Scientific American Patent Agency, Nov. 2, 1869, by Charles Peters, of Trenton, N. J., who may be addressed for further information at 122 Jackson street, as above.

Improved Oil-Stone Holder.

The old method of setting an oil-stone in a wooden box with a cover, is open to several objections. Only one side of the stone is available for use except when by considerable trouble it is taken out and reset, bottom side upwards. The vertical sides are never available. The sides of the wooden box are receptacles for grease and accumulated dirt, and also are in the way in sharpening many kinds of tools. The stone is so close down to the bench that the handles of some tools, draw-shaves, for instance, strike the bench when it is attempted to sharpen them, and an extra stone held in hand, or the stone set in the box inverted and held in the hand has to be employed. Each of these objections is entirely obviated by the neat little device shown in our engraving.



BROWN'S OIL-STONE STAND.

In this stand the stone rests upon narrow ledges at each end, the ledges being cast upon the end-plates, A. The lower parts of these plates are formed into legs. A square wooden rod, B, fits into sockets formed in the end plates and serves as a longitudinal brace. The whole is clamped firmly by means of a longitudinal rod, C, and thumb-nuts, D.

By loosening the thumb-nuts slightly the stone may be turned so as to bring either of its sides to the top, and these sides may be shaped differently, if desired, for various kinds of tools.

By placing a shelf of wood underneath the stone to strengthen it, it may be used till worn nearly or entirely through. The device is very simple and will, we think, be found a very useful one by all who use an oil-stone.

The inventor will negotiate for the manufacture of the implement on royalty, or for the sale of the entire right; preferring the former, however, as it is his desire to at once put it permanently into market as a staple article in the hardware trade. Patented, through the Scientific American Patent Agency, April 26, 1870, by Homer Brown, whom address at Hamilton, Ill.

Zinc as a Building Material.

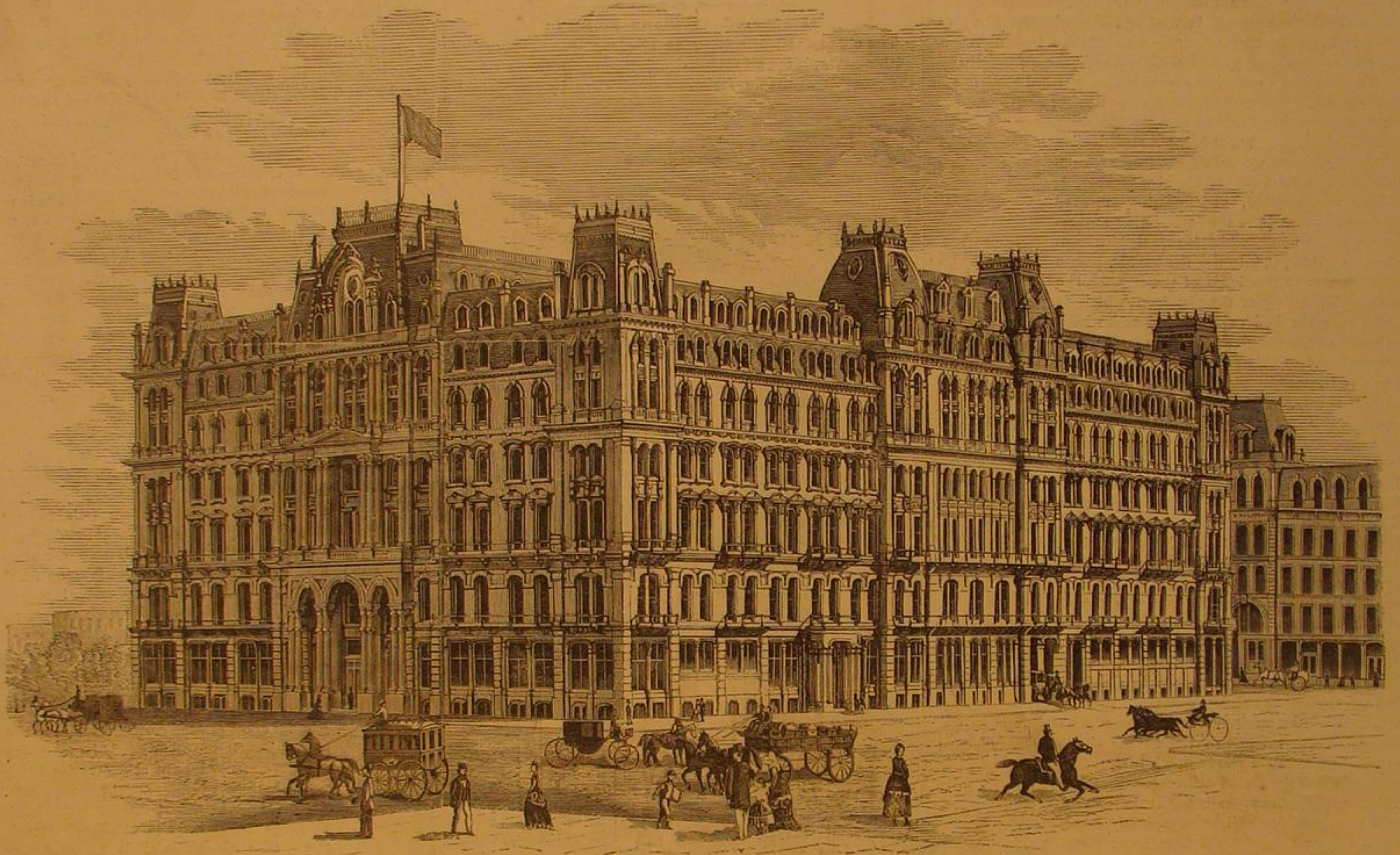
Stone and stone only, says the *American Builder*, has always been deemed by architects and others, the appropriate material to be employed in the ornamentation of buildings, and doubtless there has existed, until a comparatively recent date, the best of reasons for this theory. First, stone is durable; there is nothing ordinarily entering into the composition of our building, that, in this respect, can compare with it, and again from its peculiar facilities, few other suitable substances can be worked into the required form, offering the means for such boldness and strength in the general effect or such correctness and delicacy of detail. On the other hand, however, stone can be employed only at a considerable expense, both in working and in transportation, and, in some localities, distant from quarries, this expense reaches a point when the employment of such material is practically precluded, save where its use is an absolute necessity. In ornamented fronts especially, where stone has heretofore been considered indispensable, its use is discarding, and metal imitations are taking its place.

The principal objections raised against the use of metal, lie in the fact that it is untruthful, and therefore inappropriate, but certainly the use of an imitation in this particular is in no sense more inappropriate than the use of hollow iron columns in imitation of stone, and the employment of similar counterfeits in interior ornamentation. Prominent among the substitutes for stone is zinc, a material which has proved eminently adapted to the purpose, and is rapidly acquiring a place among the building materials from its adaptability to all form as well as from its lasting qualities. With the introduction of pressed ornaments of this material the expense of exterior decorations has been greatly reduced, and an additional advantage is gained in the fact that from the facility with which it is worked, there exists but little difference in the cost of the plainest and most elaborate patterns. The work when coated with paint suited to the purpose, may be made to resemble cut stone work so closely as to deceive the eye of any one not an expert, and in like manner the interior of buildings can be ornamented with zinc in imitation of stucco, or embellished with elaborate moldings at a small cost, which work may be cleaned at any time without fear of injury. In the ornamentation of old buildings, which if of cut stone, could only be accomplished by taking down the walls, zinc also plays a useful part, as decorations may be put on without displacing any portion of the structure. As a roofing material its value has become generally acknowledged in Europe, and, in this country, is rapidly acquiring an equally high reputation, particularly in the construction of large buildings. When exposed to the influence of the atmosphere, the oxidation that at once ensues instead of rapidly eating up the metal, soon forms a crust which hardens and effectually protects the body of the covering from further damage.

The points which we have presented above in regard to ornamentation are simply those which seem most important in demonstrating the value of zinc as a building material, and while we do not by any means advocate its use generally in the place of stone in ornamentation, where stone is plenty and cheap, yet we wish, if possible, to overcome the prejudice which appears to exist in many instances where the employment of zinc would be more economical and equally appropriate.

PACIFIC HOTEL, CHICAGO.

The Pacific Hotel Company are about to erect, at Chicago, the magnificent edifice of which we herewith give an engraving. The cost of the building is to be one million dollars and when completed it will be one of the largest and most complete hotels on the continent.



THE PROPOSED PACIFIC HOTEL AT CHICAGO.

It will occupy an entire block, bounded by Clark, Jackson, Lasalle, and Quincy streets. The opposite façade to that shown on Clark street is the exact counterpart of that on Lasalle street, save that it has full retail-shop fronts, adapting it to the business character of Clark street. The hotel has the following dimensions: front, on Clark street, 190 feet; on Jackson, 325 feet; on Lasalle street, 180 feet. A characteristic feature of the hotel is the adoption, for the first time in this country, of the internal glass-sheltered court, for the arrival and departure of guests. From the carriage court, where all the passengers and baggage are received, the former pass to the grand arcade, which occupies the second interior court of the building, upon which the three entrances on Lasalle, Jackson, and Quincy streets directly open. All the business offices of the house are thus on the lower floor, and of dimension and finish that justify the promise of the noble exterior. The house has five hundred and fifty-three rooms, exclusive of the public apartments and offices. The rentals of the company are further essentially helped by eight superb stores and twenty-two elegant offices,each the best of its class, and suited to its respective locality, on the leading retail and office street of the city. The material of the three store fronts will probably be the yellow Ohio sandstone. A proposal for a lease of the hotel portion of the structure for ten years, at a rental of $75,000 per annum, has been made. Chicago has been long favored with good hotels, but this enterprise promises, by the opening of 1872, to place her in the front rank in this respect. W. W. Boyington, Esq., of Chicago, the architect of the structure, has, in his portion of the work, achieved a most noteworthy monument of professional skill.

SCIENTIFIC INTELLIGENCE.

PASTING PARCHMENT PAPER.

It is not an easy thing to join the stiff, smooth surfaces of parchment paper on to other paper, or on to wood, pasteboard, etc. The paste does not seem to hold, and on this account this paper has not been so generally used in book-binding and for similar purposes.

The difficulty can be overcome in a very simple way. The surface of the parchment must first be moistened with alcohol or brandy and then pressed while still moist upon the glue or paste. When two pieces of parchment are to be joined, both must be moistened in this way. It is said that the paper will sooner tear than separate where it has been thus fastened together.

Another way is to put a thin piece of paper between the surfaces of parchment and apply the paste. This forms a firm joint and can with difficulty be separated. Glue and flour paste are best adapted for uniting surfaces of parchment. Gum-arabic does not answer.

ALUMINATE OF SODA.

This article is now largely employed in the manufacture of milk glass, hot cast porcelain, etc. Hitherto cryolite was used, but this mineral attacked the furnaces and was not always free from iron and other foreign substances. It is now proposed to substitute one hundred-weight of natron aluminate for the 1½ hundred-weight cryolite and $\frac{1}{10}$ hundred-weight of soda, formerly employed.

The aluminate of soda prepared in the process of the manufacture of soda from cryolite, is usually pure, and is capable of various applications, in dyeing calico, printing, manufacture of a very heavy white soap, for lakes, etc.

DISINFECTING PADS.

It is often desirable to disinfect the odor of perspiration, and this can be accomplished by means of pulverized charcoal. Take an ounce each of finely pulverized charcoal, gum-arabic in powder, and water. Put a thin paste of this between two sheets of paper or of cloth, and press by the hand or between weights, to smoothe wrinkles, and then allow it to dry in the air. It is then ready to be cut into soles for the feet or into pads as required.

FLUORIDE OF GOLD.

M. Prat, of Bordeaux, has published the results of extended researches into the properties and compounds of gold, from which we abstract the following results:

1. Chemically pure gold can be prepared in the form of sponge. 2. Gold can be oxidized by certain oxy-acids. 3. There exists a liquid chloride of gold superior to the sesquichloride, also a sesqui-iodide and a carbonate. 4. There are also two oxides, a suboxide, $Au_2 O_2$, and a binoxide, $Au\ O_2$, capable of yielding two series of new oxides.

The most important result was the preparation of spongy gold; this is accomplished by saturating a solution containing ten per cent of chloride of gold by pulverized carbonate of potash, and for each equivalent of gold salt, he adds an equivalent of a saturated solution of the same carbonate; he then treats the filtered liquid with five equivalents of pulverized oxalic acid, added in small quantities at a time, and boils the liquid for ten minutes. The gold is reduced to the state of an extremely fine powder—these grains, as if by mutual attraction, agglomerate and form a spongy mass without metallic luster and resembling a wet natural sponge, but convertible by the hammer into solid ingots. The transformation into spongy metal affords a means of separating gold from a majority of other metals. M. Prat also reasserts that he has prepared fluorine from fluoride of gold in the form of a yellowish gas similar to chlorine.

PREPARATION OF PURE NITROGEN.

Berthelot removes the oxygen from the air in the following ingenious manner: Clean copper turnings are placed in the bottom of a flask and half covered with ammonia. The flask is stopped by a cork provided with a safety tube and delivery tube, which latter can be closed with a rubber cap. After a few days the oxygen of the air is completely absorbed and can be displaced by water to which a little ammonia and copper have been added to deprive it of pure oxygen. Having been washed by concentrated sulphuric acid the gas can be preserved over mercury until required for use.

APPLICATION OF DIFFUSION IN SUGAR REFINERIES.

Abbé Moigno states that in the years 1869–1870 the number of sugar houses in which the principle of diffusion or dialysis was employed for refining sugar was 82, and that 31 additional works are in process of construction, so that in 1871 there will be 113 refineries in which practical application will be made on a large scale of Graham's important law The crystallizable sugar passes through membranes while the impurities being uncrystallizable are retained in the tank where the original solution was made. The fact that so many large houses employ this method would seem to indicate its entire practicability.

VOLUMETRIC DETERMINATION OF COPPER.

M. Weill dissolves the alloy or ore to be examined in excess of hydrochloric acid, and thus obtains the copper in the state of bichloride, which, even in minute quantities, will color the liquid bluish-green. If a solution of protochloride of tin be now added, it will transform the copper to protochloride, which is colorless. By employing a graduated solution of the tin salt the amount of copper thus transformed can be easily determined; the protochloride of tin is added until the color disappears.

CRYSTALS OF IODIDE, BROMIDE, AND CHLORIDE OF SILVER.

M. Debray has discovered that hot solutions of salts of mercury will dissolve the iodide, bromide, and chloride of silver, which salts will crystallize out beautifully on the cooling of the solution. Large and beautiful crystals were thus obtained. He also remarked that the crystals of chloride of silver were not acted upon by light, and explained the phenomenon on the principle that they probably contain traces of mercury.

OXYGENATED BREAD.

Messrs. Welton and Birch have recommended a new way of introducing oxygen into the stomach by means of bread. The air contained in the bread is extracted by means of a pump, and oxygen substituted in its stead. The bread is said to mold rapidly, which can be prevented by inclosing in cans covered with a small amount of carbolic acid. A mouthful of this bread is said to take away at once loss of appetite and to produce a pleasant sensation to persons afflicted with dyspepsia. It is also recommended in all cases of nervousness, scrofula, and defective digestion. Unleavened bread is said to be less liable to spoil than the ordinary kind.

SOLUBLE PRUSSIAN BLUE.

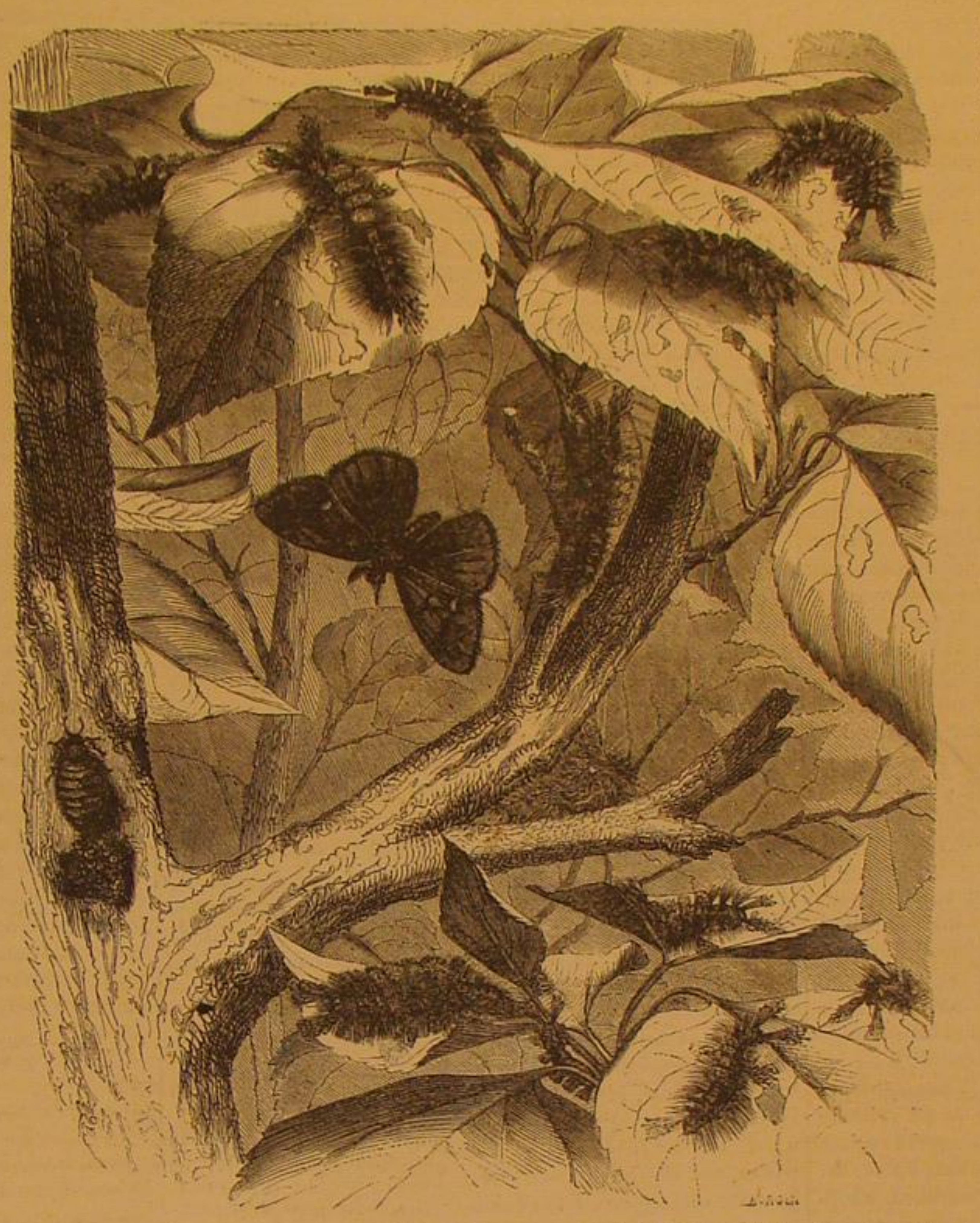
Dissolve one part, by weight, of iron wire in sufficient aqua regia to convert the whole of the metal into the chloride, and add 7½ parts of a concentrated solution ferrocyanide of potassium. Collect the precipitate into a filter, and wash out and allow to dry in the air. This form of Prussian blue is said to be soluble in distilled water, but if it be heated to 212° Fah. it loses its action of crystallization and becomes insoluble.

[For the Scientific American].

TUSSOCK-MOTHS.

[By Edward C.H. Day, of the School of Mines, Columbia College].

The group of Spinners or *Bombycidæ*, as it is scientifically termed, among the night-moths, is by far the most important to mankind of all the subdivisions of the Lepidopters. It is among these that we find caterpillars possessing pre-eminently the power of secreting silk, and of inclosing them selves, as they pass into the chrysalis stage, in a cocoon of silken fibers. In many of them, especially the larger forms—and some of the largest of Lepidopters occur in this group—the silk-secreting glands are immensely developed, and man reaps the benefit of this extraordinary provision of nature. But the greater number are unfortunately insects injurious to vegetation. Even the worm that strips the mulberry tree of its leaves would have to be accounted as a devastator, had not the ingenuity of man discovered its value as a most economic and inimitable manufacturer of raw material, producing an article otherwise unattainable. It is only in a very few of the spinners that the silk is secreted in sufficient quantities or is of a character fit for our purposes; and among those whose destructiveness is not in any way palliated by such a return of good for the evil done by them, is the insect that forms the subject of the present article. Every one with eyes for such things, must have often noticed on our shade trees in the summer "little slender caterpillars," such as here depicted, "of a bright-yellow color, sparingly clothed with long and fine yellow hairs on the sides of the body and having four short and thick brush-like, yellowish tufts on the back, that is, on the fourth and three following rings, two long black plumes or pencils extending forward from the first ring, and a single plume on the top of the eleventh ring. The head, and the two little retractile warts on the ninth and tenth rings, are coral-red; there is a narrow black or brownish stripe along the top of the back, and a wider, dusky stripe on each side of the body." (Harris). From the tufts on the back, these caterpillars obtain the name of Tusscoks, and the moths are called Tussock-moths. The scientific name for the genus is *Orgyia*, and the common indigenous American species, to the caterpillar of which the above description applies, is called *O. leucostigma*, or the "white-spot" Tussock-moth. The one here figured is the common European form, *O. antiqua*, which, however, according to Harris has been naturalized in this country, along with many other undesirable immigrants. Both species have a bad character for the damage they do to the trees they infest.



