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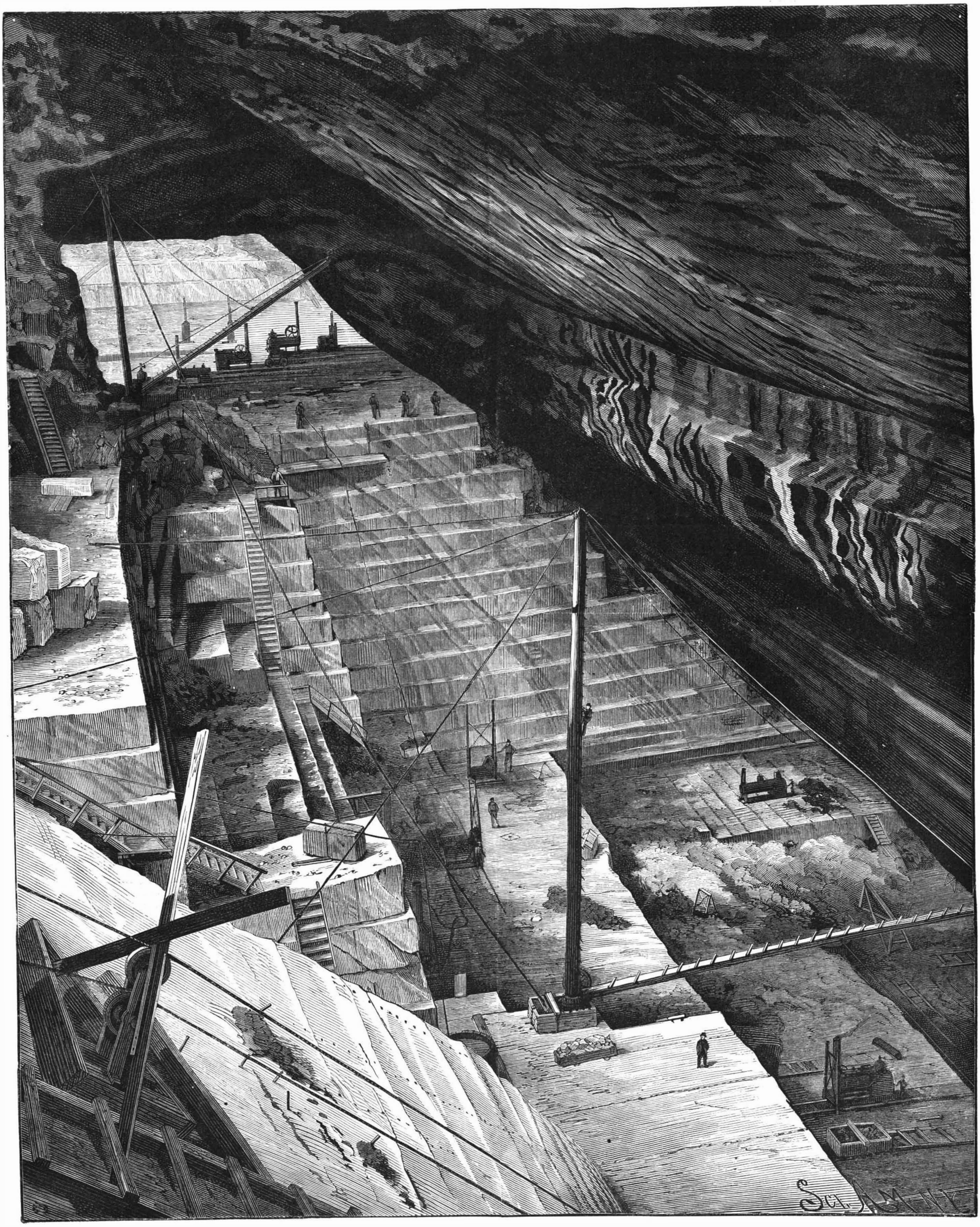

OUR BUILDING STONE SUPPLY—INTERIOR VIEW OF MARBLE QUARRY, WEST RUTLAND, VT.—[See page 18.]

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THE ANNUAL ATTACK UPON OUR PATENT LAWS.

It is with a feeling of genuine regret that we announce the commencement of the annual attack upon our patent laws in the House of Representatives. It is in no idle spirit that we make this statement. Our duty in the matter extends far beyond the noticing or chronicling of the event. The remedy and antidote is to be provided. Let our readers take individual action in the matter; let every Congressman hear from his constituents in unmistakable tones that the patent system of America is not to be disturbed, and the work will be done. Whatever bills menacing the rights of inventors shall be brought forward, a single warning will apply to all.

The bill we particularly allude to is one that was introduced during the last session in the House of Representatives by Mr. R. W. Townshend, of Illinois. Its number is 4,458. This year it has been again brought forward, and it was the subject of debate on the 20th of December in the House.

Its provisions are in brief that the United States courts shall have no jurisdiction in patent cases where the damages do not exceed $200, and that purchasers of a patent right for actual use shall not be liable for its value or for infringement in any way if, at the time of its purchase, they had no knowledge of the claims of any third party.

By one provision, infringement of the multitude of small patents is legalized. Any one could use patented churns, sewing machines, mowers, reapers, minor improvements in steam engines and general machinery, without reference to the inventor. It is well within the truth to say that a vast majority of cases of infringement could be brought within the operation of such a law.

In its second clause, the innocent purchaser of a patent right is upheld in his bargain. He may buy what another has no right to sell, playing the part really of a receiver of stolen goods, and in this transaction he is to be protected by a congressional enactment.

With the constitutionality of this act we have now no affair. It is enough to say that in the debate concerning it, its unconstitutionality, its want of clearness, and its surplusage were all subjects of attack. Our concern is for the interests of the country at large. The industries of America have been built up on and repose upon patents. Every factory large or small uses in its machinery numerous patents. Every individual workman has patent tools that expedite his labors. The farmer is perhaps more directly benefited by patents than any one else. Instead of swinging a scythe of unimproved construction through a long eleven or twelve hour day, with the result of one acre mown at the end of it, he sits at ease upon the seat of a patented harvester, and with a team of horses reaps and binds, without other help, thirteen acres of wheat a day. Reapers, self-binders, and harvesters do the work of the West, on the great prairies. In the East, where smaller farms are the rule, the hand tools used are all subjects of patents. Without the patent system, none of these implements, large or small, would have been invented. The Townshend bill professes to be aimed at the protection of this particular class, the farmers, from some mysterious "blackmailers." The existence of the latter is quite doubtful. But if such do exist, and work detriment to the agriculturists, their measure of harmfulness is nothing compared to the evils threatened by this bill. Even more than the manufacturers, the farmers should oppose it. The very class for whose protection it is professedly introduced are attacked by it.

And now we may more explicitly state what action should be taken by all who have the welfare of the country at heart. They should address their representatives in Congress. Manufacturers whose capital is pledged upon the maintenance of patent rights; farmers who could not profitably cultivate their land but for patented agricultural machinery; workmen employed to run, and who earn their living by running patented machinery to manufacture patented articles, should be heard from. Especially should the constituents of any member known to be opposed to patents address him, and tell him of their wishes.

THE MULTICHARGE CANNON.

Colonel Haskell asks Congress for an appropriation for the further test of the multicharge gun, with the expectation of furnishing a cannon that will beat the world. The trials of the Haskell gun at Sandy Hook developed the fact that his 6 inch gun, of poor metal, with a projectile of 111 pounds and powder 116 pounds, showing a pressure of 25,000 pounds at the 4th pocket, had a greater range and penetration than a Krupp 11 inch breech loading gun, of best steel, which showed an initial pressure of 40,829 pounds per square inch, projectile 760, powder 254 pounds. The contrast is great, and the results established by the trials are sufficient to warrant the construction of additional Haskell guns of best materials and workmanship for further experiments. We believe no gun of a power equal to Haskell's, size considered, has ever been produced in this or any other country. If properly made and used, the weapon promises to surpass all others. It is, moreover, a purely American gun, and its further development should be liberally encouraged. The novelty consists in attaching to the barrel of the gun, at intervals along its length, a series of exterior powder pockets, that communicate with the interior of the barrel. The ball is started from the breech by a moderate charge of powder in the usual manner; when the ball passes beyond the first pocket, the burning powder fires the charge contained in the pocket, and its pressure is added to that of the initial charge, and so on; each pocket of powder contributes successively to add a new pressure behind the projectile. The aggregate pressure of the whole powder used is thus delivered gradually by successive explosions against the projectile, which, consequently, takes a higher velocity and has more power than the ordinary single charge gun. The theory of the Haskell gun is correct, and when the best construction is ascertained, it probably will excel in performance all other forms of ordnance. But "it isn't English, you know," and consequently some of the old army and navy officers sneer at it. Nevertheless, we trust Congress will grant a liberal appropriation for the thorough testing of the new arm, and thus help in showing what home genius can accomplish. Everybody laughed at Ericsson's first little raft, with its iron-cased hogshead on deck. But it silenced the enemy, and all the navies of the world soon copied it. The first Haskell gun has proved quite as successful in its way as was the first Monitor.

REVIVAL OF PATENT NULLIFICATION.

It will be remembered in 1884 an attempt was made in Congress to pass laws in the interest of certain infringers of patents, such as railway corporations, barb fence makers, drive well infringers, and others, to prohibit patentees from recovering damages for violation of their patents, and making it lawful for any person freely to make and use a patented invention without responsibility to the inventor or his assigns. By some unaccountable folly, two of these hostile bills passed the House of Representatives by very large majorities; they were rushed through without sufficient opportunity for debate, and before their full purport could be understood by the friends of the patent system. The passage of the bills in the House raised a storm of indignation in all parts of the country, especially in manufacturing districts, and among the great body of working people, who depend for their livelihood upon the success of home industries.

To exempt infringers of new inventions from penalty was regarded as tantamount to nullifying the patent laws and wounding all the vast industries that rest upon patents.

The most energetic means were taken to defeat this unprecedented action of the House. Meetings of citizens were held, conventions were called, boards of trade convened, legislatures of States passed resolutions condemning the act, floods of protests were sent to members of Congress, and to crown all, the press of the country discussed the matter thoroughly, and gave unanimous voice against the consummation of a measure so suicidal and unjust. These combined efforts were successful. The bill was disapproved in the Senate, where it was elaborately discussed, and the impression or expectation has prevailed that its revival would not be attempted. But this expectation has proved vain. On the 20th ult. the obnoxious measure, in a new form of words, was brought forward in the House, and its passage urgently demanded.

The following is the text of the bill:

H. R. No. 4458.

Be it enacted, etc., That hereafter the United States district and circuit courts shall have no jurisdiction to hear or to try any case arising from the actual use of any patent right, or its infringement by such use, by any person in or citizen of the United States or the Territories, wherein the amount in controversy does not exceed $200 against one person or citizen.

SEC. 2. That purchasers of any patent right for actual use shall not be liable to damages, royalty, or for value of the same, or for infringing the same in any manner, who at the date of such purchase had no knowledge of the claims of any third person or that the inventor of the same has an interest therein adverse to the seller thereof. That no person who shall in good faith purchase, use, manufacture, or sell without previous knowledge of the existence of a patent therefor, any article, machine, machinery, or other thing for the exclusive use, sale, or manufacture of which any patent has been or hereafter may be granted to any person, persons, or corporation whatever, shall be liable, in damages or otherwise, for an infringement of such patent until after written notice of the existence thereof shall have been personally served on such person or persons or corporation, as the case may be, and such infringement shall be thereafter continued.

SEC. 3. That all laws or parts of laws inconsistent herewith are hereby repealed.

SEC. 4. That nothing herein contained shall affect any pending suit or proceeding in any of the courts of the United States or in any court of any of the several States.

A bill like this, which overthrows an industrial policy that has been successfully carried on almost since the foundation of the government, which cannot be otherwise than disastrous to all manufacturing interests and to the property rights of patentees, is deserving of the most deliberate consideration and the fullest discussion. But its advocates took good care to prevent this.

Under the rules, only thirty minutes were allowed for debate—fifteen in support of the bill, and fifteen against it. Mr. Townshend of Illinois, Mr. Henderson of Iowa, Mr. Morgan from Mississippi, and Mr. O'Donnell from Michigan were the chief supporters. The principal advocate was Mr. Townshend, and from his remarks we gather that his most pressing reason for wanting to pass the bill is that a few farmers among his constituents have been victimized to a small extent by parties who pretended to be the proprietors of the drive well patent; and when the rightful owner of the patent appeared and claimed ten dollars each for use of his invention they refused to pay, denounced the demand as an outrage, and have gone to the Supreme Court about it. To prevent the recurrence of such claims, the advocates of the bill ask that the laws be emasculated. But if we take away from the patentee the right to compel infringers to stop piracy and pay for use, we nullify the law, and patents cease to have value.

Some of the speakers for the bill claimed there were thousands of cases of "innocent suffering;" but none of them alluded to any distinctive examples except Mr. O'Donnell of Michigan, who cited, as his worst case, that of a farmer who, after having declined to purchase a certain machine (he does not say what it was) at a reasonable figure from the original patentee, allowed himself afterward to be persuaded to buy an infringing machine of inferior quality. He returned this machine, without loss, because it did not work well; but the original patentee compelled him to pay a few dollars for his infringement in using it. And it is to remedy hardships of this kind on the part of "innocent purchasers" that Mr. O'Donnell advocates the bill.

The chief opponents of the bill were the Hon. N. J. Hammond of Georgia, Hon. Benjamin Butterworth of Ohio, late Commissioner of Patents, and Hon. R. Q. Mills of Texas. Mr. Hammond made a very eloquent and powerful speech against the bill, in which its obnoxious features were clearly exposed. The bill will soon come up again in the House.

SPEECH OF THE HON. NATHANIEL J. HAMMOND OF ATLANTA, GA.

This bill seems a declaration that in all cases where the damages do not exceed $200 against each person sued, there shall be no suit for the infringement of a patent right. I do not know the statistics on the subject, but I will venture to guess that seven-eighths of the patents granted in this country are of such character that individual infringements will not amount to $200 damages each. This bill seems, therefore, a declaration that the constitutional protection which is thrown around patent rights shall belong only to those great and magnificent patents involving thousands of dollars, while the men who by their brain and toil have brought forth the small patents shall have no protection from this government.

Mr. Speaker, the section from which I come has very little interest in patents so far as the protection of the patentee is concerned. I can, therefore, have no wish in opposing this bill but to protect the rights of American citizens wherever they are involved. The Constitution declares that Congress shall have power—

"To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

The Supreme Court of the United States has more than once declared that a patent is a solemn contract between the patentee and the government, by which the exclusive use is granted to him for a limited time in consideration of public use ever afterward, and which, like any other contract, can be set aside only for fraud. This bill, therefore, in effect seems to declare that seven-eighths of all the patents in the United States shall by these three sections be cut down so as to be practically valueless. For, mark you, the bill gives no jurisdiction to a State court, and under the present law no State court has jurisdiction of any suit for the infringement of a patent.

This first section, it will be observed, has nothing to do with good faith or bad faith. Under it a man may in open market buy or sell a patent without authority in the patentee's face, and answer, "I damage you only to the amount of $199, and you cannot sue me anywhere." That is the first section of the bill as it seems to be intended.

Now, let us look at the next section, the section as to *bona fide* purchasers. I have shown that the first section has nothing to do with good or bad faith. Here is the section in regard to *bona fide* purchasers:

"SEC. 2. That purchasers of any patent right for actual use shall not be liable to damages, royalty, or for value of the same, or for infringing the same in any manner, who, at the date of such purchase, had no knowledge of the claims of any third person, or that the inventor of the same has an interest therein adverse to the seller thereof."

Now, Mr. Speaker, when a man obtains a patent, he is required by the law to have marked on it that the article is patented. His letters patent are of record here, just as our title deeds to real estate are recorded in the proper offices.

There is no such thing as a *bona fide* purchaser of a patented article without notice that it is patented. If the mark of patent right is on the thing, the man who buys it with his eyes open cannot be an innocent purchaser against the right of the patentee.

Again, that declares if he buys it for his personal use he may infringe it in any way whatever and not be liable. He may buy an article to use it personally, and put men all over the country to manufacture it, and yet not be liable in damages, because he was an innocent purchaser without notice.

The next paragraph of that section declares that no person who shall in good faith purchase, use, manufacture, or sell, without previous knowledge of the existence of a patent therefor, any article, machine, machinery, or other thing for the exclusive use, sale, or manufacture of which any patent has been or hereafter may be granted to any person, persons, or corporation whatever, shall be liable, in damages or otherwise, for an infringement of such patent until after written notice of the existence thereof shall have been personally served, etc.

All a scoundrel has to do is to infringe a patent, and run faster than the marshal. The greater the rascal and the better the racer are all the tests whether there can be recovery. He is a witness in court. He can swear to his good faith, after he is caught; before he is caught he will not be liable at all, because he is liable under the bill only for damages occurring after personal service of notice of his wrong.

In my section of the country there are very few patentees. We have but little enough concern, care little for them in any such sense as that. And if I were seeking to place myself upon the side which the gentleman from Illinois calls the "masses," I would go in for depriving patentees of their constitutional right. They are decidedly in the minority. But I understand that the same good faith, that the same high consideration, which should actuate us in keeping treaties with foreign nations, ought, with double force, to compel us to keep constitutional contracts with our own fellow citizens. For these reasons I hope this bill will not pass.

SPEECH OF THE HON. BENJAMIN BUTTERWORTH OF CINCINNATI, O.

MR. SPEAKER: I submit if ever there was a bald attempt to kill the goose that lays the golden egg, this is such an attempt. The industries of this country depend for their origin and growth more upon the encouragement given to the inventor by our patent system than upon every other influence and all other causes combined. It is due to our patent system that we to-day excel all others as a manufacturing nation. This bill practically "wipes out" our patent system; and, as my honored friend on the left [Mr. Hammond] said, while it may leave in a degree unimpaired some monopolies, if such a thing as a monopoly can in fairness be said to exist in this country—and there is what is near allied to a monopoly—while the provisions of this bill leave them unharmed, they at the same time not only leave unprotected, but practically confiscate, the property of thousands who by lives of thought and toil have laid the foundation of our magnificent industries. It legalizes the robbery of these, the most deserving and most numerous class of inventors.

As has well been said by the gentleman from Georgia [Mr. Hammond], not one in a thousand need be swindled unless he consents to be, and is in fact, conspicuously, a party to it. The law requires that each patented article shall be so stamped, including the date of the patent, that no one need be imposed upon if he exercises care. It is true there may be devices covered by patents which are parts of a machine and so located as not to be observable, but these are rare exceptions, and fraud or imposition in such cases is unheard of. Every intelligent person knows that under every system of laws, however perfect, some hardships will result. It is impossible to conceive of a system so perfect as to be free from hardships in individual cases, and our patent laws, in their practical operations, may, in isolated instances, be the instrument of wrong and frequently of annoyance; but compared with the inestimable blessings the patent laws, as administered, confer with lavish hand upon all our people, the inconveniences a few may suffer are as nothing, and certainly can offer no semblance of justification for the wholesale confiscation of property in patents that would result from the enactment of such a law as is here proposed. What does this bill propose? To take away the remedy in case of trespass upon and injury to the class of property created by our patent laws. It in effect authorizes A to appropriate to himself the property of B, without compensation and without redress. The right is left, the remedy taken away.

