SCIENTIFIC AMERICAN

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

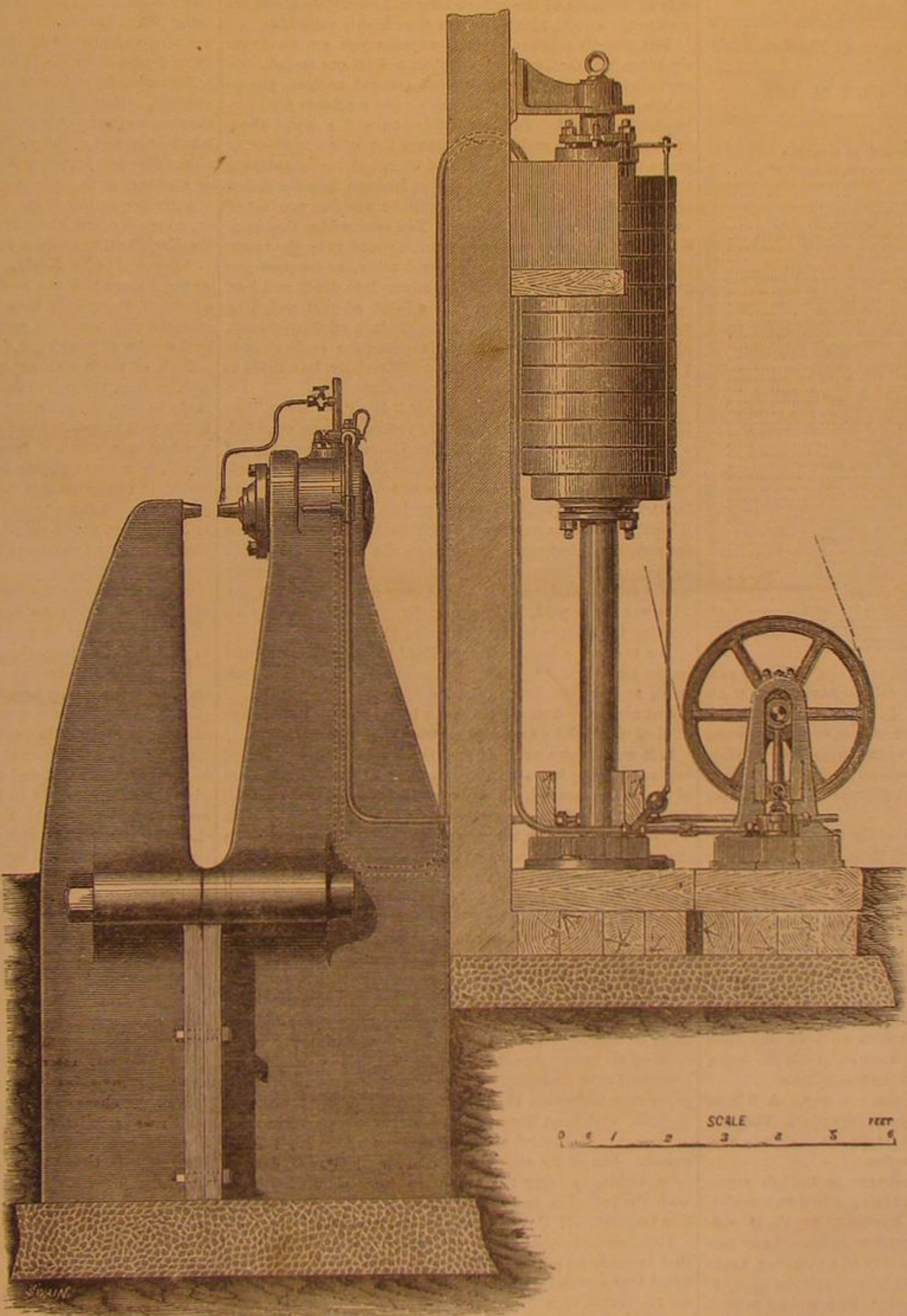
Vol. XXXIII.—No. 4. [NEW SERIES.] | NEW YORK, JULY 24, 1875. | $3.20 per Annum, [POSTAGE PREPAID.]

RIVETING BY HYDRAULIC POWER.

We illustrate herewith an hydraulic riveting machine, which is a representative specimen of the system which is now coming into extensive use abroad. It is clearly delineated in our engraving, which is selected from *The Engineer*, and requires but little description. It can deal with a row of rivets about 6 feet 6 inches long, and the compressing strain is about 80 tuns per rivet when the machine is doing its maximum, which can be reduced to 20 tuns by taking weights off the accumulator. This is by far the most powerful riveting machine ever made. One at Jarrow, England, can take in a seam 11 feet long: but the strain per rivet is only 30 tuns. The great range, however, of the Jarrow machine enables a marine boiler shell to be riveted straight off, without stopping to turn it end for end.

In the machine we illustrate, pressure is supplied by a two-throw 1¼ inch pump, which forces water into the accumulator, which is of the differential type, and loaded to 1,500 lbs. per square inch; when the accumulator is filled, a rod is caught by a tappet, stopping the suction pipe to the pumps. The water is led from the accumulator to the machine, and by a suitable valve the ram is worked. Only one valve is required for the whole plant, everything is above board and get-at-able, although, owing to the extreme neatness of the arrangement and the high pressure used, the head of the riveting standard is very small and out of the way of everything. The speed of these machines can be regulated from 25 to 2 rivets per minute. They require little or no foundation, the exhaust water returns to a small cistern, as shown, and from that it again goes to the pumps. It is needless to expatiate further on these machines, which are now in use at every large works, and in the dockyards of every European power.

The machine illustrated is one of several ordered for use in France, and is the invention and design of Mr. R. H. Tweddell, Delahay street, London, England.



TWEDDLE'S HYDRAULIC RIVETING MACHINE.

Sword Fish Exploits.

A few days ago, a couple of men. who were out in a boat, fishing in Lower New York Bay, observed a commotion among a shoal of small fish, and, rowing to the spot, found what they at first supposed, by its single fin above the water, to be a shark. They attacked the monster with a view to capture, and were astonished by the sudden piercing through of their boat bottom by the sword, 4½ feet long, of a large sword fish. They succeeded in noosing his tail, securing and killing the fish, after which he was towed ashore, and subsequently brought up to the city, to a restaurant in Park Row, a few doors from the SCIENTIFIC AMERICAN office. The New York *Express* states that the fish weighed 390 lbs., and measured 19 feet 8 inches in extreme length. It was certainly one of the finest specimens we ever saw.

The Liverpool *Mercury* has a report from Captain Harwood, of the brigantine Fortunate, lately from Rio Grande, to the effect that the vessel, while at sea, was struck and shaken by a sword fish. After discharging the cargo at Liverpool, the hull was examined and the sword of the fish found, broken off even with the outside planking. The fish had driven his sword completely through the four inch planking, leaving eight inches of the blade projecting within the vessel.

The sword fish is allied to the mackerel, which it resembles in form, and is a swift swimmer. The sword is a most formidable blade, consisting of a strong straight bone, sharp and flat, projecting horizontally from the nose, of which it is a prolongation.

The sword fish is found in considerable numbers off the island of Martha's Vineyard, coast of Massachusetts, at this season of the year. Its flesh is considered excellent food by many persons, and the annual catch is quite large. The ordinary length of the body of the fish at full growth is 14 feet, and its sword 6 feet, or 20 feet in all.

Velocity of Magnetization.

M. Deprez states that soft iron, malleable iron, and tempered steel give the same results to investigations for determining the rapidity of their magnetization and demagnetization. The duration of demagnetization is 0·00025, and of magnetization 0·00160, seconds, approximately. Gray cast iron gives still better results, the time of magnetization being reduced to 0·001 second. With this last metal, therefore, the highest possible rapidity in the transmission of signals may be attained. This is due, according to M. Deprez, to the molecular structure of the metal and not the proportion of carbon contained.

The Intensity of Different Colored Lights.

An experiment recently made at Trieste, to test the intensity of various colored lights, is worth recording in these columns, as it is naturally a matter of some interest to photographers. The experiment was a practical one, and designed for the purpose of discovering how far lights of different colors penetrate darkness, and whether they would be of any value for the lanterns of lighthouses Of course a white light is seen at a much greater distance than any colored illumination, and it is singular, too, as many of our readers have, no doubt, remarked, when viewing a fountain illuminated by various colors, that when the white light is thrown upon the drops these appear at their best. At first we may admire the violet; then a ruby light is thrown upon the falling water, and we pronounce in favor of that; then, perhaps, green, orange, and blue illumination follow, all securing our admiration in turn, until, at last, the white light is again turned on, and its brilliancy and intensity give at once finer effects than the others. In the experiment at Trieste, half a dozen lanterns, with carefully selected glass, and all furnished with oil and wicks of a like character, were set burning on the beach, and then observations were taken by a party of sailors in a boat. At half a league distant the dark blue lantern was invisible, and the deep blue one almost so, so that there could be no doubt as to their unserviceableness for lighthouses or beacons. Of all the colors, the green was visible for the longest distance, with the exception of the red, which ranked next to the white in brilliancy. It is only the green and the red—such, indeed, as our railways make use of—that are capable of employment, and the green light the Trieste authorities only recommend in the vicinity of white and red lights, as from a short distance an isolated green light begins to look like a white one.—*The Photographic News.*

Vanadium in Rocks.

Dr. A. A. Hayes, in a paper read before the American Academy of Science, Boston, in January last, states that he had detected vanadium in many rocks associated usually with compounds of phosphorus and of manganese. His mode of examination for the detection of vanadium is described in detail, but no complete analyses of any rocks are presented. The author proposes in a future paper to give a tabulated list of the rocks. He also states the occurrence of vanadium in the well water of Brookline, near Boston.

A THICK solution of marine glue in wood naphtha is a good cement for fixing glass letters. The glass must be chemically clean and must be previously scrubbed with soda, then with whitening and water, followed by thorough rubbing.

Scientific American.

MUNN & CO., Editors and Proprietors.

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

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

TERMS.

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

Club Rates:

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

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII., No. 4. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JULY 24, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

TAKING A CHANCE.

David said in his haste: "All men are liars." With equal truth and greater deliberation he might have said: "All men are gamblers." There is a fascination in taking a chance that is quite irresistible to most men, especially when the cost of the chance is small compared with the possible outcome; and the greater the promised prize, the less apt men are to think of the overwhelming probability of drawing a blank.

Just now the adventurous spirits of the country are feverish with a desire to get to the Black Hills. They know, or ought to know, that the ills that await the pioneer in that disputed region are blacker and more numerous than the hills; but report says gold is there, and multitudes are bound to have a chance for it, in spite of Uncle Sam, the Sioux, or any other hindrance.

The probabilities are a hundred to one against success in any individual case, even if the precious metal should be found in paying quantity; they are as strongly in favor of sickness, suffering, and violent death to such as win their way there. Yet the possible prize outweighs all the risks, and so dazzles the imagination that it alone is seen.

But these are reckless adventurers, you say. A life of privation and danger is what they specially enjoy. They are constitutional gamblers, and no fair type or illustration of the prudent average man of civilization.

True as to their character, but not true as to their representative character. Judging from their conduct on occasion, we must say that prudent men of business, popularly supposed to calculate the probable success or failure of any new enterprise with the passionless accuracy of a machine, are as likely to take a wild chance for a big prize—quite as likely to overlook the enormous probability that the promised prize is a fiction—as the most adventurous miner on the frontier. The one stakes health, strength, comfort, life, against a fabulous "pile;" the other stakes what is just as dear to him—his cash. Hence we have the familiar saying that the average capitalist can more easily be persuaded to go out of his regular line of business to take hold of a downright swindle (take hold honestly, we mean) than of a legitimate enterprise of reasonable promise. To the latter, he applies his customary business maxims, criticises percentages, and is the more cautious the less he knows of the nature of the proposed undertaking. In the other case, his credulity is in direct proportion to the extravagance of the promise and the depth of his ignorance.

For example, we will suppose that you, courteous reader, are a scientific metallurgist, and that you have wrought out and patented a process for the better separation of the silver from argentiferous galenas. You are in want of capital to carry out your project, so you go to the Hon. Mr. Mortgage Bond, the well known millionaire, and lay the matter before him. You show him that by the usual processes a considerable percentage of the silver remains in the lead, much to its detriment. You show him that, by your process, which is less costly than those in use, the silver is more completely separated from the lead, giving you a threefold profit, in the cheaper process, in the gain in silver, and in the superior softness of the lead.

"That is all very plausible," he will reply; "but I'm a banker. I don't know anything about metal working. But I do know that schemes like yours never turn out so well as the projectors imagine. Then the risks are very great. You will have to compete with all the wealthy firms already in the business, and they control the markets and the mines. You will have this other difficulty to contend with, and that, and that, and that."