METAMORPHOSES OF THE "STARRED TUSSOCK-MOTH"—*Orgyia antiqua.*

The male moth is the insect on the wing in the center of the picture, but the female—we hear you ask—where is she? Here on the tree on the left hand, depositing her eggs. "That! why that is a wingless creature?" In effect, she is so; though on close examination of the actual insect, you would discover little scale-like rudiments of wings. She not merely cannot fly, but she exemplifies, in the fullest degree, the law that the perfect insect is but the reproductive stage of its entire life; she escapes from the cocoon on the tree side, she there receives the attentions of the males, lays her eggs upon the very cocoon from which she has but now emerged, and dies! But the males, as we see, are gay flutterers—"Vaporers" is one name by which they are known—free to rove at will, to make love to as many of these very stay-at-home ladies as they can, or to visit their clubs, if they have any, just as much as they please. So much for female rights among the Tussock-moths! But the lady moths have no reason to complain, if they cannot go in search of their husbands, they do as well by attracting their husbands to themselves. In fact all the female spinsters exert some attraction so subtile yet so far-reaching that we fear that the idea of Mormonism must exist reversed among them. What this attraction is, or how the males perceive it, we gross mortals can scarcely conjecture. The attraction is generally supposed to be a scent, and the sense of smell in moths has been supposed to reside in the antennæ. These are in the male spinners, generally speaking, very large and plumelike, and from experiments seem to be essential as guides to the progress of the insect. Others, however, consider the antennæ as organs of hearing, and place the organs of smell elsewhere. Be this as it may, it certainly is, as Professor Blanchard remarks, a wonderful fact that a scent so subtile that we cannot perceive a trace of it when close at hand, should be perceptible to the insects, at the distance of several kilometers; from the center of a city, to the woods and fields of the suburbs; nor will the supposition that a sound and not a scent be the attraction, at all diminish the incomprehensible nature of the phenomenon. It was only a short time since that a cocoon in the house of the writer gave forth a female of the Polyphemus moth, one of our largest native spinners—frequently measuring six inches across the wings. The wings being but imperfectly expanded, she was left in a tray covered by another tray. At night we were agreeably surprised, for somehow in this instance we had forgotten the probability of such consequences, by the visits of twelve fine male moths which came flapping in through the open windows during the course of the evening, and several followed on subsequent evenings. A friend informed us some time since that under similar circumstances, ninety-six male moths, of one of our largest species, were (we speak from memory) captured in one house, attracted by one female in the course of twenty-four hours. We should have hesitated to quote the above number from memory without verification, had not Professor Blanchard supplied us with an instance that throws even these figures altogether into the shade. He tells us that M. Jules Verreaux having one day, in Australia, captured the female of a small spinner and placed it in a box, and the box in his pocket, was accompanied home by a gradually increasing flight of males, until, when he entered his house, two hundred moths followed him in!

Verily wives must be at a premium among moths as well as men at the Antipodes! From a scientific point of view, however, it would be most interesting to know whether the female exercises any preference among such a choice of suitors, or whether the most vigorous males are always the successful ones. In fact, the whole history is most suggestive of thought to the inquiring naturalist.

Singular Phenomenon in Heating Diamonds.

"A jeweler of Marseilles," says the *Scientific Review*, "having to enamel a piece of work, thought that he could without inconvenience bring it to the temperature of his muffle without taking out the valuable diamonds which were set in it. The operation succeeded perfectly several times, and then an accident occurred—the diamonds became perfectly black. M. Morren, the dean of the faculty of Marseilles, was called in to investigate the cause, and he ascertained that the successful operations had all been made with coke, while when the diamonds were blackened coal had been used, and he concluded that the black color was due to the fixation of carbon by the action of the diamond on the hydrocarbon gas. He repeated the experiment on a small scale, and found the result answer his expectations, and that by repolishing the diamonds recovered their normal appearance. He then tried the effect of oxidizing gases. A diamond heated in oxygen by means of the blow-pipe did not swell at all. But at a not very elevated temperature it took fire, and the flame could then be withdrawn without interfering with the combustion, which continued by itself. It will be seen that the result differs considerably from that noticed when a diamond is heated by voltaic electricity, and that here the first action of the heat is to transform the diamond into graphite."

Lilliputian Firemen.

A writer of an intensely interesting article in *All the Year Round*, upon the habitations of ants, thus describes the extinguishment of a fire in an ant city of the *Formica rufa*, or wood ants:

"It was composed mainly of twigs, straw, and pine spiculæ, and swarmed with insect life. Poking our walking-sticks into the top of the mound, and laying bare the upper surface, the formicans, who up till then had been wholly unaware of our presence, began to understand that calamity had come upon them. Betaking themselves, as is their wont, to the care of the young, countless thousands of them suddenly appeared, each carrying a cocoon much bigger than itself, which it was evidently anxious to deposit in some place out of the reach of a danger which, although they could not comprehend, they knew to be both formidable and imminent Such a hurry skurry, such a running to and fro, such a getting up and down stairs, as the song says, such a commotion could scarcely have been known even at Brussels on the memorable night of the ball, on the eve of the great battle of Waterloo, when it was suddenly announced to the officers of the allied armies that the French were advancing upon the city—

> When thronged the citizens with terror dumb,
> Or whispering with white lips, 'The foe—they come! they come!'

"We all looked on with interested curiosity, and one of my companions having finished his first cigar, drew a box of lucifers from his pocket, and leisurely proceeded to light a second. This done, he carelessly threw the burning match upon the ant-hill. It was an act as cruel as it would have been in Lemuel Gulliver, had that mountainous traveler willfully set fire to the city of Liliput. The formicans were for an instant confused, and appeared not to know what to do. But their perplexity was of short duration. In less than half a minute scores and hundreds of ants rushed upon the blazing beam—for such it must have appeared in their eyes—and exerting their strength simultaneously upon it, endeavored to thrust it from their city. Many of them were burned to death in the gallant endeavor, but the survivors, nothing daunted, pressed forward over their dead or writhing bodies, as if conscious that there was no safety for those who still lived as long as the awful combustible was permitted to blaze and crackle in the midst of them. I was apprehensive that the whole mound, built as it was of dry twigs, would take fire; but the mists had lain upon the mountain and the valley, the air was moist, and the flame of the match burnt upwards. Onwards rushed the resolute firemen, score upon score, hundred upon hundred, till at last they rolled the match over and over, and out of their precincts, charred and blackened, and incapable of further mischief. We all, more or less, mistrusted our eyes, and the youngest, most thoughtless, and therefore the most cruel, of our company suggested that if there were intelligence and design on the part of the ants in acting as we supposed they had done, there would be no harm in making a second experiment. No sooner said than done. Another match was ignited and thrown upon the heap, and again, precisely as on the first occasion, the ants rushed pell-mell upon the blazing intruder, to prevent a conflagration, which, had it taken firm hold, it would have been impossible for them to extinguish. Again, some of the foremost champions of the public safety lost their limbs, and many more of them their lives; and again by the mere force and pressure of numbers acting with a common purpose, the match was extruded before much harm had been done. I opposed myself to a third renewal of the experiment and succeeded in persuading my companions, although not without difficulty, that enough had been done for curiosity and natural history; that the truly merciful man was as merciful to the smallest as to the largest of God's creatures; and that we had no right, in the mere wantonness of scientific observation, to take away the life which it was impossible for us to bestow."

Floriculture at Erfurt in Germany.

A correspondent of the *Evening Post* thus speaks of the immense horticultural establishments in Erfurt, Germany:

Erfurt has been given the name of the "Garden City of Germany," and, according to recently published statistics in Upper Consistorial Councilor von Tettau's "Erfurt, Past and Present," she well deserves the title. The area devoted to horticultural purposes in and around the city is over 2,000 Prussian morgens (0·65 of an acre). About 600 morgens of this are devoted to market horticulture; 220 morgens of the latter again are devoted to the production of flower seeds; and 210 morgens to vegetable seeds. The houses for the culture of exotic plants, and the hot and cold beds, possess glass covering to the extent of 250,000 square feet.

There are 36 independent horticulturists, of whom 27 do only a wholesale trade, besides 120 market gardeners, altogether employing over 500 assistants. The vegetable and seed trade depends almost entirely upon the larger cities of Germany. Over 300,000 catalogues and price lists are annually printed for the wholesale producers, at a cost of $10,000; 50,000 of these are wholesale catalogues, and half of the latter are prepared for England and America. The amount of postage paid on these catalogues, some of which are pamphlets, and on the letters containing seeds, is very great.

For the transmission of these seeds a vast number of linen and paper bags and paper, are required, involving an annual outlay of over seven thousand dollars. Both these articles are manufactured in the surrounding villages, giving employment to a great many poor people. As all these bags must be provided with the name of the dealer, a great amount of printing is also required. An incredible number of boxes and baskets are needed for packing purposes; the latter are made by the poor people in the neighboring villages; the former are made in the Thuringian Forest. Many poor families do nothing else during winter but make wooden tickets and stocks for the flowers.

A number of little Thuringian villages are almost upheld by the manufacture of flower pots for Erfurt alone. About 600,000 are planted yearly with about 3,600,000 stock-gillyflowers. These placed in a single row would reach nearly fifty miles! In the year 1863, 150,000 pots were planted with 1,550,000 gillyflowers for seed, and these brought in an income of nearly fifty thousand thalers. The production of the gillyflower in sixteen varieties and over two hundred colors established the horticultural fame of Erfurt ever since 1810.

The cultivation of vegetables for the market is chiefly carried on in the so-called "Dreienbrunn," an area of nearly two hundred acres, which was formerly a great swamp, and used only for the production of watercress. In the fifteenth century the market gardens were all within the city walls; in the last century the watercourses in the "Dreienbrunn" were regulated, and the whole swamp changed into an immense vegetable garden. About twenty acres are still reserved for the production of cress. Before the era of railroads the Erfurt market was limited to the surrounding cities; but now the Thuringian Railroad takes the produce to Cassel, Leipsic, Halle, Nuremburg, Weimer, Gotha, and other places. Of the seeds, fifty-eight per cent is sent to Austria, twenty-four per cent to Germany, and eighteen per cent to other lands of Europe. to England and America. A large trade in dried flowers is also carried on. In some of the gardens it is very difficult to get even a single bouquet. Agriculture is also prosperous in and around Erfurt, the farmers also devoting their attention to the production of field vegetables.

THE FRICTION OF STEAM ENGINES.

[From The Engineer].

If we did not believe that it is easy to say something new on a subject which has been in a very peculiar sense worn threadbare by the inventors of cylinder lubricators and steam greasers, this article would never have been written. So far as we are aware, all the information regarding the resistance of steam engines due to friction is to be found in the circulars of inventors, one or two papers read before engineering societies by the advocates of particular methods of lubricating engines, certain theoretical disquisitions contained in text-books of mechanical science, and perhaps a report or two in the *Journal of the Royal Agricultural Society*. It is almost needless to say that the subject is one of very considerable importance; but it may be worth while to bring this importance home in a tangible form to the employer of steam power. It may be stated, in pursuance of this object, that it by no means follows that an engine giving a very high indicated duty per pound of coal is really the most economical that a manufacturer can use, for the simple reason that the power required merely to drive the engine may be so great as to render the saving in fuel valueless. A case in point suggests itself. An experiment was made some time since with a compound engine, the general particulars of which are before us. This engine was of the annular type; the large cylinder about 35 inches diameter, the inner cylinder about 15 inches, the stroke of both pistons was the same, about 5 feet, the piston rods both laying hold of the same crosshead, which was connected with an overhead beam. The experiment consisted in shutting the steam off from the inner cylinder and driving with the outer annular piston alone. It was found that the engine, then indicating the same horse-power as before, failed to drive the machinery at the proper speed; and it was not till the indicated horse-power was augmented nearly 40 per cent that the engine would do the work. On permitting the steam to find its way to the inner cylinder as before, the indicated horse-power fell to the original point, the machinery being driven at the proper speed. We shall not pretend to explain why this was the case. It is indeed difficult to understand why the fact that the inner cylinder, though open to the atmosphere, took no steam, should so enormously reduce the effective power of the engine. The facts are as we have broadly stated them, and there is no reason to think they would now want explanation if engineers had in times past devoted a little attention to the study of the phenomena of friction in the steam engine. We have no doubt whatever that many so-called economical engines are doing very bad work indeed; nor that many so-called wasteful engines as far as coal is concerned, are giving out a far higher duty than is generally believed. The entire subject is wrapped up in mist—a mist which can only be dispelled by careful experiments, extending over long periods, and properly and fairly analyzed. That a few engineers have conducted experiments on the friction of steam engines and other machines is certain; but it remains to accumulate in a single volume the statistics which these gentlemen possess, and to put them into a form which may render them generally useful. In pursuance of this object we have for some time past been accumulating data, as yet infinitely far from being complete. But these data have, at all events, done this much—they have satisfied us that ordinary theories regarding friction in steam engines based on investigations concerning the coefficients of friction between lubricated surfaces, apply most irregularly and imperfectly. In other words, there is no theory at present in existence which will enable us even approximately to predicate with certainty what the loss of effect by friction in any given engine may be. In certain cases, calculations made with this object will correspond, with surprising exactitude, with the results obtained through the indicator and dynamometer. But the engineer, resting satisfied with such occasional coincidences, is mistaken in his views. In scores of other instances enormous discrepancies will be found to exist between theory and practice—the almost total absence of frictional resistance in some engines contrasting strangely with the expenditure of power absolutely wasted, in others. It is not the mere loss of fuel alone—although that is bad enough—that has to be considered in dealing with this subject. We find engines unable to do their work overloaded and worn out; boilers burned and overtaxed; grease and oil wasted; indeed, we go so far as to hold that every horse power unnecessarily spent in overcoming the frictional resistance of a steam engine costs three times as much as if it were spent in doing useful work, and this without taking at all into account the fact that useful work returns money, while what we may term the internal work of the steam engine returns none.

The difficulties which lie in the way of ascertaining by actual experiment what the frictional resistance of an engine is are very great, and to this cause no doubt is to be attributed the greater portion of the existing ignorance of the subject. The obstacles in the way are of two kinds. In the first place, it is very difficult to put a dynamometer or brake, on large engines, whereby to ascertain their duty; and, in the second place, the amount of friction varies not only in different engines, but in the same engines in a very extraordinary way. As regards the first difficulty, we can, in the case of pumping engines, ascertain precisely how many foot-pounds of work an engine actually gives out in the shape of useful effect, while the indicator shows the work done on the piston; but from these data it is impossible to calculate engine friction exactly, because our calculations are complicated by the greater or less efficiency of the pumps. It is possible that nothing can be more deceptive than the results obtained from pumping engines, and therefore we have no hesitation in rejecting their aid in dealing with questions of engine friction. Practically speaking, the only generally available test is the indicator, used with the engine light and the engine loaded; but diagrams taken thus do not account for the extra friction due to the performance of work, though useful to some extent in their way; but no investigation of the qualities of an engine can be regarded as complete unless the dynamometer is used as well as the indicator.

As regards the variation in the loss by friction in the steam engine, a very great deal might be said which we shall not attempt to say now. It may induce others to experiment for themselves, however, if we place a few facts curiously illustrative of the peculiar phenomena of engine friction before our readers. In one case we conducted the experiment personally; for the results of the other we are indebted to a gentleman who, in superintending the replacement of ordinary boilers by the now well-known Howard boiler, has occasion to indicate a very large number of engines and on whose accuracy we can rely with certainty. In the first experiment which we shall cite we found the full power exerted by a rolling mill engine in the north of England—where, it is unnecessary to specify—to be 291·5-horse. This included the resistance due to a fly weighing thirty tuns, a bar mill with two pairs of rolls working on heavy orders, and the requisite gearing. Engine and mill empty required, according to one set of diagrams, 74·8-horse power to run them at the working speed; but according to another set of diagrams, the frictional resistance of engine and mill is less than 35-horse power, and all the diagrams were taken within a few hours. We cite this case only to illustrate the difficulties engineers have to contend with in endeavoring to estimate the friction of engines under ordinary circumstances

The other experiment is very interesting and curious as regards results. The engine was a double cylinder traction engine, built by Messrs. Howard, of Bedford. The cylinders are 8 inches diameter and 12½ inches stroke. The engine shaft can be disconnected from all the rest of the machinery, so that the whole work done by the steam consists in turning the crank shaft and overcoming the friction of the bearings, pistons, etc. With 60 lbs. of steam in the boiler, the engine, making 190 revolutions, indicated unloaded 2·64-horse power. The engine was then set to drive a brake loaded to 16-horse power, the link being put in full gear; under these conditions the engine indicated 22·55-horse power. The frictional resistance was therefore increased, by the fact that the engine was now doing work, to 6·55-horse power, or to nearly three times that of the unloaded engine. This is all plain sailing, but now comes a most remarkable fact. The throttle valve was thrown full open, or nearly so, and the engines linked up—that is, worked expansively at the same velocity, 190 revolutions per minute. The load on the brake, etc., remaining absolutely unaltered; any engineer would predict that, under these circumstances, the result would be the same; far from this being the case, however, it was now found that the effective work or duty of the engine being unaltered, the indicated power *was only* 19·86-*horse power*, so that the friction of the engine when linked up was only 3·86-horse power, or little more than one-half that of the engine working in full gear. Lest there should be any mistake about this, the brake was then loaded with 504 lbs. With the link in full gear the engine indicated 44·88-horse power; the link was then put in the first notch, and the throttle valve fully opened, everything else remaining unchanged, when the power fell to 40·92-horse, the frictional or internal resistance of the engine in the latter case thus being 3·86-horse power less than in the immediately preceding experiment. How are these facts to be accounted for? Is it that the varying strain on moving surfaces in contact, due to the action of expanding steam, is attended with less frictional resistance than is present when the metals are under the steadier strain of non-expanding steam? We shall not pretend to answer these questions. There are the facts for the consideration of those interested.

Is it too much to hope that engineers who have the opportunity, will take up this subject, and endeavor to throw light into what is at present a very dark and unexplored region of mechanical engineering? We are convinced that the results would, when time and perseverance had multiplied data, be found of very great value to those who desire to see the steam engine undergo the real improvement of which it is still capable. We venture to suggest that the general practice of indicating the engines tested by the Royal Agricultural Society while running against the brake, and the publication of those diagrams, would be productive of much good. Suppose the Society begin at Oxford?

A Curious Exhibition.

A singular idea is that of a public exhibition of fans; yet such an exhibition has been held at the South Kensington Museum in London. The object of the exhibition was to promote the employment of women in a branch of industry peculiarly adapted to them, though how such an exhibition could further this good object one fails at this distance to perceive clearly. Nevertheless the exhibition brought out some wonders of mechanism and art, according to the *Building News*, which gives a column and a half to its description.

That journal says the present collection opens with a number of Chinese and Japanese fans, just brought over by one Mr. Mitford. They are, as a rule, very tasteful and curiously inexpensive. There are also some excellent specimens of Indian fans, lent by the Indian Museum, but the object of this exhibition is not so much to show us the different materials out of which a fan may be manufactured—such as carved in sandal wood, made from palm leaves, scented grasses, pheasants' feathers, or even beetlewings—as to set before us the fan as a work of art; and works of art most of the painted fans unquestionably are. Their subjects vary in an infinite number of ways. In this collection can be seen a geographical fan from Japan, with the route between Yeddo and Kiöto marked out upon it; a Spanish fan, containing an almanac and a globe; French fans, with revolutionary subjects; Italian fans, ornamented with paintings of Scriptural stories; and historical fans of all periods, from Rebekah and Eleazer down to the fan painted by Tjichy, a Hungarian artist, and presented to the Prince of Wales on the marriage of the Princess Dagmar with the heir of all the Russias. Here, too, are fans interesting to the public as relics—Nos. 262 and 272 were once used by the ill-fated Marie Antoinette; the Queen exhibits one which belonged to the Princess Charlotte; and a very curious fan, with imitation lace cut in paper and medallions in water color, was once possessed by Madame de Pompadour. It is not possible in this journal to devote much space to an object so apparently remote from its usual province as an exhibition of fans—nevertheless, there are points of common interest which claim our attention. Many of the French fans of the highest character, many Spanish fans, and some of the Italian ones, are of the class we will call pictorial. Thus the mounts of such fans are composed principally of pictures, no doubt designed to fill the peculiar space, but still pictures such as Gay describes as subjects for decoration:

> Paint Dido there, amidst her last distress,
> Pale cheeks and bloodshot eyes her grief express.

or—

> Here draw Œnone in the lonely grove,
> Where Paris first betrayed her into love.

Such fans have, at various times, been the work of the best artists of the day. Thus No. 224 is by Peter Oliver, the celebrated miniaturist of the time of Charles I. The subject of this fan, which has been painted out square and framed, is "The Triumph of Bacchus." Again, No. 348, a French fan, was painted about 1666, by Philippe de Champagne. It has a landscape on the reverse side, by PP. Valori. There are also one or two by Lancret, and No. 126 is a beautiful work by Boucher, while among those fans whose painters are unknown, we must call especial attention to "The Queen's Fan," No. 278, the subject of which is a highly-finished copy of Guido's Aurora. Some of the Italian fans of the pictorial class are enriched at the borders and near the sticks with delicate treatments of flowers and fruits so artfully arranged as to carry the color of the picture into the setting of the fan. No. 320 is a good specimen of such fans, while No. 82 is an excellent example of the same treatment of the mount, though the stick, which is of a subsequent date and quite plain, has been added to the fan without due regard to this artistic effect. Another class of fans may be described as a combination of ornament with pictures. A beautiful example of this is found in a modern fan belonging to the Empress of the French. In the center of the reverse side is a medallion, painted in grisaille by Moreau; while on each side some beautifully executed amorini, with arabesque ornaments, are supporting the imperial crown and her Majesty's initials. Of earlier examples Nos. 336 and 339, wherein vignettes are alternated with Pompeiian ornament, are very characteristic, and deserve study, because of the classic taste displayed in them. Many of the English fans of the last century belong to this class of treatment, sometimes consisting in vignettes and ornament, and sometimes in medallion portraits and ornaments. Of this character also is the fine French specimen by Boucher, to which we have already alluded. We cannot close without drawing attention to the fans decorated by Vernis Martin, that celebrated Frenchman, mentioned by Voltaire, who combined coach painting, when it still required the skill of an artist, with the decoration of furniture, snuff-boxes, and fans. He invented a varnish which has stuck to his name, and given character to the works of his hands. The labors of fan painting may be esteemed lightly by some, but we opine that when we find such French living artists as Eugene Lami, Moreau, and Hamon, not disdaining to devote their skill and time to such works, our countrywomen may well be proud to enter into the competition.

The first attempts to establish fire insurance were made during the reign of Charles II.

Jeddo.

Jeddo, the capital city of the Empire of Japan, is in the 36th degree of latitude, and is said to be one of the finest cities in the world. The streets are wide and clean, and the fine views of the Gulf of Jeddo, with the high hills beyond, and the picturesque gardens, trees, and temples nearer, make up many curious and beautiful views for a stranger to see.

The Emperor lives in the middle of the town, in the castle, surrounded with three walls or inclosures. The nobles and great people all have very fine houses, built principally of wood, carved, stuccoed, and ornamented. These houses are generally built in squares, the middle being the residence of the owner, the rest those of servants, dependents, etc. The gardens surrounding these places are laid out in good taste; every bit of ground taken advantage of, and mimic effects of scenery, such as tiny waterfalls, ponds, rock-work, etc., very well got up.