In my judgment, this bill could not be more offensive to justice unless it literally legalized the calling of the footpad, and afforded immunity to pickpockets; since it must be evident that the acts named differ from those permitted by this bill only in this, that the footpad places the victim under duress before he robs him, while this bill authorizes the appropriation of the property of another without violence, and leaves the victim without remedy and without redress. In each case the victim loses his property; but in case the footpad takes it, it may be recovered, but the individual who is robbed under the provisions of this bill is remediless.

Not to exceed 10 per cent of the patents issued by the Government of the United States prove valuable to the patentee. Why? Because the larger per cent of patented machines and devices mark so slight an improvement, although an important improvement, in the art that the inventor is unable to reap substantial profits. Nevertheless, each improvement marks an advanced step in the art to which it belongs; and while it is usually the men who make great strides, extraordinary improvements, in an art who realize great profits, yet it is the seemingly less important improvements that have built up and made prosperous the vast and various industries of our country.

The bill has for its manifest object to deprive the honest inventor, whose labors have added to the well-being of the whole people, of his remedy to recover from the person who has willfully and knowingly taken from him his property, that which the Constitution and the laws of the country say shall be his property for a term of years. I say you prevent his recovering from the man who willfully and in violation of the Constitution and the laws of the country takes possession of his property and converts it to his own uses. Pass this bill, and you authorize every man to seize upon and convert to his own use the property of his neighbor. The product of the brain and hands of one of our citizens—if it is a new and useful improvement in any art—is by law property as much as a horse or cow; and the offense of taking the one without compensation is as great as taking the other, and is in conscience, and should be in law, as censurable.

This bill, if it should become a law, wipes out at one stroke of the pen property rights of more than one hundred millions of dollars in value. It is, in fact, impossible to calculate the mischief it will do. Ninety per cent of the present thriving industries of the country are built upon inventions covered by patents. "But then," says some friend, "we are being robbed by the system."

Mr. Speaker, I can show you, can demonstrate, that instead of that being true, this system has cheapened every product that is used in the house, in the barn, in the field, in the mill, in the shop, the forest, the factory, and on the ocean. It has cheapened all the articles we use. Instead of imposing burdens, it has scattered blessings, and this covert attempt to steal the blessings while destroying the source from whence they proceed is utterly indefensible. I wish I had time to examine this bill in detail in order to show its enormities.

[Here the hammer fell.]

A Golden Nugget.

A COMFORTABLE LITTLE FORTUNE ALL IN ONE CHUNK.

There is at present on exhibition in Wells, Fargo & Co.'s bank at San Francisco a bit of auriferous rock that any individual might be glad to possess. It might be a little cumbersome as a "specimen" scarfpin, but when the wearer reflected that it was worth between $6,000 and $7,000, he might be braced up to making the extra exertion. The nugget is one of the finest ever unearthed in California, both in size and richness. It is irregular in shape, and about the size of an ordinary Derby hat. That there is very little rock and a great deal of gold in it may be determined by its weight, which is 35 pounds troy. Quartz of this sort is usually valued at $200 per pound, and, allowing the large margin of $1,000 for rock, the nugget would be worth $6,000. The exposed rock and great gobs of gold that hang out of its sides so as to nearly hide all other composition, and make it appear almost as melted metal, are not jagged or rough, but, on the contrary, are smooth and polished in a manner that only water is capable of. The proprietors of the nugget are Messrs. Hayes & Steeleman, of Sierra City, and they have left it on exhibition for a few days before disposing of it. At the bank it attracts much attention, but the employes could furnish no information concerning it beyond that it came from Sierra County and near Sierra.—*San Francisco Examiner.*

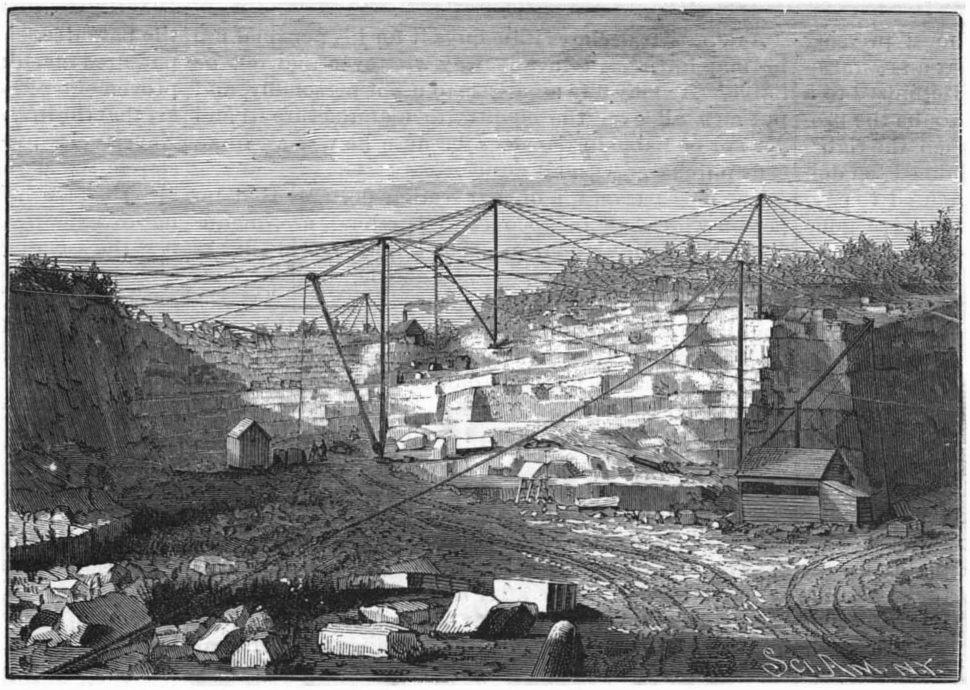
Preservation of Wood by Lime.

I have for many years been in the habit of preparing home-grown timber of the inferior sorts of fir—Scotch, spruce, and silver—by steeping it in a tank (that is, a hole dug in clay or peat, which was fairly watertight) in a saturated solution of lime. Its effect on the sapwood is to so harden it and fill the pores that it perfectly resists the attacks of the little wood-boring beetle, and makes it, in fact, equally as durable as the made wood. I have a mill which was lofted with Scotch fir prepared in this way in 1850, and it is in perfect preservation. The timber is packed as closely as it will lie in the tank, water is let in, and unslaked lime is thrown on the top and well stirred about. There is no danger that the solution will not find its way to everything in the tank. I leave the wood in the solution from two to three months, by the end of which time an inch board will be fully permeated by it. Joists and beams would, of course, take a longer time for saturation; but in practice we find that the protection afforded by two to three months' steeping is sufficient if the scantlings are cut to the sizes at which they are to be used.—*Field.*

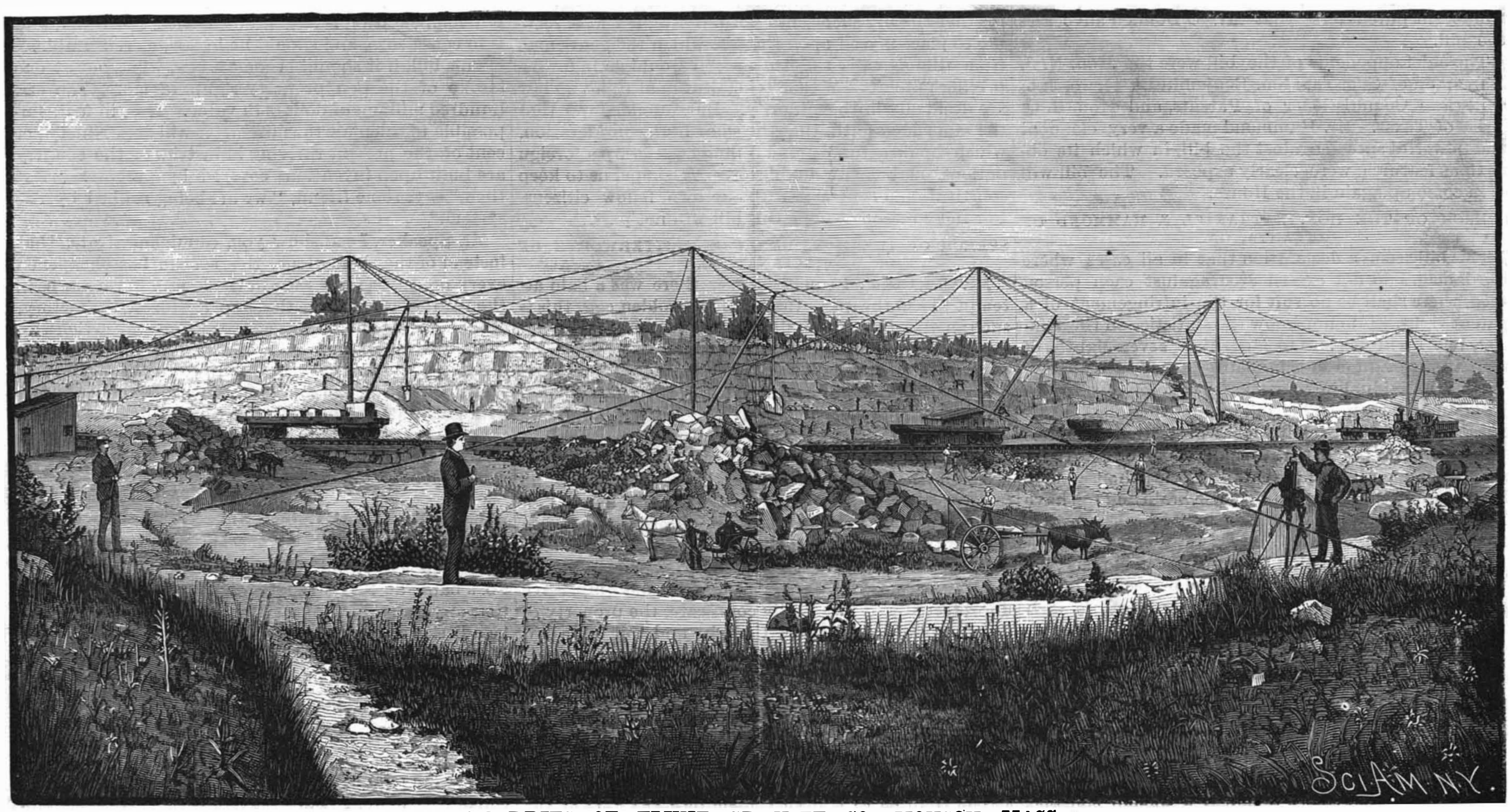
OUR BUILDING STONE SUPPLY.

We have received from Mr. George P. Merrill, of Washington, D. C., a valuable article upon the above subject, from which we derive the following. The article in full will appear in an early issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

That upward of $25,000,000 is invested in the stone quarries of the United States is doubtless scarcely realized by the majority of persons. But from the tenth census it appears that during the year ending May 31, 1880, there were in active operation in the United States 1,525 quarries of building and ornametal stones of all kinds, representing an invested capital of $25,415,497, and giving employment during the busy season to upward of 40,000 men. The total product of the combined quarries was 115,380,133 cubic feet, valued in the rough at $18,365,065.

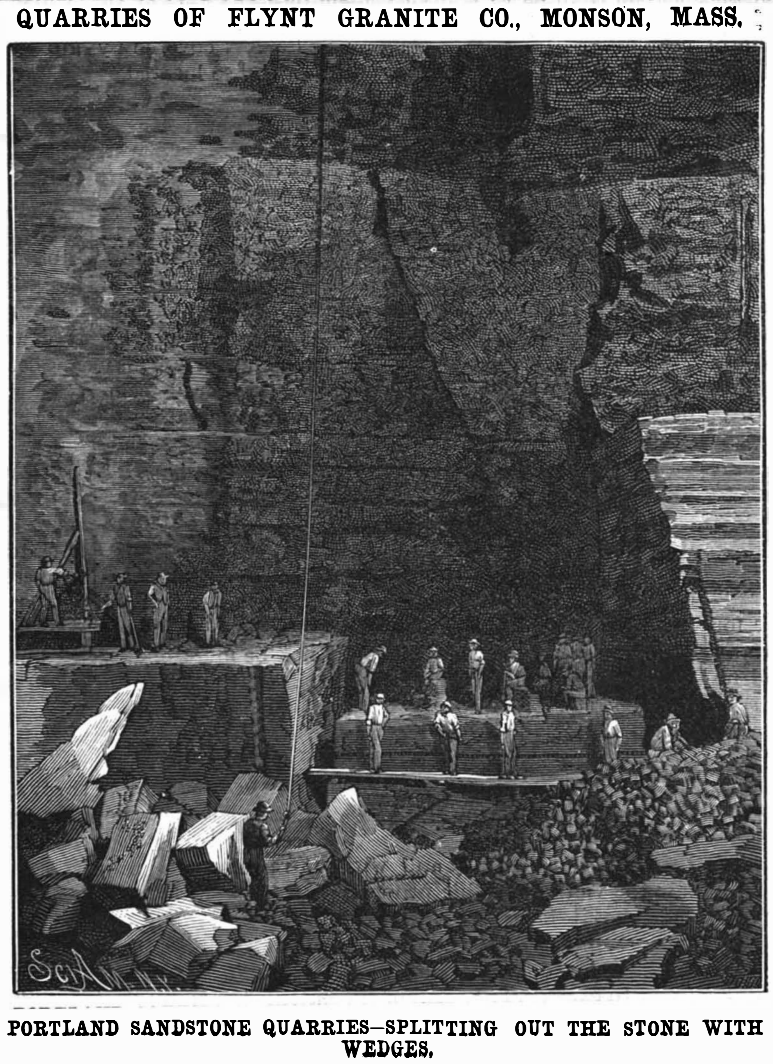


GRANITE QUARRIES, HALLOWELL, ME.



QUARRIES OF FLYNT GRANITE CO., MONSON, MASS.

Granites came first into use in this country, probably more on account of their ready accessibility than from any desire on the part of the people for so refractory a material, the matters of transportation and cost of working being then as now the controlling items in deciding what substances were to be employed. As early as 1650, a building long known as the "stone house of Deacon John Phillips" was erected in Boston from rough stone found in the immediate vicinity or brought as ballast from England. Another early stone building was the "Old Hancock House," which was constructed from bowlders of Braintree (Quincy) granite. Neither of these is now standing. In 1749–54 Kings Chapel, which is still standing on the corner of School and Tremont Streets, was erected. This also was of bowlders of the Quincy stone, and was a seventy times seven days' wonder to all who beheld it. Considering the methods employed in getting out the stone, it was a remarkable structure, for we are told that the bowlders were broken by first heating by fire, and then letting fall heavy iron balls upon them from a considerable height. Crude as was the method, the building still stands in a better state of preservation than many that have been erected since; and singularly enough, the wonder does not seem to have been that the stone could be worked at all by these means, but rather that enough good stone was obtainable, and it was universally conceded that enough more like it could not be found to build another!



PORTLAND SANDSTONE QUARRIES—SPLITTING OUT THE STONE WITH WEDGES.

The granite bowlders dotting the Quincy commons continued to furnish for many years the chief stone used in the vicinity for foundations, steps, and like purposes. Early in the present century, however, granite began to be brought into the city from Chelmsford or Westford (Hitchcock says the latter), and stone buildings became more common.

In 1818–19, stone from the same source was also shipped to Savannah, Ga., for the construction of a church at that place, but this also was obtained largely from bowlders, and such a thing as a permanent quarry systematically worked was almost unknown.

The demand for large quantities of stone for the construction of the Bunker Hill Monument caused the opening of extensive quarries in Quincy in 1825, and the construction of what has been called the first railway in America to transport the quarried material. From this date the development of the quarrying industry has gone on constantly and rapidly.

The Quincy granites are exceedingly tough and hard, of a coarse texture, and deep blue gray color; they give an appearance of peculiar solidity and strength to all buildings in which they are used, while the fact that they admit of a high lustrous polish renders them peculiarly adapted to the finer grades of monumental and decorative work. For the latter purposes they are coming more and more in vogue, and appearances indicate that with present prices and tastes the days of Quincy granite for merely rough building purposes are over, and henceforth it must be known more properly as an ornamental stone.

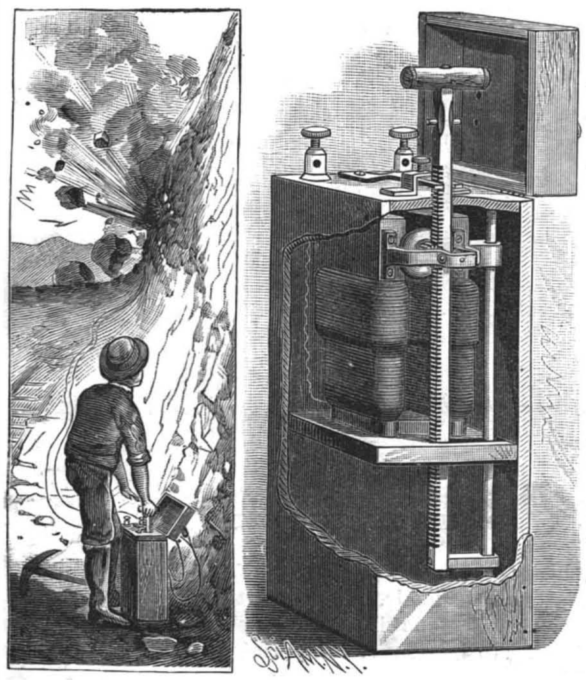
Nevertheless, there are few stones that have exercised a more pronounced effect upon American architecture. In Boston alone, out of the 312 buildings with exterior walls constructed wholly or in part of granite, 162 are of the Quincy stone.

At about the date of the opening of the "Bunker Hill Quarry" at Quincy, a granite quarry was also opened in the adjacent town of Gloucester, a "town heretofore noted only for its fishery interests," and not long after others were opened at Anisquam, but which were soon after abandoned. Quarries at Rockport just beyond Gloucester were opened in 1827, and are now in a flourishing condition, though the first year's business is said to have resulted in a net loss of $15. The celebrated quarries at Bay View, now the property of the Cape Ann Granite Company, were opened in 1848. This is now one of the best equipped in all its appliances of any quarry in the coun-

(*Continued on page* 21.)

DYNAMO ELECTRIC IGNITING MACHINE.

It is well known that the field magnet and armature of a small dynamo electric machine may be quickly brought to saturation; and that when the current is at its maximum, the breaking of the circuit will cause the extra current generated in the coils to be discharged, either through the air at the point of rupture or through a derived circuit connected with the terminals of the field magnet. In the machine here illustrated this fact is taken advantage of, and also the fact that



SMITH'S DYNAMO ELECTRIC IGNITING MACHINE.

an accelerated motion of the armature is more effective in bringing the field magnet and armature to magnetic and electric saturation than a uniform rotation of the armature. The field magnet and armature—which is preferably of the Siemens I type—are of the usual construction. Mounted upon that end of the armature shaft opposite the commutator is a pinion, with which engages a rack bar passing through the top of the casing supporting the machine and extending downward toward the bottom. The upper end of the bar is provided with a handle, between which and the top of the casing a pin is inserted in the bar and allowed to project a short distance upon each side.