In vain you try to convince him that you will have the inside track: that with a cheaper process and a purer product, you need fear no competition. You can afford to pay more for the ore and so command it, while the demand for pure soft lead is such that you need have no fear of the rivalry of those who supply an inferior quality. Your breath is wasted. The cautious capitalist is shy of patent processes. He looks only at the risks of the undertaking, and resolutely shuts his eyes to the merits which make success highly probable.

But (begging your pardon) suppose you are an arrant swindler, and that, instead of laying before our incredulous capitalist a legitimate enterprise of assured success, you go to him with a cleverly devised fraud: say a scheme for turning lead into gold. You talk glibly and with a great show of learning. You quote from a long list of authorities to prove that the growing opinion of chemical investigators is that all matter is substantially one at bottom: that the different qualities of the so-called elements are the product of varying molecular arrangement. You assure him that such is actually the case; you have demonstrated it by the transmutation of different metals into each other, as for instance gold into iron, iron into silver, silver into lead, and lead into gold. You present him with a brick of gold weighing a pound, and tell him that it is the product of three pounds of lead. Theoretically two pounds of lead are equivalent to a pound of gold, you tell him confidentially, but there is some waste in the process of transmutation.

It needs no argument to show that it is a "big thing," too big for any one man to handle. So you propose to establish a stock company to develop it, the Universal Company of Gold Refiners, of which the Honorable Mortgage Bond shall be president, with the lion's share of profit, in consideration for the capital required to set the project on foot. Of course it would not do to publish the fact that the gold is made on the premises; that would bring down the price of gold with a rush, and disorganize all established values. Secrecy would be essential. But if he had any doubt that the product was really gold, he could easily prove its quality by sending the sample brick to the mint to be tested.

Ten to one, the Hon. Mortgage Bond would bite. It would be too great a prize to miss. He could afford to risk a little on it, and would take the chance.

One more illustration: perhaps a better one for these days of Keelys and the like, not to mention their dupes.

It is well known that, as coal is now burned, the best of engines develop but a small percentage of the actual power of the fuel consumed. Suppose a clever inventor should devise a boiler capable of evaporating a third more water with a ton of coal than any boiler now in use. The supposition is not an extravagant one, and the increase of power could be easily demonstrated. The economy of such an improvement would ensure its ultimate adoption, subject only to the risk of some one's inventing something better; yet the maker of it would find it no easy task to induce men of means to furnish the capital required to put the improvement before the manufacturing public.

But suppose the same man were to get up a perpetual motion of the modern type, call it the Schwindler motor or something of that sort, and have it certified as something transcending all known principles and powers by two or three engineers of easy credulity. There would be no end of newspaper correspondents to write it up in the most eloquent English, with head lines to match. The greatest invention of the age! Unlimited power at nominal cost! No fuel required! Simplicity and safety combined! Power derived by catalysis, evolving the expansive force of nitroglycerin with the precision and gentleness of a jack screw! Explosion impossible!! Power of engine inexhaustible!!!

To interested enquirers, Mr. Schwindler could frankly say that he made no secret of his sublime invention, being confident that a grateful public would see him suitably rewarded for the stupendous benefaction he was about to confer on humanity at large. He would call the motive power of his miraculous engine expansive glycerin, not nitroglycerin, but something still more powerful, yet absolutely controllable. Its power would be developed by the passage of the glycerin over a certain compound of metals known only to himself, by which the bland liquid would be converted by catalytic action into cold vapor of enormous tension: the vapor, having done its work, to be discharged into a receiver enclosing another combination of metals whose opposite catalytic power would reconvert it into liquid glycerin without loss of substance. Once charged—and a gallon of commercial glycerin would suffice for a thousand horse power engine—the generation of power would be perpetual, without additional expense. Combining superior economy with absolute safety, the Schwindler motor could not fail to supersede all others, the Keely motor not excepted.

And there would be no lack of men eager to take a chance in a scheme so promising. What if it does fly in the face of all experience? Haven't we railways, telegraphs, steam navigation, and a score of brilliant achievements that were once as incredible to the conceited professors of Science who thought they knew everything?

It is the gambler's delusion in another form. The magnitude of the promised prize hides the multitudes of blanks.

It is useless to tell those infatuated with the dream of impossible riches that the marvelous projects which achieved success were the legitimate outcome of scientific investigations, and always in harmony with the previously discovered laws of Nature. The swindler's victims will know nothing of such things. They are not amenable to sober reason. There's a big prize in view, and they are determined to "go" for it.

THE KEELY MOTOR DECEPTION.

We continue to receive hundreds of newspapers from all parts of the country, containing the most fulsome endorsements of this most puerile deception. Nothing more lamentably exhibits the general lack, in this country, of elementary scientific education, than the editorial comments upon this subject by many of the papers. With very few exceptions, the writers are unable to perceive why the Keely chimera may not be true, the general line of argument and thought being that, inasmuch as modern discovery has heretofore revealed and produced inventions quite as startling as anything assumed by Keely and his abettors, therefore *it may be* that what he claims is well founded; and it is unwise, imprudent, to throw doubts upon his statements, especially when they are so thoroughly supported by other persons of reputed intelligence and veracity. To all of which it is a sufficient reply to say that any inventor who pretends to get something out of nothing, or to produce more force or more substance out of a given quantity of materials than they possess, is a deceiver, no matter how many respectable people join hands, like the Keelyites, to support the deception.

"People," says Keely, "have no idea of the power in water, I mean that can be drawn out of it. I purpose to run a train of thirty cars from Philadelphia to New York at the rate of a mile a minute, out of as much water as you can hold in the palm of your hand."

Both of these statements are incorrect. Estimating approximately, the power in water, or the power that it can be made to furnish, whether in liquid or vaporic form, is perfectly well known. Four thousand gallons of water, falling one foot in a minute, furnish one horse power. One sixteenth of a horse power is furnished by one cubic inch of water, if converted into vapor at the ordinary atmospheric pressure. To run a train of thirty cars from Philadelphia to New York, at the velocity of sixty miles per hour, would require not far from two hundred barrels of water and over two tuns of coal.

These are among the elementary facts pertaining to motive engineering, which no Keelyite can set aside; and which, if they were kept in mind by editors, would enable them to perceive at a glance the grossness of the present deception.

In further illustration of the need of better educational training among our business men, as a protection against stock-jobbing deceptions wrought and maintained in the name of Science, we give in another column a few gems from the most recent declarations of Keely. These were lately made to the correspondent and reporter of *Inter-Ocean*. We also give extracts from the statements of some of Keely's chief assistants, showing the rise, progress, and management of the deception. The price of the Keely stock, which at one time was very high, is beginning to ebb, and in a short time all the beautifully engraved stock certificates will doubtless find their way into the cellars of the rag and paper dealers.

THE NEW PHYLLOXERA REMEDY.

We took occasion recently to announce the discovery, by M. Dumas, of an efficient phylloxera remedy, in the alkaline sulpho-carbonates, a class of salts which hitherto have been more objects of scientific curiosity than available for any beneficial employments. As the vine growers in this country are directly interested in the result of M. Dumas' very important investigation, we propose briefly to review the nature of the above chemicals, in giving below a few facts, for which we are indebted to *La Nature*, relative to the researches of the well known French chemist.

Everybody is familiar with the potashes, sodas, and the lime of commerce. If in these substances the oxygen contained be replaced by sulphur, the sulpho-carbonates of potassium, of sodium, of calcium, and its analogue, the sulpho-carbonate of barium, are obtained. Of these, the salt most utilized at present is the sulpho-carbonate of potassium, made by calcining sulphate of potassium with carbon, forming by reduction a monosulphide of potassium. A saturated solution of the latter is made in water, and sulphide of carbon added, when, after prolonged agitation, a reddish orange liquid, marking 37° to 40° on the Baumé areometer, is obtained.

While the sulphide of carbon is by itself an efficient insecticide, it offers disadvantages through its volatility, injurious vapors, etc., which neutralize its benefits. The sulpho-carbonates on the other hand have no disagreeable odor, are not dangerous to handle, are not inflammable, and are unalterable in the soil. When in contact with acids, however, even if these be the weakest, and especially when acted upon by the moist carbonic acid which arable earth imbibes, the salts are transformed into carbonates, and disengage sulphide of carbon and hydrosulphuric acid in vapors, both of which, and especially the first, are highly poisonous. To combat the phylloxera, such gases, as experiment has proved, are the only effectual means. It is necessary not merely to poison the insects upon the vines and roots, but to render the earth in the vicinity uninhabitable by them. Besides some such substance as the salts alluded to must be employed, on account of the slow reaction of the acid, keeping up a supply of deleterious gas for several days, or longer than the insect can defy its influence by shutting its respiratory orifices.

It is found that 1442 grains of sulpho-carbonate of potassium will poison from 111 to 132 cubic feet of air, and will drive insects from 198 to 281 cubic feet of earth, killing not merely the comparatively delicate vine louse, but the larvæ of crickets and other large insects. The mode of application is to make a hole at the root of the vine, about 1 foot deep and 16 inches broad. Into this pour five or six quarts of water mixed with from six to eight quarts of the sulpho-carbonate solution at 40° Baumé. When the liquid is well absorbed, the hole is filled up, and the operator passes to another vine. The solution is thicker than water, and, when mingled therewith, percolates slowly through the ground, reaching the deepest roots.

In order to render the sulpho-carbonate of potassium or of sodium, which salts closely resemble each other in their toxic properties, easily portable, M. Dumas suggests mixing them with twice their weight of slaked lime. The powder thus obtained is very easily sprinkled over the surface of the soil.

RATE AND CAUSE OF GLACIAL MOTION.

The movement of a glacier has many resemblances to that of a river. It follows the windings of the valley; is more rapid in the center than at the sides, at the surface than at the bottom, because the center of the surface is subject to the least friction; the part having greatest motion changes to the right and to the left of the center as the glacier changes its direction; it moves more rapidly when the descent is steepest, and where there are least obstructions; it becomes broken up and uneven when the bed is rough; and a large stream is often made up of smaller ones joining one another. The distance to which the ice river flows depends upon temperature and the amount of precipitation. In cold and wet years, it may extend fifty feet further than ordinarily; while under opposite conditions, the lower edge of it may melt away more rapidly than it advances down the valley, and hence seem to recede. It always descends in summer beyond the region of snow and ice, and flowers and other summer vegetation are not uncommon in close proximity to the ice mass. The force with which a glacier advances is so great that trees and forests, houses and villages, offer no more apparent resistance than a straw in its way.

Many students of glaciers have made investigations more or less carefully, respecting the rate of glacial movement. But there are so many modifying circumstances—as position and formation of the valleys; inclination, size, and thickness of the glacier; influences of the seasons and the weather—that even in the same glacier the rate is so variable that no universal law can be established. Some move most rapidly at the upper part, least at the lower, and just the average in the middle, while others move with greatest rapidity at their lower extremity. Eight inches per day may be considsidered a fair average of all glaciers and all parts of each. In the earlier investigations on this subject, only rough and inaccurate means were used for making the measurements, such as building a hut on the ice, or leaving some object, as De Saussure's ladder, on the surface, and noting how far it had descended each year, or after an interval of several years.

The works of James D. Forbes on glacial phenomena rank among the classics of physical science. He was a precocious Scotch youth, whose mother, by the way, came very near being the wife of Sir Walter Scott when she was young; the only thing that prevented was the simple fact that she said "no" when Sir Walter wanted her to say "yes." Young Forbes was studying Science, and entreating his father to buy him a telescope when a mere child. At eight, he composed sermons. Before ten, he was reading Phædrus with his father, having previously read Cæsar. At seventeen he was contributor to the Philosophical Journal, then edited by Sir David Brewster. At twenty-four he was elected to the chair of Natural Philosophy at Cambridge. He was then a member of the Royal Societies of Edinburgh and London, and writer in the Edinburgh Review. This savan, better known as Principal Forbes, made the first accurate determinations concerning the rate of glacial movement. He used the theodolite which his father gave him, in place of a telescope. By mounting this upon the glacier in various positions, and taking an exact point of observation on the wall rock, he made correct measurements at fixed intervals of time. He also set up rows of pegs in exact line across the glacier, and, by noticing their later deviations from a straight line, determined the rate of motion in different parts.

From these exhaustive and delicate observations, he arrived at the following conclusions: (1) Glacial motion is approximately regular; (2) it is nearly as great during the night as during the day; (3) a marked increase of motion is due to heat of the weather; (4) the center of the glacier moves more rapidly than the sides.