The Japanese bestow great care on the growth and culture of timber trees. The cedars grow to great hight; the oak tree, the mulberry tree—many towns live entirely upon the silk manufacture—then the urusi, or varnish tree, of which the people make the celebrated varnish known everywhere by the name of Japan; most of their furniture is coated with this, and all their plates, dishes and drinking vessels, as they do not appear to use glass or china ones; then the camphor tree, of which the puzzle boxes are made; the pepper tree, chestnut tree, walnut tree, and many others too numerous to mention.

They are the most curious people for dwarfing all manner of trees and plants. Growing things are twisted into all manner of shapes, and flowers and fruit of one sort growing on plants and trees of other sorts, outvying even Mother Nature herself. The love of flowers is strong among even the very poorest of the people, and few are without a pot or two, or some kind of tree or shrub grown against the back of the house, perhaps, reaching in through the windows, and loved and petted almost like children.

On account of the populousness of this country, every inch of ground is improved to the best advantage, and not only the flats but the hills and mountains are cultivated, and made to produce such things as they can. The rice fields are a beautiful sight—so well kept and drained, and irrigated so carefully. They are not unhealthy as in other places. Common vegetables are also grown in abundance; indeed, the poorer classes live principally on fish and rice, varied by vegetables or wild plants. Tobacco is also grown in quantities—the Japanese being great smokers. Their pipe has a very small bowl, and hangs by a button from the girdle or belt—the people having no pockets. These buttons are often highly ornamented and expensive, and the pipes themselves works of art. The tobacco is cut in fine shreds, a bag full of which hangs with the pipe at the waist.

Nagasaki is the principal trading port with foreigners, having been the longest open to them. Decima, a small island close to this town, which is entered by a bridge, is the famous Dutch station, where for many years the Dutch people had a monopoly of trade with the Japanese—submitting to all sorts of indignities and close confinement for its sake; until within the past few years no foreign women were allowed in the place, and so the Dutch merchants had to bear this tedious exile from their families. Most of these indignities, however, were brought upon themselves, and richly deserved by their dishonest attempts to smuggle, and overreach an honest and trusting people. The Japanese are not naturally a suspicious people, and we must lay at the door of intercourse with civilized nations their being so now. They have had a hatred and contempt for foreigners which it will take years of intercourse with some of the better class of English and Americans to do away with.—*New Dominion Monthly for June.*

Twist Drills, and Recent Improvements in their Manufacture.

We condense from a paper recently read by Mr. G. Lauder, C.E., before the Liverpool Polytechnic Society, the following remarks upon twist drills:

The last half century has witnessed many important improvements in engineers' tools. Self-acting machines have been introduced and improved in numbers too great to mention in this paper.

The leading idea which seems to have controlled in all these improvements, is what has been designated the "guide principle;" as examples, we may cite the slide rest, the planing machine, etc., the objects to be attained being, first, greater accuracy in the work performed, and, second, greater speed in performing it.

After improved machines, which have enabled us to attain the first object, we have to look to the forms of the tools used in these machines, to enable us to attain the second object—speed.

Tools for cutting metals are divided into two classes, viz., paring tools and scraping tools—these being distinguished by the edge they present to the metal being cut.

The data on which our knowledge of paring tools is founded are altogether derived from practice in the workshop—workmen, themselves, he believed, having been, in a great many cases, the leaders in improvement. The best cutting angle has been found, for iron and steel, to be from 60° to 70°, and the angle of relief, 3°.

Drills have been the last tools in common use by working engineers to come under the whip of improvement, a large proportion of those now in use being of the worst conceivable form to effect the object they are designed for.

The speaker referred to the common form of drill, and at the same time, exhibited a sheet of drawings on which a number of different forms of drills were marked. Some of them depend for cutting action on—to use a homely phrase—"strength and stupidness," no attempt, whatever, being made to form a propper cutting angle. Others are more advanced in form, and have a proper cutting angle provided; sometimes a small portion of the bottom end, he said, is turned, and forms in this condition, a very excellent working tool indeed. A twist drill was next spoken of, which was the real object of bringing this paper under the notice of the society.

These drills have been known for a considerable length of time, but have not been much used in this country until recent years, Americans having been ahead in their use, and in manufacturing them as well. Strange as it may appear, it is still true, that all the drills of this class were, until within a recent period, imported from the United States.

Due consideration being given to the principles already explained, the advantages arising from the use of twist drills will be apparent at a glance:—first, they serve as a common drill, to bore a hole; second, they serve as a guide, while boring, to keep the hole true; and, third, they are so formed as to provide the proper cutting angle throughout their whole working length; fourth, they are tempered throughout their entire working length; fifth, they are ground up true to standard sizes, thus obviating any necessity for dressing. This last advantage will doubtless be highly appreciated by all who have had practical experience of the continual trouble and loss incidental to the wearing out of size of common drills.

The speaker then said, until the recent improvements which I am about to lay before you were perfected, twist drills were formed entirely by the clumsy method of cutting them out of a solid round bar, by means of milling tools, then turning, tempering, and straightening; it is but justice, however, to the parties who have been hitherto engaged in the manufacture, to say that their arrangements and machines for that purpose were admirable of their kind.

The method now pursued successfully in this country differs entirely from that just mentioned. First, the bar of steel which is destined to form the drill is rolled into a special shape, it is then cut into lengths and again rolled in cam rolls, which form a straight groove, after which the shank is formed by cresses. Next the blank, as it is now called, is passed to the twisting machine, which consists essentially of a hollow spindle having a perforated nut in the end to receive the blank. This spindle, when the machine is started, has a motion of rotation on its own axis, and, also, a motion of translation in the direction of its axis, being thus adapted to twist the blank, then held firmly at the outer end by vise clamps. Other clamps, worked by suitable gearing, close on the blank as the central spindles clear them: these serve to hold the twist given to the blank. After a blank is twisted, the clamps open, the blank is withdrawn, and the twisting spindle returns to its starting point.

After twisting, the drills are centered and rough ground, then hardened by heating in a lead bath and cooling in cold water, next tempered in an oil bath, and finally finished by grinding to a standard gage.

The main features in this method, to which it was desired to direct attention, are the forging and twisting, in contrast to cutting from the solid bar. One of the principal difficulties in carrying out the new system, just described, was getting the blanks forged—accuracy being essential; this difficulty overcome, the benefits became manifest. Recent experiments have shown, that in shaping metals, nothing is of greater importance than attending to the "flow of the metal." Every particular shape into which a bar of iron or steel is forged, having an arrangement of the particles which compose it, peculiar to itself, any departure from this natural arrangement is prejudicial. By forging and twisting these drills, this law is paid the fullest attention to, each drill being finished, so far as shape goes, before a single particle of metal is cut from it.

By way of reward for attention to this natural law, the number of drills lost from water cracks, in hardening, is inappreciable as affecting the cost of production.

Dead Weight.

The first subject on the list for discussion at the coming Master Mechanics' Convention in September, is: Can the dead weight in rolling stock be materially reduced? An ordinary freight engine with tender containing fuel and water, weighs from 50 to 55 tuns, while the weight available for traction is about 20 tuns. In cars the proportion of dead weight to load carried, either freight or passengers, is very great.

Some idea can be formed of the extent of the evil by reckoning up the dead weight in an ordinary passenger train, which we give below:

	Pounds.
Weight of locomotive and tender	104,000
One baggage car	25,000
Three 56-seat passenger cars	84,000
One sleeping car	40,000
	253,000

These cars, if filled, will carry about 194 passengers, which will give 1,304 pounds of dead weight for each person carried. This estimate is a very moderate one, and we are satisfied that practically the dead weight per passenger will be nearer 1,500 pounds with a well filled train. It must be remembered, too, that trains are usually only about two thirds full, which of course would make the relative amount of dead weight per passenger considerably more.

If we deduct the weight of water and fuel, say 20,000 or 22,000 pounds, from the total weight of a locomotive and tender of the usual American plan, and of the size we have named—that is, weighing 104,000 pounds, we will have a permanent weight of 82,000 pounds left, of which only about 40,000, or less than half, is usually carried on the drivers and used for creating "adhesion." As practical experience has indicated that 10,000 pounds weight on each driving wheel is necessary for "adhesion" with a 30-tun locomotive, we must be careful not to lessen the weight on the drivers if we attempt to reduce the dead weight.

It would not, we think, be very difficult for an experienced and skillful engineer, in designing a locomotive, to reduce materially the weight of all the parts, without impairing their strength or efficiency, especially if steel was liberally used in the construction. If the dead weight should be thus reduced, some plan of locomotive must be adopted which will still leave 10,000 pounds weight on each driving wheel. The problem is to make all the parts of the locomotive lighter, and, at the same time, arrange their weight so that a larger proportion of it shall be on the drivers; that is, if the 82,000 pounds of permanent load should be reduced to, say 60,000, 40,000 of the 60,000 must still be retained on the driving wheels.

In the construction of cars, the paramount consideration should be safety to human life. Almost any amount of dead weight would be justified, if travel were made safer thereby, and the risk of injury to passengers lessened. The comfort of travelers is also a consideration which begins to influence the weight of cars.

Seats and frames are often made unnecessarily heavy, and the fittings and moldings, ornamentally, are frequently heavy enough to depress one's spirits. It is difficult to condense in any general statements the errors which are so very common, but it is evident that in very many cases reduction in weight was not a consideration which the car builder had in his mind at all. Elaborate carving in cars always seems out of place. The impossibility of keep it free from dust seems sufficient reason for discarding it.

The proper length of cars would be an interesting subject for discussion at the Master Car-builders' Convention, now in session. The weight of a bridge increases in a proportion approximating to the square of the span, and it seems reasonable to suppose that the strength of a car would be in a somewhat similar ratio. At any rate the most economical length for a passenger car seems as yet undetermined.

Of the weight of sleeping cars we have no accurate data to figure from. We have heard the most extravagant estimates of the weight of some of them, which, if true, would make it seem extremely probable that smaller cars, giving fully as much room and comfort to each passenger, would be more economical than many of the present "palace cars."

The evil of dead weight—as, alas! all evils do—multiplies itself. Often, too, the roots of it can be found in some other vicious practice. For example, a railroad company will insist on buying cheap axles; in due course of time several of them break on account of the poor material of which they are made; immediately some one jumps to the conclusion that they are too small; so a half inch is added to their diameter, and forms a perpetual incubus of dead weight which the railroad company literally must carry fourfold on each car they run. So with castings: some badly proportioned part breaks; the pattern maker at once adds 20 per cent to the weight, instead of exercising his brain in making the broken part in some better proportion. Heavier cars necessitate heavier engines, which implies greater wear of track and machinery and increased cost of transportation.

A great part of the cure of the evil, we are satisfied, must come from the use of a better quality and more skillful disposition of material. A young artist once inquired of Sir Joshua Reynolds how he mixed his colors; the reply was, "*With brains.*" So of railroad machinery, it must be built with more skill, and by the exercise of more thought, if dead weight is to be reduced.—*Railroad Gazette.*

The Volcano Fish.

A paper having appeared some time since in a cotemporary, from the pen of the Rev. W. W. Spicer, in which the phenomenon of the expulsion of fish from volcanoes was spoken of as strange and astounding, and the idea being conveyed that the fish must have lived "in the line of fire" before being expelled. Mr. Scrope, F.R.S., writes to *Scientific Opinion*, February 23, as follows: This sensational version of a very simple fact is one only of several which, on the authority of "the great Prussian traveler," have been repeated by compilers of treatises on volcanic phenomena. The simple fact, I conceive, is that the fish in question lived in the open air in crater-lakes, such as are frequently found at the summit of trachytic volcanoes—for the reason that the fine ash, which is usually the last product of their eruptions, and therefore forms the lining of their craters, is very retentive of moisture, and consequently occasions the production of lakes at the bottoms of these hollows. Of course in these lakes the same kind of fish will probably be found as, by Mr. Spicer's own statement, are met with in other lakes at an almost equal elevation on the outer sides of these very volcanoes."

SOME time ago Piazzi Smyth went on a scientific expedition to Teneriffe, and on his return published a series of very interesting papers. In consequence of the favorable report made by him of the fitness of such high situations for astronomical and meteorological purposes, the Russian Government has resolved to establish an observatory on Mount Ararat.

IN some localities large quantities of beer yeast are run off into sewers and wasted. It contains from 7 to 11 per cent of nitrogen. M. Bernier mixes about 100 kilogrammes of the yeast with about 30 kilogrammes of quicklime and 10 of gypsum, and thus obtains a manure which may be used instead of guano.

Machine for Manufacturing Finished Screw Bolts, Nuts, and Shafting.

So difficult is it to finish up a six-sided or an eight-sided nut, in a truly workmanlike manner that to do this has become a sort of test of skill with the file among mechanics. It is somewhat remarkable that the possibilities of doing this kind of work by simple machinery in a quicker and more accurate manner than can be done by manual labor did not earlier suggest themselves to mechanical minds. Certain it is, however, that such applications are of comparatively recent date, and that even at the present time there are many shops in which nuts and bolts are finished in the vise, by the use of the file.

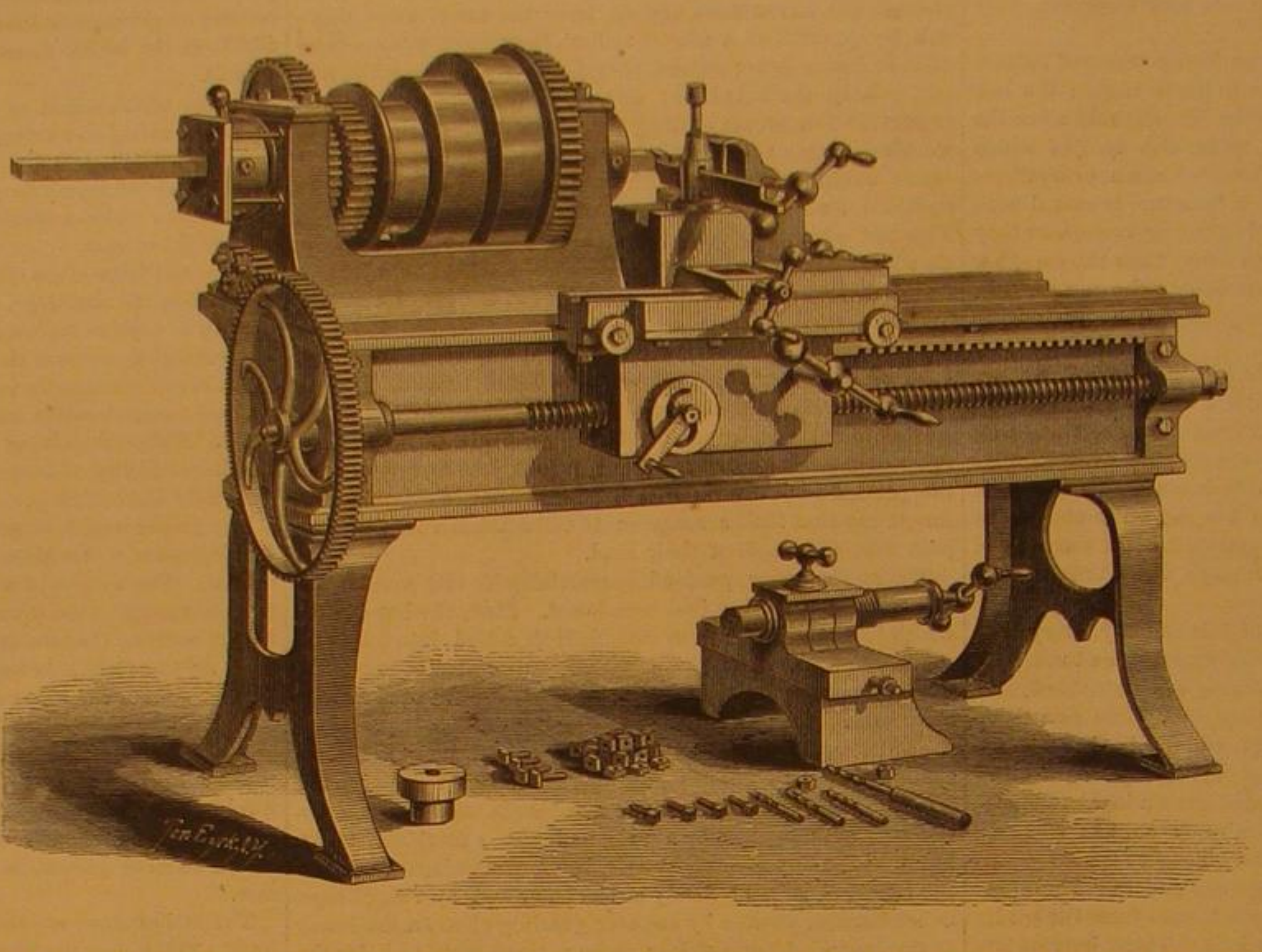
The machine we herewith illustrate is capable of finishing all sorts of screw bolts and nuts of any usual or desired size, and also turns shafting of any length and of any diameter used for most ordinary purposes.

It will be seen also, when we come to describe the principle of the machine, that a very great degree of exactness and uniformity is attainable, which specially adapts the machine for the use of locomotive works, as the extra bolt can be relied upon as being of uniform size, and therefore certain to fit.

It is also claimed by the inventor that a stronger head and thread are obtained in making the bolts in the manner he employs, and that a finished bolt can be produced by this machine cheaper than those made by forging and subsequent finishing in lathe and vise.

Fig. 1 is a perspective view of the machine, and Fig. 2 shows the form of the annular rose-cutters employed, and also a sectional view of them, showing them applied to the shaft of a bolt, as hereinafter to be described.

The general construction is that of an ordinary engine lathe. The spindle which carries the cone pulley is hollow, and through it the bar, from which the nuts or bolts are intended to be formed, or the shaft to be finished is passed. These bars, when nuts or bolts are to be made, are prismatic, having a cross section like that of the head of the bolt or the nut to be made. The cone pulleys are loose on the spindle, and by a system of gearing impart motion to the spindle itself. The bar, Fig. 1, being chucked properly to the center turns with the spindle.



RHEYDT'S MACHINE FOR MANUFACTURING SCREW BOLTS, NUTS, AND SHAFTING.

If nuts are to be formed the bar is drilled lengthwise, and a cutting tool cuts off the nut of the proper thickness. Both the drill and the tool which cuts off the nut may act simultaneously, so that the work proceeds rapidly; the cutting tool finishing one side of each of two consecutive nuts at a single cutting. In this way very accurate nut blanks may be produced with great facility.

When bolts are to be made, two sizes of rose-cutters, A and B, Fig. 2, are used. The drill is removed, and these cutters are chucked and firmly held by suitable jaws at a proper distance from each other, as shown on the shaft, C, of the bolt, Fig. 2. The bar revolving enters these cutters, as shown in the section, Fig. 2, and cuts the shafts in the form shown, leaving the shafts of the blank above the thread, and the part upon which the thread is to be subsequently cut, of proper length and size. A cutting tool, similar to that used for separating the nut blanks from the bar, serves to give the finished form to the top of the head of the bolt, shown at D, Fig. 2.

The rose cutters are also employed for finishing shafting, which can thus be turned to uniform size without employing calipers. These cutters are formed with a depression at E into which a corresponding projection upon the jaw fits, or they may be held in any other efficient manner deemed most convenient. The machine may be used as a common lathe by the use of suitable appliances which accompany it.

This machine was patented, December 29, 1868, through the Scientific American Patent Agency, by Ferdinand Rheydt, and an application for a patent or further improvements is now pending. Address at No. 224 North Franklin street, Chicago, Ill., for further information.

How to Prepare Mortar.

Though many of the accidents which are constantly taking place from the weakness in construction of our buildings, are rightly attributed to faults in the original plan, and the incompetency of the architect, it not unfrequently happens that a large portion of the blame should be placed upon the builder having the immediate charge of the work, and under whose supervision are conducted those minor details in construction upon which depend to so great an extent the stability of the whole. Walls may be made of insufficient thickness and yet stand for a long time if the masonry be good; and, again, they may be heavy enough in the plan and fall when built, if the mason does not thoroughly understand his business. In such a case, blame is often attached to the architect when an accident occurs, which should in reality hang upon the skirts of the builder. Upon the quality of the mortar used in construction depends, in no slight degree, the strength of the walls; and regarding the best method of mixing mortar, it is proposed in this article to offer a few suggestions

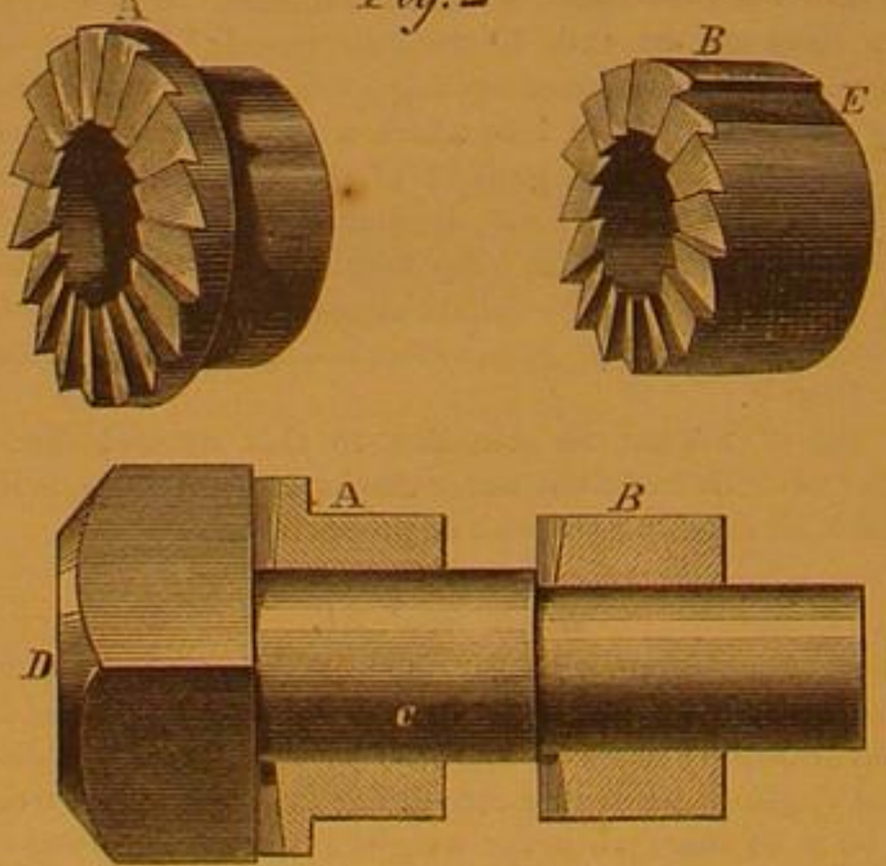
The common mode of making mortar is to first put the lime to slack in a box prepared for the purpose, and, after the slacking has continued for a time, to mix with it, in the same box, sand which has been previously screened. The mixture thus compounded is afterwards shoveled out of the box into a heap; and as mortar is required for use, a portion of this heap is drawn out and tempered to the proper consistency. In mortar prepared in this manner the mass is rarely homogeneous, lumps of unslacked lime and portions of gravel occurring promiscuously throughout the whole.