When the handle is raised in operating the machine, the pinion is rotated on the shaft without turning the armature, the clutch connection between the pinion and armature permitting of this action. When the rack bar is pushed down, a quickly accelerated rotary motion is imparted to the pinion, and the armature is rotated between the poles of the field, generating a current, which is so conducted that very little of it passes through the external or derived circuit, on account of its comparatively low electromotive force and the high resistance of the circuit. The current increases rapidly as the rack bar descends, and charges the armature and field to saturation. Just before the bar reaches the limit of its travel, its pin strikes a spring key secured to the top of the casing, and breaks the electrical connection at the instant the maximum of current and of magnetization of the field magnet is reached, so that the extra current flowing from the winding of the field and armature is compelled to pass through the external circuit, and thus heat the wires of the fuses included in that circuit, causing their explosion. The high electromotive force of the extra current enables it to readily pass through the external circuit, whose great resistance prevents the passage of the normal current.

This invention has been patented by Mr. H. Julius Smith, of Mountain View, N. J.

IMPROVED HOPPER DREDGER.

There is now being completed on the River Cart, at the works of Messrs. William Simons & Co., Renfrew, a 1,000 ton hopper dredger for the corporation of Bristol, to be used for dredging the River Avon. This fine dredger is of quite a peculiar type. It is built of steel, of light draught, broad beam, and great carrying capacity. In order to avoid the necessity of canting in the river, the vessel is fitted with twin screws, fore and aft, or four in all, and is provided with three rudders, two aft and one forward. The principal dimensions are: Length, 218 ft.; beam, 43 ft.; depth, 17 ft. There are three hoppers amidships, capable of containing 1,000 tons of dredgings.

The propelling machinery consists of two independent sets of triple-expansion engines, which will work up to 1,300 horse power. A compound auxiliary engine is used to work the bucket ladder and other gearing when the main engine is not in use. The boilers, three in number, are double furnaced, and are of mild steel. The furnaces are corrugated. The boilers are intended to work at 150 lb. pressure. The bucket ladder is fitted upon Messrs. Simons' patent traversing arrangement, by which the ladder is supported upon a horizontal fore and aft frame. By means of this frame, the latter can be projected beyond the stern of the dredger, so that a bank may be cut into by the buckets, and the vessel thus enabled to excavate its own flotation. The traversing gear is so arranged that it can be operated at any desired speed, and thrown promptly out of gear when required. The buckets are capable of raising 500 tons of dredgings per hour, and can dredge to a depth of 36 ft. below the surface of the water. The other appliances on board are similar to those fitted by Messrs. Simons on the vessels of the hopper barge type which they have recently built.

Messrs. Simons were the first to introduce the combined hopper and dredger. The first vessel of this type was built in 1872, for the Canadian Government. Since then, Messrs. Simons have constructed twenty-four vessels of the same character, ranging in capacity from 200 to 1,300 tons. The advantages claimed for the hopper dredger are that it unites in one vessel the capacities of a dredger, barge, attendant tugs, etc. A single crew is, therefore, able to perform the work of several.

According to a log recently published of the performances of an 850 ton hopper dredger supplied by Messrs. Simons to the Belfast Harbor Commissioners, the following were the results: 14,450 tons of free sand and clay were dredged and deposited at sea, at a distance of ten or twelve miles, in seventy-four hours and five minutes of engine time, at a cost for both operations of under one penny per ton for working expenses. It is calculated that the working expenses of the dredger which we illustrate this week will approximate to these figures.—*Industries.*

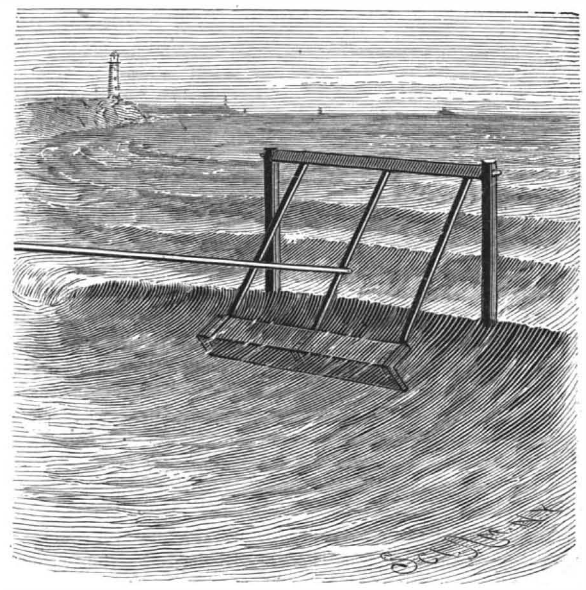
Soldering Copper.

A practical smith says in one of our contemporaries that when copper is soldered and the solder to be colored like the surrounding copper, this can be done by moistening the solder with a saturated solution of vitriol of copper and then touching the solder with an iron or steel wire. A thin skin of copper is precipitated, which can be thickened by repeating the process several times. If a brass color is desired, a saturated solution of one part of vitriol of zinc and two parts of vitriol of copper is used on the previously coppered solder and the latter rubbed with a zinc wire. To gild the soldered spot, it is first coated with copper in the manner indicated above, and then with gum or isinglass and powdered with bronze powder. A surface is obtained which, after drying, can be very brightly polished.

WAVES UTILIZED TO PUMP WATER.

I send herewith a description of a wave-operated force pump I constructed last summer, to supply my cottage with water, at Thousand Island Park, St. Lawrence River, N. Y. The water was delivered through a three-quarter inch pipe, 200 feet, with 40 feet elevation to tank. The power was obtained from the momentum of the waves, which proved ample.

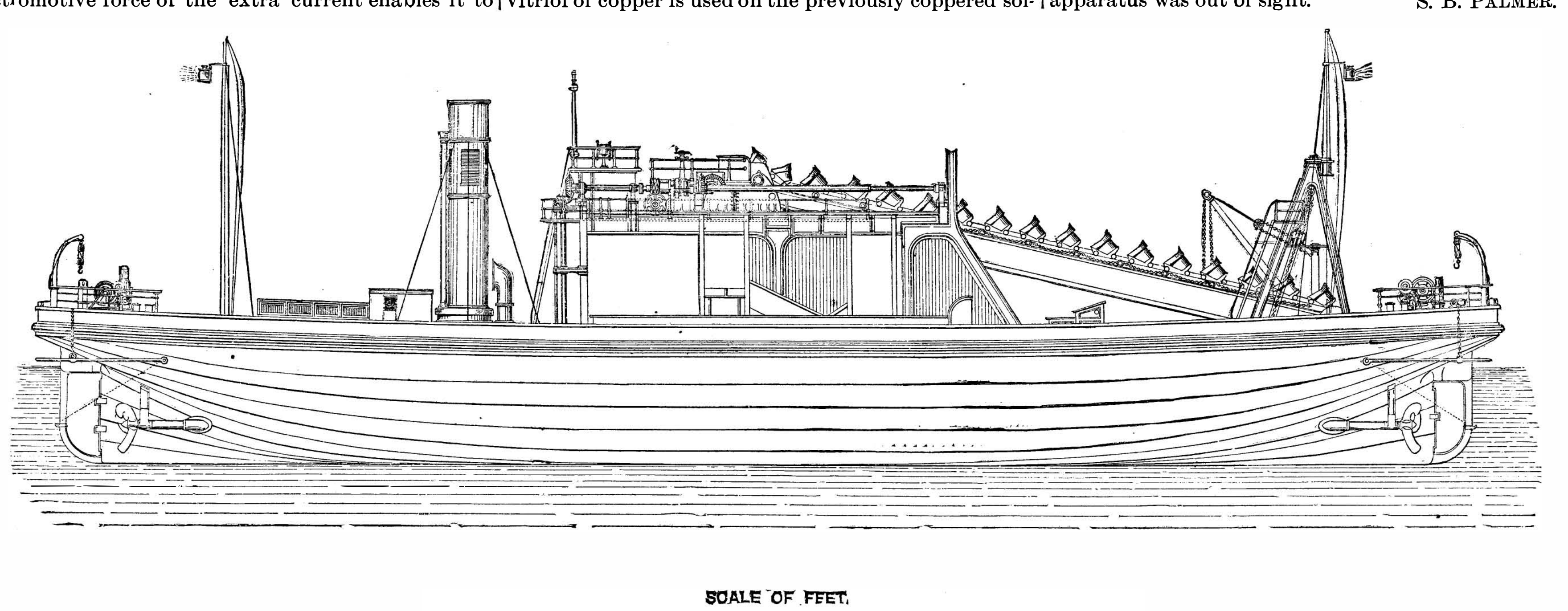
The first method by which I endeavored to obtain the power was by a float upon the water, which operated beautifully when detached, but when required to work, very little power was developed. I then hung a shaft, about six feet long, from supports an-



HOW TO RUN A PUMP BY WAVE FORCE.

chored in cribwork, as shown in the sketch, and from the shaft suspended three arms, three feet long. Suspended from the end arms was a plank trough, six inches wide. Practically, the apparatus represented a six foot wheel, like the paddle wheel of a steamer, with barely one bucket, and that having a trough-like section. A cross arm at right angles projected from the central arm, to which was attached the pump. The incoming wave would impart its force or momentum to the swinging pendulum, carrying it much or little, according to the size. It was a surprise to see how small waves could do work; that is, little swells, which would swing the bucket but a few inches, would deliver a corresponding amount of water, frequently in drops, rather than in a stream. Another lesson was learned by constructing the bucket eleven inches wide. At first, when a stream came sufficient to fill the bucket, there was not only a large waste of power, but great danger of destruction of the machine. Six inches proved to be the best width. For increase of power, increase in length is preferable. I am well aware that such apparatus might not be as practical as a windmill where heavy seas are liable to occur, as the construction of the piece to stand the shocks would be expensive. In this experiment the cost was not one-quarter that of a windmill, while the apparatus was out of sight.

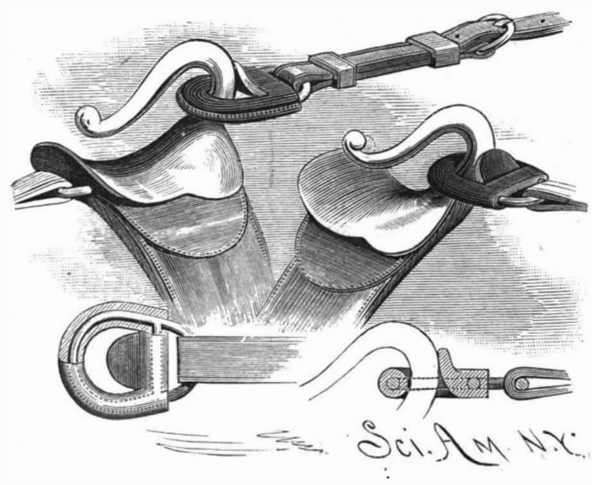
S. B. PALMER.



ONE THOUSAND TON FOUR-SCREW HOPPER DREDGER.

SAFETY LOOP FOR HARNESS CHECKS.

This loop is used on the check rein, and engages with the water hook on the saddle. It is so constructed that it cannot become detached from the hook by the working or throwing of the horse's head. The loop is composed of a core or body part, of rigid material, and a covering either of leather stitched over it or of rubber moulded to it. This covering is provided with a small projection on its inner front side, which forms a flexible tongue, arranged so that when the loop is engaged with the hook the tongue is turned upward, so as to bear against the hook. This will prevent the re-



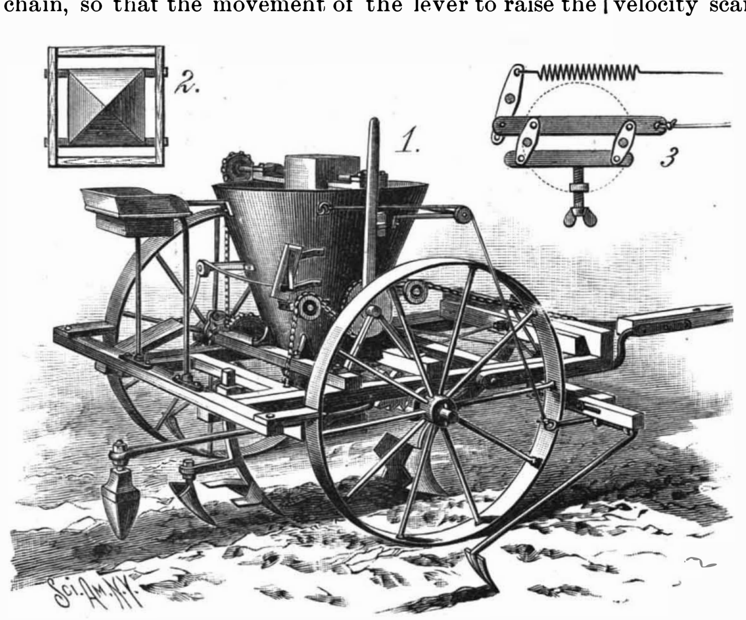
DENNIS' SAFETY LOOP FOR HARNESS CHECKS.

moval of the loop, the tongue preventing it from passing over the usual thickened outer end of the hook. When unchecking the horse, the holding tongue will be flexed in a reverse direction, out of line with the loop, which can then be readily removed from the hook.

This invention has been patented by Mr. E. K. Dennis, of New Bedford, Mass.

FERTILIZER DISTRIBUTER.

This distributer is so constructed that the discharge opening can be closed, the stirring mechanism thrown out of gear, and the plows raised from the ground by operating a single lever; all these parts can be returned to working positions by operating a treadle which can be readily adjusted to discharge more or less fertilizer to the acre. To the wheels are pivoted pawls which engage with ratchet wheels on the axle, so that the latter will be revolved only during the forward movement of the wheels. A furrow is opened to receive the fertilizer by a double mouldboard plow whose standard is secured to the cross bar of a U-shaped frame hinged to the side bars of the main frame. To the hinged frame is attached the end of a chain leading to a pulley secured to a lever the rearward movement of which raises the plow from the ground. The hopper is made funnel-shaped, and has a rectangular opening in its bottom, through which the fertilizer is pushed by radial fingers attached to the axle. Two parallel plates, Fig. 3, are so arranged as to regulate the size of the discharge opening. The plates are operated by means of a cord attached to the chain, so that the movement of the lever to raise the



VAN SICLEN'S FERTILIZER DISTRIBUTER.

plow will also close the plates and stop the discharge of the fertilizer. To the opposite sides of the lower end of a vertical shaft revolving in bearings in cross bars attached to the hopper are secured arms, which keep the fertilizer in the lower part of the hopper stirred up so that it will be fed out evenly by the fingers. As the fertilizer falls through the discharge opening it falls upon a pyramid-shaped divider, Fig. 2, by which it is separated, to prevent it from falling to the ground in bunches. The fertilizer is mixed with soil in the bottom of the furrow by a plow made with wings upon each side; this plow can be adjusted to work at any desired depth in the ground. A channel is opened in the mixed soil and fertilizer by a small double mouldboard plow. These plows are also raised from the ground by the lever. To the forward part of the side bars of the main frame is attached a cross bar, whose ends project beyond the wheels; the ends of this bar, which can be extended more or less as the desired distance apart of the rows may require, carry small marking plows. Arranged so as to fall in the furrow in the rear of the center plows is a conically pointed marker of sufficient size and weight to form holes to receive the potatoes to be planted. The marker is operated by a cam wheel having such a number of cams as will cause the marker to form holes at the proper distances apart.

This invention has been patented by Mr. James Van Siclen, of Jamaica, N. Y.

A Notable Storm.

At a recent meeting of the Royal Meteorological Society, a paper was read on the gale of October 15–16, 1886, over the British Islands, by Mr. C. H. Harding. The storm was of very exceptional strength in the west, southwest, and south of the British Islands, but the principal violence of the wind was limited to these parts, although the force of a gale was experienced generally over the whole kingdom. By the aid of ships' observations, the storm has been tracked a long distance out in the Atlantic. It appears to have formed about 250 miles to the southeast of Newfoundland on the 12th, and was experienced by many ocean steamers on the 13th.

When the first indication of approaching bad weather was shown by the barometer and wind at our western outposts, the storm was about 500 miles to the west-southwest of the Irish coast, and was advancing at the rate of nearly 50 miles an hour. The center of the disturbance struck the coast of Ireland at about 1 A.M. on the 15th, and by 8 A.M. was central over Ireland. The storm traversed the Irish Sea, and turned to the southeast over the western Midlands and the southern counties of England, and its center remained over the British Isles about 34 hours, having traversed about 500 miles. The storm afterward crossed the English Channel into France, and subsequently again took a course to the northeastward, and finally broke up over Holland. In the center of the storm the barometer fell to 28·5 inches; but, as far as the action of the barometer was concerned, the principal feature of importance was the length of time that the readings remained low.

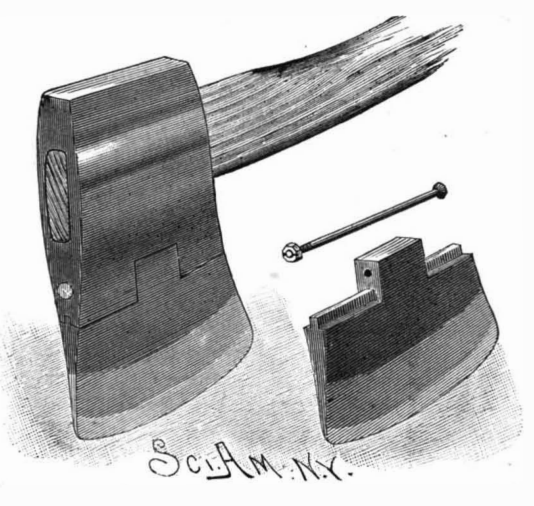
At Geldeston, not far from Lowestoft, the mercury was below 29 inches for 50 hours, and at Greenwich it was similarly low for 40 hours. The highest recorded hourly velocity of the wind was 78 miles, from northwest, at Scilly on the morning of the 16th; but, on due allowance being made for the squally character of the gale, it is estimated that in the squalls the velocity reached for a minute or so the hourly rate of about 120 miles, which is equivalent to a pressure of about 70 pounds on the square foot. On the mainland the wind attained a velocity of about 60 miles an hour for a considerable time; but, without question, this velocity would be greatly exceeded in the squalls. In the eastern parts of England the velocity scarcely amounted to 30 miles in the hour. The force of the gale was very prolonged. At Scilly the velocity was above 30 miles an hour for 61 hours, and it was above 60 miles an hour for 19 hours, while at Falmouth it was above 30 miles an hour for 52 hours.