The cause of this motion has been subject to much discussion, and, cold as the subject is, it has occasioned frequent heated contests and many warm words. Beds of tough clay will rest on a considerable slope without sliding; loose stones and *débris* will rest on a hillside with an inclination of 80°; and at the embankment formed by the material shot out from Mount Cenis tunnel, the inclination is much steeper than this. But ice, more rigid than the hardest clay, will move on a slope inappreciable to the eye. And the question stated is: "What property does ice possess which enables it to creep upon slopes down which only fluids and semi-fluids can move?" De Saussure ascribed the motion of ice to a mere gliding or sliding upon an inclined plane, like that of a piece of slate detached from the roof. But this could not take place over a very rough bed or in presence of an immovable obstruction. De Charpentier—and, in his earlier writings, Agassiz—explained the movement by an expansion of the mass due to freezing, in the crevices, during the night, of water which melted during the day. But this would necessitate an alternation of rate between day and night which the best observations do not detect.

In review of Principal Forbes' results, it is not strange that he looked upon the glacier as a river of ice, and attributed its motion to the viscous or plastic nature of the mass, in consequence of which it is urged downwards by its own weight, like tar or treacle. An infinite number of minute rents occur when the ice is subject to violent strain, and the bruised surfaces are forced to slide over one another, producing a *quasi* fluid character in the motion of the whole. This is quite consistent with the rapidity of motion in different portions, due to friction, inclination, and bulk of the glacier, and its compression on entering a narrow passage, and expansion as the channel widens. But we can hardly conceive that ice, with its known unyielding and brittle nature, could thus be changed merely by its own weight. Tyndall also ascribed the motion to fracture and regelation, due to the pressure of its own weight, and extending to every minute particle. Faraday had previously noticed that two moist pieces of ice freeze together when in contact. Canon Mosely opposed the last two theories with the idea that there is a constant displacement of ice particles over and alongside one another, to which is opposed that force of resistance known in mechanics as shearing force, which force weight alone is not able to overcome. He claims that, considering ice a solid body throughout, there must be some other force besides gravity to drive it forward, as even clay, so much more yielding than ice, does not descend by mere weight.

Another theory held by Professor James Thomson and his brother, Sir William, and advanced by two or three others about the same time, is based on the idea that the freezing point of water is lowered by pressure. Condensation as the result of pressure diminishes the capacity for heat, and hence some latent heat becomes sensible. This free heat, instead of remaining free, expends its force in melting contiguous molecules of ice. As water occupies less space than ice, the melted ice makes more room for the unmelted particles; these then have space to yield to pressure, and move in the direction in which it is exerted. The water, subject to less pressure, moves in the direction of gravity, and, coming in contact with ice colder than itself, freezes. The ice again resists pressure and is melted, and in this way there is a constant change in the position of molecules, which has the effect of giving ductility and movability to the mass. Ice has been subjected to great force in Bramah's hydrostatic press, by which it can be made to assume any desired shape by the use of suitable molds. This is explained by supposing that the pressure liquifies the ice, which, in the melted state, conforms to the shape of the mold and then consolidates when the pressure is removed. This theory seems quite plausible and is accepted by many. The only apparent objection is in the question as to whether the weight of the superincumbent mass is capable of producing pressure sufficient to liquefy the ice below; and we are not aware that this question has yet been conclusively answered.

Croll's theory, which is considered the only tenable one by another class of physicists, ascribes the motion to heat rather than to pressure. The heat of the sun melts the surface of the ice, and if it were constant would in time melt the solid mass; but when the sun's rays are removed from any molecule, it congeals and, by its condensation, gives off heat which melts another molecule. The molecule, during the instant it remains water, is acted upon by gravity and assumes a lower position in the ice mass; this on freezing gives off its heat to a lower molecule, which in its turn seeks a lower place. The heat of the sun is thus transmitted through ice by the melting and freezing process, from molecule to molecule, and every melted molecule sinks lower in the mass. Thus the sun's heat causes the ice gradually to work down hill. The sun is aided, in heating the interior, by warm winds and rains which are admitted by cracks and fissures (always abundant), by the internal heat of the earth, and by heat caused by friction of the moving mass on the bottom. Experiments made by Professor Agassiz, by means of a hole in the ice 200 feet deep, lead to the conclusion that the internal part of a glacier has a comparatively high temperature, and in winter this is greater than the surrounding atmosphere. But his results were somewhat contradictory, and the real state of temperature in the center is mainly a matter of conjecture. The objection to this theory appears in Forbes' results, that motion is approximately regular—nearly as great during the night as during the day.

All the investigations thus far noticed on the rate and cause of glacial motion have been confined to local glaciers, like those of the Alps. In our own age there is manifestly but little opportunity to study phenomena connected with any existing continental ice sheet. We may some day obtain information in this line from a study of a sheet glacier of Greenland, and would doubtless have been able before now, if arctic explorers had succeeded in reaching points sufficiently far north. Agassiz said, at Penikese: "Since we have no positive data, we can form some idea of their motion by the number of icebergs which they send forth annually; for these icebergs could not exist but for the advance of the glaciers into Baffin's Bay, where their ends are lifted up by the water, broken off, and floated south. We do not know what these icebergs amount to, though it would not be difficult for an observer at the south end of Baffin's Bay to ascertain approximately by counting the number of icebergs that pass a given point annually." He assumes that the continental glaciers moved at least as fast as 100 feet per year. At this rate it would take over 50 years for a boulder of Lake Superior copper to travel one mile south; and as some are found 500 miles south of their home, it would have required 25,000 years to reach this distance. This affords us one of the many indications of the vast antiquity of our globe.

In the Boston Society of Natural Science a few weeks ago, Professor Shaler, while accepting Croll's theory in the main for the movement of local glaciers, advanced the belief that the cause of *sheet* glacial movement was the melting of ice at the bottom by the pressure of the superincumbent mass, and that this water, in its effort to escape in the direction of least resistance—or towards the edge,—would push forward boulders, gravel, etc., and thus cause the southerly movement of erratics. He thinks the ice sheet itself did not move, and attributes the cause of scratchings on the boulders and bed rock to local movement at the edge of the ice sheet when it was melting, which movement Mr. Croll's theory may explain. The continental glacier, on account of the unevenness of the earth's surface, must often have moved up hill for miles, and sometimes for hundreds of miles, if it moved at all, and for this he thinks there is no adequate explanation.

SCIENTIFIC AND PRACTICAL INFORMATION.

GROWING ROSES.

"An Old Rosorian" says: "Roses require a strong soil, highly enriched with good rotten manure; an open situation and loamy soil for the strong growing, hardy kinds, and a protected aspect and light soil for the teas and other tender varieties. The hybrid perpetuals in my judgment are the most desirable among the hardy roses, as they are the best for all the various purposes to which they are applied in garden and lawn decoration. The teas, however, are the diamonds *par excellence* of the race, although needing great care in their culture. I advise that they be grown in pots, and sunk in the ground during the summer, and removed to a cold frame or greenhouse during the winter. If left remaining in the open ground, they should stand on the south side of a wall, fence, or hedge, and on the approach of cold weather, receive a covering in the form of a shed open to the south, and the plants have a liberal supply of manure over the surface of the ground, and plenty of leaves over the whole plant. If roses are set out in autumn, perform the operation very early in November, so as to allow the roots to obtain a hold in the soil before cold weather. Give them a thorough dressing of manure to protect against sudden changes. Choose a dry day for planting, the drier the better. Be careful to tread the soil firmly around the plants; this is very important. A cloudy day is the most desirable for removal; and moisten the roots first, to be followed by a thin coat of dry earth over the fibers."

CHEAP COOKERY.

We noticed, while visiting a large steel-making establishment recently, that the workmen at noon ingeniously utilized the ingots of steel, which lay cooling in the yard, as cooking stoves, and seemingly prepared their dinners over the heated metal as easily as over a fire. The idea is a good one, and might be adopted with advantage by the men in all metal-working concerns. We believe that the custom is not common among the workmen in this country, nor in the ironworks in England, though it owes its origin to and has long been practised in the tin melting establishments of Cornwall. It is considered quite a civility there to offer a visitor a chop nicely broiled over a recently run ingot of tin. The big hammer block, we were told as an especial wrinkle, is the best place to fry things, as it is smooth and usually just hot enough. Ingots are ordinarily rough and generally somewhat too warm. In winter time, a workman can economize considerably, and at the same time get a hot dinner, by thus utilizing the wasted heat of the metal.

PORTLAND CEMENT.

Three tests are used:—1. Resistance to tensile force. 2. Specific gravity. 3. Water test. The first is by making a specimen briquette in a mold with a transverse section of 2·25 square inches, the specimen being held vertically in clips, which is placed under the short arm of a steel yard balance, and broken. Mr. Bazalgette used a test of 500 lbs. on an area of 2·25 square inches after 7 days immersion in water. The second method is by finding the weight in pounds of the struck bushel. The water test is useful when the others cannot be applied. It consists of gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality. The weight of good Portland cement ranges from 100 lbs. to 130 lbs. per bushel, equal to from 80 lbs. to 102 lbs. per cubic foot. The lighter kinds set more rapidly than the heavier, but are weaker. Mr. Bazalgette specified a specific gravity of 110 lbs. to a bushel.

THE VORACITY OF PICKEREL.

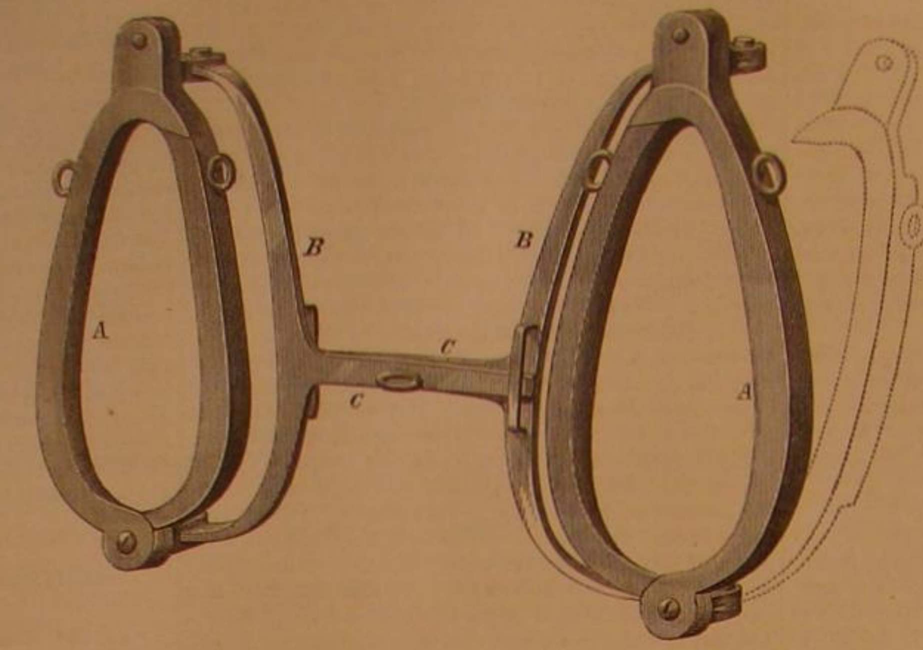
According to M. Peupion, who has been practically investigating the subject, a pickerel will eat 47 pounds and 4 ounces of fish per pound of its own weight per year.

THE following is one way to cut a bottle in two: Turn the bottle as evenly as possibly over a low gaslight flame for about ten minutes. Then dip steadily in water; and the sudden cooling will cause a regular crack to encircle the side at the heated place, allowing the portions to be easily separated.

IMPROVED HORSE YOKE.

The horse yoke illustrated in the annexed engraving is intended to enable horses to be attached to plows and other implements without using traces or whiffletrees, enabling the horse to perform his labor with ease, especially among trees and in other situations where the whiffletrees obstruct the work. The hames, A, are placed on the horse collar, as usual, and are made in two parts, hinged together on a pivot at the bottom, and fastened at the top by a screw. B B are the two sections or the yoke, which are joined by the horizontal bars, C. The hames, A, are made with projecting ears, which are slotted horizontally to receive the ends of the yoke, which are jointed by pins or screws in the top and bottom of the hames. The bars, C, are joined by the draft pin, shown in the engraving, and can play up and down to accommodate the position of the horses. It will be seen that the yoke is self-adjusting, the hames turning freely on the pins by which they are jointed to the yoke. Breeching and cruppers may be used when considered necessary, but harness in general can be dispensed with by using this arrangement.

Patented April 13, 1875, through the Scientific American Patent Agency, to Rufus Stratton and George Olmsted. For further particulars address the inventors at Hazardville, Conn.



STRATTON AND OLMSTED'S HORSE YOKE.

A NEW PYROMETER.