The proposed improvement in mortar-making provides an entirely different mode of operations, and, it is believed, obviates all the evils attending the present system.

The plan to be adopted which, in the estimation of the writer, is at once the most thorough and the most economical, is as follows:

Three boxes are first constructed, the first box being higher than the second, and the second box higher than the third. These boxes are connected by passages, at which are placed screens, such as are ordinarily used in mortar-making. Into the first box is put lime for slacking, and there mixed with water and manipulated until it is about the consistency of cream; after which it is allowed to run through the screen

Fig. 2



into the second box. It should be premised that, while the process is conducting, boards are placed over the screens and removed only when it is desired to unite the contents of different boxes. After the lime has been admitted to the second box, unscreened sand is thrown into the box in quantity deemed sufficient to make the mortar. The sand and lime, thus mixed, are then run through the screen into the third box or mortar bed, and there allowed to stand for twenty-four hours, when the mortar becomes fit for use, and requires no further tempering or mixing before its application.

The advantages of the above method are very apparent. In the first place, about one-fourth less lime is required than in mortar made in the usual way, and the mortar is more thoroughly mixed—and, therefore, much better—than that dealt with by the common process. Again, since the different boxes are separated by screens, the preliminary labor of screening is entirely avoided, all the lumps of unslacked lime being retained in the first box, and all gravel and foreign matter in the sand are retained, in a similar manner, in the second box. After the mixture is finally run into the mortar bed, all the refuse matter remaining in the first and second box can be shoveled out, and the boxes made ready for a repetition of the process. While the mortar is running into the third box, lime can again be slacking in the first box, withou loss of time until the mortar-bed is filled. The bed can be made of any dimensions to hold the mortar required in the construction of a large building. In regard to the quality of the mortar made by the above process there can exist little doubt. It is more easily applied, more durable, and better adapted for all kinds of work than that made in the usual way. The writer has followed the system for many years, and has continually greater reason to be satisfied with its decided superiority.—*Condensed from the American Builder.*

Fog Signals.

In some places there is a curious natural provision for fog-warning, in the fact that the spots in question, generally islands, are the habitation of large numbers of sea-birds, which make a noise that can be heard far away. The South Stack, near Holyhead, is a well-known example; and in these places the birds are generally preserved and fostered as benefactors to mankind. But such cases are rare, and artificial expedients have to be resorted to. Bells have been tried—we all know the story of the Inchcape Bell, and have heard of the Bell Rock on the Scotch coast; and every yachtsman has passed the Bell Buoy at the entrance of Southampton Water—but the sound of both bells and gongs has been found to be so damped by fog as to be heard only a short distance away. Guns are troublesome, and not always suitable; and there has been, until lately, much difficulty in finding anything that would do. A short time ago, however, an invention by an American, Mr. Daboll, was brought to the notice of the Trinity House authorities; and, as it appeared promising, it was tried with so good a result that it may probably come more extensively into use as a fog-signal. We have been allowed, by the courtesy of the authorities, an inspection of the apparatus, and will endeavor to explain its construction and action to our readers. It is a very powerful horn or trumpet, blown by highly-compressed air, the sound being produced, however, not on the principle of either of these instruments, as ordinarily used in military bands, but on that of the clarionet or the brilliant trumpet-pipes of an organ. The sound of a clarionet is due to the vibration of what is called a *reed—i. e.*, a thin tongue of elastic material, which is placed so as to cover a long opening or slit leading into the pipe of the instrument. The reed is fixed at one end, the part over the opening being left free to vibrate. When the player covers the reed with his mouth and attempts to blow into the tube, the reed, by its flexibility and elasticity, alternately closes the opening and leaves it again, allowing a jet of air to enter the tube every time the opening is free. By this action the reed is set into quick vibration; and the puffs of entering air, following each other in regular succession and with great rapidity, give rise, on well-known acoustical principles, to a musical tone. This tone is further modified in quality by reverberation in the tube of the instrument, and is greatly strengthened by the bell-shape given to its extremity. The pipes of what are called the *reed-stops* of an organ are on the same principle as the clarionet; but the vibrating reed is in this case a thin plate of brass, varying in size according to the pitch of the note; but, for the middle tones, an inch or two long, a quarter to half an inch wide, and the substance of a thin card. The mouth of the player is represented by a box, inclosing the whole of the reed apparatus, and the pipe is generally of metal, conical in shape, or with a bell-mouth some inches in diameter. The fog-horn is essentially of the same construction as the reed-pipe of an organ, but with all its parts magnified to colossal dimensions. The reed, instead of being a thin leaf of brass, is a thick plate of hard steel, five inches long, two inches wide, and a quarter of an inch thick at the root, tapering down to an eighth of an inch at the loose end. The tube is of brass, eight or ten feet long, gradually expanding in diameter till it finishes in a bell-mouth two feet across. The pipe is placed vertically, its upper part projecting through the roof of the building, and being bent into an elbow, so as to make the bell part horizontal, delivering its sound straight out to sea. The compressed air for sounding the horn is supplied from a reservoir, into which it is forced by pumps worked with mechanical power. In the experimental apparatus a hot-air engine, of American contrivance, is used for the purpose; but a small steam-engine would probably be a more simple and trustworthy machine. A duplicate engine is required in case of any part getting out of order. The pressure of air required to sound the pipe is on the same magnified scale as the pipe itself; in an organ it amounts only to an ounce or two on every square inch; for a fog-horn it is from five to ten pounds, and the quantity of air required at this pressure is very large, but the volume of sound is immense.—*Cornhill Magazine.*

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Contents:

(Illustrated articles are marked with an asterisk.)

THE MANAGEMENT OF RAILWAYS.

It has often been said that it is easy to discover that a man is sick, but not so easy to tell what will cure him. It is easy to see that our railroad system is giving birth to enormous monopolies, but it is not easy to say how this can be helped now. Yet we find editors who think themselves able at a single sitting to concoct a plan which shall meet all the exigencies of the case. We confess we are unable to do this. The subject appears to us beset with difficulties; difficulties only to be discovered by long and able thinking, and which render the application of the proper remedies a task only to be accomplished by experienced and careful legislators.

We have been led to these remarks by the perusal of an editorial in *Hunt's Merchants' Magazine*, wherein the evils of the present system are pointed out and a remedy, which the author confidently pronounces adequate, is suggested.

That journal says justly: "The temptations to fraud on the part of railway directors are now enormous, and the checks upon them are trifling. For instance, a secret compact is made between the boards of two competing or connecting roads, by which one is sold or leased to the other at an enormous price; the directors and their friends at once buy up the one stock, and perhaps sell immensely of the other, and then publish the contract which changes the value of the stocks, and close their speculations in the market with large profits. Or, a secret arrangement is made for an unusual stock dividend out of profits which have been carefully concealed from the public, and even denied on oath by the officers of the road, and the stock bought at low prices by the 'ring' is, after the dividend, sold at a vast advance to the public. In many such instances the value of their own property has been depressed by the secret compacts of the directors who hold it in trust, or immense issues of new shares have been privately sold to an unsuspecting public; and when the exposure was made, the stock has suddenly fallen, and the conspirators, by their breach of trust, have enriched themselves with the spoils of those they pretended to represent."

This picture is not in the least overdrawn, but the question is, what are we going to do about it?

The author of the article referred to, says: "The one condition of success in such intrigues is secrecy. Secure to the public at large the opportunity of knowing all that a director can know of the value and prospects of his own stock, and the occupation of the 'speculative director' is gone."

To meet these difficulties he proposes that railway companies shall be compelled to publish all their financial statistics in a clear and intelligible form as soon as they can make them up. But how compel them? Surely this must be done by legislation, and we have seen in this State how extremely easy it is to legislate power into the hands of these corporations, but how hard it is to get the power away from them.

Is not the fault somewhat further back than corporations? and is it not rather in our own vicious system of legislation upon private interests? Limit the power of the legislature to bills of an entirely public character, and open the way to free competition, and would not the corporations find themselves powerless to injure public interests?

As to the stockholders, each man knew or ought to have known, when he bought his stock, the conditions under which he holds such property, and expected, or ought to have expected, that the larger stock-holders would control their own shares as well as those of the smaller. Therefore they who thus willingly or ignorantly entered into such a copartnership cannot complain if its terms are carried out to their full extent.

The writer referred to also suggests the prohibition of "every form of railway sale or consolidation by the companies," and thinks that only by this means can swindling be prevented. How this suggestion is to be carried out he does not tell us. It certainly seems to us not only impracticable, but contrary to all the fundamental principles upon which property is now held under the control of its legal possessors. Once let it be granted that those who own property may be legislated out of the power to control or sell it, and where will the end be? Clearly in the setting of limits beyond which neither individuals nor associations can acquire and hold property. For to lose the power to control and sell is, in effect, to cease ownership.

The solution of this question, if it ever reach a solution, will never be arrived at by any such loose and ill-considered propositions as this.

Monopolies can hardly endanger the right of the public so long as they encounter free competition. We do not pretend to set forth any plan by which this free competition can be secured, we leave that for those who are more competent to deal with it.

RECENT PROGRESS IN CHEMISTRY.

The past year has witnessed the introduction of a large number of new compounds into daily use, and the consequent increase of our knowledge of the best methods of manufacture, and the properties of bodies about which we could hitherto obtain very little information, even in the most complete works on chemistry. A recent bulletin, published by the extensive chemical manufactory of E. Schering, in Berlin, affords matter not to be found in any books, and hence we propose to condense the information for the benefit of our readers.

The hydrate of bromal, to which the formula of $C_2\,Br_3\,HO + 2\,H_2\,O$ is given, crystallizes in white needles, or by slow crystallization in the same form as blue vitriol, though colorless. It has a similar taste and smell to the hydrate of chloral, and is easily soluble in water and alcohol. Salts of silver ought not to produce a precipitate with these solutions.

The hydrate of bromal has hitherto been confined to scientific investigations, as experiments upon animals have shown that its effects are more anæsthetic than hypnotic. Chloral, originally discovered by Liebig nearly forty years ago, was not fully studied until recently. It is a perfectly colorless liquid, having the same boiling point as water, with a specific gravity of 1·5, and a sharp, biting taste, and undergoes spontaneous decomposition, so that it cannot be kept for any length of time. If one equivalent of water be added to it, it forms a dry crystalline mass known as the hydrate of chloral, and one equivalent of alcohol produces similar crystals of an alcoholate of chloral; the chloral has at present merely a scientific interest.

The alcoholate of chloral yields white, transparent, hygroscopic crystals, closely resembling the hydrate of chloral in taste and smell, but less soluble than the latter in water—a reaction that will enable chemists to detect a mixture of the two compounds. If we heat the alcoholate of chloral in twice its volume of water, it melts without dissolving and immediately crystallizes out under the water on cooling, while the hydrate of chloral at once goes into solution and remains dissolved. Sulphuric acid heated with the alcoholate becomes brown, but with hydrate of chloral remains colorless. Nitric acid of 1·2 specific gravity gives ruddy fumes of nitrous acid when heated with the alcoholate, but no fumes are produced under similar circumstances with the hydrate of chloral. It is of the utmost importance to know these reactions as the close resemblance between the alcoholate and hydrate may lead to serious mistakes, as the properties are unlike and the alcoholate ultimately acts like alcohol itself. The hydrate of chloral has been pretty fully described in our columns, but some practical details remain to be recorded. Its manufacture has assumed enormous dimensions, especially in England and America, but no establishment is able to make large contracts on account of the difficulties which still arise in its preparation. The workmen are so much affected by the fumes of chlorine and hydrochloric acid that they require to be constantly relieved, and this occasions delay and annoyance. It is difficult for the American manufacturer to compete with the German, owing to the high price of alcohol in this country and the revenue tax imposed upon it. The contradictory properties ascribed to the hydrate of chloral by different experimenters may be accounted for on the ground of the presence of the alcoholate in consequence of defective preparation. It is an agent not to be tampered with, and only to be trusted when coming from perfectly reliable sources. If it should be substantiated that in the hydrate of chloral we have a sure remedy for sea-sickness, as well as for the most obstinate cases of sleeplessness, it will prove one of the most important and beneficent contributions made by chemical science during the present century. In Germany the retail of this article is prohibited without the prescription of a physician.

A number of new and important compounds of carbolic acid have been discovered, which are prescribed in cases of putrid wounds for injections, and generally as disinfectants. Among those may be mentioned the sulpho-carbolate of zinc, which is inodorous, crystalline, and easily soluble in water and alcohol; the sulpho-carbolate of soda, a white crystalline powder; and the sulpho-carbolate of copper, resembling blue vitriol in color. A great objection to the employment of carbolic acid as a disinfectant is the persistent odor it has as usually sold for this purpose. This difficulty seems to be obviated in the case of the compounds mentioned above, and it is to be hoped that they will come into general use. Chloræthyliden is a new anæsthetic, the properties of which have only partially been studied, but which promises to be valuable.

The above are a few of the most important of the recent contributions of chemistry to the every-day wants of man.

A few months ago they were utterly unknown, now they afford investment for a large amount of capital, and give employment to many skilled workmen, besides conferring untold blessings upon suffering humanity.

OTHER WORLDS THAN OURS.

Our readers are well aware that we do not regard mere speculation of any sort as likely to either add to man's knowledge or happiness. The question as to whatever other planets in the solar system besides our own are, or may be inhabited, is one which must be classed among fruitless and profitless speculations. We find on this earth enough of evil to surmount, enough of solid fact to discover, and enough recorded learning to acquire, to tax all our energies without wandering off to other planets in vain guesses that they are or may be inhabited.

If we grant that they are full to overflowing with all sorts of living things, and that creatures as highly organized as men are, or as angels are supposed to be, dwell thereon, what application of this assumption can be made that will better the condition of mankind in the least, or give him the slightest insight into anything it is desirable for us to know.

Wild speculations have been indulged in about the possibility of establishing communication with these suppositious inhabitants, and perhaps deriving from them knowledge beyond anything that science has yet dreamed of, or hath entered into the heart of philosopher to conceive. Nay, Emanuel Swedenborg claimed to communicate with the inhabitants of Jupiter, but so far as we know the world has never got any good from the communication.

In some respects the present is an age of strange incongruities. On the one hand we have a class of men who profess to walk solely by faith; on the other hand, there is a class who profess to walk solely by the light of demonstrated facts or logical inferences from the results of experience. Between these two classes lies another, to which we may apply the commercial term, "middle-men," who profess to be scientific yet who are willing to indulge in speculations which certainly exact as large a degree of faith, as the dogmas of those who would make faith the sole rule of action.

Mr. Richard A. Proctor, F.R.A.S., is one of this class. Having attained some reputation as an astronomer, he has of late been indulging in speculations upon the old never-to-be-settled question of the plurality of worlds, and Longmans, London, has published in a book entitled "Other Worlds than Ours," what might as well have been styled "The Visions of Proctor"—a work from his pen in which the subject is stated to have been studied (?) under the light of present scientific researches.

Our knowledge of the book is at present confined to what the English *Reviews* have said about it. These *Reviews*, so far as we have seen them, are very favorable to the work. Taking, therefore, what they have set forth as a fair index of the line of argument pursued by the author, we find that very few of the facts upon which he bases his speculations are new, and further, that all he says or can say upon the subject may be summarized thus:

It is not impossible, so far as we can ascertain the conditions which exist upon the surfaces of some of the planets, that living creatures may exist upon them, therefore it is quite probable they do exist there. It is possible that peculiarly organized beings may have a high degree of intelligence, and it is further possible that the probable beings which may exist upon—say Mars for instance—may be highly enough organized to possess a high degree of intelligence; therefore it is quite probable that some of the living beings upon that planet are highly intelligent.

This is, we think, a full and fair showing of the argument.

In the statement of facts from which the possibility of animated existence is inferred, we find very little that is new, and the claim that present astronomical science possesses facts warranting such an inference, that were not possessed fifty years since has very little to support it.

Such new facts as have been obtained, and which are available for the purpose of such speculations, are confined principally to the planet Mars. There is little doubt that, on that planet, the conditions of climate and atmosphere are very analogous to that of our globe; but this admitted, the question again resolves itself into one of probabilities.

We grant the probabilities, and find that we get very little satisfaction from our liberality. We cannot send ships to Mars, and open up a commerce with its inhabitants. We do not know how they stand upon the Women's Rights question, or whether a jury of twelve intelligent sons of Mars would have convicted or acquitted McFarland. We cannot even send missionaries to convert the—in all probability—teeming population of that planet, or get up societies for the amelioration of his—it may be—oppressed multitudes.

We do not know whether all the people who dwell upon his face are suffering because the first man and woman would eat forbidden apples, or whether they are all in some huge garden of Eden, enjoying themselves in the most beatific manner.

Perhaps, however, it would be possible to get a word or two with them by making use of one of our vast prairies and adopting Dr. Dick's plan of drawing thereon huge geometrical figures.

Finding it thus possible to communicate we suggest the first question be, "Are you happy?" With what breathless suspense shall we await the answer, and if it should be—as it is quite probable it might be—"NO!" how gratified we shall all feel that the benevolence of the Creator has not left this world alone in its misery. It would almost make this planet explode with envy should the reply be "Yes."

MACFIE THE IRREPRESSIBLE UPON PATENT LAW.

Even the London *Spectator*, which supports Mr. Macfie in his opposition to the patent laws, gives that irrepressible gentleman little credit for skill in argument, and acknowledges that very much of what he has said only tends to show defects in the present English system of patents, rather than any good reason for its abolition.

Not content with making absurd arguments and illogical speeches, Mr. Macfie has collected into a volume, speeches, papers, and expressions of opinion, which he no doubt considers as "*squelchers*," but which sensible, sober thinkers are prone to denominate as the most unmitigated bosh.

The only logical conclusion to which this gentleman's arguments tend, is one which he is too short-sighted himself to see, namely, the utter renunciation of individual rights to the possession of property, be the same patent rights, copyrights, or anything else that men are now able to procure for themselves by virtue of genius, tact, and industry.

In that Utopian state of society for which some long, and fewer hope, when every man shall live solely for the good of all men, when land, chattels, wives, and children shall become common property; when all selfishness shall be done away, and each shall prefer to see his neighbor enjoy, rather than to enjoy the fruit of his labor himself, Mr. Macfie would find the principles he advocates precisely the thing.

To suppose, however, that in the existing state of human society men will consent to relinquish their rights to property in thought, or the results of their mental toil, and allow a distinction to be made between these rights, and those by which they hold the results of physical toil, is to suppose them on the average, to be as incapable of drawing a logical conclusion as Mr. Macfie himself; a state of general imbecility we are unprepared to admit. Of course everybody would be free if there were no laws of any kind. We should then have free trade, free stealing, free murder, free starvation, and a host of other freedoms which men have thought it wise to resign for another kind of freedom, *i. e.*, freedom to go and come unmolested, to accumulate wealth, and to improve their bodily and moral condition.

In Mr. Macfie's code carried out logically to its conclusion, A may plant and cultivate a hill of potatoes, which, as soon as he has dug them, all the other letters of the alphabet may seize and appropriate, provided there is enough to go around. True, A is compensated for his loss by the right to invade the onion patch of any other letter, and devour turnips wherever he finds them growing. Thus we get back to the old original savage game of grab. It will not take long for B to find out that he is stronger than A or C; nor long for A and C to find that their chances for either potatoes, onions, or turnips, are small and slim when B is around

No man would get pay for anything he might do, but would live, if he lived at all, by stealing, unless, as we said above, each would work for all, and uniform distribution were secured, a thing which even the early Christians found difficult, as we learn from "Acts," the widows were neglected in the daily distribution.

We believe in neither Mr. Macfie nor his logic, and the logic of the *Spectator* is little better when it says:

"One of the most serious considerations with regard to the Patent Laws is that they are already being removed in other countries, and that the competition to which our manufacturers will thus be exposed must embarrass them in their business, while reducing the value of patented inventions. Mr. Macfie gives us a message from Count Bismarck to the North German Parliament, recommending the total abolition of patents throughout the new Confederation. The Second Chamber in the Netherlands passed a similar resolution by 49 ayes to 8 noes. It has already been found in some remarkable instances that countries restricted by patents cannot hold their own against others in which manufacture is unimpeded. M. Chevalier tells us that France cannot export Bessemer steel to Prussia, and that the French makers of velvet suffer in like manner from Prussian competition. The history of the aniline dyes discovered by Professor Hofman, but patented by others, teaches the same lesson. French manufacturers who had to pay £40 a kilogramme for what cost only £12 out of France, flocked by shoals from their own country and set up new factories in Switzerland and Belgium. The danger to every trade which is weighted by patent restrictions becomes the more formidable as those restrictions are removed in other States."

Let England adopt a wise protective system, and the policy of other European nations in regard to patents need not trouble her.

Uses of Mica.

Recently scales of mica have been used for spectacles and in optical instruments. The chief use in this country is in connection with stoves, and it is now quite an article of commerce, especially in New England. Many furnace doors are now supplied with small holes closed with mica, which serve as windows to enable the engineer to see the state of the fire without letting in a blast of cold air by opening the door. Many varieties of mica abound in curious markings, which have attracted the attention of microscopists as affording some clue to the true origin of this stone. Mica is one of the constituents of granite, and contains potash, and sometimes lithia and other alkalies. Stove dealers are the chief consumers of this article.

PATENT RIGHTS IN CONGRESS.

Our readers will probably recollect—as we noticed it at the time—that President Grant's first veto was that of a bill to extend the patent of Rollin White, the inventor of the Smith & Wesson revolver. We have never had a doubt that the veto was a righteous one.