The erratic course of the storm and its slow rate of travel while over the British Islands were attributed to the presence of a barrier of high barometer readings over Northern Europe, and also to the attraction in a westerly direction, owing to the great condensation and heavy rain in the rear of the storm. The rainfall in Ireland, Wales, and the southwest of England was exceptionally heavy. In the neighborhood of Aberystwith the fall on the 15th was 3·83 inches, and at several stations the amount exceeded 2 inches. Serious floods occurred in many parts of the country. A most terrific sea was also experienced on the western coasts and in the English Channel, and the number of vessels to which casualties occurred on the British coasts during the gale tell their own tale of its violence. The total number of casualties to sailing vessels and steamships was 158, and among these were five sailing and one steamship abandoned, five sailing and one steamship foundered, and forty-two sailing and two steamships stranded. During the gale the lifeboats of the Royal National Lifeboat Institution were launched fourteen times, and were instrumental in saving thirty-six lives.

THE total number of visitors to the Colonial Exhibition, London, recently closed, was 5,550,749, and the average daily attendance was 33,846.

AX WITH DETACHABLE BLADE.

This ax is provided with a detachable blade which can be renewed when worn or destroyed, thus saving the expense of a new ax, otherwise necessary. The body of the ax is formed with a transverse groove and a deeper slot at right angles thereto, to receive a corresponding tongue and projection or tenon on the detachable bit, the parts being rigidly united by a bolt passing transversely through the body and the extremity of the tenon. The advantages of this construction consist in its great simplicity and consequent



GOODIER'S AX WITH DETACHABLE BLADE.

cheapness, resulting from the facility with which the parts can be made, the close-fitting joints secured, and the easy detachability of the parts, a single bolt alone having to be removed to permit the withdrawal of the blade.

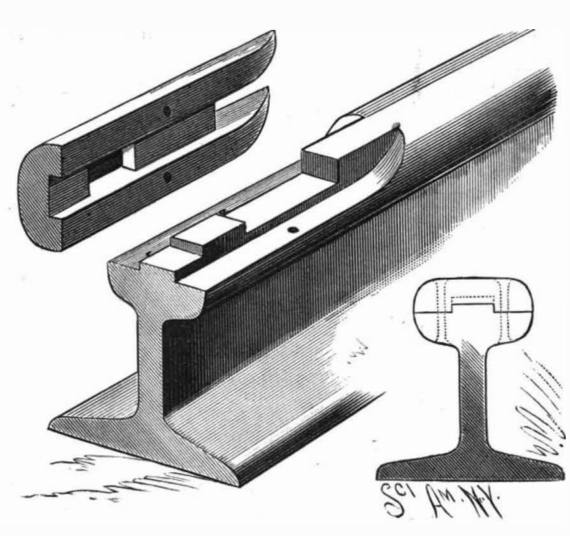
This invention has been patented by Mr. Nicholas Goodier, of Dardanelle, Ark.

Steaming vs. Fumigating.

A correspondent of *The Garden* directs the attention of plant growers and orchid growers to the advantages of the practice of boiling tobacco juice in houses for the destruction of insects over the old practice of fumigating. One great advantage is that the steam does not scald nor discolor the most tender foliage nor the most delicate flower; that it can be done without previous preparation, *i. e.*, drying the foliage, etc.; and that the operator can walk about in the house if necessary during the operation.

REPAIRING RAILS.

When railroad rails are battered and worn by use, they are generally removed and the worn portion cut away, thereby shortening the rail and necessitating the relaying of the track. The design of this invention, which has been patented by Mr. George Stratton, of Plainview, Minn., is to repair the rails without removing them from the roadbed, and to provide a rail end better adapted to withstand the wear than the end of the ordinary rail. The end of the rail is cut away so as to form rabbets, leaving a tongue in the middle of the head. The tongue is then cut transversely, so as to leave a lug. The end is then fitted with a cap made of steel of superior quality, hardened



STRATTON'S DEVICE FOR REPAIRING RAILS.

and tempered to enable it to withstand the wear to which it is subjected, and secured in place by rivets or bolts. The tongue being received in a corresponding groove in the cap prevents the latter from moving laterally, while the lug prevents end motion. The end may be milled away to leave a T-shaped tongue, which is received in a recess in the cap. At the ends of the recess are holes to receive rivets whose L-shaped heads engage the tongue. The rivets are upset so as to thoroughly fill the holes, and are finally riveted down in the countersunk upper ends of the holes.

OUR BUILDING STONE SUPPLY.

(*Continued from page* 18.)

try. The material, of which there is an annual output valued at nearly a quarter of a million dollars, is coarse, but exceedingly strong, and of a blue gray or greenish color.

In the Hallowell granite quarries, situated some two or three miles out of the town, the rock lies in the form of huge imbricated sheets of all thicknesses up to eight or ten feet. So slightly do they adhere to one another that it is but necessary to free the stone at the sides by a few drill holes and blasts to obtain blocks of almost any required size. The material is almost white in color and of so fine and even a grain that it can be utilized for all manner of constructive purposes, excepting, perhaps, interior decorative work. One can but experience a feeling of surprise on passing into the companies' shops to find himself surrounded on all sides by sculptors of American, Spanish, and Italian nativity busily engaged in reproducing from plaster models by dint of hammer and chisel a great variety of imitative forms, not of course excepting the winged figures which in our youth and ignorance of the possibilities of anatomy we have been taught to suppose represent the future forms of those who are sufficiently good in this world to be rewarded in the next.

To Maine belongs the credit of producing the only red or pink granite that can at all successfully compete in our markets with the imported Scotch granites or those from the Bay of Fundy, New Brunswick, though excellent varieties for general building, and which are used to a less extent, occur in several other States.

The celebrated Concord, N. H., granites are from quarries in the immediate vicinity of the city from whence they derive their commercial name, and are quarried to the value of some $200,000 annually. This stone closely resembles that of Hallowell, Me., and is used for similiar purposes. Although popularly known as the Granite State, New Hampshire ranks but fifth as a granite producer, being preceded by Maine, Massachusetts, Rhode Island, and Connecticut. Granites of excellent quality also occur in the Archæan formations of the Appalachian system as far south as northern Georgia, though they are now but little quarried. Near Richmond, Va., occurs an excellent bed of this stone, which furnished the material for the State, War, and Navy department buildings in Washington.

Ever since the discovery of the wonderfully beautiful effects produced in marbles by the early sculptors and decorators, these stones appear to have been regarded by the people at large with a sort of veneration amounting in some cases almost to fetichism; and any stone to which the name is now applied seems generally accredited with possessing all the qualities of beauty and excellence of those first used. This is, however, far from the case; and while the name includes stones of rare beauty, it is also made to cover others suitable only for general building purposes, and which are perhaps poor at that.

From a scientific standpoint, there is no difference between a marble and ordinary limestone or dolomite, the rocks having precisely the same composition and origin, but one possessing such color and structural peculiarities as render it desirable for ornamental or decorative work, while the other through the lack of these same qualities is relegated to the more ordinary purposes of general construction.

Of the $2,000,000 worth of marbles anuually produced in the United States, more than one-half is from quarries in Vermont, and the remainder nearly altogether from Massachusetts, New York, Pennsylvania, Maryland, and Tennessee. The material is imported to the value of about $600,000 annually, the supply coming largely from Italy, though smaller amounts are brought from France, Belgium, Portugal, Egypt, and Algeria.

The narrow belt of limestone from which is obtained the supply of Vermont marble extends from a point beyond the Canadian line throughout the entire length of the State, and thence through western Massachusetts and Connecticut to Long Island Sound. Since early in the present century numerous quarries have been opened along this belt, but at the present writing the most extensive lie within the limits of the little village of West Rutland, cozily nestling among the green hills of central Vermont. The quarries themselves, to which the village owes its entire business prosperity, lie along the western base of a low range of hills, which, to the ordinary observer, give no sign of the vast wealth of material concealed beneath their gray and uninteresting exteriors.

In the quarry the stone is found in layers from two to four feet in thickness, often mottled and streaked, and varying in color from pure white to deep blue gray and almost black. These layers, instead of lying horizontally one upon another, are at the surface steeply inclined and almost on edge, so that the same quarry at the same time may be producing marbles of half a dozen grades of color and quality.

In quarrying, the best beds are selected, and upon their upturned edges excavation is commenced; first by blasting, to remove the weathered and worthless material, and afterward by channeling, drilling, and wedging, no powder being used lest the fine, massive blocks become shattered, and rendered unfit for use. The quarry thus descends with almost perpendicular walls to a depth of sometimes more than 200 feet, when the beds are found to curve, and pass under the hill.

The descent to the bottom of the pit is by means of numerous flights of wooden and suspiciously shaky-looking steps, bolted to the quarry wall. At the bottom, everything is cold and dripping wet, and the atmosphere of that heavy feeling that can be described only by the suggestive word *dank*.

Steam channeling machines moving slowly back and forth over their narrow roadbeds spitefully strike upon the rock clanging blows with long chisels, which rapidly produce deep grooves some two inches in width and of any desired depth up to several feet. Closely after these follow the gadding machines, which drill or bore circular holes along the bottom and sides of the blocks, into which wedges are introduced and the stone split from its bed. The Wardwell channeling machine, which is the one most commonly in use, cuts a continuous groove at the rate of 75 to 150 square feet per day, thus doing the work of from 25 to 50 men by the old hand process. As the expense of operating the machine is only about $10 per day, the advantages of this method are obvious. It is claimed for the diamond gadder that it will do its work at the rate of 180 feet a day in rock of as soft and even a texture as marble. By the old hand methods, 12 feet was considered a fair day's work. Three men are required for each channneler and two for each gadder, while a large force is employed in handling the loosened blocks and preparing the way for the machines.

In spite of their threatening aspect, accidents at the quarries are, we are told, very rare. Nevertheless, it is with a feeling of relief, as well as one of weakness at the knees from continuous climbing, that we find ourselves once more on the surface, and breathing the dry, pure air which comes wafted gently down the valley.

The marbles of New York are also largely suitable only for general building, owing to this same defect. Two varieties from Chazy and Plattsburg, in Clinton County, are, however, notable exceptions. In these the process of metamorphism has not been carried to the same extremes as in the Vermont stone, and the resultant effects of pink and red fossil shells embedded in a gray and reddish background are very pleasing. Under the names of "Lepanto" and "French gray," these stones are now in the market, and, with the exception of those of Tennessee, have been more used for furniture and interior decorations than any other American marble.

The finest marble for general decorative work which the country yet affords is undoubtedly that of Hawkins and adjacent counties in eastern Tennessee. Since its first introduction into the Capitol building at Washington, this stone has been a universal favorite, and justly so. In colors varying from light pinkish, mottled with white, through all shades to deep chocolate red, it offers sufficient diversity to suit the most fastidious, while the closeness and compactness of its texture, with almost absolute freedom from flaws, renders the production of larger surfaces, without recourse to the process of filling, than is possible in any other marble, native or foreign, with which the author is acquainted.

One of the most unique marbles in this country is found in the beds of Devonian limestone near Charles City, Iowa. The rock is of exceedingly fine and compact texture, non-crystalline and full of fossil shells and corals. The colors are dull, varying from light drab to brownish, but it acquires a smooth surface and quite uniform polish, showing to beautiful advantage the fossil remains, often six or ten inches in diameter, firmly embedded in the fine drab ground-mass.

Of limestones other than marbles, stones used only for general building, but which, owing to color and lack of polish, are unsuitable for decorative work, we have time and space to notice only the fine grained, light colored varieties of Indiana, Illinois, and Kentucky. These are often oolitic in texture, and vary from almost white through dull cream color to drab. The evenness of the grain of these stones, their softness, and at the same time toughness, render them adapted, in a remarkable degree, to general building and highly carved work, especially for country residences, and in cities where there is but little smoke or gaseous exhalations from manufactories.

The quarrying of sandstone, or *freestone*, as it is so often called, appears to have begun with the itinerant working of the extensive beds of Triassic brownstone in the vicinity of Portland, Connecticut.

The present industry is comprised in three large quarries, extending from a point near the ferry northward along the river for some three-fourths of a mile. These vary from 50 to 150 feet in depth, and their total yield of stone of all grades, during the time of their operation, has been roughly estimated at 4,300,000 cubic feet.

The total product of the three quarries for this year was 781,600 cubic feet, valued at not less than $650,000. In their present condition, the approaches to these quarries are more interesting than beautiful. The ground is strewn with huge blocks of stone, about and among which swarm the busy workmen and the ever-present small boy and omnivorous goat. The beds of stone lie nearly horizontal; and in quarrying, a natural point face is often selected as the quarry wall, which is followed down to any practicable depth, leaving thus an absolutely perpendicular wall on three sides, from 100 to 150 feet in height. The fourth side is usually less abrupt, allowing passageway for teams and workmen. In getting out stone, large masses of several hundred tons weight are first loosened from their bed by means of blasting, the drill holes being sometimes twenty feet in depth, ten inches in diameter, and charged with from twenty-five to seventy-five pounds of powder. These large blocks are then broken up by cutting, with picks, long grooves, into which iron wedges are inserted at intervals of a few inches from one another. Workmen armed with heavy hammers then pass along this line, dealing telling blows upon the wedges, until the stone yields to the strain, and falls apart. The blocks are then attached to a steam windlass and drawn to the surface.

Very little of the stone is dressed at the quarries, nearly all being shipped in the rough to New York and other large cities, where it is worked up as occasion demands.

Massachusetts, New Jersey, Pennsylvania, and Maryland also furnish large quantities of this material, while the deep blue gray "bluestones" or flagstones of New York and Pennsylvania, and the "Euclid bluestones" and "Berea grits" of Ohio, are almost too well known to require especial notice. The first mentioned of these are found in New York State, in a comparatively narrow belt west of the Hudson River, mainly in Albany, Greene, and Ulster Counties, and belongs geologically in great part to the Hamilton group of the Devonian formations. But one of the most important sandstones at the present day is that known as the Berea grit, or more popularly perhaps the Ohio freestone of Ohio.

This stone occurs in beds from ten to seventy-five feet in thickness and occupying a belt of country extending from the southeastern corner of Ashtabula County westward into Erie County, and then southward to the Ohio River. In quantity, it is needless to say it is inexhaustible. In color it is light, almost buff, of fine and even texture, and soft enough to work readily and evenly in any direction. It is by far the most common sandstone now in use, both for general building and for trimming purposes, in the United States.

The Flynt Granite Company was established in 1839, and has been in successful operation up to the present time. The extensive quarries, located at Monson, Mass., yield a granite in which mica is replaced by hornblende, as in the Quincy and Rockport granites. The stones are, therefore, much less affected by chemical agents than those in which mica is present, while the uncommonly small percentage of the alkalies, soda and potash, both in the light and dark varieties, greatly increases the power of resisting atmospheric influences. The iron in these granites is in the form of magnetic oxide, which is unchangeable. Those constituents which favor disintegration are present in such unusually small proportion that these granites should remain practically unchanged for an indefinite length of time, and they are, consequently, peculiarly well adapted for building purposes.

Two Men on the Foot Plate.

"There can be no doubt that the presence of two men on the foot plate, each having the glass gauge in full view, is a great safeguard against low water. . . . The regulation of the feed must then be left entirely in the hands of one man, and if he commits an oversight, and allows the water to get too low, the other man cannot so clearly see and correct the mistake."—*Railroad Gazette.*

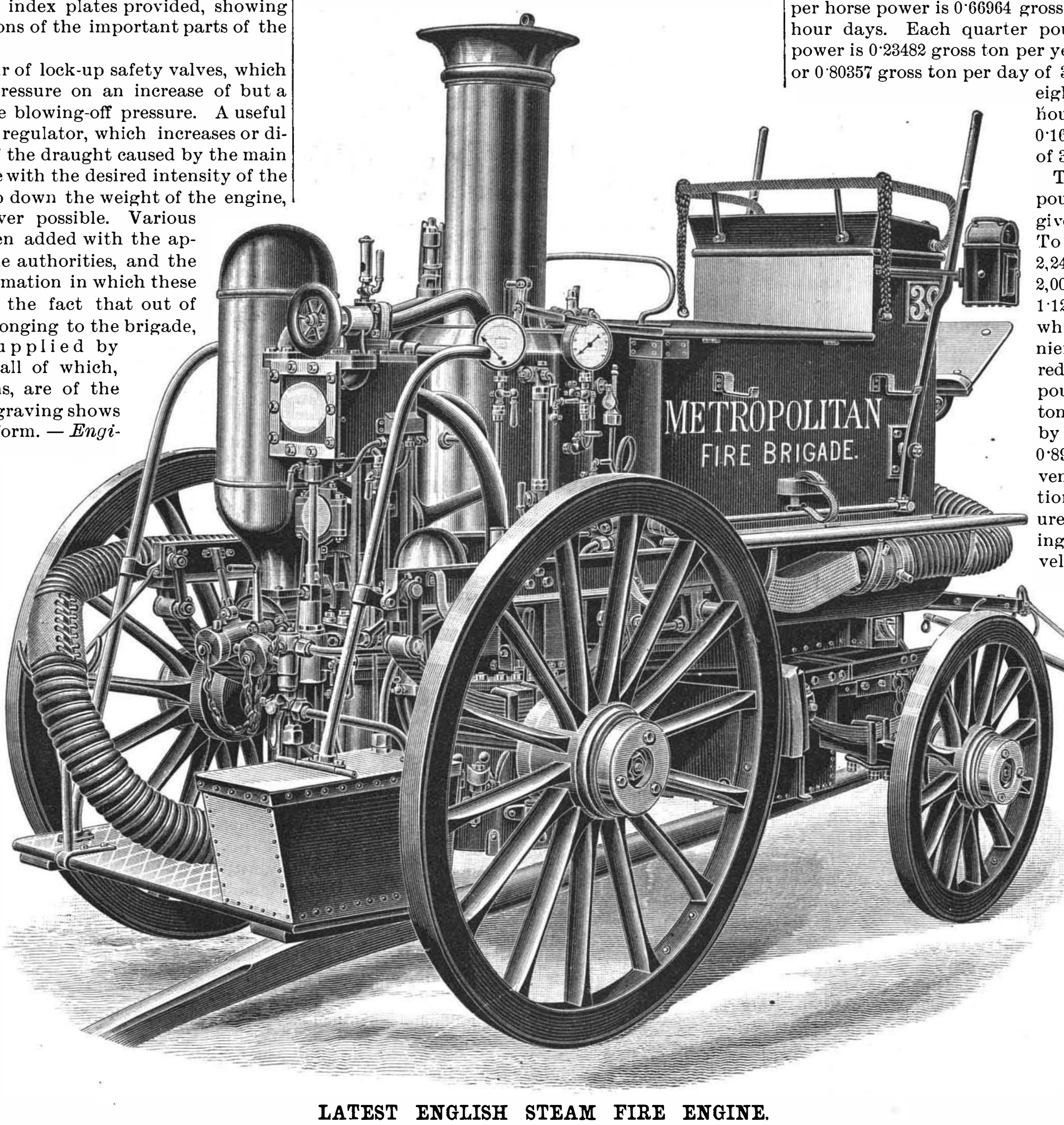
Our esteemed contemporary appears to be in error. No experienced fireman would think of trying a gauge cock, touching a throttle, or criticising or offering advice to his engineer. The etiquette of the foot board makes the engineer supreme, while he is running his engine, in all that pertains to its management, and for *any one* to offer him advice *then* is to assume he does not understand his business. This is the reason "traveling engineers" do not get better results, and why they tend to disorganize and cause trouble in *many cases*, as engineers will frequently quit the road before they will submit to be dictated to by another engineer. What chance, then, does the *Gazette* suppose a *fireman* would stand in "assisting" his engineer by trying his water? The writer once saw a new, but "fresh," fireman knocked senseless with a copper hammer in the hands of the engineer, because the fireman observed, "Jim, your water is getting low, isn't it?" and at the same time trying a gauge cock.