M. J. Salleron is the inventor of a novel form of pyrometer, an engraving of which, herewith given, we extract from *La Nature*. The instrument consists of a cylindrical vessel, C, Fig. 2, of copper contained in an outer brass jacket, E. *d* is a disk of wood supporting the inner vessel, the radiation and conduction of heat from which is farther diminished by the air space intervening between it and the enveloping cylinder.

The vase, C, is first filled with about half a pint of water measured in the flask, V, and the initial temperature of the liquid, *t*, is noted from the thermometer, T. A cylinder of copper, M, weighing 1,530 grains, is then placed in the furnace, the temperature of which it is desired to measure, and is held in a recess in the end of an iron tube, L. As soon as the cylinder is heated to the same degree as that of the furnace it is quickly removed, and, by reversing the tube, L, dropped upon a stand inside the vessel, C, which stand is then agitated by means of the rod, *a*. The mercury in the thermometer will rise rapidly, and finally remain standing before beginning to descend. While stationary its indication, t', is noted. The temperature can then be calculated by the formula: Temperature $=50\ (t'-t)+t'$. For example: Suppose before the immersion of the copper the temperature of the water is 15° C$=t$; after the experiment it is 25° C$=t'$; then the temperature of the locality measured, $T=50(25-15)+25=525°$ C.

Copper cannot be employed for determining temperatures exceeding 1,832° Fah.=1,000° C, since its point of fusion is too nearly approached. In such case a platinum cylinder, M, weighing 2,355 grains may be used, and the coefficient 50 in the above formula is replaced by 100.

It will be seen that this plan offers a simple instrument for determining high temperatures, which any mechanic can easily make, or which, in case of necessity, may be extemporized with always available materials.

Fig. 1.

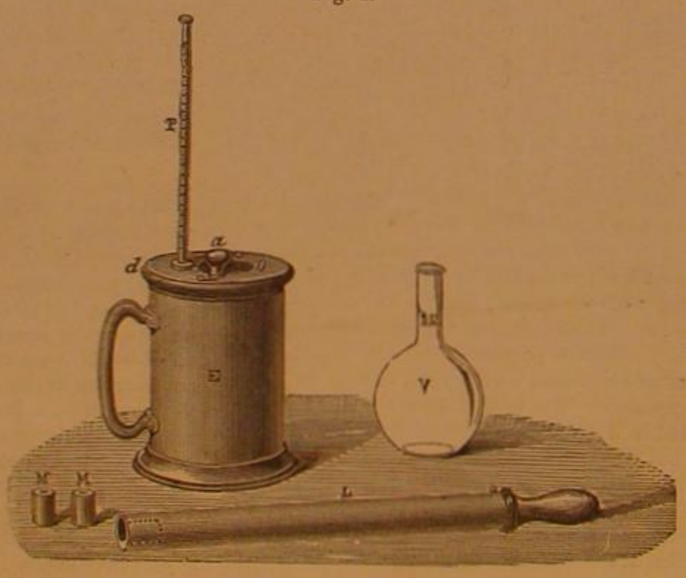
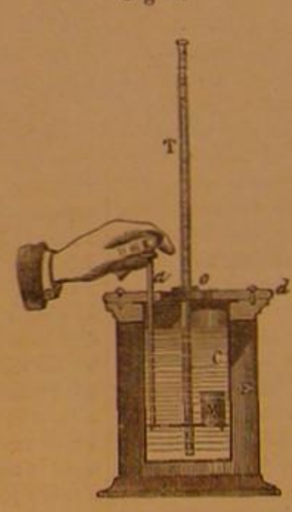


Fig 2.



SALLERON'S PYROMETER.

Reducing Force.

It is the practice of many manufacturers, on the approach of the dull business season, usually beginning about the present time, to seek to economize by discharging a number of their workmen, giving the latter to understand that they will again be employed when trade becomes brisk in the fall. This course, naturally the first to suggest itself under the circumstances, does not appear to us to be the wisest that can be adopted. It certainly does not enure to the benefit of the discharged workmen, who find themselves out of a situation at the very time when work is hardest to get, nor are the employers likely to gain much in the long run, when they sever their connection with hands thoroughly familiar with all details of their particular business, and run the risk of having to instruct a new gang in the fall, should the old workmen prefer to remain in places obtained during the summer. We have always advocated the view that, if both employers and employed would treat each other more as men and manifest a reciprocal interest in each other's welfare, there would be less feeling on the part of one class that workmen are but machines to exact the greatest amount of labor from at the least cost, and less of the efforts on the part of the workmen to extort the greater amount of wages from their employers in return for the least and poorest labor.

The *Carriage Monthly* takes a very sensible view of this custom of reducing force in the summer time, and suggests a method whereby the same may be avoided, which, at the same time, is just as economical and much better calculated to meet the favor of the workmen. "If it became necessary to reduce our force, were we engaged in manufacturing," says the editor, "we would assemble the whole number and address them in this wise:

"Gentlemen, the present standing of trade will not permit our continuing a full force. Neither do we wish to, nor will we, discharge any competent employee. Such work as we have we will give you. So many will work each week in each department, and alternate, so that the amount will be equally distributed. This will allow all engaged in our employ to earn at least part if not full wages. If there are any who may feel aggrieved, and prefer accepting other situations, we shall place no obstructions in their way, and shall gladly receive them into our employ on a full resumption of business."

To those who have never tried this method, we would suggest that they give it a fair trial, and compare notes of this plan with notes of the old one of a wholesale discharge. Unless it be most needy operatives, there is hardly a man in the whole force but would gladly accept a few weeks' recreation after many months of arduous toiling.

Snow-White Salicylic Acid.

It is well known that the salicylic acid prepared by Kolbe's process does not possess a pure white color, but is more or less yellow. The salicylic acid manufactured and furnished to the trade by Dr. F. von Heyden in Dresden, according to the above patent, is a whitish powder with a strongly yellow hue, from which by recrystalization tolerably colored crystals are obtained. Kolbe himself says that, in order to obtain snow-white salicylic acid, the crude acid should be converted into an ether by the usual method, and this again decomposed by caustic soda, and so on. However, the boiling point of the ethylic as well as the methylic ether is so high that at this temperature a portion of the salicylic acid begins to decompose. For my part, I have never succeeded in obtaining in this way more than one fourth,of the quantity of salicylic acid originally employed, in the form of a chemically pure product.

As the use of salicylic acid for medicinal and surgical purposes is continually increasing, a method of purification, whereby the yield is much larger and almost the entire quantity of salicylic acid present can be separated from its colored impurities with little trouble and at a small expense, will be welcome. Salicylic acid, we know, cannot be sublimed without decomposition. It splits up into carbonic and carbolic acids. On the other hand, salicylic acid volatilizes in a space filled with any gas or vapor at a temperature far below its boiling point and even far below its melting point. If the vapor from a boiling aqueous solution of salicylic acid be condensed, it readily gives the reaction of this acid; and if salicylic acid is exposed to a current of air heated to 212° Fah., it rapidly loses weight.

I made use of this phenomenon in the process here described for the preparation of pure salicylic acid, and found, after many unsuccessful experiments, that superheated steam was best adapted to the distillation of salicylic acid. For this purpose I had made a little double-walled copper boiler, by placing two copper tubes of unequal diameter one within the other, and closing the ends with plates of copper soldered with hard solder. The space between the two tubes was filled through a suitable opening with melted paraffin, and in this opening was placed a thermometer so that I could continually observe the temperature. The interior of this double boiler held the crude salicylic acid, and to the highest part was attached two tubes. One tube served to introduce the superheated steam; through the other the boiler was filled with crude salicylic acid, and it afterwards served as exit for the steam laden with acid. This tube should have a diameter of at least 0·6 inch, because otherwise it is easily stopped up by the escaping salicylic acid. The double walled boiler used in my experiments was so large that I could operate on about as much as 2 lbs. of crude acid at one time. To the last mentioned tube of at least 0·6 inch diameter, is attached a straight tin tube of the same width, passing through a Liebig's condenser and kept always cold. On the upper end of the tin tube, where it is connected with the copper boiler, a small lead tube with a funnel is soldered on; and through this, cold distilled water is allowed to drop continually during the distillation.

When the apparatus is all arranged, the boiler is heated until the thermometer in the paraffin marks 338° Fah. Superheated steam at 338° Fah. is allowed to enter the interior space through the narrower tube. This steam is generated in a glass flask of 3½ pints capacity,and is superheated by passing it through a long thin lead pipe coiled in an iron pot containing paraffin, which is heated to 338° Fah. As soon as the crude salicylic acid has acquired the temperature of the surrounding paraffin, which always takes some time,its distillation begins, the acid passing off with the accompanying steam so rapidly that the tin tube would be stopped up very soon, in spite of the continually dropping water, unless the pipe is continually cleared by means of a glass tube, or, better still, a split stick of well boiled pine wood, which reaches all the way to the boiler. The salicylic acid appears at the lower end of the tin cooling pipe as a thick magma of snow-white color, and is caught in a beaker glass placed under it. At the close of the operation the temperature of both paraffin baths is raised to 365° Fah. In about 2 hours, the operation is finished. Only a slight black resinous residue remains in the boiler. The salicylic acid which goes over has only a slight odor of carbolic acid. By pressing out the crystalline mass, boiling it in distilled water, and recrystallizing, it is easily freed from the carbolic acid. By recrystallization from distilled water (well water, or a filter which has not been washed with hydrochloric acid,contains enough iron to impart to it a reddish color), it can be obtained in beautiful, absolutely white crystals. One must not neglect to carefully clean the tin tube with ether before beginning the operation, to remove the grease that always accompanies the manufacture.

In the manufacture on a large scale, high pressure steam could be substituted for the paraffin baths. In high pressure steam itself, employed directly, the salicylic acid scarcely distils at all. I tried, among other things, to distil the acid by the direct action of steam at a pressure of 5 atmospheres, at which pressure the temperature is 320° Fah., but did not succeed; the steam scarcely carried a trace of acid with it. Evidently the boiling point of the acid was correspondingly raised by the increased pressure. I conjecture that the distillation of salicylic acid under diminished pressure, say half an atmosphere, would take place still more readily.

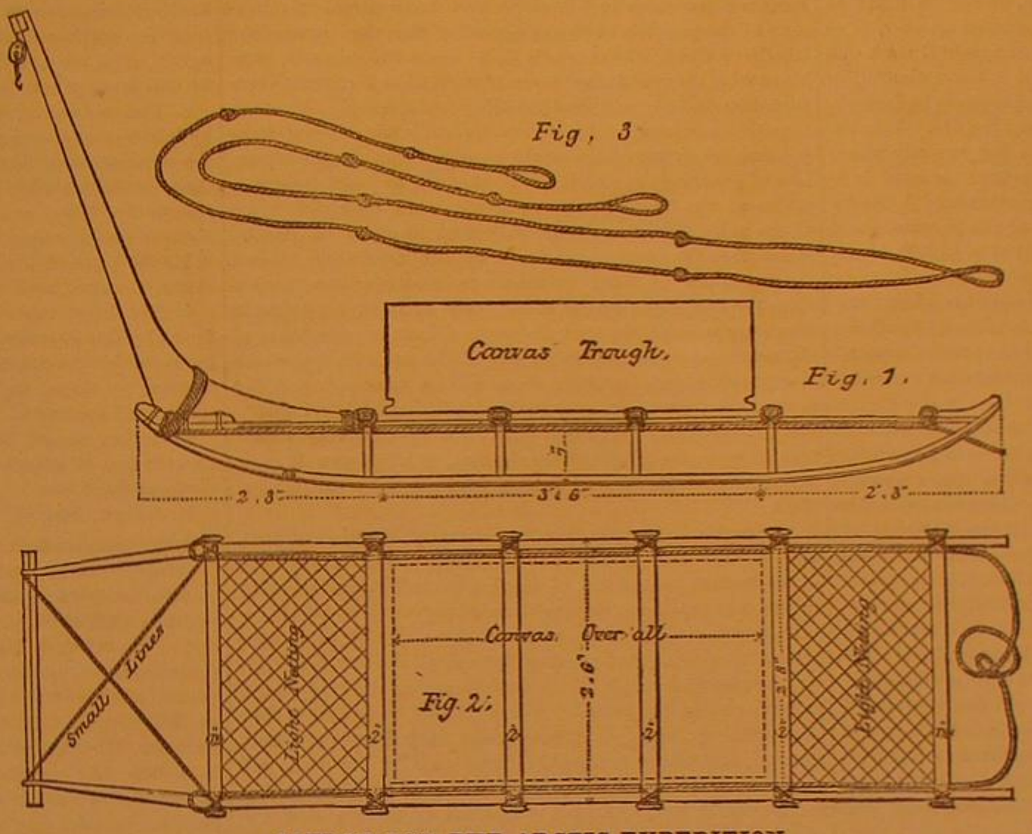
I would farther recommend a stirrer for the salicylic acid boiler, so as to give it more opportunity for contact with the vapor passing through it.—*Dr. Aug. Rautert, in Polytechnisches Notizblatt.*

A LONDON architect has submitted to the municipal authorities of that city a plan for a gigantic pyramidal necropolis, which is to cover five acres of ground, and yet be capable of holding in its vaults 625,000 corpses.