In the House of Representatives on Wednesday, June 22, the bill was reconsidered, General Butler supporting its passage over the veto of the President; whereupon Mr. Farnsworth accused General Butler of having received $2,000 for his support of the measure. General Butler retorted that the charge was false, malicious, and infamous, and stated that the $2,000 received by him were counsel fees, received in a case tried before the Supreme Court, the brief in which cost him four weeks' work. He considered the money honestly earned, and doubtless so will the public.

The Joint Committee on Retrenchment lately directed to investigate settlements by the Navy Department of contracts made by Isherwood, Chief of the Bureau of Steam Engineering under the last administration, for steam machinery, held a meeting on the evening of the 22d June. No witnesses were examined, but the Hon. William E. Chandler was present by invitation, and in reply to a question he stated that he knew nothing personally of the settlements, but acted as the counsel of Henry W. Gardiner and others, in their efforts to defeat an extension of the Corliss patent and in the preparation of papers placed before the House Appropriation Committe, to defeat an appropriation to pay Corliss' certificate, given by G. W. King, the present head of the Steam Engineering Bureau, in settlement of contracts with the Corliss Steam Engine Company, of Providence, R. I. This Company had contracts unfinished when the present administration came into power. A settlement was made, by which engines began were left unfished, the Department agreeing to pay some $250,000.

USES OF FLUOR SPAR.

In an article on fluor spar as a flux, Vol. XXII., page 288, we stated that in the manufacture of iron, "the proper proportion is about 50 pounds to 100 pounds pig iron, or 40 pounds to 100 pounds spiegel iron." In both of these cases for 100 pounds read 100 *centners*—this makes the proper proportion 50 pounds fluor spar to 11,000 pounds pig iron, or 40 pounds to 11,000 pounds spiegel iron.

FLUOR SPAR IN GLASS MANUFACTURE.

E. Richters, in Waldenburg, Germany, states that the substitution of fluor spar for lime in the manufacture of glass allows of a great reduction in the amount of glauber salt, and greatly promotes the melting of the frit.

As the result of numerous experiments conducted on a large scale, he found that with the same consumption of fuel and similar length of time, the amount of glauber salt required could be diminished one half by substituting fluor spar which had previously been pulverized and calcined for the lime usually employed.

In countries where fluor spar can be had in abundance, its introduction into glass manufacture would appear to offer many important advantages. The following are the proportions taken:

	With fluor spar.		With lime.
Sand	115·44 lbs.	....	116·40 lbs.
Fluor spar	27·69 "	Lime	15·55 "
Glauber salts	4·90 "	....	8·00 "
Manganese	4·00 "	....	3·00 "
Charcoal	2·00 "	....	2·00 "
Glass frit	299·00 "	....	248·00 "

A Warning to Thieves.

The *Journal of Commerce* notices with astonishment that bank officers, who pay such large sums for safety vaults, burglar-proof locks, steel-lined chests, and all the other very proper protections against robbery, neglect to add one of Holmes' Electric Alarms. With this, well arranged, a gong might be set ringing on the first opening of the door or window of a banking house, making sufficient noise to waken a whole village. Mr. E. Holmes, whose office is at No. 7 Murray street, showed us recently a large gong that he had arranged especially for bank alarms. Some banks in this city are protected in this manner. It is well worth the attention of those interested, and we write solely for their benefit from our own knowledge and experience, without any solicitation from the owners of that invention.

A New Use for Oxygen.

We are informed by M. Widemann, who is connected with the works of the New York Oxygen Gas Company, that the use of oxygen in renewing and increasing the flow of oil in petroleum wells, has been so successful that a regular trade has sprung up in oxygen gas for this purpose. The gas is injected into the wells through tubes, and mingling with the hydrocarbon vapors, forms an explosive mixture which, when ignited, completely opens seams which have become clogged, and thus renews the flow.

COMPRESSED FISH OFFAL FOR MANURE.—In a recent article upon the uses of codfish the compressed offal was spoken highly of as a manure. Mr. W. F. Rickard, F. C. S., formerly of London, writes us from Leviathan Mine, Cal., that he is the inventor of the process therein described as French. He further writes that the compressed offal does not decompose by exposure to the air. Samples which had been lying about his London office four years have been found perfectly hard and sweet, proving thereby that the article may be exposed in bulk without the cost of packages.

COCKROACHES can be destroyed by using smooth-glazed china bowls, partially filled with molasses and water. Set the bowls against something by which the insects can get in; they will not be able to get out.

PATENT OFFICE AFFAIRS.

The business of the Patent Office is now in a flourishing condition, and the present is a favorable time to enter applications. Inventors will find the SCIENTIFIC AMERICAN PATENT AGENCY ready to attend to the prosecution of claims with the greatest dispatch. By reference to our register, we find that we have made upwards of twenty-four thousand preliminary examinations into the novelty of alleged new inventions. This great experience, together with the fact that a large proportion of all the business with the Patent Office, for the past twenty years, has been conducted through this Agency, suggests to inventors the surest and best means to secure their rights.

We give opinions free, and all we require is a rough sketch and description of the invention.

Inventions patented through this Agency receive notice in the SCIENTIFIC AMERICAN.

MODELS.—In order to apply for a patent the law requires that a model shall be furnished, not over a foot in any of its dimensions, neatly and substantially made. Send the model by express, prepaid, addressed to Munn & Co., 37 Park Row, New York, together with a description of the operation and merits of the invention.

CAVEATS.—Whenever an inventor is engaged in working out a new improvement, and is fearful that some other party may anticipate him in applying for a patent, it is desirable, under such circumstances, to file a caveat, which is good for one year, and, during that time, will operate to prevent the issue of a patent to other parties for the same invention. The nature of a caveat is fully explained in our pamphlet, which we mail free of charge.

EUROPEAN PATENTS.—Probably three-fourths of all the patents taken by American citizens in Europe have been secured through the SCIENTIFIC AMERICAN PATENT AGENCY. Inventors should be careful to put their cases in the hands of responsible agents, as in England, for example, the first introducer can take the patent, and the rightful inventor has no remedy. We have recently issued a new edition of our Synopsis of European Patent Laws.

All communications and inquiries addressed to Munn & Co., respecting patent business, are considered as strictly confidential.

THE REPORT OF COL. W. A. ROEBLING, CHIEF ENGINEER OF THE N. Y. BRIDGE CO.

The Superintendent and the Chief Engineer of the N. Y. Bridge Company, who have in charge the erection of the great suspension bridge over the East River between New York and Brooklyn, have made their reports. That of the Superintendent, Mr. W. C. Kingsley, pertaining chiefly to the financial matters, we shall pass without special notice. That of Col. Roebling, however, is so interesting and instructive, and the work is of such importance, that we make room for nearly the whole of his report, omitting only some introductory matter.

SURVEYS.

The general line, known as the Park route, had before been determined, but no actual line had ever been located upon the ground, the bridge line having been simply traced upon the largest and best maps procurable of both cities.

WORK WAS COMMENCED

in June, 1869. One single air line run through over the tops of the houses from the City Hall, in New York, to St. Ann's church, in Brooklyn, at once showed a discrepancy of more than fifteen feet between it and the line laid down on the maps. Several center lines were run on trial, each a little further to the east on the Brooklyn side and more to the west on the Chatham street, New York side, until one was found that was satisfactory.

In the location of bridges some attention is paid to the difficulties likely to be incurred in getting foundations for piers, in making approaches, etc., but here such consideration had to be ignored, and the towers and anchorages placed wherever the exigencies of the case brought them. The charter fixed the terminus on the Brooklyn side in the square on the corner of Sands and Fulton streets, etc., and on the New York side it was desirable to bring it as nearly as possible to the corner of Nassau and Chatham streets. The foundations of the Brooklyn tower threatened to encroach upon one of the main slips of the Fulton Ferry unless kept far enough to the east, but by doing so the New York tower unavoidably occupied one of the slips of the Roosevelt street ferry. Any further movement to the east would bring the approach over Prospect street to a point where no head room was left between the grade of the street and the bridge crossing it. The same was true in regard to North William street.

Other difficulties summed up showed that no change from a straight line was admissible. The center timbering established a minute and detailed survey. Since then the Brooklyn foundation has been placed in its proper position on this line, and any change is impossible.

In August, 1869, I was appointed Chief Engineer. At the first meeting of the Board of Directors, in September, 1869, the Executive Committee were empowered to proceed with the foundation of the Brooklyn Tower, and to complete the same up to high-water mark. Mr. Horatio Allen was appointed Consulting Engineer, and Mr. Wm. C. Kingsley, General Superintendent. To Messrs. Webb and Bell the contract to built the caisson was given.

THE BROOKLYN FOUNDATION.

In the meantime a boring made in 1867 showed gneiss rock at a depth of 96 feet below high water. The strata penetrated consisted in the first place of surface filling through alternate layers of hard pan and boulders of trap embedded in sand and clay. Below 50 and 60 feet depth the material was so compact that the bore hole stood without tubing for weeks. No necessity existed, therefore, for going down to rock; a depth of about 50 feet would suffice. But the great desideratum to be attained was a uniform character of the soil over the whole space of the foundation whatever the depth might be. It is well known that the drift formation of Long Island presents a great variety of strata in comparatively short diagonal distances Within a hundred or two feet on either side of this foundation, there is no bottom so to speak, and piles are driven a great depth into mud; whereas in the center of our foundation the depth of water was only a few feet the existing ferry slip had been blasted out at a great expense, and to drive an iron-shod pile even two feet into that material was the work of hours. This hard material, however, occupied only a part of the foundation, which comprises an area of 17,000 square feet. One third of the area towards the east was much softer in character; to meet the requirements of the case a heavy solid timber foundation was decided upon, of sufficient thickness to act as a beam, and having the requisite mass to insure a uniform settling. The importance of a uniform foundation becomes evident at a glance when we consider the size of the tower, weighing 35,000 tuns, with a hight of three hundred feet above the foundation upon which the permanent pressure is 1½ tuns per square foot. In addition, the buoyancy of the timber enables us to dispense with the screws ordinarily used in towing a caisson.

In regard to durability, it is well known that timber immersed in salt water is imperishable, and to protect it against worms it is merely necessary to sink it beneath the river bed. It at once suggested itself to make the timber platform as far as possible a part of the

CAISSON.

This has been done by making the roof of the caisson a solid mass of timber, of fifteen feet in thickness. The object and purposes of a caisson in sinking a pneumatic foundation is too well known to need any description here; it is merely a diving-bell on a vast scale. It may well be said that, since the unparalleled achievement of Captain Eads, at St. Louis, the word caisson has become a household word among American engineers.

The caisson of the East River Bridge is a large inverted vessel or pan, resting bottom upwards, with strong sides. Into this air is forced, under a sufficient pressure to drive out the water. Entrance is had to the large working chamber, thus formed underneath, through suitable shafts and air-locks. The material is taken out through water shafts, open above and below, and two supply shafts send down the material subsequently needed for filling up the air chamber.

The dimensions of the caisson are rectangular; length, 163 feet, width, 102 feet, hight 9 feet 6 inches. Thickness of roof, 5 feet. The sides form a V, and are 9 feet thick where they join the roof, sloping down to a round edge. The inner slope of the V has an angle of 45 degrees. The lowest part of the slope is formed by a semi-circular section casting, protected by a sheet of boiler plate, which extends up three feet each side. A heavy oak sill rests on the casting, and it consists of a stick nearly two feet square. The three succeeding courses are laid lengthwise, after that the alternate courses are heading courses. The whole mass is thoroughly bolted together by drift bolts, screw bolts, and wood-screw bolts. In addition there are heavy angle irons uniting the V to the roof. At the corners the courses of timber are halved into each other, and strapped together for further security. The roof is composed of five courses of twelve-inch square yellow pine sticks, laid close together, bolted sideways and vertically, and having a set of heavy bolts running through the five courses. The outer edge of the caisson has a batter inward of one in ten to facilitate its descent into the ground.

To make the caisson air tight, the seams were all thoroughly caulked for a depth of six inches, inside and out, and in addition a vast sheet of tin unbroken throughout, extends over the whole caisson, between the fourth and fifth course, and down the four sides to the shoe. The tin on the outside is further protected by a sheeting of yellow pine. The space between the timbers was filled with hot pitch. As air under pressure of forty or fifty pounds will penetrate wood with ease, the inside of the air chamber was coated with an air-tight varnish, made of resin, minhaden oil, and Spanish brown. The air-tightness up to the present time is quite satisfactory, and only one fifth of the air pump on hand is sufficient to keep the water out.

The yellow pine timber was selected specially for the purpose. It came principally from Georgia and Florida, and much of it was so pitchy that the sticks would not float. The average specific gravity of all the timber was 48 degrees per cubic foot. Every bolt hole is bored with a large drift to insure the hold of the bolts. As the construction of the caisson proceeded, the iron work of the water-shafts, air-lock shafts, and supply shafts was put in. This work was done under contract by Messrs. Hubbard & Whitaker, of Brooklyn.

The water shafts, two in number, are square shafts, three eighths boiler plate, properly stiffened by angle irons, and well secured to the caisson. They are seven feet by six feet six inches, and are open above and below, the lower edge extending twenty inches below the edge of the shoe. The water inside of them rises and falls with the state of the tide outside. The material to be taken out is shoved under the edge into the water shaft by the laborers inside, and is then taken out by the so-called clamshell dredge of Morris & Cummings, of New York—the only known instrument which possesses the precise action of the human hand in picking up things. Any other arrangement for excavating in the shape of a revolving dredge or a sand pump was out of the question. The air shafts are 3·6 feet in diameter, and extend simply through the timber on top of which the air locks are placed. The supply shafts are two inches timber, twenty-one inches diameter, and of indefinite length—they have a door at the bottom and one on the top with an equalizing pipe. They are filled full of made air, and the whole contents fall into the air chamber below.

It was the original intention to have made the air chamber under the caisson one entire space without any divisions into compartments, thus facilitating the excavation of the material. Various considerations led to the abandonment of that view. Since the caisson was to be launched like a ship, a certain number of launching ways were required, and these required a stiff frame from the launching way up to the roof. Again, in the boulder soil, only a few points of the edge would have rested and supported the weight at any one time. But the chief point was the rise and fall of the tides and their effect on the caisson. The extreme rise and fall is 7½ feet. If the inflated caisson is just barely touching the ground at high water, it will press upon the base with a force of 4,000 tuns at low tide, all of which has to be met by the strength of the shoe and the frames. And it is not until the caisson is permanently righted down that the continuous excavation can take place inside. The frames are proportioned somewhat to the strains in launching, and form a heavy truss of pine posts and stringers with three-inch sheathing on each side, and side braces to the roof every six feet. The ends of the frames are secured to the sides of the V by knees.

It was concluded to limit the pressure of the caisson during the launch to 2¼ tuns per square foot of launching surface. This required seven ways in all, two under the edges and five under the frames. The total launching weight of the caisson was 3,000 tuns, containing 111,000 cubic feet of timber and 250 tuns of iron. It was launched sideways—that is, with the long face of 168 feet by 14 feet 6 inches high facing the water. The ground-ways were laid at an angle of one inch per foot, the caisson standing fifty feet back from the end of the ways. To buoy up the forward end of the caisson as it entered the water, and thus prevent its entire immersion, a temporary water-tight compartment of two-inch plank was put in, one third the distance across. It served its purpose admirably. A full complement of wheel barrows, crabs, and winches were likewise stowed away in it. The ground-ways consisted of two timbers of eleven inches square each, bolted together sideways. They were grooved like the guide of a planer, and the upper launching way fitted their grooves correspondingly. The great danger of launching so large a mass on seven ways consists in the liability one end going faster than the other, and thus wedging the caisson fast on the ways. Only the outer ways were provided with ribbands. They however, proved superfluous to accelerate the motion of the caisson as it entered the water, and thus overcome the increasing resistance. The ways were laid crowning to the amount of eighteen inches in their length. The launching ways were likewise continued ten feet back of the caisson, and provided with shoes against the sides, it was desirable that the rear edge of the caisson should leave the end of the ground ways uniformly, and not stick fast on one—a thing likely to occur, since the ways stopped at the low-water line, and the rear edge would fall at once into deep water. The above arrangement answered the purpose.

On the 19th of March, 1870, the launch took place; in every respect a success. As soon as the last block was split out, the caisson commenced to move. The impetus it had acquired in the first part of its course proved sufficient to overcome the immense resistance offered by the water. It would seem that if the ways had been about twenty feet longer, the caisson would have lost its headway. The air caught inside the air chamber aided materially in buoying up during the launch. Neither the battering rams provided to start her, nor the checks and levers intended to hold her back until the proper time, were needed. The deck of the caisson was not submerged, nor was there any wave of translation in front, as might have been expected. An air pump and boiler had been placed on the caisson before landing. This was at once set in motion, and in a few hours the water was all displaced from the air chamber, the air blowing out at one corner, thus proving a satisfactory state of tightness. When the air was afterwards allowed to escape entirely, the top of the caisson settled within seventeen inches of the water, which happened to agree with previous calculations.

The launching arrangements, as well as the entire responsibility of the launch rested with the builders, and they accomplished their results by simple common sense arrangements, no money being wasted on elaborate precautions or preparations.

PREPARATIONS OF SITE.

It had been estimated that the same length of time would be required to prepare the bed for the caisson as to build it. Owing to unforeseen difficulties, possession of the ground was not obtained until Jan. 1st, 1870. The winter had hitherto been mild, and continued so, much to our advantage; and during most winters it would have been impossible to do anything. The preparation of the site consisted in establishing a rectangular basin open towards the water side, surrounded on three sides by a wall of sheet piling leveled off to a uniform depth of eighteen feet at high water. This depth was decided upon because one corner of the side had that depth of water already, and because a certain depth was necessary to float in the caisson at all stages of the tide. The dismantling of the space—the ferry slip—drawing a hundred piles, tearing out 350 feet of fender sheathing, removing of 350 feet of heavy cribbing, filled with stone and dredging of the loose material on top, required in all about a month. The dredging was done by Mr. Tebo by day's work, two machines of the Osgood patent being used. The drawing of the piles was done partly by pile drawers and in part by the "ox," a steam crane-boat well adapted for the purpose. At the same time it became necessary to cut away half of the pier separating the foundation from the main slip of the Fulton ferry which was accomplished without interfering with the ferry. All the timber and piles taken out were found to be infested with thousands of sea worms; the ravages, however, were confined to the space between low water and the mud line. A pile which was sixteen inches in diameter below the mud, perfectly sound and free from worms, would be found eaten away to a thin stem of three inches just above the mud, and all timber was affected alike. This shows the necessity of going below the top of the river bed with our timber foundation, and also proves its entire safety in that position.

MATERIAL REMOVED.

In all, there were 10,700 yards of material removed, the bulk of it in the course of a month, comprising the filling in and surface mud. A line of soundings then taken showed 3,000 yards yet to be removed before the level of eighteen feet was reached. The character of this material was next to solid work, some of the dredges could make but the slightest impression upon it, neither the Osgood nor the powerful grapnel of Morris & Cummings. All of the old charts of the harbor showed this point to be a reef of rocks or boulders, and these had been covered by filling in from the shore. Recourse was necessarily had to powder. Surface blasts were not used at all because the locality forbade the use of heavy charges which are essential for success. A surface charge of less than three hundred pounds would have been of no effect. It was determined to make holes in the bottom by means of an iron pile driven in and afterwards withdrawn. Into the bottom of this hole say, four or five feet deep, a canister containing fifteen to twenty pounds was inserted by a diver when the pile driver was hauled back and the charge exploded by electricity. The result was a small crater and the loosening of contiguous boulders from their bed. Three iron piles were used, two of five inches and one of six inches, twenty-two feet long and shod with steel at the point and head. Two pile drivers were coupled together for this work and a double gang of laborers employed day and night under charge of Captain Scott. A A week's practice reduced the matter to a system and developed the kind of canister to be used, the exploders and the battery. From the ordinary tin canister we passed to second-hand, lap-welded, wrought-iron tubes, cut in lengths of two feet and plugged at each end, which proved effective, but the supply getting scarce, recourse was had to cast-iron shell with sides one half an inch thick. They possessed the additional advantage of dropping to the bottom of the hole of their own weight. The average number of blasts made by one gang in ten hours was thirty-five. The greatest delay was experienced in withdrawing the pile which frequently resisted the united efforts of both pile drivers hauling on treble blocks with their engines, and a thorough shaking did more good than any amount of steady strain.

THE BATTERY

used was a small frictional machine, inclosed in a light rubber case, and was supplied from the Oriental Foundery, of Boston, as were the exploders. This machine was instantaneous in its effects and never out of order, and with it any number of charges could be set off at the same time. After a thorough blasting the Osgood dredge could work to advantage for a short time. Many of the boulders were too large to be picked up by a dredge, and a few were taken out by the Morris & Cummings grapnel, while others were slung under water by divers, having first been loosened by blasting and then lifted by the divers.

Those that were too heavy were floated along under water to a space back of the foundation and there dropped. The whole process was expensive, but still very effective. The casual observer, to whom the surface of the water appeared the same day by day would think that nothing was done, but the diver who slung boulder upon boulder night after night, had a different story to tell.

This driving of iron piles afforded a thorough knowledge of the entire ground. On the side towards Marston and Power a dozen blows would drive the pile down forty feet through soft clay, where it was brought up by a harder stratum. But in the center there is a ridge-shaped layer of hardpan, varying from two feet to eight feet in thickness. Frequently 100 blows of the 1,500-pound hammer were required to drive the pile three feet into this material. Towards the ferry the clay again disappeared, giving way to boulders of all sizes, packed close together, a coarse sand filling up the spaces between. On the river side all sand or clay was washed away, leaving the bare stone.

As the time passed along, all work was confined to the lines of the frames and edges of the caisson, leaving the ridges between, to be removed afterwards, from under the caisson. Three fourths of the boulders consisted of the trap rock of the Palisades, the rest gneiss, with a few sporadic boulders of red sandstone. Holes of extra depth were blasted for the location of the water shafts. In the south shaft the pile finally penetrated through eight feet of hard pan, and there struck into loose sand.

None of the dredges were adapted for such work. The bucket should have been discarded entirely and replaced by one long plow-shaped tooth, fastened to the dipper handle, solely with a view of rooting up the material The ordinary dipper presents too much surface for penetration.

The cost of dredging out the soft material on top was about sixty cents per yard, and of the hard material below, including the blasting $3·62 per yard.

1,173 blasts were fired consuming 13,000 pounds of powder.