Many glass gauges on locomotives have a brass tube around the glass, with a narrow slit in it toward the engineer only, thus cutting off the fireman's view of the water, unless he gets over on the engineer's side to see it.

NEW STEAM FIRE ENGINE.

The illustration below represents the latest design of steam fire engine supplied by Messrs. Shand, Mason & Co. to the Metropolitan Fire Brigade, London, and combines various improvements made in accordance with the desires of the chief officer, being specially adapted to suit the many varying circumstances under which a fire engine has to work in London. The chief aim in these improvements has been to make an engine of great power, to simplify the working parts, and to add to this strength and lightness. Within the last few years these engines have been improved by increasing the area of the steam cylinder and the valve area of the pump, thus obtaining a larger delivery of water at a higher pressure. Lubricating apparatus has been added, which lubricates the whole of the working parts from one oil box. The mode of feeding the boiler by means of feed pump and injector has been simplified and improved in a manner which will probably become the standard for this important part of steam fire engines of this type. As regards the boiler, additional heating surface has been provided to suit the increased power of the engine. The boiler fittings have been entirely rearranged and index plates provided, showing the fireman the positions of the important parts of the interior of the boiler.

The boiler has a pair of lock-up safety valves, which relieve all excess of pressure on an increase of but a few pounds above the blowing-off pressure. A useful addition is the blast regulator, which increases or diminishes the power of the draught caused by the main exhaust in accordance with the desired intensity of the fire. In order to keep down the weight of the engine, steel is used wherever possible. Various other details have been added with the approval of the brigade authorities, and the best proof of the estimation in which these engines are held is the fact that out of forty-six steamers belonging to the brigade, thirty have been supplied by Shand, Mason & Co., all of which, with a few exceptions, are of the type of which the engraving shows the most improved form. — *Engineering.*



LATEST ENGLISH STEAM FIRE ENGINE.

The Severn Tunnel.

This stupendous work, which has entailed an outlay of upward of £2,000,000, was opened for the local passenger traffic between Bristol and South Wales on the 1st instant, the first through service having been deferred till the double line is completed between Pilning and Bristol. The length of the tunnel is 4¼ miles, of which 2¼ miles are beneath the bed of the river, with a minimum cover between the crown of the tunnel and the water of 45 ft., and a maximum of 100 ft. With the exception of a short length, the under river passage, which is 26 ft. wide and 20 ft. high, has been bored through hard sandstone, conglomerate, red marl, and new red sandstone, dynamite and tonite being used for the blasting, and the holes being made by rock-drilling machines worked by compressed air, the cost of this work being roughly estimated at £100 a yard. The work was carried on night and day, the electric light being used.

The tunnel throughout is lined with Staffordshire and other vitrified brick, set in cement to a thickness of 3 ft. in the crown of the arch, near the river bed depression, this thickness being graduated off to 2 ft. 3 in., as the gradient rises one in ninety on the Monmouthshire side, and one in a hundred on the Gloucestershire side. Four times have the works been flooded during the last fourteen years. In 1879 a great spring was tapped, and the whole of the workings were inundated. Sir John Hawkshaw was then appointed engineer in chief; and, acting in conjunction with Mr. Charles Richardson and Mr. T. A. Walker, who took the contract, cleared the works with heavy pumping machinery.

In 1881, when the junction between the headings was within a month or two of being made, the water came in from the river bed in a depression, and mastered the pumps. The depression was filled in with clay puddle in bags, and the junction of the headings was effected in September, 1881, the two meeting within three inches. In October, 1883, the spring which had flooded the tunnel in 1879 was again tapped, and the water poured in at the rate of 27,000 gallons per minute, and again flooded the working. Four more powerful pumps were erected, and the works were again cleared. In the same month the works on the Monmouthshire side were flooded by a huge tidal wave, which poured down the Marsh shaft, and imprisoned fifty men, three of whom lost their lives. To prepare the tunnel for the passenger traffic, a Guibal fan, 40 ft. diameter, and capable of discharging 240,000 cubic feet of air per minute, has been erected, and there is on the site pumping power sufficient to raise 26,000,000 gallons of water per day.—*Industries.*

Struts and Ties in Carpentry.

It depends entirely on the position of the pieces in respect to their points of ultimate support, and of the direction of the external force which produces the strains, whether any particular piece is in a state of extension or of compression. The knowledge of this circumstance may greatly influence us in the choice of the construction. In many cases we may substitute slender iron rods for massive beams, when the piece is to act the part of a tie. But we must not invert this disposition; for when a piece of timber acts as a strut, and is in a state of compression, it is next to certain that it is not equally compressible on its opposite sides through the whole length of the piece, and that the compressing force on the abutting joint is not acting in the most equable manner all over the joint. A very trifling inequality in either of these circumstances (especially in the first) will compress the beam more on one side than on the other. This cannot be without the beam's bending and becoming concave on that side on which it is most compressed. When this happens, the frame is in danger of being crushed and soon going to ruin. It is, therefore, indispensably necessary to make use of beams in all cases where struts are required of considerable length, rather than of metal rods of slender dimensions, unless in situations where we can effectually prevent their bending, as in trussing a girder internally, where a cast iron strut may be firmly cased in it, so as not to bend in the smallest degree. In cases where the pressures are enormous, as in the very oblique struts of a center or arch frame, we must be particularly cautious to do nothing that can facilitate the compression of either side. No mortises should be cut near to one side; no lateral pressures, even the slightest, should be allowed to touch it. We have seen a pillar of fir 12 inches long and 1 inch in section, when loaded with three tons, snap in an instant when pressed on one side by sixteen pounds; while another bore four and a half tons without hurt, because it was inclosed (loosely) in a stout pipe of iron.—*The Architect, London.*

Useful Facts for Steam Users.

The following figures, taken from the Liverpool *Journal of Commerce*, will be found of use for ready reference in calculating the amount of fuel used, saved, or wasted by an engine or boiler in the usual working year of 300 days of 10 hours each, and also in a working year of 300 working days of 24 hours each, such as is the customary run of establishments working 144 hours per week. Each pound of coal per hour per horse power amounts in 300 10-hour days to 1·33928 gross tons of 2,240 pounds each, and in 300 24-hour days to 3·21428 gross tons. Each half pound of coal per hour per horse power is 0·66964 gross ton per year of 300 24-hour days. Each quarter pound of coal per horse power is 0·23482 gross ton per year of 300 10-hour days, or 0·80357 gross ton per day of 300 24-hour days. Each eighth pound of coal per hour per horse power is 0·16741 gross ton per year of 300 24-hour days.

The gross ton of 2,240 pounds avoirdupois is given in these calculations. To reduce gross tons of 2,240 pounds to net tons of 2,000 pounds, multiply by 1·12 or divide by 0·8928, whichever is more convenient; and conversely, to reduce net tons of 2,000 pounds to gross or legal tons of 2,240 pounds, divide by 1·12 or multiply by 0·8928, according to convenience. In the application of the foregoing figures, suppose a condensing steam engine to develop 175 horse power with forty pounds initial pressure above atmosphere with a coal consumption of 3¼ pounds per hour per horse power, and that by increasing the initial pressure to 50 pounds by the gauge the work was 185 horse power, with a coal consumption of 2¾ pounds per hour per horse power, the saving per year of 300 10-hour days is 0·66964 gross ton for each horse power, or 6 66964 = 126·2834 gross tons, and the saving per year of 300 24-hour days is 160,714 × 185 = 297·32 gross tons.

The Purity of Mid-Atlantic Air.

In the course of an address on the action of micro-organisms on surgical wounds, Prof. F. S. Dennis, of New York, states that during his last trip across the Atlantic he made some experiments to test the purity of the air about 1,000 miles from land. He employed capsules of sterilized gelatine, and exposed them for fifteen minutes. One capsule was exposed in the stateroom upon the main deck of the steamer. Within 18 hours over 500 points of infection had developed. Two capsules exposed in a similar manner in a cabin on the promenade deck, where the circulation of air was free, showed five or six points of infection each ten days afterward. A capsule exposed over the bow of the ship was found to be entirely uncontaminated. These experiments are on the same lines as those of Pasteur and Tyndall upon the mountain air of Switzerland, and, so far as they go, they show the germless condition of mid-oceanic air, and also the need for much more efficient ventilation in the staterooms of even the first-class American liners.—*Lancet.*

STEEL, when hardened, decreases in specific gravity, contracts in length, and increases in diameter.

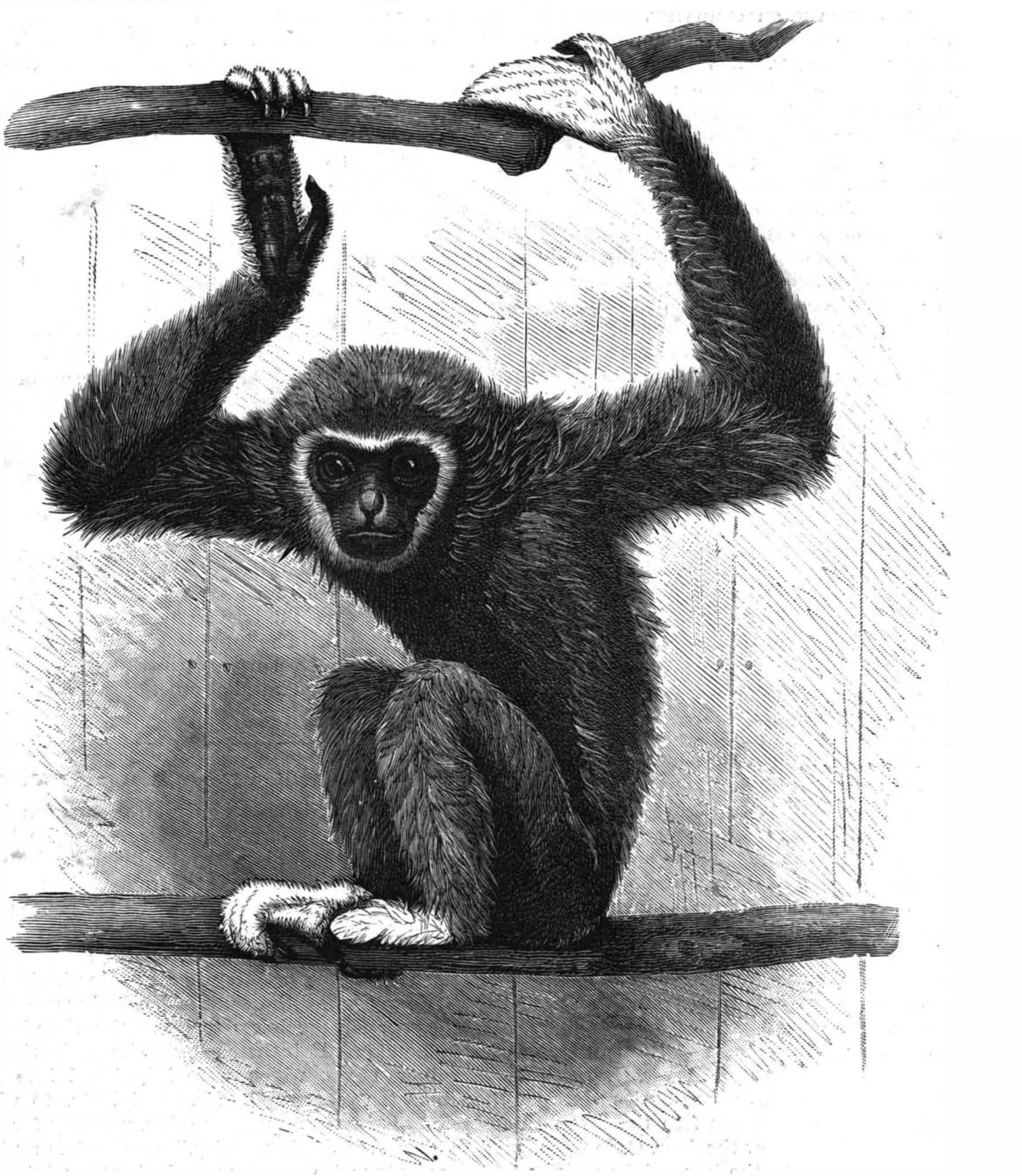
THE GIBBON IN THE BERLIN ZOOLOGICAL GARDEN.

The long-armed ape (*Hylobates lar*), shown in the accompanying cut, is considered the best representative of the anthropomorphic apes, on account of the finely shaped, human-like head, the lack of a tail, the prominent forehead and jaws, and the nose, which is only slightly flattened; but his upper limbs are very much out of proportion. It is well known that when a man stretches his arms out to their full length, the measure from the tips of the fingers of one hand to the tips of the fingers of the other hand is equal to his height. In the case of the gibbon, this measure is double his height. When his arms are allowed to hang, they reach the ground. This ape has been rightly called "a dwarf among anthropoids." His greatest height is about 2 ft. and 3 in., while other members of this species, such as the gorilla, orang-outang, and the chimpanzee, are considerably larger. The long white hands and the frame of light hair around the face are characteristic features of this animal.

The gibbon is the only one of the anthropomorphic apes which is capable of walking upright without any support, but his gait is very peculiar, his body swinging back and forth, and his arms being extended like balancing poles. The limbs of this animal show to their best advantage when he is in his element, that is, in the trees. His movements are light and elastic as he swings rapidly from branch to branch, making graceful curves, and he flies from one tree to another without apparent exertion. Brehm called the gibbon a "bird in an ape's shape," and "the best rope dancer under the sun."

The home of the gibbon is Farther India. Once caught, he soon becomes tame, and delights his keeper by his affectionate and trusting disposition. An explorer tells of the extraordinary love of the mother gibbon for her young, and, speaking of her care for them, he says:

"I have often seen the mother take her children to the water, and, not allowing herself to be disturbed by their cries, wash their faces so clean that many a human child might envy the young ape the care it received."—*Illustrirte Zeitung.*



THE GIBBON IN THE BERLIN ZOOLOGICAL GARDEN.

NEW PROCESSES IN THE MANUFACTURE OF BEET SUGAR.

Among the new apparatus that have recently been devised for use in the manufacture of sugar from beet roots, there are some that are sufficiently original to be described to our readers.

In this industry, it is necessary, in the first place, to weigh the beets, and this is one of the most important of the new operations, since the tax is based upon the gross weight of the roots, and is very high. It is important, then, to weigh only the clean material, that contains only the sugar, and to get rid of all extraneous matter, such as water, earth, gravel, etc.

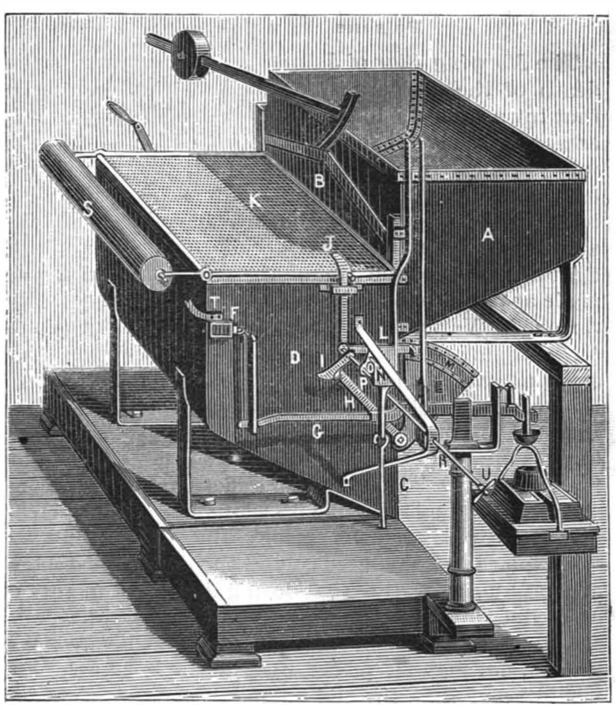


Fig. 2.—AUTOMATIC MACHINE FOR WEIGHING BEETS.

The apparatus shown in Fig. 1 effects this object perfectly, as has been proved in practice. It is called by its inventor a revolving-brush wiping and conveying machine. The apparatus consists of parallel cylindrical brushes revolving in the same direction. These brushes are composed of pissava, whalebone, or steel wire.

Their core consists of a wooden roller keyed to an iron axle. All the brushes are fixed between the two sides of a wrought or cast iron frame, and their journals run in bearings. One of the ends of each of the axles is provided with a bevel wheel, which is actuated by a series of pinions keyed upon a longitudinal shaft. This latter is fixed upon supports at one side of the conveyer, and is connected with the motor through a belt.

The apparatus operates as follows: The beets make their exit from the washer all covered with water (and often, too, with bits of earth that have not been removed by the washing), and fall into the wiping conveyer. The object of the latter is to remove from them, during their travel to the hopper of the weighing machine, all the water and mud that covers them.

Without this drying and cleaning, the valueless material would be weighed, and pay the same rate of tax as the saccharine material.

The beets enter the conveyer on the upper surface of the rollers, and here are quickly caught by the bristles of the brushes, and are revolved and rubbed by each brush in turn from the moment they enter until they drop into the hopper of the scales. The motion of the roots is continuous. They revolve between each pair of brushes isolatedly, pulled forward by the brush in front and backward by the one behind. In such a situation, they pivot upon themselves and present every portion of their surface to the friction of the brushes.

The roots that follow fall against those that are pivoting between the two brushes, and free them from the hind brush, while the one in front carries them further along. The same operation is effected between each succeeding pair of brushes, in a continuous, regular, and rapid manner. The beets undergo a vigorous rubbing from the bristling rollers, from the moment they enter until they make their exit from the conveyer. When the roots have reached the end of their journey, they are both dry and clean, and are then fit to be presented for taxation. The apparatus is capable of cleaning from 33,000 to 44,000 pounds of roots per day.

The next apparatus that we shall mention is an automatic weighing machine for use in sugar works. The administration of indirect taxes now levies his tax upon the raw beet, instead of, as formerly, upon the sugar as it comes from the manufactory.

It is therefore necessary for the administration and the manufacturer to use great care in the important operation of weighing. Both parties have to take great precautions to prevent causes of error, and sometimes possible frauds, in the taking of weights and in the verification made by each. Every detail has been fore seen with remarkable minuteness by the law. It has become necessary to devise scales that shall make the mind of the administration easy, and at the same time satisfy the sugar manufacturer. Such apparatus have to satisfy very many conditions in order to be accepted by the administration, and at the same time have to be relatively simple, in order that they may be applied with facility and without any stoppage in their operation.