TO EBONIZE wood, collect lamp black from a lamp or candle on a piece of slate. Scrape off the deposit, mix with French polish, and apply to the object in the ordinary way

THE NEW ARCTIC SLEDGE.

Among the many elaborate arrangements for securing success to the British Arctic expedition, a new form of sleigh (or sledge, as the English call it) is to be employed, and *Engineering* gives the following account of the vehicle and its use:



SLEDGE FOR THE ARCTIC EXPEDITION.

After passing through Davis' Strait and up Baffin's Bay, the vessels will push on at once northward through Smith Sound, which has of late years been explored by the Americans as far as the 82d parallel. One of the advantages of this route is that, it having been determined that Smith Sound, as far as it had yet been explored, is bounded by a continuous line of coast, stations could be fixed all along it, where provisions might be left, so that in case of any accident happening to the ships so as to necessitate their abandonment, there would be a safe journey back to Baffin's Bay insured, on the banks of which, at Upernavik and other places, Danish settlements exist. There is a hope, too, that this coast line stretches still further northward, and this route thus affords additional advantages to the sledge exploring parties, as they would not be tied so much to time their return home before the breaking up of the ice as would otherwise be the case. This return home, when it has to be accomplished over the frozen sea, is sometimes a matter of considerable danger; and as it would be impossible for a single sledge to go by itself further away from the ships than the distance which could be traversed while half its provisions lasted, the following system of combined movement is adopted. A number of sledges start together, each with its proper complement of men under an officer, and all provided with sufficient provisions to last for fifty days. After traveling together for six days one sledge is dropped with only six days' provisions to take it back to the ships, the remainder of its provisions being divided up among the other sledges. The dropped sledge immediately returns to the ships, reprovisions, and proceeds to the original point where it was dropped, where it forms a depot. The remaining sledges, in the mean time proceeding onwards, continue to drop a sledge at the end of every six days, making up their fifty days' store of provisions from each one before leaving it. Each sledge as it is dropped forms a depot, and returns to reprovision from the one already established behind it. In this way a constant communication can be kept up with the ships as a base of operations, and the last sledge allowed to proceed forward fully provisioned for a journey of 50 days. The sledges which have been provided for the expedition are of three sorts, namely, 5, 7, and 12 man sledges respectively.

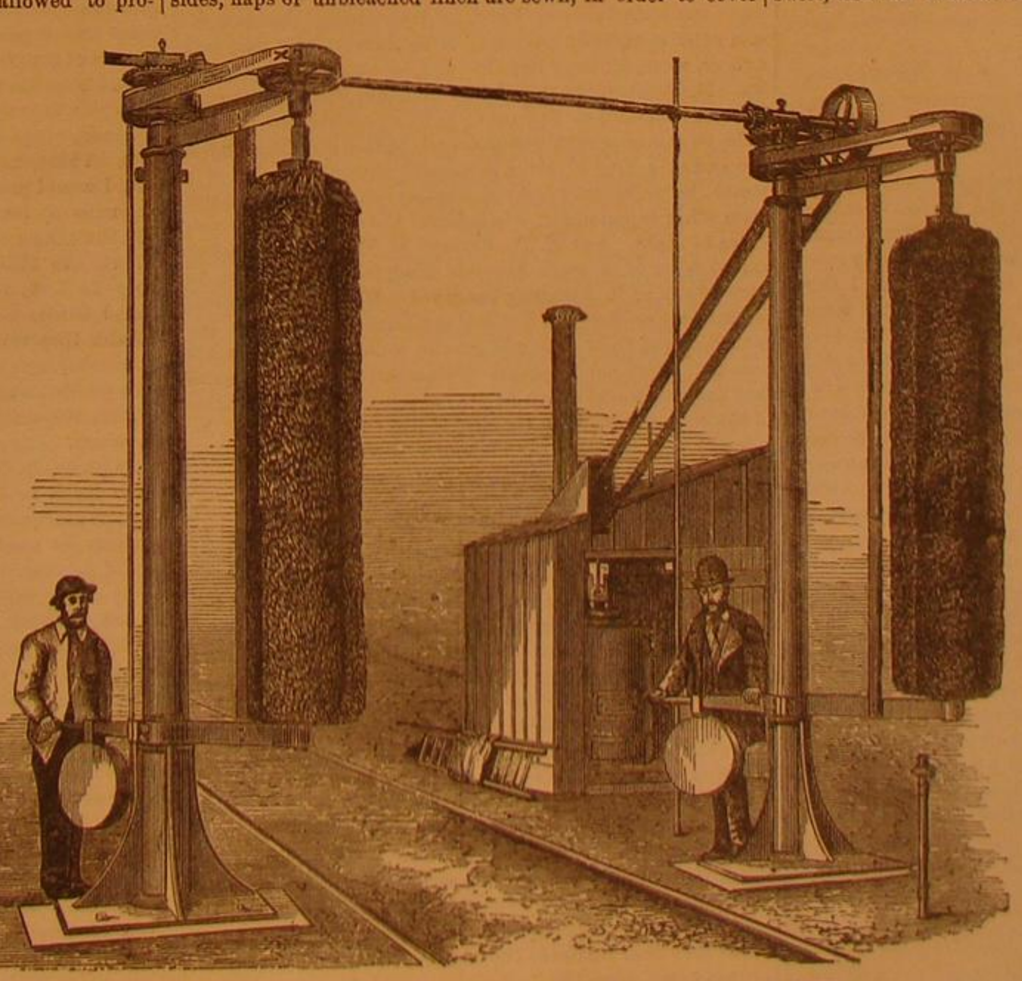
The accompanying engravings show a 5 man sledge, which consist of two runners made of English ash, straight for a length of 3 feet 6 inches amidships and turned up for a distance of 2 feet 3 inches at each end, and fitted with a steel shoe plate $\frac{1}{16}$ inch thick and two and a quarter inches broad. The bearers, on which the platform of the sledge is laid, are made either of English ash or Canadian elm, secured to the runners at each end by an elm chock, and supported by ash poppets tenoned into both the runners and bearers, and riveted through with brass rivets $\frac{1}{8}$ inch in diameter. The crosspieces, which are also of ash, are 2 feet 8 inches long, 2 inches wide, and 1 inch thick, slightly rounded on the top, and are lashed to the bearers with straps of hide which has been previously rendered soft and pliable by being soaked in warm water. When these lashings get cold, they shrink exceedingly tight and hard. The drag rope span, which is fitted after the crosspieces have been lashed, is made of 1 inch rope with an eye at each end to fit over the horns of the rear end of the sledge. It passes through two small grummets on each of the cross bars, and a hide strap which is formed round the forepart of the runners. The bight is about 3 feet in front of the sledge and is provided with an eye and thumb toggle to fasten the drag ropes to. The latter (Fig. 3) are made of 1 inch rope middled, and have their bight toggled to the span on the sledge. Three Turk's heads are made on each leg of the drag rope at equal distances apart to fasten the drag belts to. These drag belts are made of light horse girth 3 inches wide and 5 feet long, with an eyelet hole worked in each end, into which a piece of 1 inch rope 12 inches long is spliced, having at its other end a copper toggle $\frac{1}{4}$ inch thick and $\frac{1}{2}$ inch in diameter. This is attached to the drag ropes below a Turk's head with a Blackwall hitch, so that in case of necessity it can be instantaneously detached by loosening the strain upon it.

To assist the crosspieces in forming a platform on which to fix the sledge bottom, two fore and aft lines are clove-hitched round the end crosspieces and stretched as taut as possible, being placed about 9 inches apart, and 9 inches from the side of the sledge.

The sledge bottom itself is formed of stout canvas, stretched down to the bottom of the sledge and laced to the two end crosspieces, and is intended to aid the sledge trough in supporting the load and to keep it from being chafed by the working of the sledge. The trough is also made of canvas, and has a tatling worked round its bottom edge (not, however, projecting beyond it), into which are let eyelet holes 6 inches apart, by which it is laced to the bearers and end cross pieces in order to keep it in its place. To its ends and sides, flaps of unbleached linen are sewn, in order to cover the lading and to keep out the snowdrift and cold. At each end a network is stretched to take the cooking utensils, which are the last things put on and the first taken off. The lashings for fastening down the lading on the sledge consist of 12 fathoms of 1 inch untarred hemp or manilla rope. The sledge back forms no unimportant item in the construction, as on it can be hoisted a sail, which, in case of a fair wind, is of great assistance in relieving the men from dragging. This back is shown fitted in the diagram, and is attached to the sledge by hide lashings.

IMPROVED RAILWAY CAR-WASHING MACHINE.

We publish herewith an engraving of an apparatus for washing the sides of railway cars, recently invented by the Earl of Caithness. It consists essentially of two large vertical brushes driven by a steam engine; a number of dirty carriages, making up a train of any length, is passed slowly between these revolving brushes; water is thrown upon the side of each railway carriage, 2 feet in advance of the brush, from a vertical iron pipe pierced with small holes, placed at an average distance of 8 inches from each other. A second water pipe, pierced with similar holes, directs another series of small jets of water directly upon the brushes. The whole arrangement is not very dissimilar in principle to that of hair brushing by machinery.


THE EARL OF CAITHNESS' CAR-WASHING MACHINE.

This invention was made and patented towards the end of last year. Lord Caithness recently visited this country, and, says *The Engineer*, "a week or two since returned, bringing with him an exceedingly efficient and well made stationary engine of 4 horse power, manufactured by the Baxter Steam Engine Company, at Colt's firearms manufactory. This little engine, which is very popular in America, is used to drive the brushes at King's Cross station, London, where the apparatus is in use.

In a recent experiment a train of twelve dirty carriages, of different sizes, was passed between the brushes. The time occupied in so doing was $4\frac{1}{2}$ minutes, and, although this was the first experiment tried with the completed apparatus, the results were gratifying. During these four minutes it became evident to the observers that three conditions at least affected the results. The chief of these was the velocity with which each carriage was drawn between the brushes by the locomotive, those which were passed most rapidly being less perfectly cleansed than those drawn more slowly. Another condition was the amount of pressure of the brushes against the sides of the carriage, which pressure was completely under the control of the man who used the apparatus. A third condition was the distance between the holes in the vertical pipes, which projected the water upon the sides of the carriages. The motion of the train, as the small jets of water played upon it, caused the jets to describe parallel lines upon the sides of the carriages; and when the motion was too swift, and the brushes themselves not quite saturated with water, small portions of the carriages were liable to pass without being wetted. These and other little points were noted before the train had passed half way through the brushes on its first trial; the speed of the train and the pressure of the brushes were then so regulated that the last half of the train passed as perfectly washed as could be desired. Before the train passed between the brushes it was palpably dirty, and after it came out it was palpably well cleaned, windows and all.

In using apparatus of this kind in practice, the trains will probably have to be pushed backwards and forwards on sidings, so that they will run between the brushes once in one direction and once in the other; but in order to brush them on each of these occasions, it will be necessary to use reversing gear to drive the brushes, so that they can be turned in one direction while the train is entering the siding, and in the other direction while it is leaving. The brushes are made of horsehair.

THE repeated applications, to copper or brass, of alternate washes of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze; but a quick mode of producing a similar appearance is often desirable. To this end the articles may be immersed in a solution of 1 part perchloride of iron in 2 parts water. The tone assumed darkens with the length of immersion. Or the articles may be boiled in a strong solution of nitrate of copper. Or, lastly, they may be immersed in a solution of 2 ozs. nitrate of iron and 2 ozs. hyposulphite of soda in 1 pint water. Washing, drying, and burnishing complete the process.

Correspondence.

The Iron Horse.

To the Editor of the Scientific American:

In your issue of June 12, you refer to the $5,000 prize, offered by the president of a horse railroad company in Philadelphia, for a substitute for the horse for working street railroad cars. The conditions required are that the device shall be acceptable to the company, that is to say, it must be satisfactory to at least two thirds of the members of the company; and that the company shall have exclusive control of it. To reach the first condition, an engine must be constructed in the most simple and substantial manner, at an expense of at least $3,000, exclusive of the mental work and the plans of the inventor; this would be a *low* estimate for the first machine, provided such could afterwards be furnished at $2,000 as a standard article of manufacture. The engine must then be placed upon the track and run any where from six months to a year, two years perhaps, or until it is found possible or impossible to satisfy two thirds of the members of the company, all at the expense of the inventor; and the cost will probably amount to from $800 to $1,500, in addition to the $3,000 for the engine.