While the dredging was going on the inclosure also proceeded—an outer row of piles was first driven and fastened back to anchors and logs, in order to resist the pressure of twenty-two feet of earth—five feet inside of this a line of close sheet piling was placed with sufficient marginal space for towing in the caisson.

During April, six air-compressing machines were placed in their foundations, and satisfactorily tested. They were manufactured by the Burleigh Rock Drill Co., of Fitchburgh, Mass. Each engine is twenty-horse power, and drives two single acting air cylinders of fourteen-inch stroke and fifteen-inch diameter. Every engine has its own boiler, and they are all so connected that the stoppage of no one boiler or engine will affect the rest.

A large condensing vessel serves to precipitate the moisture in the compressed air and deliver dry air into the caisson. A ten-inch main leads the air underground a distance of 150 feet to the caisson, where it branches, and two rubber hose of six inches diameter lead the air to the supply shafts and thus into the caisson. Self-acting clock valves prevent the escape of the air in case anything should happen to the hose. All the air conductors have been tested to a safe limit. A blacksmith and carpenter's shop have been erected, the fires being blown by compressed air. One compressor has been set apart to compress air to 65 degrees for the purpose of working two Burleigh rock drills in the caisson.

Two double engines have been set up by Morris & Cummings to work the dredges in the water shaft, and two more engines are ready to hoist and set stone on the caisson by means of three large derricks with horizontal booms, yet to be placed on the caisson.

On the first of May the leveling off had proceeded far enough to bring down the caisson from Greenpoint. A contract had been entered into in the mean time with Webb & Bell to lay the ten additional courses of yellow pine timber, and advantage was taken by them of the delay to put on two of the courses at Greenpoint, where the caisson was lying afloat.

THE CAISSON WAS TOWED DOWN

by six tug boats, under charge of Capt. Maginn. The pump was kept in operation and the air chamber fully inflated, the great buoyancy possessed by the V-shaped sides prevented any tilting or loss of air. This inflation was essential, as in one part of the river there was only a foot space between the bottom and the lower edge of the caisson. At the turn of the tide the following day, the caisson was easily hauled into place.

A double row of piles incloses it on the outside, and also supports the track and turntables for the stone cars.

By June 20th all the courses of timber were laid. The courses cross each other at right angles, with space between of actually four and five inches—every two feet four inches the stick is fastened down by a one-inch drift bolt. The whole mass is thus bound together into one solid unyielding platform. Each course was properly adzed off, and the original course of two piles with which the frames were laid is still preserved—the amount of timber laid in five weeks amounts to over 100,000 cubic feet. The space between the timbers is filled in with concrete, which serves to add to the necessary weight, as well as to harden and preserve the timber.

It is composed of four parts of clean washed beach gravel from the Sound, two of sand, and one of cement. The gravel is small, uniform in size, and perfectly free from impurities. Various brands of cements have been used so far, comprising in addition to the Rosendale cements, the yellow cements from Coplay, Pa., Akron and Fayetteville, N. Y. The latter are all quick setting, but do not attain the ultimate hardness of the slower setting Rosendale cement, especially where the latter has been ground of extra fineness by special agreement.

As the timber was built up the covers were slipped back and the outer spaces filled in with concrete, so that at its upper corner there is a mass of concrete from four to five feet thick, which serves to protect the timber.

The additional sections of water shaft as well as the air locks were put up, in the meantime permanent air connection was established. The air locks are seven feet high, and six feet six draw inside; the sides are half inch boiler plate and heads of cast iron, with oval doors eighteen by twenty-two inches; six bulls-eyes light up the interior.

These locks as well as the sections of water shaft were made by the Morgan Iron Works, and are very creditable specimens of workmanship.

To avoid the lengthening out of the air shafts the air locks are placed within water tight compartments, which occupy the spaces of the well holes in the Towers, and will keep out the water when the top of the timber is submerged.

The air chamber was first entered May 10th through the air locks, and gradually, as the caisson settled more, the force of laboring men has been increased.

The removal of the temporary wooden compartment and shoving out of the material under the edges was accomplished in due time, as well as the opening of two doorways through each of the frames.

For three weeks past a gang of 40 men has been at work in the caisson, for eight hours every day, under charge of Mr. Young, principally in leveling off and removing boulders which happened to lie under the frames and edges. A deposit of dock mud, from two to three feet deep, has made this work exceptionally unpleasant. The dredges, which are now beginning to work, will remove it in a short time. The removal of large stone from under the shoe, some of them containing 100 cubic feet, is a matter requiring considerable skill and perseverance. It has so far been accomplished by means of blocks and falls, crabs and winches, and hydraulic pulling jacks. In extreme cases blasting will be resorted to.

During this time the caisson has daily

BEEN RISING

with every high tide and resting on the ground again at low water, requiring most of the work inside to be done at low water, where the caisson is comparatively free from water. As the edge does not readily sink into the hard soil it is expected that there will always be some water. Since the edge of the shoe is rounding, it allows the air to blow off before the level of the water has reached the lowest limit; this is caused by any trifling agitation in the level of the water inside, which gives the escaping air a chance to establish an outgoing current before the head of water inside becomes sufficiently great inside to overcome it.

By constantly building up on top the center of gravity has been raised considerably, and the caisson is now in a condition of unstable equilibrium—that is, it does no longer rise uniformly with the rise of the tide. One end will remain on the ground and the other rises as much more in proportion, and the more it rises the more surface it presents to the upward pressure of the air on that side, the general level of the water inside being governed by the level of the highest point of the shore.

This rising of one end of the caisson is attended by another phenomenon of imposing appearance. As the tide rises, and the downward pressure of the caisson is about being overcome by the increased tension of the air inside, as well as the buoyancy of the water outside, one end of the caisson will suddenly rise six inches or more. The result is that for a few minutes the tension of the air inside exceeds the head of water outside, and a tremendous outward rush of air takes place under the shoe, carrying along a column of water of hundreds of tuns to a hight of sixty feet at times. This continues until a return wave inside of the caisson checks it. These blow-offs are not felt to any extent by the men inside, beyond the warning noise and momentary draft created.

The magazine of force contained in 170,000 cubic feet of compressed air is so large that the loss of a few hundred tuns is a trifle. A system of pipes is put in the air chamber for the purpose of illuminating the air chamber with calcium lights, a trial of which has resulted favorably; with moderate pressures candles answer very well.

THE FIRST COURSE OF STONE

is now being laid. Its weight, together with the concrete on top of the timber, will probably suffice to ground the caisson permanently, and thus permit the erection of setting derricks on the caisson. The stone setting will then keep uniform pace with the excavation, and by the time the desired point is reached the masonry is far above the water level.

The stone used for these land courses, which will be permanently under water, is the Kingston limestone, furnished by Noon and Madden. These stones have both beds cut, but the sides and builds left rough, with vertical quarry joints, the projections not exceeding two and a half inches. The beds are exceptionably wide. As the base of the masonry work resting on the timber is very much larger than the section of masonry at the water level, it is considered that this class of masonry is equally as good, and certainly far cheaper than regular dimension stone. All the stone in any one course are cut to a uniform size. Above low water granite will be used on the water face, and subsequently throughout as freestone.

The first or corner stone of the extensive pile of masonry to be raised above the caisson, unlike as it was to ordinary affairs of this kind, was a massive block of limestone from the quarry at Kingston, Ulster Co., and in extent was three feet wide by eight in length, weighing about 5,800 pounds, or 165 pounds to the cubic foot; and it is of this material that the foundation below low water mark will consist.

Additional borings are now being made for the N. Y. tower. The boring made two years since was 400 feet away from the actual site of the tower. This one is directly on it. The same stratum of thirty feet of the finest quicksand has been penetrated, but boulders have been encountered at a depth of eighty feet, and the indications are that rock will shortly be reached.

Plans have been perfected for the New York caisson. It is somewhat larger than the Brooklyn caisson. Owing to the greater depth to which it is necessary to go, and the greater pressure of air to be encountered, it will be lined with boiler plate inside, otherwise it is constructed of wood.

Other means besides the water shaft will be provided for the removal of the fine quicksand. Successful experiments to that effect have been made by Mr. Allen and Mr. Collingwood, during the summer. The depth of water varying from thirty-five to forty feet at the site of that pier, the management of the caisson during its descent will be somewhat different, and a slight change in the frames and floor will be made.

To Mr. C. C. Martin, formerly chief engineer of Prospect Park, and now engineer of construction on the caisson, as well as to Col. Paine in superintending the building of the caisson and the excavation inside, I am under continued obligations. Also to Mr. Collingwood, in charge of the designing room, and to Messrs. Van der Bosch and Hildenbrand, draftsmen.

Respectfully submitted, W. A. Roebling, Chief Eng. N. Y. Bridge Co.

CONTRACTS.

We learn from Mr. Kingsley's report all of the work thus far which could well be done by contract has been let—after advertising for proposals—to the lowest responsible bidder.

The following are the principal contracts awarded.

The contract for making the caisson was awarded to Messrs. Webb & Bell, shipbuilders, of Green Point, L. I., and they have received for its construction one hundred thousand, two hundred and seventy-four dollars and fifty-one cents ($100,274·51). This contract was awarded on the 30th day of October, 1869, and the work was prosecuted with such energy, and with such fidelity to the plans furnished as entitle them to very great credit. A contract was entered into with Messrs. Mayhew & Co. for 1,800,000 feet, board measure, of yellow pine timber, at thirty-two dollars per thousand. This contract was promptly filled, and the timber was of superior quality.

On October 29, 1869, a contract was made with Messrs. Wilder, Son, & Co. for 1,800,000 feet, board measure, of yellow pine timber, at thirty-one dollars and fifty cents per thousand. This was delivered in time for the caisson, and was in all respects satisfactory.

On November 10th, 1869, a contract was made with Messrs. Hubbard & Whitaker, of Brooklyn, for the construction of the air, water, and supply shafts, shoes, shoe plates, etc., for the caisson, they being the lowest bidders.

On January 22, 1870, a contract was made with Messrs. Morris & Cummings, of New York, to furnish, and put in position complete, and ready for use, two of their machines for dredging, including the engines, hoisting gear, and buckets, for the sum of $9,000. These are in position and nearly ready for use.

On March 21, 1870, a contract was made with Messrs. Noon & Madden, of Kingston, N. Y., to furnish 5,000 cubic yards of limestone for the foundation of the Brooklyn tower of the bridge. The delivery of the stone has been promptly commenced, and the indications are that it will be supplied as fast as required for the work.

On April 11, 1870, a contract was entered into with Messrs. W. Taylor & Son, of Brooklyn, to furnish two engines for hoisting stone from the scows to the tower, for the sum of $2,250 each. The time for the delivery of these has not yet expired, but the work on them is well advanced.

Note.—The laying of the stone upon the top of the caisson was commenced the 15th of June, the day the above report was made public. One of the dredges spoken of in the report commenced working on Wednesday, the 22d. The caisson ceased rising with the tide on Saturday, the 18th, the tide being low, and a considerable weight of stone having been placed upon the structure. It is now thought that the weight will be added as fast, or faster than the tide increases, so that the caisson has probably risen for the last time.—[Eds.

ICE PITCHER CASE.—IN THE U. S. CIRCUIT COURT, EASTERN DISTICT OF PENNSYLVANIA.

Colburn, Executrix of James Stimpson, vs. George B. Garrett & Co.—This was an action brought by the administratrix of James Stimpson to restrain the defendants from manufacturing and selling ice pitchers.

The claims of the patent are:

1. *A pitcher for preserving ice water cool, combined with double walls inclosing between them air or equivalent non-conducting material, so arranged as not to impair the portability of the pitcher, and its capability of discharging its contents by pouring, nor its capacity for holding water.*

2. *In combination with a double-wall ice pitcher, a nose, lip, or spout, through which the water is discharged, and a movable cover across the discharge-way, which prevents access of air into the pitcher thereat except during the act of pouring.*

The defendants, Garrett & Co., manufactured and sold ice pitchers having both the features claimed, except that the cover over the spout was hinged so as to hang vertically. They denied the validity of the patent, and relied mainly upon old teapots and coffeepots manufactured by Isaac S. Williams, of Philadelphia, forty years ago, having, as it was alleged, double walls; also upon an old teapot which has been in the family of Mrs. Fine, in Philadelphia, for many years, having double walls.

The court decided that the teapots referred to as the "Fine" teapot and the "Williams" teapot are not the same invention as the ice pitcher of James Stimpson, and that the first and second claims of the plaintiff's reissued patent are valid, and that the defendants have infringed the same, and that a decree be entered for plaintiff with costs, and that the case be referred to John Cadwalader, Jr., Esq., as master.

Harding for plaintiff; Diedrick for defendant.

NEW BOOKS AND PUBLICATIONS.

Life at Home; or the Family and its Members. Including Husbands and Wives, Parents, Children, Brothers, Sisters, Employers and Employed, the Altar in the House, etc. By Rev. William Aikman, D.D. 1 vol., 12mo. Nearly 300 pp., tinted paper, muslin, beveled boards. Price, plain, $1·50; extra gilt, $2·00. S. R. Wells, publisher, 389 Broadway, New York.

This is a very excellent and timely book, one that should be read by parents and children alike. The counsel is wholesome—the criticisms none too severe.

Lippincott's Magazine, for July,

contains an article from the pen of Justin McCarthy on "The Petticoat in the Politics of England," which contains much to instruct and something to amuse. A paper on "The Hypothesis of Evolution, Physical and Metaphysical," by Edward D. Cope, states arguments and facts in support of this doctrine, and at the same time suggests some "consequent necessary modification of our metaphysical and theological views" resulting from its acceptance. "A Week among the Mormons" adds but little to our knowledge of Young and his followers, but will interest readers who are not tired of the subject. "Negro Superstitions," by Thaddeus Norris, is a very readable and entertaining article. The usual amount of lighter reading is supplied, and is of good quality.

The Atlantic Monthly, for July,

opens with a poem by Longfellow, "The Alarm Bell of Atri," which will be read with delight by all lovers of poetry. "Equal, yet Divine," by Burt G. Wilder, touches upon that absorbing question of the time the future status of woman in society. "Criminal Law at Home and Abroad," by Francis Wharton, and "The Shipping of the United States," together with Mr. Burt's contribution, are the solid dishes of the feast. The usual side dishes and dessert are added.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

1,429.—Automatic Barrel-Filling Apparatus.—S. C. Catlin, Cleveland, Ohio. May 18, 1870.

1,454.—Rolling Metallic Rods or Wire.—J. P. Blake, Medway, Mass. May 19, 1870.

1,487.—Machinery for Grinding Hand Saws.—W. F. Semple, Mount Vernon, Ohio. May 23, 1870.

1,490.—Treating Leather.—Ed. Fitzhenry, Boston, Mass. May 23, 1870.

1,500.—Earth Closets, etc.—C. A. Wakefield, Pittsfield, Mass. May 4, 1870.

1,503.—Making Metal Cop Tubes.—James Eaton, Boston, Mass. May 24, 1870.

1,508.—Connections for Fire Engine Hoses, etc.—Loftus Perkins, London, England, and M. Gibs, Washington, D. C. May 24, 1870.

1,512.—Washing Machine.—J. T. Owen Philadelphia, Pa. May 25, 1870.

Machinery for Forming Bats of Wool for Felting Purposes.—L. Robinson, Matteawan, N. Y. May 25, 1870.

☞ **A number of Moore's Rural New Yorker** (the Great National Illustrated Rural, Literary, and Family Newspaper,) will be sent free to every reader of the Scientific American, who sends address to D. D. T. MOORE, 41 Park Row, New York.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Pictures for the Parlor—Prang's latest Chromos, Hart's Seasons. Sold in all Art Stores throughout the world.

Wm. Roberts & Co., Designers and Engravers on Wood, 36 Beekman st., New York, would respectfully announce that they are now prepared to receive orders from Manufacturers, and others, for engraving of machinery, views of stores, factories, trade marks, etc., etc.

Wanted.—A man of thorough knowledge or practical experience in casting white metal, buffing, burnishing, and silver plating, to go West. Address, with references, P. O. Box 5302, New York city.

For sale at a Bargain—10-Horse Boiler—a good one. For particulars, address A. H. Walker, Oswego Center, N. Y.

Carpenter Planes, the best quality, made by Tucker & Appleton, Boston. Send for list.

Of Washing Machines, there is nothing to be compared with Doty's.—Weekly Tribune, Dec. 15, 1869.

For Sale—The Right for the six New England States of L. Bertsche's self-fastening caster, the best caster ever used. Address L. Bertsche, 8th Ward, Allegheny City, Pa.

Scientific American.—Back Nos., Vols., and Sets for sale. Address Theo. Tusch, City Agent, Sci. Am., 37 Park Row, New York.

A Superintendent wanted in a large wood-working and machine shop, in the State of New York. Address, in own handwriting, stating references, past experience, salary expected, etc. An interest in the business will be offered to the right person, if it is desired. Address "Superintendent," P. O. Box 773, New York city. The Editor of this paper will vouch for the responsible character of the establishment needing the above service.

Wanted—A good second-hand Stationary Engine, from 12 to 15-H. P., built within the past two years. Send full description, with name of maker and lowest price. Address P. O. Box 159, Bridgeport, Conn.

The "Patent Steam Gong," in use for Fire Alarms, Fog Signals on steamboats, factories, etc. Have a musical tone, and have been heard thirty miles. Manufactured by the Union Water Meter Co., Worcester, Mass.

West's Great American Tire-Setting Machine sets tire without removal from the wheel, saving ninety per cent over the old method. West & Fish, Genesco, N. Y.

To Brick Makers.—A new style of Brick, for Paving Sidewalks, just patented. Warranted to lie solid and never to rock when trod upon. Rights for sale cheap by the inventors, Moffat & Thomson, 121 Otter st., Philadelphia, Pa.

Wanted.—Situation as Superintendent or foreman in Machine Works. Fifteen years' experience. Address P.O. Box 1016, Worcester, Mass.

Wanted.—A good second-hand Roper 4-horse Engine. Address, with price, Wm. J. Mack, East Norwich, L. I.

Wanted.—A good Patent Salesman. Box 115, Cuba, N. Y.

The best boiler-tube cleaner is Morse's. See cut inside page.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 84 Front st., New York.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

Direct-acting Steam Circular Saw Mill—Mill and engine combined in one machine. The power of the engine applied directly to the saw without belts. They are now in successful operation. Patent applied for. E. H. Bellows, Worcester, Mass.

For foot-power engine lathes address Bradner & Co., Newark, N.J.

Machinists and others using Fine Tools, send for illustrated catalogue. Goodnow & Wightman, 23 Cornhill, Boston.

Tempered Steel Spiral Springs for machinists and manufacturers. John Chatillon, 91 and 93 Cliff st., New York.

One 60-Horse Locomotive Boiler, used 5 mos., $1,200. Machinery from two 500-tun propellers, and two Martin boilers very low. Wm. D. Andrews & Bro., 414 Water st., New York.

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves.

For tinmans' tools, presses, etc., apply to Mays & Bliss, Plymouth, st., near Adams st., Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Winans' boiler powder, 11 Wall st., N. Y., removes Incrustations without injury or foaming 12 years in use. Beware of Imitations.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

J. H. P., of Ark., asks, will a 100-pound weight drive light machinery, sewing machines, etc. We answer that a 100-lb weight falling through a sufficient space in a given time would drive the Great Eastern, were the power thus developed applied to the propulsion of that monster. This correspondent is evidently laboring under a very common misapprehension; the confounding of statical pressure with mechanical power. Statical pressure is not mechanical power. It never did and never will do work in the sense in which the term work is used in mechanics. It takes on an average about one tenth of a horse power to drive a sewing machine. To yield this power a 100-pound weight would need to fall through a space of three and three tenths feet in one minute of time, and continue moving at that rate.

J. H. P., of N. Y.—This correspondent writes in regard to the use of hellebore to kill currant worms. He says the white hellebore is as good as the black. This weed is also known as poke, or itch weed. It is not so expensive as the other. He makes a strong decoction of the leaves and stems, pours off the liquor, and applies it cold, with a watering pot. He says that a single application made at the night time, that is, when the eggs are all hatched, will be effectual in destroying the worms. He asks for something to kill maggots which destroy onions. Can any of ou correspondents inform him?

W. & B., of Tenn.—Petroleum products, such as gasoline, are tested for their specific gravity by an instrument called an hydrometer. The lighter the fluid the deeper this instrument will sink into it. Gasoline or benzine spoken of as being 85° allows the instrument to sink to that number marked upon the stem.

M. H. S., of N. Y.—We cannot at this distance say what makes the bearings you describe heat; there are many things that might do it. The belts may be too tight, the bearing surfaces too small for the weight they support, or the lubricator used may be of a kind which evaporates as soon as the bearings become warm. We think it likely that the bearing surfaces are too small.

J. K., of Pa.—We should regard a scale of three eighths of an inch in thickness as dangerous in any steam boiler. To drive any engine at greater speed while performing an increased amount of work will require more steam, and consequently more fuel. Your question cannot be answered more definitely without more complete data.

S. K., of Mo.—Your solution of the 2d mechanical problem given out some weeks since is correct; it was also given by another correspondent. See article entitled "New Mechanical Movements" in last issue.

L. R. P., of N. H.—There are various methods of making solid emery wheels, mostly patented, and therefore not available to you except by purchase. We cannot describe any of them in this column.

J. G. S., of Vt.—What is meant by the pitch of saw teeth is the inclination of the face of the tooth up which the shaving ascends, and not the intervals from tooth to tooth as in wheels.

N. F. E., of Vt., wants a size that will cause bronze to adhere to paper, linen, etc., and which will not stain or color. Do any of our correspondents know what will do the business?

J. W., of L. I.—The plan of compressing air into receptacles to be afterwards used as motive power is old. It has many elements of impracticability which we cannot specify here.

T. A., of Mass.—Medals when dipped into the "bronze dips" described on page 265, are to be subsequently washed in water, and brushed. That is the whole of the process.

C. G., of Ohio.—Carbolic acid in weak solution is recommended as a preservative of awnings from mildew. Chloride of zinc has also been used.

A. A. E., of Mich.—A cement called marine glue is kept for sale pretty generally in drug stores, which unites wood and resists moisture.