The apparatus under consideration is one of the best of its kind, and one of the least complex, considering the diversity of the uses required of it. According to law, a weighing apparatus must close the door upon the arrival of new beets when the scale box is full, and

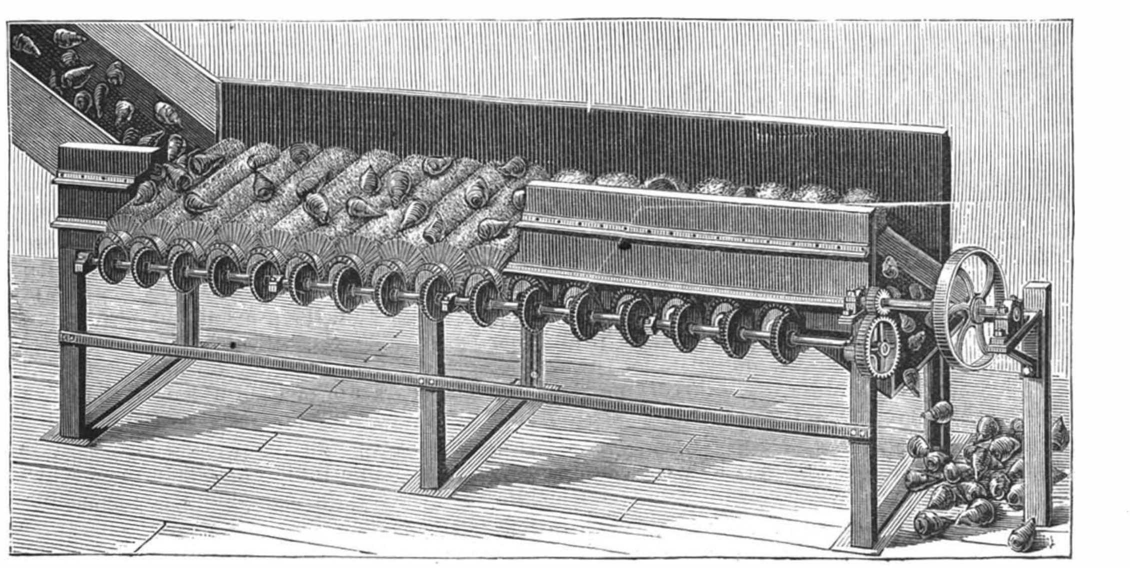


Fig. 1.—MACHINE FOR CLEANING BEETS.

not be able to open it, on emptying, as long as beets can enter to be weighed. It must, moreover, be unable to open upon emptying, when the weight is not regulated to the agreed upon amount (say 1,000 lb.), or when the cover of the weighing compartment is not closed. Everything has been thought of. This shutting down of the cover prevents beets being inserted by han: into the weighing compartment while the latter is open for the exit of the weighed roots.

The apparatus must likewise prevent beets from entering the weighing compartment as long as the latter is not perfectly closed. Then an automatic motion causes the cover to open, and unbolts the door. Every weight taken is inscribed automatically in a counter placed under lock and key in a glass case.

The operation of weighing, which must be effected as rapidly as it is accurately, on account of being done 400 times a day, is performed as follows: The beets first enter the upper box, A (Fig. 2), which is closed by a door, B, which slides up and down. When the door is down, the upper box is open, and the roots fall into the weighing box, D, which is placed directly upon the scale platform. The cover, K, is then necessarily lifted. The boxes, A and D, are made of iron plate. They have sloping bottoms, and have a regulated capacity (say of 1,000 lb.). While the box, A, is emptying into D, it is impossible to open the door, C, through which the roots make their exit. Two sectors, E, connected with the hinge of the door, C, are placed at each end of the latter. In the engraving, these are shown in the position they take when the door is closed. They are held fast in this position by the sliding door, B, which, descending in advance of them, checks them, and renders it impossible to open the door, C.

When the box, D, has its proper weight of roots, the door, B, is raised by means of a weighted lever. The box, A, is then closed, and there is no longer any obstacle to prevent the sectors from moving to the left; that is to say, from following the motion of the door, C, when the latter opens to let the beets out of the box, D. Before this occurs, however, it is necessary to regulate the weight to say 1,000 pounds, and to close the cover, K.

Upon the one axis in common of the two sectors, E, and the door, C, there is a stiff lever, H, which keeps the sliding door, B, closed as long as it rests upon the catch, I. This latter will not free the lever, H, and consequently will not allow the door, C, to open, until the quantity of beets in the box weighs exactly 1,000 pounds.

The weight having been regulated, the two indices placed under the eye of the employe of the sugar house tally with each other. The employe then shuts down the cover, E, which, in closing, abuts against the head, J, of the lever, J P L (that pivots upon the apex, R, of its angle), and engages therewith, thrusting back, as it does so, the vertical part, J P, of the lever, and lifting its end, L. This latter then comes in front of the slider, M, of the sector, E. Prior to this, the end, L, was in front of one of the guides of the slider, M, and still barred passage to the sector, E, and prevented the opening of the door, C, because the cover, K, was not down.

The weight is now regulated, and the fastened down cover prevents any further addition to the box. The roots can now be removed by permission of the agent of the administration. The latter places his hand upon the handle, U, of the rod, R, and, revolving it by a motion from left to right, pushes backward the catch, I. The lever, H, which was resting upon the catch, I, and kept the door closed, now becomes free; and the door, C, under the weight of the beets in the box, D, turns on its hinge and opens.

The tax agent is enabled to unbolt the door, C, because the weight is accurate and the indices agree. In such a case only will the head of the lever, P, which is connected with the rod, R, that carries the catch, I, enter the notch, O, of the plate, N. Such entrance of the head, P, into the notch, O, is necessary in order to permit of the motion that disengages the catch, I, from the lever, H. The plate, N, which is fixed to the movable rod of the scale indices, travels therewith, and descends if the charge of the box, D, is heavier than 1,000 pounds, but rises if the weight is not great enough. When there is an overweight, the lever head, P, strikes the plate, N, above the notch, O, and, when the weight is insufficient, the head strikes beneath it. In either case the agent will not be able to disengage the catch, I, and, consequently, leave the door, C, free to open. This is the gist of the system: It is necessary to be able to shove the catch, I, to the left in order to disengage the door, C; and such a motion cannot be effected except when the lever head, P, presents itself directly in front of the notch, O, in the plate, N, and when the said head can enter the notch under the action of the handle, U. In order to obtain this position, it is indispensable that the weight shall be exact and that the indices shall agree.

The number of weighings is figured in the counter, F, through the action of the connecting rod, G, connected with the sector, E. This latter travels with the door, C, with which it is connected, going to the left when the latter opens and to the right when it closes. Every motion, the to and fro one included, inscribes a unit in the counter, F. When the door, C, is closed, the sector is situated back of the open door, B, and the latter forms an obstacle to C's opening. When, on the contrary, B is closed, and the door, C, is open, the sector is beneath B, and it is then impossible to close the latter as long as C remains open. This also is a condition that is exacted by the administration.

The mode in which the apparatus is maneuvered is, in brief, as follows: The employe of the sugar works opens and closes the door, B, by means of a weighted lever, and then shuts down the cover when the weighing is finished and regulated. Then the tax officer comes in and manipulates the handle, T, that unfastens the catch, I, and sets the door, C, free. This latter opens of itself under the pressure of the beets in the box, D. When the latter has discharged its contents, the sugar works employe brings the door back to its former position, and through the same motion all the parts become firmly locked again. The cover is open, and the sliding door of the box, D, again becomes free to descend, in order to allow of the entrance of a new supply of beets to be weighed. Neither the tax officer nor the representative of the sugar works can touch the mechanism that guarantees the accuracy of each operation, since this is surrounded by a grating carrying the state seal. The interests of the manufacturer and of the public treasury are thus perfectly guarded by this honest mechanical adjunct of the bureau of taxes. —*La Nature.*

German Willow Boxes—A House Industry.

Box making is notoriously an occupation in which only the poorest of people engage. In the East End of London it affords a scanty living to hundreds of families, who have to work from early morn to far past dewy eve in order to earn a few pence per gross, which is the reward of their labor. Miserable as this work and its pay may be, it will astonish some to learn that the peasantry in a remote district of South Germany follow the same work during one period of the year for much less remuneration than is obtained in London. It is these people who make the German willow boxes, which were introduced into London about ten years ago by Mr. Paul Metz, to whom the credit is in a great measure due, not only for creating a demand for this "sundry," but also for providing the peasantry with employment during the winter months, when it is impossible for them to follow their outdoor work. Mr. Metz was led into this trade through first supplying some confectioners' boxes, but it was only after considerable preliminary difficulty that he was able to strike upon a timber which would yield "chips" at all equal to the English willow. It may not be generally known that willow boxes are almost indigenous to Great Britain; on the Continent pinewoods are employed for making the "chips" used by pharmacists there, and the same kind of boxes have been brought into the English market since Mr. Metz introduced the German willows; but these pinewood boxes are much inferior in color and finish to the true "willow."

In the district to which we have referred, Mr. Metz has a central agency, superintended by a trustworthy overseer, who collects the timber, and has it cut up into logs for sale to the peasants. After the harvest season is over, the peasants go to the agency and receive a supply of wood; this they take to their homes, and slice it by hand into the thin shavings which are required for the sides and ends of the boxes. The slices are then suspended from the ceilings until they are thoroughly dried. Slicing is done by the father of the household or the elder sons, but in the other operations all members of the family who are able to lend a hand are employed.

After drying and smoothing out the slices of wood, they are stamped out into the circular pieces for top and bottom—which operation is done with punches obtained from the agency—and the long narrow pieces required for the sides. This operation differs from that followed in making pill boxes, in which case a long tube of cardboard is first made, and then cut up into shorter cylinders of the required size. In the case of willow boxes, the operation is much more tedious, as will be seen. The next part of the operation is the formation of the box; this is simply done by taking a disk, the edge of which is smeared with a peculiar quick-drying cement, passing round it a strip of the wood, and placing below the overlapping edge a touch of the cement. The box is then slipped between two parallel wooden bars, which allow free sliding, and yet prevent the bent wood springing back. The cement, although quick-setting, does not become firm for half an hour or more, so that the two bars are of such a length that by the time a box traverses from one end to the other it is practically firm, although the worker passes in the boxes with remarkable rapidity. The cement which is used is one of the secrets of the industry; it is a home-made article, free from glue, yet strong and capable of resisting either damp or heat to a wonderful degree. The bodies and lids of the boxes are both made in the manner described, and, after being fitted, are carried to the agency, where they are examined, counted, and payment made according to number. This payment is very low, as may be judged from the fact that a man earns only from 5s. to 6s. per week, young children from 2s. to 2s. 6d., and youths about 4s. But even this miserable pittance is "found money" to the peasants, and, were it not for these German willows, they would in most cases have no employment during the winter, or would have to take to a lower class of box making. There are over a thousand families engaged in the industry, apart from those employed in the agency to pack the boxes. It is rather a remarkable fact that the boxes, although made entirely by hand, and necessarily passing through several hands, are yet spotlessly clean. In this respect they are no way inferior to machine-made boxes, while they have a polish about them which English willows do not have. This, we believe, is natural to the wood, and is enhanced by the peculiar manner of cutting it into slices and drying.

After the boxes are packeted and packed in cases they have to be carried long distances, both by land and sea, before they reach London; but, notwithstanding this extra expense, the German boxes have competed successfully in the market against old established English manufacturers without the aid of any subsidy. This is the more notable from the fact that these boxes have never been included in the stock of the German durggists, nor indeed were they known in Germany until Mr. Metz established the industry. A German *apotheker* would use a small porcelain pot for sixpennyworth of ointment, but he would screw up a pennyworth in a piece of paper. There does not seem to be much chance of preserving the manufacture for England. The elements of cheapness which Germany possesses in the cheap labor, a fairly abundant supply of suitable wood on the spot, and, not the least important, a ready market, have been indicated, and are likely to remain. For many years the supply of English willow has been steadily growing smaller, and it is a matter of difficulty to get wood sufficiently white. When it is obtainable, its price is as many pounds as the German wood is shillings, so that the German willows have the advantage from the first. On a recent visit to Mr. Metz's warehouses in Jewin Street, we were asked to pick out at random any packages of the boxes from the general stock. As some attempts have been made to depreciate the quality of the German boxes, it is only fair to say that in no case did we find any one box either soiled or with any part uncemented or likely to become so.—*Chemist and Druggist.*

Poisoned by a Cobra.

The *Morning Star* of Jaffna, in Ceylon, reports the death of the taxidermist of the Victoria Museum in that town from the bite of a cobra, under curious circumstances. While feeding a cobra, which he thought was harmless from previous extraction of the poison bag, it suddenly bit his hand. For a few minutes he took no notice, thinking the bite harmless, but pain and nausea soon began. Carbolic acid was applied, ligatures were bound round the arm, an incision was made at the bite, and the blood of the arm was wholly removed. Various antidotes were used, but the unfortunate man lost the power of speech, and soon after every muscle seemed to have become paralyzed, and breathing entirely ceased. Artificial respiration was, therefore, resorted to, and this operation was unceasingly continued for nine hours, when at last the patient made an attempt to breathe, and soon regained consciousness enough to make his wants known. He steadily improved until the Friday, the accident having taken place on a Wednesday, and then astonished those around him by stating that during the severe operation of Wednesday night he was conscious of all that was taking place, but was unable to make his feelings known, not having power over a single muscle. It would seem that the poison paralyzed the nerves of motion, but not those of feeling, for he could see and hear and feel, although the physician, even by touching the eyeball, could get no response either of feeling or consciousness. His partial recovery was, however, followed by a high fever and inflammation of the lungs, and he died, perfectly conscious, on the following Sunday.

A Costly Machine.

The Waterville, Me., *Mail* describes a machine invented by Prof. Rogers, of Colby, which inscribes upon a polished surface from 30,000 to 50,000 parallel lines in each square inch, and which is of much use in the conduct of his astronomical labors. It was not perfected without an outlay of several thousand dollars. A single screw, which is twenty inches in length, and employed directly in the inscription of the lines above mentioned, after several attempts at construction, was finally produced, only after an expenditure of $3,000. The very limited use, the editor adds, to which the machine can be put renders the procurement of a patent wholly unnecessary.

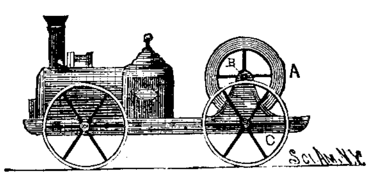
SCIENCE IN TOYS.

I.

One who knows all of science that may be learned from toys is truly an advanced scholar, inasmuch as there is scarcely a branch of physics that is not in some way represented in toys. It is true that it is sometimes difficult to distinguish between scientific instruments and toys. In the light of the accepted definition of the word toy, viz.," a thing for amusement, but of no real value," some overpractical individuals might class a large proportion of physical instruments as mere toys, while, on the other hand, the simplest plaything might, in the estimation of a scientific man, have great value as an illustration of some fact in science.

The collection of toys illustrated is by no means as extensive as it might be; but it is quite sufficient to show that a great deal of scientific knowledge may be gained by the study these seemingly insignificant things.

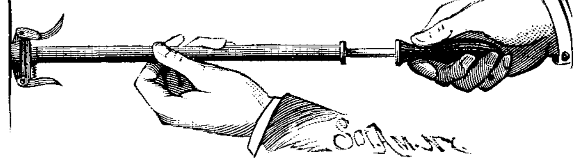
The property of inertia, the storage of power, the transfer of power by friction, and the conversion of rotary into rectilinear motion, are illustrated by the locomotive shown in the annexed engraving. The flywheel, A, is mounted on the shaft, B, which rests on the supporting and driving wheels, C. The wheel, A, is spun by means of a string in the same manner as a top. By virtue of its inertia, the wheel, A, tends to continue its rotary motion. If unaffected by outside influences, it would run on forever; but the friction of its bearings and of the air, gravitation, and the earth's magnetism, all combined, soon bring it to rest.



INERTIA LOCOMOTIVE.

The power imparted to and stored in the wheel, A, is given out in turning the wheels, C, overcoming friction, and propelling the machine forward.

The compression and elasticity of gases, the generation of heat by compression, the transference of force by means of a gaseous body, the disruptive power of compressed air, and the impact of air on air, are all illustrated by the simple toy known as the popgun.



THE POPGUN USED AS A PNEUMATIC SYRINGE—IGNITING TINDER.

The popgun shown in the engraving* is perhaps the best one in the market for the purpose, but any other of good construction will answer. This particular one is arranged for clamping a piece of strong paper across the end of the barrel; but to permit of creating a strong pressure, and also to allow the operator to readily look inside the barrel, a piece of thick mica is substituted for the paper.

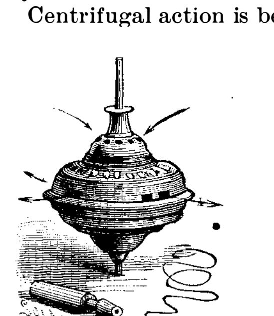
When the end of the popgun is placed against the wall, and the piston is pushed in, the volume of air contained by the barrel is greatly reduced. When the piston is released, it immediately returns toward the point of starting; the pent-up and compressed air exhibiting its elasticity by acting as a spring in pushing back the piston.

Tinder placed in the popgun will be ignited when the piston is quickly and forcibly pushed in while the air is confined by the mica plate.

When the end of the gun is removed from the wall and the thick mica plate is replaced by a thin one, a sufficient pressure will burst the plate, showing that the power applied to the piston has been transferred by the air to the mica plate.

The impact on the surrounding air of the air suddenly discharged by the gun produces a sound like that caused by the forcible contact of two solid bodies.

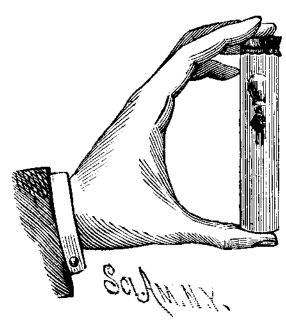
Centrifugal action is beautifully exhibited by the ordinary choral top. As the top spins, air, entering the holes at the top, is discharged through the holes at the equator by centrifugal action. The air, in going through the top, passes through a series of reeds, setting them in vibration, producing agreeable musical sounds.



THE CHORAL TOP.

Another top recently described in these columns exhibits centrifugal action by means of a liquid.

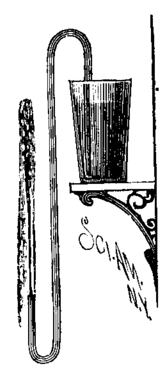
The hydrostatic toy known as the Cartesian diver illustrates the several conditions of floating, immersion, and suspension in equilibrium. In a tall, slim glass tube, closed at the bottom and nearly filled with water, is placed a porcelain or glass figure having a glass bulb attached to its head. The glass bulb has a small hole in the bottom, and is filled partly with water and partly with air, the proportion of air and water being such as to just allow the bulb to float. The top of the tube is closed by a piece of flexible rubber tied over its mouth. The pressure of the fingers upon the rubber communicates pressure through the water to the air contained by the bulb, causing the air to occupy less space and increasing the weight of the bulb in proportion to the amount of water forced in. As the weight of the bulb increases the diver descends, and when the finger is removed from the elastic cover of the tube, the air regains its normal volume, and the bulb, becoming lighter, rises to the top of the jar.