If the invention proves to be more economical and satisfactory to the company, and less objectionable to the city authorities and the general public than the present horse system, the inventor receives $5,000, provided he deeds his entire interest in the invention to this company.

Doubtless the president and directors of this road are men of good sense and generous impulses, and would be willing to furnish the successful inventor with a free ticket home in addition to the $5,000 prize, and would also pass his name along to posterity. I think, however, that the $5,000 is offered as a reward for the use of an invention on their line only; if so, it is a very fair offer, and would enable the inventor to get a tolerable recompense for his invention eventually.

Were it not for an unaccountable prejudice against the use of steam cars on public thoroughfares, horse railroad companies would have a successful substitute for their horses in the shape of an improved steam car or light locomotive. A steam car has already constructed and tried which is competent to answer fully every reasonable condition as a substitute for horses on street railroads; all that is need to ensure its success is that the manufacturers on their part shall proportion the machinery a little better, and employ more thorough workmanship, and that the city authorities and the public on their part shall remove their prejudices and give a lively countenance and support to the enterprise, and the thing is done. Steam cars and light locomotives will soon become a more economical, successful, and satisfactory institution in our cities than the present system of horse cars.

The products of combustion from the improved furnaces of these light machines will prove to be far less annoying and deleterious to health than the products of combustion from the mass of diseased horse flesh now required to do this work. With horses, the process of consumption and contamination goes on continuously night and day, work or no work, until death; with engines it ceases with the hours of work.

Worcester, Mass. F. G. Woodward.

The Iron Horse.

To the Editor of the Scientific American:

As one of many inventors and patentees to whom you allude as engaged upon this problem, I did not fail to note the proposition of Mr. Flower on page 340, or your comments on page 369, vol. XXXII. You have therein very fairly stated the problem in most of its bearings, but one point I think was omitted. The problem, as I understand it, is not merely to obtain the power of one, two, or three horses, but to obtain that power with the condition of endurance throughout many consecutive hours. For instance, I am informed that it requires twelve horses to draw a street car sixteen hours. Hence, in one sense, the requirements of a street car come within the limits of "ten, fifteen, or twenty horse power," within which you give the opinion of the Scientific American that the locomotive is preferable. Again, while as you say the horse is easier to raise than to build a locomotive, the cost of twelve horses is considerably more, at present prices; and the stokers will agree that coal for the engine is cheaper than oats for the horses. And to whatever evils the iron horse is subject, including priming, running away, and premature dissolution by explosion, he is not, thus far, subject to the epizoötic; yet his introduction will not lessen, but rather increase, the usefulness of the most universally useful animal in the world, as the locomotive has already done.

When analyzed, this problem is but a form of an old contention, or rather emulation, as to which can work best and most effectively, cheap labor or expensive skill; and however doubtful the result may now seem, the conditions of the problem are rapidly changing. F. H. Richards.

New Britain, Conn.

A Handy Life Preserver.

To the Editor of the Scientific American:

Nearly every man has his own life preserver. It is not generally known that, when a person falls into the water, a common felt hat can be made use of as a life preserver. By placing the hat upon the water, rim down, with the arm around it pressing it slightly to the breast, it will bear a man up for hours. Any one doubting the above can take an old hat, and try it in a bucket of water, or when bathing, and he will soon be convinced.

Charlotte, Mich H. J.

The Mechanical Force of Light.

To the Editor of the Scientific American:

Has it occurred to you that the remarkable discovery of Dr. Crookes, the mechanical or repulsive force of light, may offer a satisfactory solution of a great cosmic problem? I am one of those who believe that matter never had a beginning and can never have an end, any more than time ever had beginning or can have end, or than space has a beginning and an end; nor do I believe that, when a planetary system has passed through its incalculable cycles of formation, and through the decadence of its central source of light and heat, and becomes barren and desolate, it will for ever remain a dead system. I think you have struck the keynote of the problem in your suggestion that the tremendous repulsive force, of the sun's light upon the planets, combines with the centrifugal force of revolution to prevent them from approaching and finally falling into the sun. No other hypothesis is tenable, for we are certainly not receding from the sun, as we assuredly would be were it not for the attraction of gravitation; and the fact that we are not receding, while at the same time the incalculable repulsive force of the sun's light must inevitably tend to make us recede, shows that the centrifugal force of our revolution around the sun is not of itself sufficient to continue our distance from the sun, but that the added force of light repulsion is necessary to maintain that distance. Now by decadence of the source of light, the dying out of the sun's forces (which is inevitable), this repulsive force will be removed, and the desolate planets of our system must with equal inevitability fall into the sun; for as this light force is assuredly necessary to keep the planets from the sun, so to remove it must precipitate them, in due course of time, into the central mass.

The forces that would thus be generated, of light and heat, have already been estimated; and it seems clear to me that, in the instant conversion of these solid bodies into the disintegrated, vaporous, expansive substances which would result from these collisions, is found the material for a new system, beginning and passing through all the cycles of time and formation through which astronomy has shown that our present system has passed. There may be other forces than the centrifugal and light forces which keep the planets from the sun, and which upon removal, by decadence of the sun, will precipitate "the eternal smash;" but as neither force nor matter can be lost, and as it is childish to assume that the cosmic system was destined to begin and end with a single formation of suns and planets, so it is inevitable that, from some such cause as that which I have inadequately foreshadowed, the operations of the Universe which we now witness will continue for ever; in ever changing forms, it is true, but absolutely without end.

Washington, D. C. W. E. Sawyer.

The Mechanical Force of Light.

To the Editor of the Scientific American:

In a recent number of your paper, Mr. R. L. Taylor showed that the motive power of light was known 30 years ago. In Rees' "Cyclopædia," a work published at least 70 years ago, I find the following: "Some writers have attempted to prove the materiality of light, by determining the momentum of its component particles, or by showing that they had a force, so as, by their impulse, to give motion to light bodies. M. Homberg imagined that he could not only disperse pieces of amianthus and other light substances by the impulse of the solar rays, but also that, by throwing them upon the end of a kind of lever, connected with the spring of a watch, he could make it move sensibly quicker: whence, and from other experiments, was inferred the weight of the particles of light. But M. Du Fay and M. Mairan made other experiments of a more accurate kind, which exhibited no such effects as M. Homberg imagined. However, Dr. Priestley informs us that Mr. Mitchell endeavored to ascertain the momentum of light with still greater accuracy, and that his endeavors were not altogether unsuccessful. Having found that the instrument which he used acquired, from the impulse of the rays of light, the velocity of one inch in a second, he inferred that the quantity of matter, contained in the rays falling upon the instrument at that time, amounted to no more than the twelve hundred millionth part of a grain. In the experiment, the light was collected from a surface of about three square feet; and as this surface reflected only about half what falls upon it, the quantity of matter contained in the rays of the sun, incident upon a square foot and a half of surface, in one second of time, ought to be no more than the twelve hundred millionth part of a grain, or, upon one square foot only, the eighteen hundred millionth part of a grain. But the density of the rays of light at the surface of the sun is greater than at the earth in proportion of 45,000 to 1: there ought, therefore, to issue from one square foot of the sun's surface, in one second of time, in order to supply the waste by light, one forty thousandth part of a grain of matter, that is a little more than two grains a day, or about four millions seven hundred and fifty-two thousand grains, which is about six hundred and seventy pounds, avoirdupois, in six thousand years; a quantity which would have shortened the sun's semi-diameter no more than about ten feet, if it was formed of matter of the density of water only. Priestley, *ubi supra*, page 389." C. M. Bradbury.

24 Bollingbrook street, Petersburgh, Va.

Grasshoppers in the West.

To the Editor of the Scientific American:

In No 24, of your volume XXXII, page 369, I find, in an article regarding grasshoppers, this remarkable statement: "The size of the locust is from that of a flea to that of a house fly." As this statement does injustice to the great and growing States of Missouri, Kansas, and Nebraska, States which are as fertile as the valley of the Nile, I submit the following for your consideration:

1. I send you a box of grasshoppers by express, to give you visual proof of their size, varying in length from 1 to 2¼ inches. This will convince you that your fleas and house flies must be very large. The statement you published in regard to the size of our grasshoppers is nothing less than a libel on the fair fame of this part of the Great West, and you must retract or suffer the consequences of your calumnious reports. Even our grasshoppers are indignant to learn that they are as small as fleas and house flies.

2. The section of country now completely devastated by these grasshoppers is about 100 miles square, with this city near the northeast corner of the square. Fields of wheat, barley, corn, etc., of 160 acres are laid waste in a single day by this hungry and devouring plague.

3. The number of the grasshoppers can be expressed only by infinity, with one million as the unit; no arithmetician can compute their number. Some farmers have been killing them by the bushel and by the wagon load, before they were able to fly. They are now beginning to fly, and the whole air is as full of these insects at mid-day, say from 9 o'clock A.M. till 5 o'clock P.M., as with snow flakes during a snow storm in winter, and having a similar appearance.

4. Not the farmers only, but all classes of people are sufferers by this grasshopper scourge. Even railroading is much hindered by the grasshoppers, and trains of cars are often stopped by them, as they are so numerous. In sorrow, I speak only the truth.

5. Having regard for the truth, I send you the above and also the box of grasshoppers. If you doubt my statements, then come and see. R. R. C.

St. Joseph, Mo.

[Our correspondent errs in declaring us in error, as our previous remarks were based on the ocular proof of specimens of hoppers forwarded to us, and the statements of the journals published in the immediate vicinity of the insect raid. We referred, however, to the young locusts, as, is obvious from the means mentioned for their extinction, as of course, after their wings had grown, the insects would find no difficulty in clearing such obstacles as ditches and streams. The box of hoppers, which we have duly received, furnishes very excellent evidence that the insects in our correspondent's neighborhood are fully of the size stated by him, but certainly do not disprove the fact that there was a period in their history when their dimensions did not exceed those of the flea or the house fly.—Eds.]

The Colorado Potato Beetle.

To the Editor of the Scientific American:

From various articles in yours and other papers, I gather that the Colorado potato bug has so far proved rather more than a match for the proverbial Yankee ingenuity. Will you allow me to suggest a plan by which I think it probable this destructive insect may be got rid of?

I take it for granted that the bug preys upon the plant in one year, deposits its eggs in the ground during the autumn, and that they are hatched next year, and, in their turn, feed upon the plants, and so on. Further, I have read that this insect travels over new land at about 60 miles per annum; but this of course is over land well stocked with the potato plant, its special food.

My plan is to divide the territory of the United States into imaginary strips of land, north and south, each fifty miles wide. These may be numbered for reference. In the year 1876, I would propose to confine the growth of the potato to the strips of land numbered 1, 5, 9, 13. In the next year, 1877, the potato would be grown only on the strips numbered 3, 7, 11. In 1877, therefore, the insects in the strips of territory 1, 5, 9, 13, will have to travel over fifty miles of ground before meeting with any food; and this I think it probable they would fail to do, and would therefore perish. If, however, the insects should be able to traverse this distance without food, the strips would have to be made wider. In 1878, the strips 1, 5, 9, 13 would again be planted with the potato. The cultivators of the strips 2, 4, 6, 8, etc., would probably feel aggrieved by the inability to grow the potato for 2 or 3 years; but some arrangement might be made, of an equitable nature, to meet their case. It is evident that the adoption of this plan would necessitate the carriage of potatoes over a maximum distance of 25 miles for the supply of the inhabitants of the non-potato-growing strips; but the question appears to be either the extinction of the bug or of the potato plant. The plan, if attempted, would no doubt require the management of a geographical department of the United States, who would easily arrange and advertise a list of places for 1876, 1877, and 1878, in which the potato should be grown, and in which it should not; and I doubt not the agriculturists of the United States would be willing to give the plan a fair trial.

Thomas A. Cotchett.

2 Craig's Court, London, England.

Possible Recovery of the Lost Elgin Marbles.

Out of seventeen cases of marble sculptures taken by Lord Elgin from the Acropolis in Athens in 1802, twelve reached the British Museum, and the remainder were lost, with the ship in which they were stored, by the foundering of the vessel during a severe storm off the Island of Cerigo. M. Makoukas, a resident of that island, has recently informed the Archæological Society of Athens that the marbles are now plainly visible, lying on the bottom of the sea at a depth of about 96 feet, and it is stated that prompt measures will be taken for the recovery of the valuable relics.