G. E. R., of Mass., wants to know what will exterminate black ants from beams and flooring which they have bored into.

D. L. B., of Pa.—We published a rule for the computation of the sizes of cone pulleys on page 157, last volume.

W. W. W., of Ohio.—The expression "groin arch" is a misnomer; "groined arch" would be a correct term.

S. M. C., of Ohio.—The true length of the old measure called a digit is three fourths of an inch.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Machine for Boring Posts and Pointing Rails.—Rudolph Martin and Matthew Harner, Taneytown, Maryland.—This invention has for its object to bore fence posts in order to the making of mortises therein, and to sharpen fence rails in order to the insertion of their pointed ends in such mortises.

Street and Station Indicator for Railway Cars.—Edward L. Dean Newburgh, Ohio.—This invention has for its object to cause the index finger of a dial plate affixed to the inside of a street car to travel over its surface and point out the names of streets and stations as they are successively reached.

Saddle.—George Horter, New Orleans, La.—The object had in view in making this invention was the production of a very cheap, and, at the same time, a very durable saddle, mainly for use in districts like the Southern and South-western parts of the United States where horse-back riding is the chief means of locomotion, and where most of the inhabitants are very poor.

Water Wheel Attachment.—W. A. Cobb, Orange, Mass.—This invention has for its object to prevent water wheels from being stopped by the "back water" of floods. To this end the invention consists in providing a casing extending from the floor of the flume on which the wheel rests to the bed of the river, which casing receives the water flowing from the wheels through the floor of the flume, and discharges it through one of two pipes, a short one for ordinary use and a very long one for flood seasons, which discharges at a point not affected by the high water of the stream, and consequently renders the casing and flume impervious to the surrounding water, the gate to the short pipe being, in the mean time closed.

Honey-Bee Palace.—Nathaniel F. White, Mount Pleasant, Iowa.—This invention relates to a new and useful improvement in a house or palace for honey bees, in which their hives are placed and where they are protected from moths and from the weather.

FRUIT DRYER.—Newton C. Cooley, Wyoming, Del.—The invention consists in a fruit-drying case, provided with partitions that divide it into separate chambers which communicate at one end with a hot-air flue, and at the other end with an escape passage leading to a chimney, and which are furnished with screens for holding fruit, malt, hops, or other article to be dried in the current of hot air that sweeps through the chambers, the moisture drawn from the fruit in each chamber being carried off therefrom directly to the chimney without rising through the other chambers and damaging the fruit therein.

FRUIT JAR.—Thomas P. Gibbons, Philadelphia, Pa.—This invention consists in a metallic collar provided with an inwardly projecting flange at its lower end, in combination with an outwardly-projecting flange on the head of a fruit jar, in such manner that, by the two flanges, the collar is prevented from being removed from the jar, while there is no obtrusion to slipping the collar down on the neck of the jar for convenience in filling.

PADLOCK.—Edward L. Gaylord, Terryville, Conn.—This invention consists in an inclosing case for a padlock struck in two plates with a lap, or tongue and groove joint at their edges; also in a spring coiled in a recess in the butt of the shackle, and operating so as to automatically throw the shackle open when released from the tumblers, and hold it open until it is shut by direct pressure.

MUCILAGE OR INK STAND.—Franklin T. Grimes, Liberty, Mo.—This invention relates to that class of inkstands in which the space, if any, in the reservoir above the ink is a vacuum; and the invention also consists in partitions placed in the ink reservoir so as to divide the latter into separate compartments, in order that, if the vacuum be destroyed in one part of the reservoir by an irruption of air, it may still be preserved in the remaining portions.

RAKING ATTACHMENT FOR HARVESTERS.—William W. Miller, Zionsville, Ind.—This invention has for its object to furnish an improved raking attachment for harvesters, which shall be so constructed as to sweep the grain from the platform of the harvester by a slight movement of the driver's foot whenever a sufficient amount of grain has been cut to form a gavel, depositing the grain at the rear of the drive wheels so as to be entirely out of the way of the machine at its next passage.

FARM GATE.—Howard Piper, Haskins, Ohio.—This invention relates to improvements in that class of gates which are arranged to slide back and forth in opening and closing, and consists in arranging the post on which the gate slides, so that it may be raised up to admit of sliding the gate above the snow, or for other purposes. The invention also consists in a peculiar arrangement of the gate with the said post for sliding therein, and for arms for bracing the ends of the gate laterally.

HAY LOADER AND CARRIER.—Galen Meaders, Jeffersonville, Ind.—This invention relates to a new and useful improvement in a vehicle for gathering and transporting hay.

SEEDER AND CULTIVATOR.—J. T. Trowbridge, Akron, Ohio.—This invention has for its object to improve the construction of the seeder and cultivator, known as the "Champion of Iowa," so as to make it simpler in construction, stronger, more effective in operation, and more convenient in use.

ARTIFICIAL FUEL.—E. F. Loiseau and C. F. Requin, Nashville, Tenn.—This invention has for its object to practically utilize coal dust as fuel.

LUBRICATOR.—David Adamson, Bremen, Germany.—This invention relates to improvements in that class of lubricator cups, in which a piston is employed to receive steam pressure for forcing viscid or coagulating material out of the cup.

THREE-WHEELED CARRIAGES.—C. H. Barrows, Willimantic, Conn.—This invention has for its object to so construct the steering apparatus of three-wheeled carriages, that the vehicles can be more readily controlled, and less apt to be overturned than the ordinary carriages now in use.

DUST-PROOF VENTILATING WINDOWS.—M. C. Murphy, Boston, Mass.—This invention relates to improvements in ventilating windows, and consists in the employment, either with the ordinary plain glass windows or not, of two or more sashes with vertical, concave, or convex strips of glass or other substance, set in the upper and lower bars of the sash, with narrow spaces between the edges, and with the centers of the concave faces of the strips of the second set behind the spaces between the first, to cause the particles of dust carried in the air to strike against the concave surfaces and fall into discharge passages in the bottom of the window frame, and escape at the outside.

POWER APPARATUS.—Wm. Hammill, Parma, Mich.—This invention relates to improvements in machinery intended for generating power for driving light machinery, and has for its object to provide a simple arrangement of vibrating and swinging weights or pendulums and springs, which with the aid of an attendant for moving them past the "dead points," may be set into and kept in motion.

SLED BRAKE.—J. E. Coutant, Rondout, N. Y.—This invention has for its object to furnish an improved brake for attachment to bob and other sleds, which shall be simple in construction, effective in operation, and conveniently operated, being worked by the action of the horses in holding back the sled.

GRAIN LIFTERS.—Wm. M. Jackson, Woodland, Cal.—This invention relates to improvements in grain lifting or elevating attachments to heading and reaping machines for straightening the lodged grain in advance of the cutters, and consists in an improved arrangement of means for elevating or depressing the lifting or elevating fingers or shoes moving in advance of the cutters, when applied to the heading machines. This invention also comprises an improved construction of the shoes, which move in advance of the cutters to support the elevating fingers.

REFRIGERATING ATTACHMENT TO WELLS.—J. L. Wiley, Vermont, Ill.—This invention relates to apparatus for use in connection with wells, for the reception and suspension immediately above the water of articles of food for preservation in warm weather, and it consists in the application along the walls of the well from the bottom to the top, and projecting a suitable distance above the top of the guide rails, and the application thereto of a crib capable of moving up and down, and of holding the articles to be preserved, and a winding crank, rope, and balance weight, for raising and lowering the crib.

GRAIN BINDERS.—Wm. B. Oglesby, Bridge Prairie, Ill.—This invention relates to improvements in grain binding attachments to reaping machines, and consists in one or more pairs of clamps mounted on a horizontally revolving support, and provided with a twisting device and a tucking device, and arranged to be held open for reception of the gavel by the weight of one of the jaws, which is closed up by a fixed bent rod, or cam, after reception of the gavel, and the twister and tucker are set in motion by toothed racks, gearing with pinions attached to them as they are moved past the said racks, twisting the band of straw previously placed in the clamps by hand, and securing it by tucking the end under, as in hand binding, after which the over jaw falls open, and the bundles are ejected by a fixed rod, having one end arranged to stand in the path of the bundle when carried by the open jaw.

MERCURIAL EXPANSION ENGINE.—Charles G. Wilson, Brooklyn, N. Y.—This invention has for its object to furnish a simple, cheap, safe, and reliable motor, designed for use where any small power is required, and which shall be so constructed that it may be easily manipulated and kept in repair.

SAW SET.—Moritz T. Klahre, Bloody Run, Pa.—This invention has for its object to furnish an improved saw set by means of which a number of the teeth of the saw may be set upon both sides at the same operation, and which shall at the same time be simple in construction, effective in operation, and conveniently and quickly operated, and which may be easily adjusted to set the teeth more or less, or to set different sized teeth as may be required.

SULKY HARROW, CULTIVATOR, ROLLER, ETC.—James A. Casey, Maysville, Ky.—This invention has for its object to furnish an improved machine which shall be so constructed that it may be readily adjusted for use as a harrow, cultivator, or roller, doing its work well in either capacity.

WEANING BIT.—Isaac L. Baker, Prairie City, Kansas.—This invention relates to a new and useful device for weaning colts and calves, and for other purposes, and it consists in so forming a bit that air is admitted into the mouth in the act of sucking, thereby preventing a vacuum being formed, and consequently the flow of milk.

DOOR AND SHUTTER BOLT.—G. B. Green, Philadelphia, Pa.—The object of this invention is to provide a durable, safe, and ornamental bolt fastening for doors and shutters, and to be employed in all situations where it may be found useful; and it consists in the use of a slotted sliding bolt, and in plates of ornamental casting, or ornamental plates struck up or swaged of any form, or size, or design, which plates are attached to the studs which pass through the doors or shutters.

ANIMAL TRAP.—Samuel Arnold, Silver Springs, Tenn.—This invention relates to a new and useful improvement in traps for catching rats or other animals, birds, or fishes.

ADJUSTABLE SCHOOL DESK.—Charles H. Loomis, New Philadelphia, Ohio.—This invention relates to a new and useful improvement in desks or tables for school-rooms and other purposes, whereby they are made more convenient and useful than such articles have heretofore been, and it consists in making the top adjustable, so as to suit pupils of different ages, and so that the desk or table may be made to accommodate a person in an office, or elsewhere, while either standing or sitting.

APPARATUS FOR ROLLING AND COOLING BARRELS, CASKS, ETC.—David Cammerer, Cincinnati, Ohio.—This invention has for its object to construct an apparatus for agitating and cooling barrels and casks immediately after the inner sides of the same are covered with pitch, or other water-proof composition.

SPRING PACKING.—John Hughes, Saxton, Pa.—The object of this invention is to provide a spring packing for steam cylinder pistons, which shall be simple and durable, and readily adjustbale to the walls of the cylinder.

CULTIVATOR.—Joseph Adams, Manteno, Ill.—This invention has for its object to furnish an improved cultivator, which shall be so constructed and arranged that the plows may be easily adjusted closer together or farther apart, and raised or lowered to regulate the depth at which they work in the ground.

GATE LATCH.—W. R. Goodrich, Whitestown, N. Y.—This invention has for its object to furnish an improved drop latch for gates, which shall be simple in construction, convenient in use, and effective in operation.

QUARTZ CRUSHER.—Jesse Quaintance, Bucyrus, Ohio.—This invention relates to improvements in quartz crushers, of that kind in which two or more rotary crushers are employed upon a circular bed.

PAPER FILE.—William Boyrer, New York city.—This invention relates to a new file for music, newspapers, etc., and has for its object to preserve the paper, and to allow the same to be opened flat at every place. The invention consists, first, in providing removable elastic cord holders to the ends of the covers, and, secondly, in the application to the said holders, of one continuous cord, to which a suitable number of separate papers may be attached.

MORTAR-MIXING MACHINE.—Seth Wetmore, Wellsboro, Pa.—The object of this invention is to construct a machine by which mortar, for building purposes, can be more completely mixed and tempered than by the ordinary manual process.

CLOTHESLINE HOLDER AND STRETCHER.—Nathaniel E. Buffington, North Providence, R. I.—The object of this invention is to provide an apparatus for properly holding clotheslines, so that the same will not be worn or chafed where they are bent to form angles, and also to permit their being properly stretched to take up the slack produced by use.

DOOR STRIPS.—Jerome M. Gray, Hamilton, N. Y.—The object of this invention is to provide simple, durable, and efficient means for preventing wind and water from entering dwellings, and other buildings, beneath and around outside doors, and it consists in the use of one or more thicknesses of felt, or cloth, or other pliable or elastic material, attached to the bottom or lower portion of the door, supported and held in place by means of an adjustable spring rod, and, in combination therewith, of one or more elastic rods or fillets, in the casing of the door, or in the door itself.

SAFETY CAPS FOR CANS.—Horace C. Alexander, New York city.—This invention has for its object to furnish an improved safety cap for cans, which shall be simple in construction, effective in operation, and convenient in use.

VIOLIN HOLDER.—Isaiah H. Arey, Boscawen, N. H.—This invention has for its object to furnish an improved violin holder, or chin rest, for violins, which shall be so constructed as to adapt it for holding the violin in proper position almost without effort, and which shall, at the same time, be simple in construction and easily attached to and detached from the instrument.

HORSE HAY FORK.—John S. Yinger, Manchester, Pa.—This invention has for its object to furnish an improved horse hay fork which shall be simple in construction, strong, durable, not liable to get out of order, and conveniently operated.

MACHINE FOR STRIPPING BLUE GRASS SEED.—Major Joseph W. Stivers, North Middletown, Ky.—This invention has for its object to furnish a simple convenient, and effective machine for stripping the seed from blue grass while standing in the field.

REAPER AND MOWER.—Jesse C. Miles, Bloomington, Wis.—This invention relates to improvements in reaping and mowing machines, and consists in improved attachments for guiding the caster wheel, to hold the machine up to the standing grain, to cut the full breadth on sidehills; also, to prevent it from tipping over, and to prevent side draft.

ROTARY PUMP.—William A. Allyn, Boston, Mass.—The object of this invention is to provide a machine for throwing a constant stream of water by means of an annular piston, operated by means of an eccentric on a central shaft.

ROTARY PUMP.—August Leuchtweiss, Cincinnati, Ohio.—This invention relates to a new rotary pump, which is constructed to throw a continuous stream, with great force, and without requiring great power. The invention consists in the combination of a paddle wheel with a rotary cut-off wheel and stationary packing for the same.

Official List of Patents.

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Patent Solicitors, No. 37 Park Row, New York

104,398.—FOLDING DENTAL CHAIR.—C. M. Adams, Canton, Miss.
104,399.—CULTIVATOR.—Joseph Adams, Manteno, Ill. Antedated June 11, 1870.
104,400.—LUBRICATOR.—David Adamson, Bremen, Germany.
104,401.—POTATO DIGGER.—James Albaugh, Lyons, N. Y.
104,402.—SAFETY CAP FOR CANS.—Horace Clifton Alexander, New York city.
104,403.—ROTARY PUMP.—William A. Allyn, Boston, Mass.
104,404.—AUGER BIT.—Albert L. Andrews, Bristol, Conn. Antedated Dec. 21, 1869.
104,405.—VIOLIN HOLDER.—Isaiah H. Arey, Boscawen, N.H.
104,406.—ANIMAL TRAP.—Samuel Arnold, Silver Springs, Tenn.
104,407.—HARVESTER.—A. P. Ayres, Chicago, Ill.
104,408.—WEANING BIT.—Isaac L. Baker, Prairie City, Kansas.
104,409.—THREE-WHEELED CARRIAGE.—Chas. H. Barrows, Willimantic, Conn.
104,410.—JIG SAW.—Thomas Blandin, Charlestown, Mass.
104,411.—CAR STARTER.—Robert Bogardus, New York city.
104,412.—SOLDERING IRON.—Jabez A. Bostwick, New York city.
104,413.—NOZZLE AND SEALING CAP FOR SHEET-METAL CANS.—Jabez A. Bostwick, New York city.
104,414.—APPARATUS FOR FILLING OIL CANS.—Jabez A. Bostwick, New York city.
104,415.—PAPER FILE.—William Boyrer, New York city.
104,416.—INSTRUMENT FOR GIVING FLUID MEDICINE TO ANIMALS.—Henry Adolph Brandes, Newark, N. J. (Francis H. I. Bosch executor).
104,417.—TUNING PIN FOR PIANOS.—Julius M. Branig, New York city.
104,418.—TREE PROTECTOR.—Sterne Brunson, Benton Harbor, Mich.
104,419.—CLOTHES-LINE HOLDER AND STRETCHER.—N. E. Buffington, North Providence, assignor to himself, John Rich, and Lysander Flagg, Smithville, R. I.
104,420.—DOOR KNOB.—G. W. Cady, Providence, R. I.
104,421.—APPARATUS FOR AGITATING AND COOLING BARRELS AND CASKS DURING THE PROCESS OF PITCHING.—David Cammerer, Cincinnati, Ohio.
104,422.—DEVICE FOR ROASTING AND BAKING.—John J. Carroll, Washington, D. C.
104,423.—SULKY, HARROW, ETC.—James A. Casey, Maysville Ky.
104,424.—MACHINE FOR FELTING HATS.—Angelo Cattaneo (assignor to himself and Henry Lefort), Newark, N. J.
104,425.—CABLE STOPPER.—E. R. Cheney, Boston, Mass., and John J. Emery, Owl's Head, Me.
104,426.—PIPE TONGS.—E. B. Clark, Philadelphia, Pa.
104,427.—INCLOSED TAIL RACE FOR WATER WHEEL.—W.A. Cobb, Orange, Mass.
104,428.—WATER WHEEL.—Alpheus C. Corpe, Stafford, Conn.
104,429.—SLED BRAKE.—John E. Coutant, Rondout, N. Y.
104,430.—NOZZLE AND CAP FOR OIL CANS.—E. T. Covell, Brooklyn, N. Y.
104,431.—SOLDERING MACHINE.—E. T. Covell, Brooklyn, N.Y. Antedated June 6, 1870.
104,432.—VIAL FOR FILTERING COLLODION.—D. H. Cross, Bennington, Vt.
104,433.—METHOD OF COVERING WHIPS.—V. W. Crowsen (assignor to himself and Stephen Massey), Westfield, Mass.
104,434.—MANUFACTURE OF WHITE LEAD.—James Cuddy, Pittsburgh, and G. S. Selden, Philadelphia, Pa.
104,435.—FARM GATE.—John Dickason, Vevay, Ind.
104,436.—GAGE KNIFE FOR CUTTING LEATHER.—C. T. Durham, James Wood, and Theodore Hair, Norristown, Pa.
104,437.—VISE.—Jacob Edson, Boston, Mass.
104,438.—MACHINE FOR CANNING FRUIT.—John H. Ellis, Peoria, Ill. Antedated June 11, 1870.
104,439.—APPARATUS FOR TOWING CANAL BOATS.—A. H. Emery and Gabriel Leverich, New York city.
104,440.—DIE FOR FORGING EARS FOR CARRIAGE SPRING HEADS.—John Evans, New Haven, Conn.
104,441.—SHIELD FOR PADLOCKS.—C. C. Gale, Indianapolis, Ind.
104,442.—MACHINE FOR FORMING EYELET STOCK.—Thomas Garrick, Providence, R. I.
104,443.—MACHINE FOR FEEDING STOCK TO EYELET MACHINE.—Thomas Garrick, Providence, R. I.
104,444.—HAND STAMP.—Jeremiah C. Gaston, Cincinnati, Ohio.
104,445.—CARD CLOTHING.—Artemas W. Gates, New York city.
104,446.—PREPARATION OF MINERAL BATH TO IMITATE MINERAL WATERS.—Otto Gavron, New York city.
104,447.—LATCH FOR GATES.—W. R. Goodrich, Whitestown, N. Y.
104,448.—WEATHER STRIP FOR DOORS.—J. M. Gray, Hamilton, N. Y.
104,449.—BOLT FOR DOORS AND SHUTTERS.—G. B. Green, Philadelphia, Pa.
104,450.—RAIN-WATER CONDUCTOR AND FILTER.—James C. Hall, Battle Creek, Mich.
104,451.—MECHANICAL MOVEMENT.—Wm. Hammill, Parma, Mich.
104,452.—MILKING STOOL.—Geo. W. Haviland, Fort Dodge, Iowa.
104,453.—INSTRUMENT FOR REMOVING TWINE AND WIRE FROM BOTTLES.—John T. Haviland, San Francisco, Cal.
104,454.—MACHINE FOR BOARDING LEATHER.—J. W. Hildreth, Boston, Mass.
104,455.—SIDE SADDLE TREE.—William Hill, New York city
104,456.—SIDE SADDLE.—William Hill, New York city.
104,457.—AUGER.—R. H. Hopkins, Hinsdale, N. H.
104,458.—MITER MACHINE.—James R. Howell, Buffalo, N. Y.
104,459.—PISTON PACKING.—John Hughes, Saxton, Pa.
104,460.—GRAIN LIFTER AND HARVESTER.—W. M. Jackson, Woodland, Cal.
104,461.—COOKING STOVE.—S. S. Jewett and F. H. Root, Buffalo, N. Y.
104,462.—CAR COUPLING.—Wm. J. Johnson, New Orleans, La.
104,463.—METALLIC BRACKET.—A. D. Judd, New Haven, Conn.
104,464.—METALLIC BRACKET.—A. D. Judd and E. M. Judd, New Haven, Conn.
104,465.—SPRING BOLT FOR WINDOWS.—Morton Judd, New Haven, Conn.
104,466.—THERMOMETER.—John Kendall, New Lebanon, N. Y.
104,467.—SAW SET.—Moritz Theodore Klahre, Bloody Run, Pa.
104,468.—Suspended.
104,469.—ROTARY PUMP.—August Leuchtweiss, Cincinnati, Ohio.
104,470.—BLEACHING DARK SOAP AND "FOOTS."—Oscar Loew assignor to John M. Pendleton), New York city.
104,471.—ARTIFICIAL FUEL.—E. F. Loiseau and C. F. Requin Nashville, Tenn.
104,472.—ADJUSTABLE SCHOOL DESK.—C. H. Loomis, New Philadelphia, Ohio.
104,473.—HEAD REST.—Baxter Lyon and Charles M. Curtis Springfield, Mass.
104,474.—SHIPS' PORT.—C. E. Marshall, Chicago, Ill.
104,475.—BREAST STRAP FASTENING FOR HARNESS.—J. H. Martin, Columbus, Ohio.
104,476.—MACHINE FOR BORING POSTS AND POINTING RAILS—Rudolph Martin and Matthew Harner, Taneytown, Md.
104,477.—PAPER BOX MACHINE.—Charles A. Maxfield, New York city.
104,478.—JOURNAL BEARING FOR CALENDAR ROLLS.—Wm. McAdams, Newton, Mass.
104,479.—DEVICE FOR MOLDING AND CASTING PIPE.—John McClelland, Washington, D.C.
104,480.—HAY GATHERER AND CARRIER.—Galen Meaders, Jeffersonville, Ind., assignors to himself and Rozel Weissinger, Louisville, Ky.
104,481.—LAMP.—R. S. Merrill, Hyde Park, assignor to himself, W. B. Merrill, and Joshua Merrill, Boston, Mass.
104,482.—HARVESTER.—Jesse C. Miles, Bloomington, Wis.
104,483.—HARVESTER RAKE.—Wm. W. Miller, Zionsville, Ind.