THE CARTESIAN DIVER.

The toy hydrogen balloon and the hot air balloon act in the air in the same manner as the air-filled bulb in the water.

The simple siphon embodies all of the principles of hydraulics. It is a pump in which the water itself acts as a continuous piston, the piston being constantly discharged and renewed. It shows the forcible projection of water, and illustrates the various conditions of raising and forcing water, and of its conveyance through pipes.

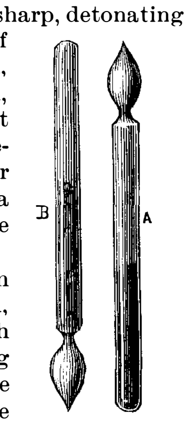


SIPHON.

The water hammer consists of a vacuum tube, partly filled with water or other liquid. A sudden downward and upward movement of the tube, when held in the position shown at A, causes the liquid to leave the bottom of the tube as the tube goes down, and strike forcibly on the bottom of the tube as the tube moves up. The liquid meets with no resistance, and in striking produces a sharp metallic clink, which sounds like the breaking of glass.

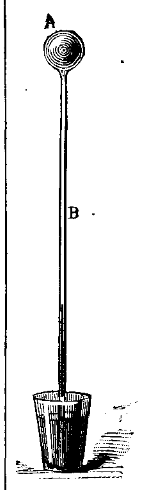
This tube shows, on a small scale, what happens in steam pipes when they give forth the sharp, detonating sounds so often heard in the pipes of steam heating apparatus. The steam, by condensation, produces a vacuum, into which the water rushes with great velocity, and meeting with no air resistance strikes the end of the pipe or another body of water, producing a sound suggestive of the bursting of the pipes.

When the tube is inverted, as shown at B, and the bulb is held in the hand, the rapid evaporation, by the warmth of the hand, of the liquid flowing through the narrow neck of the tube and down the inner surface of the bulb creates a pressure of vapor, which finds exit through the neck of the tube, and bubbles up through the main body of the liquid, and is condensed either in the liquid or above it. Sometimes the tube, when designed for use in this way, contains the figure of an imp, which the ebullition of the liquid agitates violently.



WATER HAMMER.

The air thermometer, consisting of an air bulb, A, and capillary tube, B, plunged in a colored liquid, shows changes in the volume of air due to expansion and contraction under changes of temperature by the rising or falling of the column of the colored liquid in the capillary tube. It is a sensitive thermometer, but of little practical value, on account of the variability of the volume of air by barometric changes. G. M. H.



AIR THERMOMETER.

* This toy was patented in 1868 by Charles Kirchhoff, who, it is said, realized handsome profits from his invention.

Mercuric Chloride in Diarrhœa.

It is seldom that an allopathic practitioner acknowledges indebtedness to the homœopathic school, but this is what Dr. Millard, of Edinburgh, does in a letter to the *British Medical Journal* regarding the use of mercuric chloride in diarrhœa, to which we have previously referred. He writes:

"I did not obtain my information of the use of hydrarg. perchlor. in this form of diarrhœa from Dr. Ringer's excellent work, as Dr. Macdonald perhaps supposes, but from probably the same source that Dr. Ringer obtained his, of which, to any one that knows, the book bears many traces, namely, from homœopathic treatises. But it matters not whence the knowledge comes—I know it to be an excellent remedy in the form of diarrhœa I previously described. If not adopted too late in the case, it is invariably successful. I have lately had four cases to test its merits; two recovered, and two were in a state of almost collapse when seen, one of these dying one hour after my first visit. In the other, the diarrhœa was checked after three or four doses, but the infant, a very weakly child, died from convulsions a few hours afterward."

Domestication of the Buffalo.

A gentleman is now successfully domesticating the American buffalo at Stony Mountain, Manitoba. Starting his herd in 1878 with four heifer calves and one bull, it now numbers sixty-one head; the greater number pure buffalo, the rest half breeds. When we saw them in January, all were sleek and fat, and yet they were then living on the open prairie and feeding on the prairie grasses covered by snow. At this time the snow was deep and the thermometer had, for long, registered 20° or more below zero. In January of the preceding year one of the cows had calved on the plain, and although at the time the thermometer registered 38° below zero, neither cow nor calf appeared to suffer in the least. When a blizzard comes on, the animals lie down together, with their backs to the wind, and allow the snow to drift over them, so that under the combined protection of their own wool and the snow they are quite warm. Not one of this herd has ever exhibited the slightest symptoms of disease, although the only care they receive is occasional watching, to prevent them from straying away. Thus, winter and summer, they live and thrive on the bare prairie, with numbers undiminished by any of the ordinary cattle scourges, and with expenses for care reduced to a minimum.

Once a year the great fleece, weighing from ten to fourteen pounds, is shed, and its manufacture into thick warm cloth was at one time a regular industry at Winnipeg, until it was discontinued by the extirpation of the animals in the adjoining region. In its market value, the buffalo is not behind its smoother relative; for even if the quality of the meat is inferior, the difference is more than made up by the great weight of the animal and by the value of the robe, which usually brings from ten to fifteen dollars. As draught animals, they have proved a success; for notwithstanding their great strength, endurance, and activity, they are as easily handled as ordinary oxen. In one particular only is the buffalo far inferior to other species of cattle, and that is as a milker; but to the ranchman milk is really of no consequence.

Mr. Bedson, the owner of the herd, after experimenting with crosses, is well satisfied with the hybrid, as it is in shape more like the domesticated cow, and is also a fair milker. Yet we doubt that this gain is sufficient to compensate for the deterioration of the fur; while, also, it would be a matter of endless regret if, in the prosecution of these experiments, the original pure race were lost. The rate for increase of the buffalo, though theoretically the same as with other cattle, is really much higher, on account of the lower rate of mortality.

When the present herd is sufficiently increased, it is intended to divide it among several prairie ranches in localities where once the wild buffalo found its choicest pastures. This amounts almost to a restocking of the buffalo region.—*Agriculturist.*

Street Railway Traffic in New York.

During the year ending Sept. 30, 1886, there were carried on the street railways of New York city 325,427,015 passengers. We believe this is by far the greatest passenger traffic of any city in the world, although New York is not the largest city. By way of comparison, the figures of 1885 are placed in a parallel column

ROAD.	1885.	1886.
Broadway and Seventh Avenue	21,952,529	32,698,899
Central Cross Town	3,666,617	4,044,913
Central Park, North and East River	15,066,770	15,155,902
Christopher and Tenth Streets	4,316,777	4,209,426
Dry Dock, East Broadway and Battery	17,419,852	17,154,601
Eighth Avenue	13,664,391	13,853,261
Forty-second and Grand Street Ferry	8,208,552	7,446,644
Harlem Bridge, M. and F.	3,296,738	3,637,357
Houston, West St., and Pavonia Ferry	4,352,704	4,592,634
New York and Harlem	15,972,361	18,201,236
Ninth Avenue	4,175,580	4,459,089
Second Avenue	19,367,370	21,059,707
Sixth Avenue	16,998,137	16,788,059
South Ferry (returns of 1884)	546,851	*550,000
Third Avenue	32,000,000	27,750,000
Twenty-third Street	10,311,145	12,697,914
Manhattan Elevated	103,354,729	115,109,591
Forty-second Street and St. Nicholas	2,445,587	6,016,782
Total passenger traffic	297,116,690	325,427,015

* Estimated.

The Fastest Torpedo Boat.

An official trial lately took place at Gravesend of the last new torpedo boat built by Yarrow & Co. for the British Government. A continuous run of two hours was made, during which were six runs of the measured mile. The average speed during the entire run was 22·39 knots per hour. The highest speed on two of the mile runs was 23 knots per hour, or about 26¼ miles per hour. Length of the boat, 125 ft.; beam, 13 ft.; mean draught, 3 ft. 4 in.; load carried, 10 tons; vibration, practically none; circle, 80 yards in 59 seconds; steam pressure, 140 pounds; highest revolutions per minute, 411.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. John Bersch, of Kingston, Pa. Combined with a drawhead having a transverse perforation, the coupling bar has its upper and lower edges with inclined shoulders to fit against an inclined top and bottom of the drawhead mouth, the coupling pin being held forward by a spring, and there being a pin-withdrawing mechanism.

A street bridge has been patented by Mr. John O'Donnell, of Albany, N. Y. It is formed of a series of girders rabbeted on opposite edges, adapted to abut at opposite ends against the curbs of the side of the street, with rollers at their ends, which rest on the sidewalk and permit moving the girders laterally along the street, there being corrugated floor sections fitted to the rabbets of the girders and halved together to form tight joints.

A grading machine has been patented by Mr. John C. Sage, of Gainesville, Ga. It is especially designed for use in widening the sides of cuts through which a line of railway passes, and is mounted on tracks on a flat platform car, on which are also dirt receptacles, the dirt being cut out by scoops and carried by conveyer belts to the receptacles, the grader moving along over a train of platform cars chained to the track, with the mouths of the scoops open in the direction in which the grader is moving.

MECHANICAL INVENTION.

A forging roller for nail machines has been patented by Mr. George E. Michon, of Essex, N. Y. The invention consists of a pair of steel pins carried by the stock in a position to be borne upon by the side face of the roller, whereby the usual wear upon the small side of the stock is greatly reduced or entirely overcome, and the oil reservoir is so located that almost every drop will be used up before it is necessary to replenish the supply.

AGRICULTURAL INVENTION.

A cotton chopper and cultivator has been patented by Mr. Robert E. Clark, of Fort Motte, S. C. This invention covers a novel construction and arrangement of parts in that class of machines where the stalks to be left standing are covered up while plows throw earth upon and crush down the remaining uncovered stalks, the covers shutting down over the plants to be protected as the machine is drawn forward.

MISCELLANEOUS INVENTIONS.

A fender has been patented by Mr. Baker V. Butts, of Halifax, N. C. It is formed of an inner and outer plate and damper, and designed to attach to open fireplaces to prevent coal, sparks, etc., from snapping out into the room, while in no way interfering when thus used with the draught of the fireplace.

A safety attachment for elevator cars has been patented by Mr. Charles R. Whittier, of Yonkers, N. Y. It is to prevent the elevator car from falling in case the hoisting rope should break, and consists of a special arrangement of wedges and counterweight rope, in connection with the hoisting ropes.

A nut lock has been patented by Mr. Charles O. McBride, of Muscatine, Iowa. A wire is clamped between the washer of the bolt and the beam to which the bolt is applied, and bent around the nut and twisted together, making a simple, inexpensive, and secure lock to prevent the bolt from turning.

A combined door plate, bell pull, and mail receiver has been patented by Mr. Michael A. McGlinn, of Lancaster, Pa. The plate has an oblong aperture corresponding with the mail-receiving aperture in the door, and a pivoted spring-actuated plate which acts also to operate the door bell.

A suspender end has been patented by Mr. William Bloomberg, of New York city. This invention consists in making the end portion solid and the adjoining upper part cut into strands and braided, all being of leather, making the suspended end thus formed pliable edgewise and elastic.

A spring for vehicles has been patented by Mr. Albert Barling, of Racine, Wis. This invention covers a novel arrangement of coil springs, with auxiliary springs to relieve the main springs, making an easy riding vehicle with a small load, while the construction is such that a heavier load will be well supported.

A miner's pick has been patented by Mr. James M. Matthews, of Pocahontas, Va. It is formed with a solid yoke, and detachably secured to a handle recessed to receive it, by a screw bolt, making a light yet strong pick, in which the old form of an eye pierced therein is dispensed with in attaching the pick to the handle.

A bobbin reamer has been patented by Mr. Stephen C. Ketchum, of Winchendon, Mass. This invention covers a centering spindle adapted to accurately fit the interior upper bearing, and a special rotating and longitudinally traversing reamer, arranged to revolve and travel upon the spindle, for reaming out an enlarged interior base bearing of the bobbin.

A harness has been patented by Mr. William Olewine, of Hazleton, Pa. Double back straps are attached to the hames and to the rump ring, in combination with hip straps and crupper attached to the ring, so that there will be no pulling or working up of the collar, as with a single back strap, and no danger of choking the horse.

A safety snap hook has been patented by Mr. Isaac M. McKay, of Rocklin, Cal. It has a polygonal-chambered shank, with an arm arranged to slide on the shank for closing the hook, and a spring-acted tongue for engaging the arm and holding it in a closed position, the hook being designed for use in connection with harness, ship's rigging, and mining machinery.

Taping furs forms the subject of a patent issued to Mr. Charles Theinert, of New York city. This invention covers the method of taping, and also the fabric as an improved article of manufacture, making a fur fabric in which the continuity of the hairs of the fur will be practically unbroken, however the fur may be bent fur side out when in use.

A water closet has been patented by Mr. August F. Blesch, of Columbus, Ohio. This invention covers an improvement in that class of closets which are supplied with flushing tanks, and provides a siphon communicating with the tank and suitable means to start the same, so that, if the chain be pulled but for an instant, a thorough flushing will result.

A fancy show card has been patented by Mr. Charles Kernitz, of Long Island City, N. Y. It is made in the form of a shield, and curved in semi-cylindrical form, with a three-armed strap secured to the side parts and lower end of the shield, making a card especially designed for firemen's use in advertising balls and displaying other notices.

A guide board has been patented by Mr. William W. Case, of Baptistown, N. J. Combined with a head having a vertical dovetail recess are clamp plates with vertical flanges on their rear edges engaging the dovetail recess, and a sign board held between the clamp plates, making a strong and durable sign board, that may be set to point in any direction.

A wire stretcher has been patented by Mr. Andrew B. Graham, of Burleson, Tex. This is a machine with a shaft carrying a movable pinion, racks with clamping jaws, pawls, etc., whereby the parted ends of a broken strand of wire may be brought together to be bound, being designed for use in mending wire fences, telegraph wires, and for similar purposes.

A grain weighing and registering apparatus has been patented by Mr. William H. Ernst, of Chase, Kan. It has two movable hoppers, a shifting gate or valve which conducts the grain into the hoppers, and devices for weighing and registering, the apparatus being simple in construction and automatic in operation.

A folding sponge basket has been patented by Mr. David A. Gabay, of New York city. It consists of a number of circularly arranged compartments elevated from the floor, adapted to revolve around a central fixed standard, the various parts being made detachable, whereby the entire structure may be folded for shipment.

A necktie fastener has been patented by Mr. George B. Haines, of New York city. The invention consists of a scarf made of a piece of cloth folded over a metal shield, and having a detachable fastener to which the neckband is attached, preventing the scarf from being affected by perspiration, and the metal shield preventing the scarf from losing its shape.

An ironing table has been patented by Mr. Daniel C. Woodward, of West Randolph, Vt. It is a table which may be readily folded together to be out of the way, and in which, as ready for use, one end is supported free from all obstruction for ironing such articles as require the introduction into them of an ironing board.

An animal poke has been patented by Mr. Finley E. Benson, of Lake Park, Ia. It is designed to prevent an animal from spreading apart the wires of a fence when attempting to pass through, for which purpose an outwardly projecting hook is so arranged just back of the horns as to cause barbs to prick the neck of the animal as it makes the attempt.

A slag cart has been patented by Mr. August Werner, of Leadville, Col. It is formed of an annular frame, with axles, with a bowl received in and having a flange resting upon the frame, to support the bowl in position for use, while there is a segmental cover pivoted to the edge of the bowl, having a central spout for the discharge of the lighter melted matters.

A composition of matter to be used in soldering has been patented by Mr. Arthur P. Smith, of Pipe Stone, Minn. It consists of melted tallow purified with quicklime, white wax, and resin, combined after a specified manner so that it will stand every climate, and making a composition by which many of the objections to the fluxes in common use are avoided.

A harness saddle has been patented by Mr. Albert L. Liston, of Pleasant Plains, Ill. The object of this invention is to provide a saddle tree in which the loops and various parts for receiving the straps are secured by dovetailed tongues and grooves, in connection with retaining screws or bolts, rendering the different parts secure without an undue amount of fitting.

A pinch bar has been patented by Mr. William Franklin, of Corry, Pa. It consists of a simple system of compound levers, having a longitudinally slotted base in which the pinch bar lever is pivoted, the hand lever being pivoted in the slot of the base piece, whereby cars with heavy loads can be started more readily than can be done with pinch bars of ordinary construction.

A hose carriage has been patented by Messrs. Conrad A. Dorr and Edward B. Hill, of Brooklyn, N. Y. The hose reel is mounted on wheels, and has pulleys of different diameters, with endless chains, combined with pulleys carried by the axle of the hose carriage, and a sliding clutch, whereby the traction of the hose carriage may be utilized for reeling up the hose.

A time stock feeder has been patented by Mr. Louis Deguenant, of Cour-Cheverny, France. The invention consists in a box or feed receptacle divided into one or more compartments, with discharge vents and gates or valves, and mechanism actuated by clockwork for operating them, whereby food, water, etc., may be automatically distributed to stock and other animals at the proper time.

A combined shutter bower and fastener has been patented by Messrs. David Conner, of Groton, Conn., and Frederick A. S. Perry, of New York city. It has a vertically movable bolt or latch secured to the inner side of a shutter, and a securing plate provided with a series of notches or openings, arranged in the arc of a circle, and adapted to be entered by the vertical bolt, the device being simple and easily applied.

A combination tool has been patented by Mr. Joseph D. Galloway, of Belmont, Kansas. It has offset pivoted jaws, with lever handles, with serrated semicircular notches in the jaws and in the handles, and with a hammer face on one side of the jaws, the tool being for use as a pipe tongs, hammer, screw driver, tack claw, wire cutter, measure, pliers, and for other purposes.

A subterranean water collecting dam has been patented by Mr. David H. Valentine, of Brooklyn, N. Y. The dam is combined with a conduit upon its source side, the dam and conduit being built from a central point or reservoir in a valley, up an elevation or hillside, and serving to intercept the earth flow of spring water through gravelly soil to the ocean or any watercourse.

A combined feeder and hopper for cotton gins has been patented by Mr. John P. Ketteringham, of Natchez, Miss. This invention covers a novel construction and combination of parts, so that the cotton will be fed to the gins uniformly, the feeders readily adjusted to feed more or less cotton in a given time, and that they will not have to be moved when it is necessary to remove the gin saws.

A swinging paddle for vessels has been patented by Mr. Berend Doscher, of Charleston, S. C. This invention covers a novel construction and combination of parts for a system of propulsion of vessels by an easily controlled arrangement of swinging paddles at the sides, whereby it is designed that the vessel may be propelled forward or backward, or turned short around without reversing the engine.

Eyeglasses form the subject of a patent issued to Mr. George W. Hassellund, of New Castle, N. Y. Combined with the frames of a pair of eyeglasses are pivoted nose pieces, provided with removable cylindrical yielding contact pieces, so that the contact surface may be readily removed and replaced, while there is also a spring of peculiar form for connecting the eyeglasses.