It is interesting to observe that the appliances by which these archæological treasures will be regained have sprung into existence since the marbles have reposed in the depths of the sea. Seventy-three years ago, the diver's dress and the vulcanized rubber of which it is made were unknown, and the works of ancient art have had to remain in their watery prison until, in the progress of inventive skill, means have developed themselves, by which their liberation, once presenting insurmountable difficulties, is now rendered a comparatively easy proceeding. Lord Elgin gained possession of the marbles through a firman of Sultan Selim III. Greece was then but a province of Turkey; the battle of Navarino had not been fought; and before achieving its independence, the country for many years after remained under the rule of the Turk, who at his pleasure bestowed upon foreigners the relics which, by modern Athenian archæologists, are deemed of priceless value.

Mineral Wool.

The utilization of blast furnace slag recently discovered bids fair to be of some importance. It is stated that if a jet of steam be injected into a current of fluid scoriæ, fine, supple, and elastic filaments are obtained. With certain slags these are of a brilliant white and resemble cotton thread. The material is remarkable for its non-conductibility of heat, and hence may be profitably used for covering boilers and for other purposes in which it is desirable to prevent radiation.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

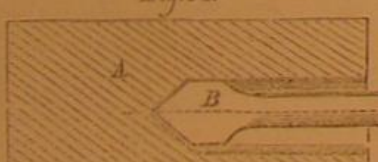
NUMBER XXVII.

DRILLS AND DRILLING.—FLAT DRILLS.

A drill is, all things considered, the most effective tool employed by the machinist; for while its cutting edges are necessarily of decidedly undesirable angles and form, it sustains the very roughest of usage, and yet will bear more strain in proportion to its strength than any other cutting tool. The reason of this is that it is supported by the metal upon which it is operating, and is thus prevented from springing away from its duty. This support may be of two kinds, first, that due to the wedge shape of the main cutting edges, one to the other, and second, that to be derived from making the diameter of the drill parallel for some little distance behind the cutting edges, so that the sides of the drill, by contact with the sides of the hole, serve to guide and support the drill. The latter, however, only comes into operation at and after such time as the drill has entered the metal sufficiently deep to drill a recess of the full diameter of the drill.

The support given to the drill, in the first instance cited, arises from the tendency of either of the cutting edges to spring away from the cut, which is, of course, counterbalanced by the opposite cutting edge having the same tendency, but in an opposite direction, so that between the two the drill is held to a central position; and also from the tendency of the drill point to force itself forward (by reason of the pressure behind it) as far into the cone formed by the end of the hole as possible, as the end of the hole and the cutting end of the drill are two cones, one being forced into the other. In a drill properly ground (that is, having its cutting edges at an equal angle to the center line of the length of the drill, and the cutting edges of an equal length from the center or point of junction of the cutting edges) both the cutting edges and the sides of the drill act as supports and guides, tending to sustain it under the strain and keep it true. If, however, the drill is not ground true, the strain upon it becomes very great, because the whole force of the cut is then placed upon one cutting edge only, and is continuously tending to thrust the point of the drill outwards from the center of the hole being drilled, hence cutting a hole larger in diameter than the cutting part of the drill, that is to say, a hole whose diameter will be twice that of the radius of the longest cutting edge of the drill, measured from the center line of the length of the drill. If, under such conditions, one side of the drill bears against the sides of the hole, as shown in Fig. 98, A being the metal and B the drill, there will be

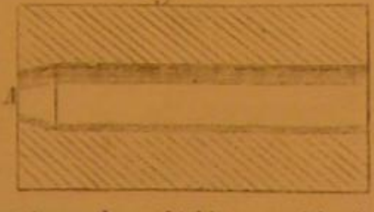
Fig. 98.



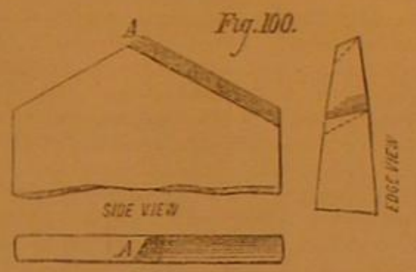
created two opposing forces, independent of the strain necessary to sever the metal, one being the endeavor of the point of the drill to keep to the center of the hole, because of the conical shape of the end of the hole and point of the drill, and the other being the endeavor of the cutting edge to force the drill to one side and the point of the drill out of the center of the hole. And as the pressure of the side of the drill against the side of the hole will tend to force the drill to revolve true with that side of the drill so that the point of the drill will revolve in a circle and not upon its own axis the result will be a hole, neither round, straight, nor of any definite diameter, as compared to the diameter of the drill.

Drills that are a trifle too small for the required size are sometimes purposely ground a little out of true so as to cause the hole to be larger than the drill, but the action of such drills is distorted, and it is impossible to estimate exactly how much deviation is necessary to the required increase of diameter of the hole. Part of the power driving the drill is lost, the loss being due to the creation of the above opposing forces, and the drilling operation is slow by reason of only one edge of the drill performing any cutting. Hence, the feed of the drill being only half as rapid as it should be, it is an unmechanical expedient and a loss of time, especially if the hole is to be drilled clear through the metal: for in that case, as soon as the point of the drill emerges through the metal and the drill is therefore released from its influence, the cutting edges will gradually adjust themselves to the hole, and drill the remainder of the hole to the size of the diameter of the drill, the hole when finished appearing as in Fig. 99. Thus the end, A, of the hole will require to be filed out, entailing in all more loss of time than would be required to make a drill of the proper diameter.

Fig. 99.



The importance, then, of taking especial pains to grind a drill true being apparent, we may next consider how thick the point of the drill should be. It is here that the main defect of the drill as a cutting tool lies, for it is impossible to make the cutting edge across the center of the drill (that is, the cutting edge across the thickness of the drill, connecting the cutting edge on one side of the drill to the cutting edge of the other side, as shown at A in Fig. 100) sufficiently keen



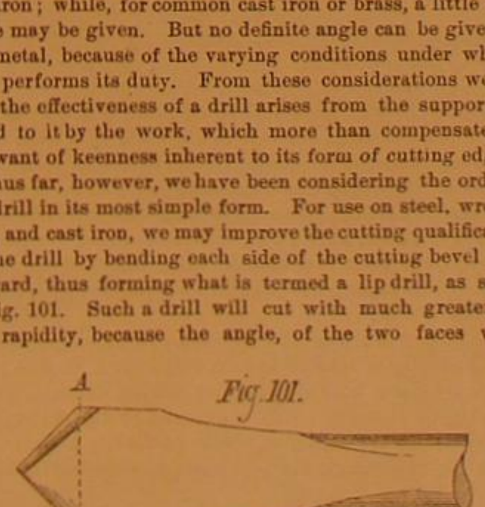
to enable it to enter the metal easily, without grinding the angles of the two cutting edges very acute, as shown, in the edge view of Fig. 100, by the dotted lines, which would so weaken the cutting edges as to cause them to break from the pressure of even the lightest feeding. The only alternative, then, is to make the point of the drill as thin as is compatible with sufficient strength; and this will be found to be of about the following proportion:

Diameter of drill	Thickness at point
1-8 inch	1-64 inch
1-4 "	1-32 "
3-8 "	3-64 "
1-2 "	1-16 "
5-8 "	1-16 "
3-4 "	1-16 "
7-8 "	1-16 "
1 "	3-32 "

The flat face must be made gradually thicker as the full diameter of the drill is reached.

The angle at which to grind the end of the drill is governed to a large extent by the kind and degree of hardness of the metal to be drilled, the angle shown in Fig. 100 being suitable for wrought iron, steel, or unusually hard cast iron; while, for common cast iron or brass, a little more angle may be given. But no definite angle can be given for any metal, because of the varying conditions under which a drill performs its duty. From these considerations we find that the effectiveness of a drill arises from the support rendered to it by the work, which more than compensates for the want of keenness inherent to its form of cutting edge.

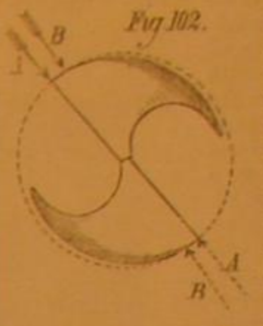
Thus far, however, we have been considering the ordinary flat drill in its most simple form. For use on steel, wrought iron, and cast iron, we may improve the cutting qualifications of the drill by bending each side of the cutting bevel edges forward, thus forming what is termed a lip drill, as shown in Fig. 101. Such a drill will cut with much greater ease and rapidity, because the angle, of the two faces whose



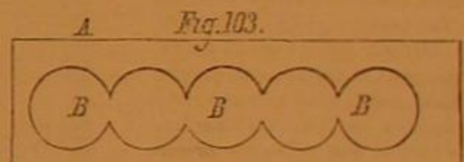
junction forms a cutting edge, is much more acute, while the cutting edge is, at the same time, well supported by the metal behind it, which advantages are to be obtained in no other way. The cutting edges of this drill are similar to those on the twist drill.

TWIST DRILLS.

Twist drills are not, as is usually supposed, of the same diameter from end to end of the twist, but are slightly taper, diminishing towards the shank end. The taper is usually, however, so slight as to be of little consequence in actual practice. Neither are twist drills round, the diameter being eased away from a short distance behind the advance or cutting edge of the flute backward to the next flute, so that, were we to grind the cutting end square or level, instead of conical, it would appear as in Fig. 102.



The object of this is to give the sides of the drill as much clearance as possible. The part of the diameter from A to B, on each side, is left of a full circle, which maintains the diameter of the drill and steadies it in the hole. If, from excessive duty, that part from A to B should wear away at the cutting end of the drill, leaving the corner of the drill rounded, the drill must be ground sufficiently to cut away entirely the worn part, otherwise it will totally impair the value of the drill, causing it to grind against the metal, and no amount of pressure will cause it to cut. The advantage, over other drills, possessed by twist drills lies first in that the cuttings can find free egress, which effects a great saving of time, for plain drills have to be frequently withdrawn from the hole to extract the cuttings, which would jam between the sides of the hole and the sides of the drill, and the pressure will frequently become so great as to twist or break the shank of the drill, especially in small holes. In point of fact, the advent of twist drills has rendered the employment of any other form for use in small holes (that is to say, from ½ inch downwards) totally inexcusable, except it be for metal so hard as to require a drill tempered to suit the work. The other advantages of the twist drill are that it always runs true, requires no reforging or tempering, and, by reason of its shape, fits closely to the hole, and hence drills a very straight and smooth hole. It is also not liable to be influenced so much by an air or other hole or soft spot which may exist in the metal being drilled. These qualifications render the twist drill a very superior tool for the finer classes of work, and for such purposes as drilling metal away to form a key way or slot; for in the latter case, the holes may be drilled so closely together that they will run one into the other, as shown in Fig. 103, A being the piece of metal, and B B, the holes. A com-



mon flat drill is incapable of performing such work. The twist drill will not, however (in holes of a moderate depth, that is to say, holes whose depth is not more than four times their diameter), do so much duty in a given time as a common drill, especially if, in iron or steel, the latter be slightly lipped: the reason being that the latter, stronger in proportion to its diameter, will stand more strain, and may therefore be fed much more rapidly in all cases wherein the depth is not too great to permit the cuttings from finding egress before becoming jammed in the hole.

FEEDING DRILLS.

Much more duty may be obtained from a drill by feeding it by hand than by permitting the gearing of the machine to feed it, because, in hand feeding, the sense of feeling indicates to the operator how much cut the drill is capable of standing, and he can therefore vary the rate of feed, keeping it up to the maximum obtainable on the degree of hardness of the metal being drilled. Dullness of the cutting edges, hard or soft spots in the metal, or any other variation in the condition of the drill or in the metal being drilled, is at once perceived by hand feeding. Drilling machines have, it is true, several degrees of feed, but the fact is that the human hand can feed the drill at any rate that can be obtained by means of machine gearing; and having behind it the human mind, it is enabled to accommodate itself to the numerous and variable conditions against which no provision can be made in automatic feed gearing. No positive rate of feed, either for any particular size of drill, or for any definite kind of metal, can be given, because of the always present variations in the degree of hardness of the metal to be cut, and furthermore because, in the case of iron and steel, the facility of supplying the cutting edges with oil seriously affects the attainable rate of feed to the drill. If, for instance, the hole is being drilled horizontally, as in a lathe, and is very deep, so that it is difficult to freely supply the cutting end of the drill with oil, the feeding must proceed slowly or the cutting edges of the drill will soon become destroyed. Here, also, it may be well to state that, if oil be supplied to a drill cutting cast iron or brass, it will cause the cuttings to jam between the sides of the drill and the sides of the hole, until the pressure becomes so great as to either stop the drilling machine or lathe, or else twist or break the drill. The rate of feed, and the speed at which the drill should revolve, depend upon the hardness of the metal under operation, although not to a very great extent, except in the event of the metal being unusually hard, in which case the drill should revolve very slowly; for not much latitude in the degree of hardness of the drill is permissible, for fear of impairing the strength of the drill.