104,484.—Double Lever Master Wheel.—D. E. Mitchell, Rural Dale, Ohio.
104,485.—Sleeping Car.—Geo. F. Morse, Portland, Me.
104,486.—Ventilating Window for Railroad Cars.—M. C. Murphy, Boston, Mass.
104,487.—Grain Binder.—Wm. B. Oglesby, Ridge Prairie, Ill.
104,488.—Pail Ear.—Joel A. Otis, Rutland, N. Y.
104,489.—Harvester.—John G. Perry, Kingston, R. I.
104,490.—Harvester.—John G. Perry, Kingston, R. I.
104,491.—Evaporating Cane Juice.—Simeon A. Poche, Parish of St. James, La.
104,492.—Machine for Grinding Rollers.—J. M. Poole (assignor to himself, Wm. T. Porter, and T. S. Poole), Wilmington, Del.
104,493.—Combined Stove Door and Hearth.—J. A. Price, Scranton, Pa.
104,494.—Concentrating the Juice of Tomatoes.—Christopher T. Provost, New York city.
104,495.—Clothesline Reel.—D. D. Pugh, Brooklyn, N. Y. Antedated June 11, 1870.
104,496.—Quartz Crusher.—Jesse Quaintance, Bucyrus, Ohio.
104,497.—Gridiron for Stove and Range.—J. M. Read, Boston, Mass.
104,498.—Cultivator and Roller Combined.—Linas G. Reed and Erastus E. Reed, Stark county, Ill.
104,499.—Pocket or "Charm" Letter Scale.—George S. Rice, New York city, assignor to Vulcanite Jewelry Company.
104,500.—Turbine Water Wheel.—B. F. Sampson, West Brookfield, Mass.
104,501.—Steam Radiator.—Sidney Sanders, Springfield, Mass.
104,502.—Breech-loading Fire-arm.—Edward L. Sargent, Watertown, N. Y.
104,503.—Thrashing Machine.—William Schnebly, Hackensack, N. J.
104,504.—Spring Bed Bottom.—D. A. Scott (assignor to Allen C. Richards), Cincinnati, Ohio.
104,505.—Twine Holder.—James S. Smith, Middletown, Conn.
104,506.—Meat Cutter.—John E. Smith, Buffalo, N. Y. Antedated June 15, 1870.
104,507.—Method of Making Files.—Thomas S. Smith, Cincinnati, Ohio.
104,508.—Seed Stripper.—Major Joseph W. Stivers, North Middletown, Ky.
104,509.—Bolt and Rivet Trimmer.—Mathias Theisen, Waukon, Iowa.
104,510.—Steam Heater.—Samuel D. Tillman, Jersey City, N. J.
104,511.—Steam Generator.—Samuel D. Tillman, Jersey City, N. J.
104,512.—Propelling Vessels.—Samuel D. Tillman, Jersey City, N. J.
104,513.—Metallic Pavement.—Samuel D. Tillman, Jersey City, N. J.
104,514.—Composition Roll for Clothes Wringers.—William Henry Towers, Boston, Mass.
104,515.—Seeder and Cultivator Combined.—James T. Trowbridge, Akron, Ohio.
104,516.—Shield for Gas Burners.—Hiram J. Wattles, Rockford, Ill.
104,517.—Child's Chair.—Abraham H. Wehser, San Francisco, Cal.
104,518.—Potato Digger.—Daniel B. Westfall, Lyons, N. Y.
104,519.—Mortar Mixer.—Seth Wetmore, Wellsborough, Pa.
104,520.—Glue or Cement.—Nelson S. Whipple, Detroit, Mich.
104,521.—Beehive.—N. F. White, Mount Pleasant, Iowa.
104,522.—Steam Generator.—S. Lloyd Wiegand, Philadelphia, Pa.
104,523.—Refrigerating Attachment for Wells.—J. L. Wiley, Vermont, Ill.
104,524.—Preparing Gold for Dentists' Use.—Richard S. Williams, New York city.
104,525.—Lamp for Burning Candles.—Thomas Scott Williams and Freeman A. Taber, Boston, Mass.
104,526.—Mercurial Expansion Engine.—C. G. Wilson, Brooklyn, N. Y.
104,527.—Apparatus for Bending and Upsetting Tire.—John T. Woodward, Bowling Green, Ky.
104,528.—Paddle Wheel.—L. W. Wright, Brooklyn, N. Y.
104,529.—Horse Hay Fork.—John S. Yinger, Manchester, Pa.
104,530.—Fare Box for Omnibusses, etc.—W. H. Young, Chicago, Ill.
104,531.—Gas Heater.—Amos Adams, Sturgis, Mich.
104,532.—Mode of Uniting Edges of Knitted Goods.—Satterlee Arnold, Claverack, N. Y.
104,533.—Steam Generator.—Wm. Arthur, Newport, Ky.
104,534.—Channel for Boots and Shoes.—Robert Ashe, Boston, Mass.
104,535.—Apparatus for Indicating the Position of Elevators.—William Stuart Auchincloss, New York city.
104,536.—Grain Measuring Attachment to Thrashing Machines.—Benjamin Baker, Addison, Mich.
104,537.—Grinding Mill.—John G. Baker, Philadelphia, Pa.
104,538.—Spring Bed Bottom.—William W. Bartlett, Portland, Me.
104,539.—Drawing Knife.—C. C. Barton, Rochester, N. Y.
104,540.—Edge-Iron for Shoemakers.—E. D. Beales (assignor to himself and John Dages), Gallipolis, Ohio.
104,541.—Vise.—Jonas D. Beck, Liberty, Pa.
104,542.—Billiard Cushion.—John Berlien, Chicago, Ill.
104,543.—Car Coupling.—Abraham Beucus and Tennes Beucus, Waupun, Wis.
104,544.—Cane Mill.—Leopold Biddle, Knoxville, Iowa.
104,545.—Horse Hay Rake.—L. S. Bortree, Grand Rapids, Mich.
104,546.—Life Preserver.—Thos. B. Boyd, St. Louis, Mo.
104,547.—Detaching Hook.—John Bozorth, Camden, N. J.
104,548.—Log Loader and Piler.—James G. Brady, Forest Hill, Mich.
104,549.—Soap.—Leonard Brockett, West Haven, assignor to himself and David L. Stillson, Ansonia, Conn.
104,550.—Boiler and Washer.—E. C. Brooks, Norwich, N. Y.
104,551.—Combined Wood and Concrete Pavement.—J. Warren Brown, Washington, D. C.
104,552.—Clothes Dryer.—W. H. Buell, Union City, Mich.
104,553.—Metal Roofing.—Thomas Carter, Niles, Ohio.
104,554.—Printing Ink.—G. W. Casilear, Washington, D. C.
104,555.—Gate.—John D. Chambers, Williamsport, Ind.
104,556.—Gate.—John D. Chambers, Williamsport, Ind.
104,557.—Draft and Hold-back Attachment.—William H. Chamberlin, Medina, N. Y.
104,558.—Lamp Shade Supporter.—E. E. Conrad (assignor to Henry Coulter and B. H. Jones), Philadelphia, Pa. Antedated June 12, 1870.
104,559.—Fruit Dryer.—Newton C. Cooley, Wyoming, Del.
104,560.—Sole Edge Finishing Machine for Boots and Shoes.—Louis Coté, St. Hyacinth, Province of Quebec, Canada.
104,561.—Thread Cutter for Sewing Machine.—John Crowe, Guelph, Canada.
104,562.—Asphaltum or Concrete Pavement.—Austin G. Day, Seymour, Conn.
104,563.—Street and Station Indicator for Railroad Cars.—Edward L. Dean, Newburgh, Ohio.
104,564.—Buckle.—Thomas Duncan, Brookville, Md.
104,565.—Tatting Shuttle.—B. L. Fetherolf, Tamaqua, Pa.
104,566.—Passenger Register for Horse Cars.—Eugene L. Fitch (assignor to himself and Carlos Clough), West Eau Claire, Wis. Antedated June 17, 1870.
104,567.—Hoisting Apparatus.—O. H. Flook, Middletown, Md.
104,568.—Stop Valve.—James Flower, Detroit, Mich.
104,569.—Wagon Step.—M. C. Floyd, Bloomfield, Ill.
104,570.—Animal Trap.—Francis Fox, Meadville, Pa.
104,571.—Grain Separator.—Abram Gaar, Richmond, Ind.
104,572.—Padlock.—Edward L. Gaylord, Terryville, Conn.
104,573.—Apparatus for Utilizing the Exhaust Steam of Steam Engines.—Henry Gerner, New York city.
104,574.—Fruit Jar.—Thomas P. Gibbons, Philadelphia, Pa.
104,575.—Beer Funnel.—William Golden, Flint, Mich. Antedated June 11, 1870.
104,576.—Sucker-rod Joint.—Adam Good, Jr., Titusville, Pa.
104,577.—Combined Rule, Level, Clinometer, etc.—E. A. Goodes (assignor to "Philadelphia Patent and Novelty Company"), Philadelphia, Pa.
104,578.—Machine for Rounding and Dressing Irregular and Regular Forms.—H. A. Gore, Goshen, Ind.
104,579.—Water Wheel.—William Greenwell, Ripley, Ill.
104,580.—Car Truck.—G. H. Griggs, Worcester, Mass.
104,581.—Heating Stove.—John Grossius, Cincinnati, Ohio.
104,582.—Machine for Cutting Bevels on the Tenons of Spokes.—A. F. Gue, Eastmanville, Mich.
104,583.—Buggy Seat.—Christian Haas, Chicago, Ill.
104,584.—Grinding Ledger and Fly Blades, Planer-Knives, etc.—Charles Hardy, Biddeford, Me.
104,585.—Blower.—Dexter D. Hardy and E. E. Wood, Cincinnati, Ohio, assignors to P. H. Roots and F. M. Roots, Connersville, Ind.
104,586.—Device for Forming Channels in Rivers.—A. W. Harlan, Croton, Iowa.
104,587.—Apparatus for Treating Diseases by Means of Galvanism.—J. B. Hatting (assignor to himself and Stephen Sherlock), New York city.
104,588.—Cooling and Producing Ice.—C. E. Haynes, Boston, Mass.
104,589.—Bottom for Wash Boilers and Similar Vessels.—G. H. Hazelton, Philadelphia, Pa.
104,590.—Sewing Machine.—H. P. Henriksen, Copenhagen, Denmark, assignor to C. E. Brosser, Paris, France.
104,591.—Corn Planter and Fertilizer.—A. L. Holcomb, Hopewell, N. J.
104,592.—Lining Bessemer Converters.—A. L. Holley, Brooklyn, N. Y.
104,593.—Duplex Pressure Gage.—P. B. Hovey, New London, Conn.
104,594.—Dredging Machine.—D. S. Howard, Lyons' Falls, N. Y. Antedated June 11, 1870.
104,595.—Motive-power Apparatus.—Abram Jackson, Lebanon, Tenn.
104,596.—Boot Crimper.—Samuel W. Jamison, Newark, N. J.
104,597.—Clothes line Holder.—C. A. Kalck, Philadelphia, Pa.
104,598.—Lock.—W. M. Keefer (assignor to himself and James Harding), Chicago, Ill.
104,599.—Machine for Shaving Heels of Boots and Shoes.—A. B. Keith, North Bridgewater, and T. K. Reed, East Bridgewater, Mass., assignors to Azra B. Keith.
104,600.—Water Wheel.—James C. Kelly, Groveland, N. Y.
104,601.—Hank for Sails.—George Kirtland, Westbrook, Conn.
104,602.—Faucet.—John Knoche (assignor to himself and Henry Varwig), Cincinnati, Ohio.
104,603.—Paddle Wheel.—W. F. Knowlton (assignor to himself and W. T. Clark, St. Cloud, Minn.
104,604.—Pump.—R. M. Lafferty (assignor to himself and E. P. Smith), Three Rivers, Mich.
104,605.—Water Elevator.—James F. Latimer, Detroit, Mich.
104,606.—Clamp.—J. J. Lebeau, Cincinnati, Ohio.
104,607.—Corpse Preserver.—E. F. Lenox and Charles Eckhart, Trenton, N. J.
104,608.—Motive Power for Sewing Machines.—E. J. Leyburn, Lexington, Va.
104,609.—Picture Knob.—H. C. Luther, Providence, R. I., and C. E. Richards, North Attleborough, Mass.
104,610.—Motive Power for Sewing Machines.—G. W. Manson, Jersey City, N. J., assignor to himself, C. M. Vandervoost, and R. B. Westbrook.
104,611.—Broiler.—Benjamin Marshall, Marietta, Ohio.
104,612.—Tuck Creasing Mechanism for Sewing Machines.—C. F. Martine, Boston, Mass.
104,613.—Saw Hanging.—Sylvester G. Mason, Rochester, N. Y.
104,614.—Apparatus for Cooling Buildings and Making Ice.—W. S. Mason, Raleigh, N. C.
104,615.—Drain-tile Machine.—F. M. Mattice, Cleveland, Ohio.
104,616.—Steam Pump.—J. R. Maxwell and Ezra Cope, Cincinnati, Ohio.
194,617.—Mirror and Picture Frame.—Wm. McConnell, Clarksville, N. J.
104,618.—Harvester.—L. J. McCormick and W. R. Baker (assignors to C. H. McCormick & Bro.), Chicago, Ill.
104,619.—Hardening Magnesian Limestone.—John McMurtry, Mt. Sterling, Ky.
104,620.—Molders' Rammer.—E. H. Meigs (assignor to the Roys & Wilcox Company, East Berlin, Conn.
104,621.—Paper-folding Machine.—Wm. Mendham (assignor to Edwin Chambers and Cyrus Chambers, Jr.), Philadelphia, Pa.
104,622.—Method of Fastening Leads.—John Merlett, Round Brook, N. J.
104,623.—Lamp.—R. S. Merrill, Hyde Park, assignor to himself, W. B. Merrill, and Joshua Merrill, Boston, Mass.
104,624.—Lamp Burner.—Rufus S. Merrill, Hyde Park, assignor to himself, W. B. Merrill, and Joshua Merrill, Boston, Mass.
104,625.—Lamp Burner.—Rufus Spaulding Merrill, Hyde Park, assignor to himself, W. B. Merrill, and Joshua Merrill, Boston, Mass.
104,626.—Spring Sulky.—Edward Milner, Marquette, Mich.
104,627.—Churn Power.—George T. Montague, Keokuk, Iowa.
104,628.—Bolster Plate.—Thomas Morgan, Marquette, Mich.
101,629.—Process and Composition for Water-proofing Leather, etc.—Wm. Morris, Philadelphia, Pa.
104,630.—Button-hole Sewing Machine.—Isidor Nasch, Berlin, Prussia.
104,631.—Ditching Machine.—L. D. Noble, Cerro Gordo, Ill.
104,632.—Portable Apparatus for Curing Meats, and for other Purposes.—H. J. Noyes and Samuel C. Talcott, Ashtabula, Ohio.
104,633.—Bed Spring.—August W. Obermann, Chicago, Ill.
104,634.—Running Gear for Carriages.—Thomas O'Brien, Quincy, Mich.
104,635.—Argand Oil Burner.—Geo. K. Osborn, New York city.
104,636.—Revolving Fire-arm.—W. I. Page (assignor to himself and C. E. Robinson), Boston, Mass.
104,637.—Lath Machine.—S. M. Palmer and G. E. Palmer, Sandy Hill, N. Y.
104,638.—Manufacture of Useful and Ornamental Fabrics from Vegetable and Animal Fibers.—Eugene Pavy, Paris, France.
104,639.—Saw-gumming and Sharpening Machine.—E. W. Phelps, Elizabeth, N. J.
104,640.—Watch-chain Lock.—Simon Pinover (assignor to Kaufmann Brothers), New York city.
104,641.—Combined Pump and Siphon.—William Pitman, New York city.
104,642.—Apparatus for Carbureting Air.—R. H. Plass, New York city. Antedated June 11, 1870.
104,643.—Metal Soles for Boots and Shoes.—Jas. Punderford, New Haven, Conn.
104,644.—Trowel.—Franklin Reed, Canton, Mass.
104,645.—Lathe for Making Awl Handles.—Franklin Reed, Canton, Mass.
104,646.—Harness Hook.—Michael Reilly, Covington, Ky.
104,647.—Machine for Rolling Metallic Roofing Plates.—G. A. Reynolds, Rochester, N. Y.
104,648.—Paint for Roofs.—Thomas C. Rice, Worcester, Mass.
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104,659.—Stop-motion for Steam Engines.—John Storer, Peekskill, N. Y. Antedated June 9, 1870.
104,660.—Needle for Sewing Machine.—Edwin Strain, Newton, Mass.
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104,675.—Water Meter.—G. B. Wiggin, South New Market, N. H., assignor to Orville Peckham, trustee, assignor to G. B. Wiggin and J. W. Hoard.
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104,679.—Car Coupling.—J. C. Wrenshall, Baltimore, Md.
104,680.—Process and Apparatus for Preserving Fruits, Vegetables, etc.—J. C. Wrenshall, Baltimore, Md.
104,681.—Re-sawing Machine.—James York, Jr., Monroe, Mich.
104,682.—Breech-loading Fire-arm.—L. V. Young, St. Louis, Mo.
103,098.—Stove Grate.—Reuben Solliday, Allentown, Pa.—Dated May 17, 1870.

REISSUES.

4,036.—Corn Sheller.—John Bowles, Augusta, Ga., for himself, and S. P. Ross, Pittsburgh, Pa., assignee of John Bowles.—Patent No. 89,550, dated May 4, 1869.
4,037.—Shoe.—Charles Buffum, Lynn, Mass., assignee of Joseph B. Johnson.—Patent No. 46,299, dated Feb. 7, 1865.
4,038.—Division A.—Excavating Machine.—O. S. Chapman, Canton, Mass.—Patent No. 63,857, dated April 16, 1867.
4,039.—Division B.—Excavating Machine.—O. S. Chapman, Canton, Mass.—Patent No. 63,857, dated April 16, 1867.
4,040.—Liquid Meter.—Jose F. De Navarro, New York city, assignee, by mesne assignments, of Franz Wagner.—Patent No. 99,366, dated Jan. 25, 1870.
4,041.—Sidesaddle.—John T. Gathright, Louisville, Ky., assignee of himself and John C. Freeman.—Patent No. 94,737, dated Sept. 14, 1869.
4,042.—Grate.—James Old, Pittsburgh, Pa.—Patent No. 87,790, dated March 16, 1869.
4,043.—Globe Steam Valve.—The Rock Valve Manufacturing Co., Ludlow, Vt., assignee of E. A. Rock.—Patent No. 74,144, dated Feb. 4, 1868.

DESIGNS.

4,156.—Trade Mark.—William A. Burke, Lowell, Mass., assignor to "The Proprietors of the Tremont Mills."
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4,163.—Wire Broiler.—W. J. Johnson, Newton, and H. A. Hildreth, Lowell, Mass.
4,164.—"Baschlik."—Martin Landenberger, Philadelphia, Pa.
4,165.—Shape of a Hood.—Martin Landenberger, Philadelphia, Pa.
4,166.—Table Caster.—C. H. Latham, Lowell, Mass.
4,167.—Plates and Feet of the "Dexter" Cooking Stove.—John Martino & John Currie (assignors to Chas. Noble & Co.), Philadelphia, Pa. Antedated May 26, 1870.
4,168.—Dog Muzzle.—F. J. Meyers, Covington, Ky.
4,169.—Breast Collar for Harness.—W. R. Olmsted, Fayette, N. Y.
4,170.—Bottle.—O. H. P. Rose, East Greenwich, R. I.
4,171.—Cooking Stove.—Garrettson Smith and Henry Brown, Philadelphia, Pa., assignors to C. S. Francis, Henry Francis, H. L. Buckwalter, J. A. Buckwalter, and John Sheeler.
4,172.—Heating Stove.—G. Smith and H. Brown, Philadelphia, Pa., assignors to C. S. Francis, Henry Francis, H. L. Buckwalter, J. A. Buckwalter, and John Sheeler.
4,173.—Ring and Buckle.—James E. Strode, Hillsborough, Ill.

EXTENSIONS.

Boot Tree.—C. T. Eames, Milford, Mass.—Letters Patent No. 14,951, dated May 27, 1856; reissue No. 1,292, dated March 25, 1862; reissue No. 2,466, dated Jan. 29, 1867.
Operating Steam Stamps.—Adelia E. Ball and Edwin P. Ball, of Chicopee, Mass., administrators of William Ball, deceased.—Letters Patent No. 14,944, dated May 27, 1856.
Grinding Circular Saws.—Wm. Clemson, Middletown, N. Y. Letters Patent No. 14,950, dated May 27, 1856.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

Machine for Preparing Fibrous Substances for Spinning.—James Apperly and William Clissold of Dudbridge, Great Britain, have petitioned for the extension of the above patent. Day of hearing Nov. 16, 1870.

Repairing Railway Bars.—Geo. Johnson, Marshall, Mich., has petitioned for an extension of the above patent. Day of hearing Aug. 24, 1870.

Harvester.—William P. Mason, Elmira, N. Y., has applied for an extension of the above patent. Day of hearing Aug. 24, 1870.

Saw Gummer.—Richard H. Garrigues, Salem, Ohio, has petitioned for an extension of the above patent. Day of hearing Aug. 24, 1870.

Machine for Sweeping Streets.—Robert A. Smith, Philadelphia, Pa., has applied for an extension of the above patent. Day of hearing Aug. 24, 1870.

Mode of Constructing Walls and Floors of Cellars.—Sophia A. Moen, Stamford, Conn., and Philip L. Moen, Worcester, Mass., have petitioned for an extension of the above patent. Day of hearing August 24, 1870.

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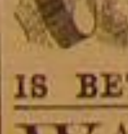

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