A door bell has been patented by Mr. Frederick Sanderson, of Chicago, Ill. It is a simple and cheap device, intended for a mechanical imitation of an electric bell, both in sound and appearance, the bell being operated by a push button and without the use of a winding spring, a series of vibrations being communicated to the hammer of the bell by a single push of the button.

A hot water apparatus has been patented by Mr. Sam. F. Collins, of Binghamton, N. Y. This invention relates to attachments for boilers from which frequent draughts of hot water have to be taken, and in which it is desirable to keep the water at a uniform or a given temperature, and provides novel means for automatically regulating the heat of the water in the boiler, either above or below the boiling point.

A buttoner has been patented by Mr. Charles E. Cookerly, of Kansas City, Mo. It consists of two crossed levers, with eyes at one end for receiving the thumb and finger, and at the other end oppositely arranged hooks for grasping the neck of the button, one of the levers having a pivoted cap plate for covering the button and the hooks, to prevent the button from catching at the sides of the button hole.

A land anchor has been patented by Mr. Cyrus C. Pratt, of Lincoln, Kan. It is an expansible anchor, adapted to be inserted in a cylindrical hole bored in the earth, and arranged to expand when the tie or rod with which it is connected is drawn, being designed to make buildings more secure on their foundations, and also to effectively anchor bridges, wharf boats, etc.

A secondary battery has been patented by Messrs. Victor Sass and Karl Friederich, of Berlin, Germany. The electrodes for accumulators are made by heating the zinc and lead together in equal parts, and then heating the composition until a complete oxidation of the lead sets in, after which the heated pliable mass is formed into plates, from which the zinc is dissolved by the use of dilute sulphuric acid.

A camera stand has been patented by Mr. John J. Higgins, of New York city. The top is formed of two or more hinged parts arranged to fold one upon the other, and the legs each consist of an upper section formed of parallel bars connected together by plates, the lower section being pivoted between the lower ends of the parallel bars, and carrying a spring-acted latch for holding the leg in an extended position, with other novel features.

The placing and manipulating of marine torpedoes forms the subject of a patent issued to Mr. Charles S. Aylesworth, of Speegleville, Tex. The torpedoes are connected to guide lines passing under anchored sheaves, and leading to a point where all are connected to a single manipulating line which leads to the shore, whereby the torpedoes may be drawn out of the way of friendly vessels, and automatically resume their position.

A tether has been patented by Mr. William B. Farrar, of Greensborough, N. C. From an iron stake driven into the ground, on which is a spring casing, extends a tether pole, at such angle that it will rise above the stock, and to the outer end of this pole is fastened the tethering rope, to which the stock are tethered, the tethering pole moving freely around the post, so that in traveling around the rope will not get under the feet of the stock.

A wick tube for oil burners has been patented by Mr. William H. Wilder, of Gardner, Mass. This invention consists of a novel arrangement for the support of the spindles of the wick raisers, and an arrangement whereby the intermeshing gears carried by the spindles are inclosed and protected, so that the wicks may be uniformly raised throughout their width, and the wick tube will not be injuriously affected by heat.

A telegraph transmitter has been patented by Mr. James W. Shryock, of Trinidad, Col. It consists of a series of sliding bars or rotating disks carrying transverse ribs corresponding in width to the dots and dashes of characters, a contact spring moved by the ribs, and making contacts corresponding in duration with their width, combined with the bar of a circuit opener and closer, and with other novel features, to transmit electric signals and characters by a single motion of the finger for each character.

A vaginal syringe tip has been patented by Mr. Charles B. Dickinson, of Brooklyn, N. Y. It is composed of tubes of soft rubber upon a socket, the whole surrounded by an outer closed tube of soft rubber, so that it will bend and yield to any excess of pressure.

NEW BOOKS AND PUBLICATIONS.

FIRST ANNUAL REPORT OF THE FOREST COMMISSION OF THE STATE OF NEW YORK, FOR THE YEAR 1885. Albany, 1886. Pp. 362.

This interesting and carefully compiled volume contains a report which was transmitted to the State Legislature, May 18, 1886. It shows what is being done for the preservation of the forests of this State. The origin of forest fires is given in some detail, and the sad results of these destructive agents are shown on a map accompanying the volume. The tenth census of the United States is quoted to show that nearly 150,000 acres of woodland were thus destroyed in 1880. Windfalls, landslides, lumbering, timber stealing, tanning, wood pulp, charcoal burning, iron manufacturing, railroad building and operating, are all treated of as affecting the question of preservation. The drying of springs and streams is spoken of, and the views of experts on the subject are given. The rules established by the commission, as regards fires principally, are given in the text. Special agents' reports on the condition of different counties come next in order. The co-operation of the Adirondack and Catskill guides is asked for in the furtherance of the objects of the commission. The suggestion is also made that "Arbor Day" be made coincident with "Decoration Day," in order to secure a universal interest in the planting of trees. In the body of the work, European methods of forest preserving are described. In the appendix are given the laws of the State pertaining to the subject in question, a very full bibliography of forestry with reference to leading libraries of this country, and a list of land in the State forest preserve. The work is ably compiled, represents much labor, and embodies information that it would be hard to find elsewhere.

ALUMINUM: ITS HISTORY, OCCURRENCE, PROPERTIES, METALLURGY, AND APPLICATIONS, INCLUDING ITS ALLOYS. By Joseph W. Richards, A. C., Chemist and Practical Metallurgist, Member of the Deutsche Chemische Gesellschaft. Illustrated by 16 engravings. 12mo, 36 pages. Philadelphia: Henry Carey Baird & Co. Price, $2.50.

At last a glaring vacuity in English scientific literature has been filled, and, we may say, very satisfactorily. The author states in his preface that he has endeavored to give every fact of value published in regard to this subject, whether in English, French, or German. The different divisions of the subject are given in the words of, and credited to, the original authorities, such as Deville, Woehler, and others, in addition to the author's own comments. The order of treatment adopted is logical and convenient, commencing with the history of the subject, next describing the occurrence of aluminum-bearing minerals, after this the properties, physical and chemical, of the metal, and then its metallurgy. We notice that the chapter on sodium, altogether interjected as subsidiary to the main subject, is very complete and of much value. Especially interesting will be found the part entitled "Reduction of Aluminum by Other Agents than Sodium," in which, for instance, we find eleven pages devoted to Cowles' process, and seven pages to reduction by zinc. In conclusion, we would remark that, while here and there a point might be raised as to the homogeneity of a chapter, yet we can suggest no fact bearing on aluminum which has been omitted from the book.

GEOLOGICAL SURVEY OF ALABAMA. On the Warrior Coal Field. Eugene Allen Smith, Ph.D., State Geologist. Henry McCalley, A.M., C., and M.E., chemist and assistant geologist. Pp. 571. Montgomery, Alabama, 1886.

This is an exhaustive report on these extensive coal fields, of special interest at the present day, when Alabama is so rapidly coming to the front as an iron-producing State. Exact details as to thickness and disposition of various seams at various localities make up the bulk of the work. At the end an extensive collection of proximate analyses of over eighty specimens of coal are given. Some are of really surprising purity, others are of a low grade. Other analyses of fire clays, slates, clay, iron, stones, and millstone rock are also given. The geological details, re-enforced by the analyses, make the work of great value in the economic sense, as indicating the probable quantity and quality of coal in any given locality.

THE TRIBUNE BOOK OF OPEN AIR SPORTS. Illustrated. Pp. 500. New York, 1886.

In this work all the leading outdoor recreations are treated of, by special writers and experts on the subjects. Seventeen sections are included, and in them fifteen sports, such as rowing, yachting, running, and archery, are described. Anecdotes relating to the different subjects, and the records of amateurs and professionals, are included. The opening chapter is by William Blaikie, on "Why we Want to be Strong." The names of George Goldie, Thomas Clapham, David Kirby, W. S. Rossiter, and Charles E. Emery, who figure as contributors, give an idea of the quality of the writers. A very acceptable chapter on useful facts, such as the treatment of accidents, fording of streams, care of the eyes, and the like, closes the work. It is provided with an index. It is given as a premium to subscribers to the New York *Tribune.*

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) E. E. C. asks if a person weighs any more after eating a hearty meal than before, and is it the same with drinking as with eating? A. Immediately after eating or drinking, a person weighs more than before it.

(2) H. M. W. asks under what pressure gas for illuminating purposes is usually kept in the city mains. Also whether such gas is wastefully soluble in water if the two are in juxtaposition. A. The pressure of illuminating gas in street mains varies from 1 to 4 inches of water. It is not wastefully soluble in water.

(3) J. H. B. says: In a life of the Empress Josephine I have recently read, it is stated that on the 9th of November, 1799, the President of the Directory and guests were surprised by receiving "a telegraphic announcement that Bonaparte had that day landed at Frejus." Was not that date prior to the use of the telegraph? A. The telegraph then used was the semaphore, or visual telegraph. Posts or spires on which were movable arms were employed to convey intelligence.

(4) W. B. writes: I have some bone black from which I wish to make a porous receptacle for the absorption of gases. I wish to make it as porous as is consistent with durability. What substance shall I use to make it adhesive, and in what proportion? Can this substance be baked out in a common oven, or will it require greater heat? A. Mix the bone black to a thick stiff paste with molasses and water, or with coal tar. Then, after shaping, it must be baked at a red heat. This can be done in a good fire by inclosing it in a vessel and covering it with charcoal or sand. An ordinary flower pot might answer as containing vessel for baking at home.

(5) X. Y. Z. asks: 1. Where can I find a good account of the isolation of fluorine, recently hinted at in *Nature?* A. See the *Chemical News*, current volume, pp. 36 and 51. The original papers appeared in the *Comptes Rendus* of the French Academy of Science. 2. Have or have not diamonds been made in the laboratory? A. See the information on this subject in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 216 and 218. 3. What is the present accepted number of elements? A. Sheppard's Chemistry (1886) gives sixty-eight, but there are several elements since claimed to be isolated, whose existence is not altogether accepted. 4. The highest temperature obtained by the electric arc? Also by combustion? A. By combustion, practically between 2,000° and 2,500° Centigrade. By the electric arc, undetermined, but far higher. 5. How many products have been obtained from the distillation of coal, in making illuminating gas? A. Their name is legion. See article on gas, by Professor C. F. Chandler, in Johnson's Cyclopedia.

(6) C. E. McC. asks what size of cotton-covered copper wire he must use on magnet in short circuit to get greatest drawing power, with one or two cells gravity battery. A. The size of wire to be used on electro-magnets depends upon the size of the magnet covers. We should recommend No. 16 or 18 wire as probably adapted to your wants.

(7) G. F. E. asks how to prepare a solution for copper electro-plating, also if one "crowfoot" battery has power enough for experimental work. A. For copper plating, a solution of sulphate of copper is required, obtained by dissolving blue vitriol in water. One crowfoot battery will answer for experimenting.

(8) T. N. C. desires (1) a receipt for a varnish for brass. A. An excellent brass lacquer consists of 8 ounces shellac, 2 ounces sandarac, 2 ounces annotto, ¼ ounce dragon's blood resin, 1 gallon spirits of wine. The article to be lacquered should be heated slightly, and the lacquer applied by means of a soft camel's hair brush. 2. A cheap, simple method for generating hydrogen gases for inflating toy balloons? A. Fill a bottle about one-quarter full with zinc turnings, then pour water half way up the bottle and add a few drops of sulphuric acid. Fill the opening of this bottle with a cork through which a glass tube is made to pass. The generated hydrogen will escape up the tube, and then can be collected in the balloon.

(9) B. A. H. asks (1) directions for making wax moulds for moulding plaster centers for ceilings. A. Plaster centers are moulded in plaster moulds, oiled with linseed oil. In making an original design, you may use beeswax and whiting melted with a few drops of oil to soften, so that it may be worked. Clay is also used for designing patterns; oil the clay pattern before pouring on the plaster of Paris. 2. What thickness would a cast iron box 6 inches by 6 inches inside have to be made to hold 330° of steam heat? A. 330° heat in steam is equivalent to 90 pounds pressure; your box, if a cube, should have the inside corners rounded, and be about ⅜ inch thick for safety.

(10) A. S.—We know of no iron cement made as you describe. A strong, apparently welding cement may be made as follows: Take equal parts of flour sulphur and dry white lead with one-sixth part of borax; incorporate thoroughly in a mortar. When used, add to as much as you require for immediate use, sulphuric acid just enough to make a paste, which spread thinly on the surface and press them together with clamps. In 4 or 5 days the joint will be strong, and appear as if welded.

(11) W. P. J. asks why a loose pulley of certain size, or a wheel such as is used on a band saw machine, shakes when running a certain speed, whereas if the speed is decreased or increased the vibration ceases. A. The cause is the synchronism between the time of revolution of the wheel and the vibration of the band saw. At the speed in which they correspond, the vibration of the band is increased. This phenomenon often takes place with belting, sometimes extending to the floors and the building. We know of a case where at a certain speed of the engine the walls of a building shake.

(12) J. C. V. asks: 1. How can I restore the polish on opals blurred and scratched by wear? A. By rubbing with oxide of tin or putty powder on a piece of chamois skin, wet; finish with refined chalk, also on chamois skin, wet, then wash the opal with a soft brush and water. With a little care this may be done without taking it from the setting. 2. How can the original white color of silver filigree jewelry be restored when tarnished by wear or shop worn? A. First wash the articles in a solution of 1 fluid ounce of liquid potassa in 20 of water, rinse, and then immerse in a mixture of salt 1 part, alum 1 part, saltpeter 2 parts, dissolved in 4 parts water. Let them remain for five minutes. Wash in cold water, and dry with chamois leather. 3. Is there any metal that is oppositely affected from steel by heat? In other words, is there any metal that contracts from the same cause that steel expands, or are there any two metals that are oppositely affected by heat and cold? A. No. 4. Does glass expand and contract enough in hot and cold weather to materially affect a glass pendulum? A. Glass expands less than any metals by heat, but is not as good as dry lancewood, varnished with shellac, for pendulums.

(13) H. E. T. asks if there is anything that can be practically used as a substitute for eggs in plum puddings, etc., and where it can be obtained, or how made. A. There are various so-called egg powders in the market, but they are of no great value, and we know of no satisfactory substitute for eggs. An old fashioned receipt for plum pudding without eggs is a cupful each of suet, flour, sugar, raisins, currants, one-half cupful of citron, with spices, and then add just enough milk to make it of the consistency of cake. Finally add two teaspoonfuls of baking powder and boil for three hours.

(14) H. B. B.—Either a solution of cupric oxide, *i. e.*, black oxide of copper, dissolved in aqua ammonia, or an ammoniacal solution of basic cupric sulphate, possesses the property of dissolving cellulose. This solvent power increases with the amount of copper in the solution. We would advise you to have the solution made up by some competent druggist.

(15) C. M. K. writes: I have a piece of furniture on which is what appears to be a very fine piece of inlaid work, but on close examination I find that the inlaid work is first sawed out and then put into some kind of black wax, and all polished, which presents a very fine appearance. How is the work done? A. The inlaid work is sawed out, as you say, and then attached to the work by means of glue; the wax used is ordinary sealing wax carefully applied to the interstices with a hot tool. The secret of the work lies in the skillful application of the wax and in the subsequent finishing.

(16) W. D. G. asks if there is any practical way of making chain with the links solid, or without welds or soldered joints. A. Solid link chain is now made by malleable iron works for special purposes by casting. It is not as strong as welded test chain, but answers for special purposes. We know of no way of completing a wrought iron chain without welding. Every other link may be made solid in a drop press. See SUPPLEMENT, No. 569, for information about chain casting.

(17) C. G. writes: Where a locomotive engine is running at the rate of say 50 miles an hour, is not the valve cut off by link motion, so it does not travel whole length of its stroke? A. The valve travels according to the position of the link slide, which governs the throw of the valve, and also the cut-off. This is entirely under the control of the engineer through the link lever, and has nothing to do with the speed of the engine, but to control it by shortening or lengthening the cut-off by the stroke of the valve. You are right.

(18) W. M. S. desires a recipe for a quick drying varnish. A. Use the following: Pulverize 1 ounce sandarac, ¼ ounce mastic, ¼ ounce elemi, dissolving them in ½ ounce Venice turpentine, and adding to it a solution of 4 ounces shellac and 3 ounces oil of lavender in 12 ounces alcohol.

(19) B. G. asks: How long will it take for a tap on the telegraph wire to go around the world? A. On a good land telegraph line of length equal to the circumference of the earth, about one second would be needed. Ocean cables would considerably increase this, even to several seconds.

(20) J. H. M. asks: Will you please inform me what combination of metals, spirits, or chemicals is the most and quickest, or most sensitive to heat and cold as to expansion or contraction, that would act on the principal of the thermometer? A. The question is too indefinite for answer. The expansion of a gas is, in general terms, the most sensitive indicator of heat.

(21) W. L. asks: In reference to the dynamo described in SUPPLEMENT, No. 161, what difference will there be in the current, if the space between the armature and field magnets is one-sixteenth inch or a little over? A. A clearance of one-sixteenth inch is not too much for efficient working.

(22) W. H. N. asks: What is the difference between the composition of the wind and the atmosphere? A. There is no difference in the composition; wind is atmosphere in motion.

INDEX OF INVENTIONS

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December 21, 1886,

AND EACH BEARING THAT DATE.

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

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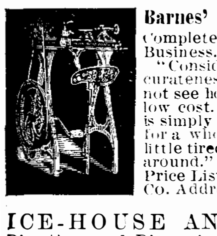

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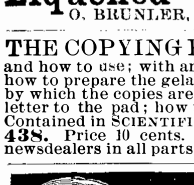

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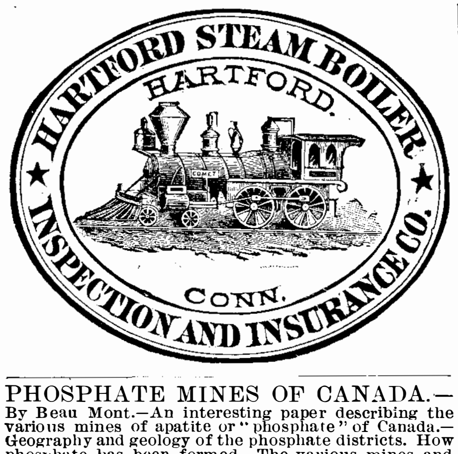

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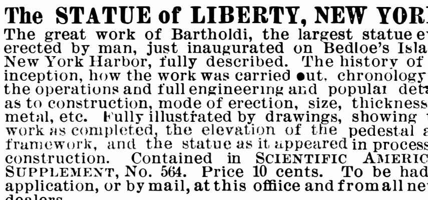

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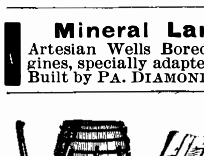

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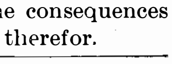

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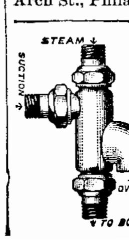

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