TO FIX labels on tin, use French polish or a solution of shellac in naphtha or alcohol.

ARTESIAN WELLS.

There are three conditions essential to the successful boring of an artesian well: 1, a fountain head more elevated than the locality where the boring is to be undertaken; 2, a moderate downward dip of the strata, toward the site of the well, as a steep angle is unfavorable and permits the water to flow away beyond the reach of the boring, which must needs pass at an acute angle through few layers of rock; 3, alternation of porous and impervious strata beneath the surface soil. It is sometimes the case that the head of water is at so high an elevation that the column bursts forth from the ground as a fountain, throwing up a continual jet. By raising the water above the surface in a pipe, and letting it flow over, convenient water power is obtained. Artesian wells are applied to this purpose at many localities in France, the water they supply being found sufficient to run heavy machinery. From the great depth at which the currents of water are reached, the supplies may be regarded as permanent. A well at Aire, in Artois (from which name the word "artesian" is derived), France, has flowed steadily for a century, the water rising above the surface at the rate of 200 gallons a minute; and at Lillers, in the same country, one well has given a constant yield since the year 1126.

The large engraving (Fig. 1) given herewith represents the artesian well of Grenelle, a suburb of Paris. Seven years and two months of constant labor were devoted to the boring, the rock being extremely difficult to pierce. The water-bearing stratum was reached at a depth of 1,802 feet, when the water was discharged at the rate of upwards of 880,000 gallons in 24 hours. The force is such that the water ascends to a hight of 120 feet above the surface, in the pipes in the elegant structure which has been erected over the bore. The present yield of the well is about 500,000 gallons per 24 hours. The water is at a uniform temperature of 82° Fah., and is used to warm some large hospitals in the vicinity. During the boring, and when at a depth of 1,254 feet, it is related that a drill broke and fell, with 270 feet of rods, to the bottom, necessitating fifteen months of constant labor to remove the pieces.

In the United States the deepest artesian well is that bored for the insane asylum in St. Louis, Mo. This has reached the enormous depth of 3,843 feet, or, in that locality, 3,000 feet below the sea level. This would give a water pressure at the bottom of 1,293 lbs. to the square inch. The deepest bore in the world is one, begun as a rock salt mine and yet uncompleted, at the village of Sperenburg, some twenty miles from Berlin. Its present depth is 4,194 feet. In the Desert of Sahara some seventy-five shafts have been sunk, which yield a aggregate of 600,000 gallons per hour. The effect of this supply is said to be plainly apparent upon the once barren soil of the desert. Two new villages have been built, and 150,000 palm trees have been planted in more than 1,000 new gardens.

In the engravings accompanying this article, from Mr. E. H. Knight's American "Mechanical Dictionary" (published by Messrs. J. B. Ford & Co., New York city), will be found represented a number of the tools used in the operation of boring rock. A common mode of performing this labor is shown in Fig. 2. Two men walk around and turn the handle of the boring tool, which is screwed into an iron rod. In moderately soft ground the weight of the men and the rotation of the handle will cause the boring chisel to penetrate, but in rock it requires to be hammered down. The operation is greatly facilitated by suspending the boring rods from a beam, fixed at one end and worked by a man at the other, assisting, by its elasticity, the efforts of those below in alternately raising and depressing the tool to give it the necessary pounding motion. The hole being thus opened, a valved cylindrical auger, Fig. 3, is introduced. When this is turned, the valve is opened by the pressure of the comminuted rock or earth below, the latter enters the cylinder, and is thus removed.

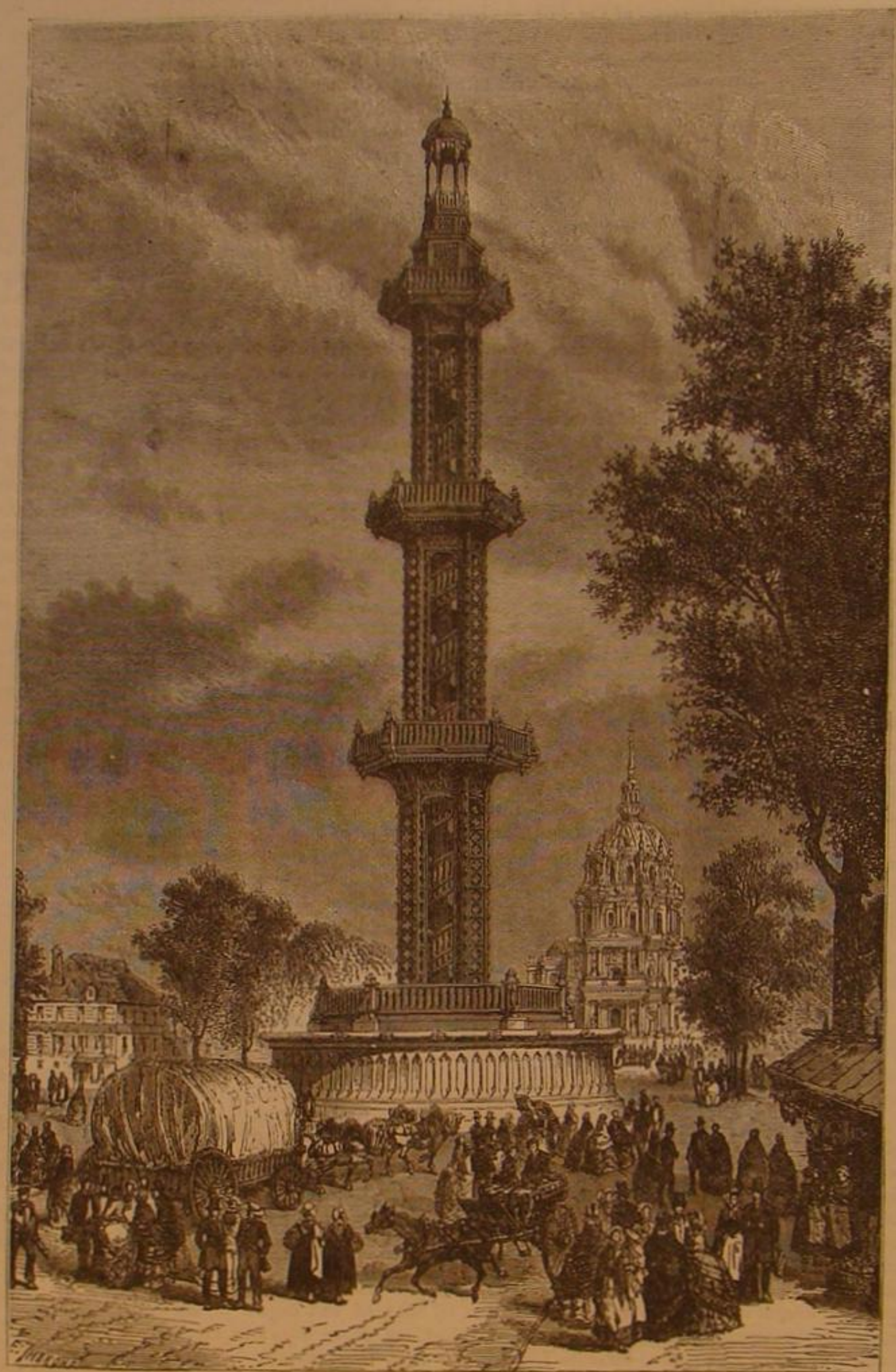
In Fig. 4, *a* is a plan and elevation of an auger used for boring in clay or loam; *b* is an S chisel for hard rock; *c* exhibits a hollow valved auger, for boring through sand or bringing up rock previously pulverized by the chisel; *d* is a spring reamer for enlarging a hole previously bored: this is passed down through the pipe, and, on reaching its bottom, expands to a distance regulated by the screw and swivel connecting the two spring cutters, the cutting edges of which are placed reversely.

Figs. 5 and 6 exhibit different kinds of tools for penetrating earth and rock. The rods frequently break in boring; and for raising the portion broken off below, various devices have been contrived, one of the most simple of which is represented in Fig. 7. It consists merely of a worm, which screws around the rod, which is retained only by friction when lifting. This is available only when the weight of the broken part is insufficient to overcome the friction.

In Fig. 8 the shaft has a point, cutting lips, and a floor on which the earth is received. It is forced into the ground by the screw on the shank, which rotates in a nut at the junction of the legs of the tripod, which is raised above the spot where the auger enters. The end of the screw staff is keyed to a stirrup, in which it turns. Above the stirrup is a coupling piece, having inclined projections fitting in corresponding recesses in the upper part of the stirrup, in such a manner that the shaft is made to operate the screw when boring, while a reverse motion will raise the screw out of the ground without turning it. In Fig. 9 the shaft has a screw point and angular rings, above which is the floor of the dirt chamber. The soil is scooped up by the usual flange, and is elevated in the chamber by the spiral which is braced by the axial rod.

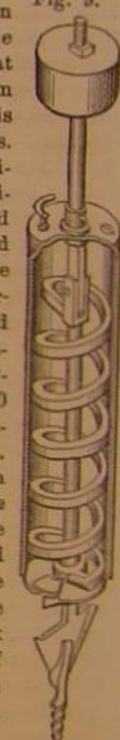
Numerous artesian wells are being sunk along the line of the Union Pacific Railroad, in order to obtain water for the locomotives and for the workmen laboring in the coal mines along the route. The first well is at Separation, 724 miles from Omaha, and the last one is at Rock Spring, 832 miles. It is believed that for agricultural purposes the mineral salts could be washed out of the water obtained from wells in the above vicinity, so that soil irrigated therewith would probably prove remarkably productive. A flowing well, furnishing 1,000 gallons per hour, will water a section of 640 acres. If bored 1,000 feet in depth, the cost would be about $10,000. Out on the plains this outlay would make a most productive farm, which might be made the nucleus of a stock range of thousands of acres, having besides an ample supply for human consumption.

Fig. 1.



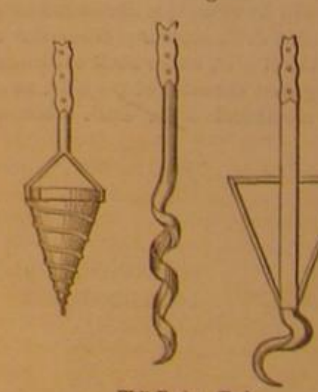
ARTESIAN WELL.
GRENELLE, PARIS, FRANCE.

Fig. 9.



McMahen's Earth-boring Auger.

Fig. 6.

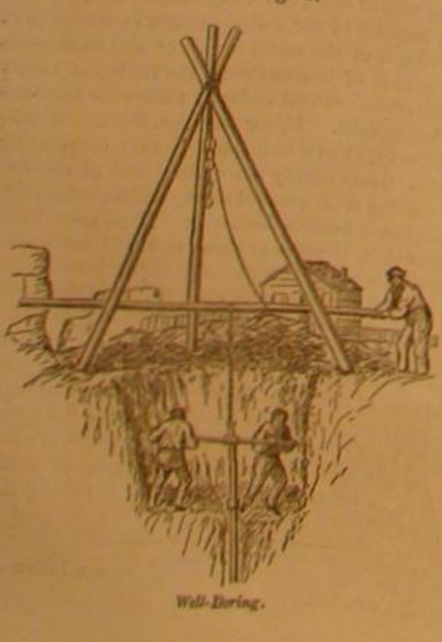


Well-Boring Tools.

Fig. 7.

Rod-Lifter.

Fig. 2.

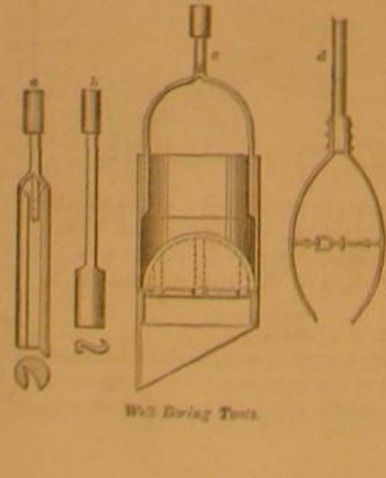


Well-Boring.

Fig. 3.

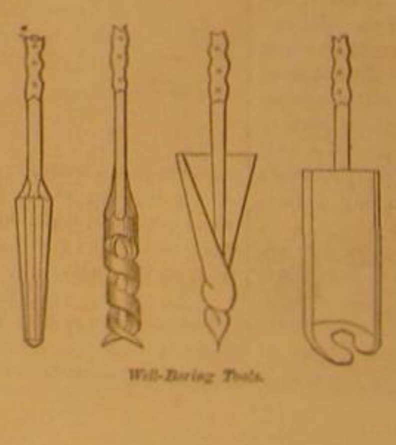
Hole-Cleaner.

Fig. 4.



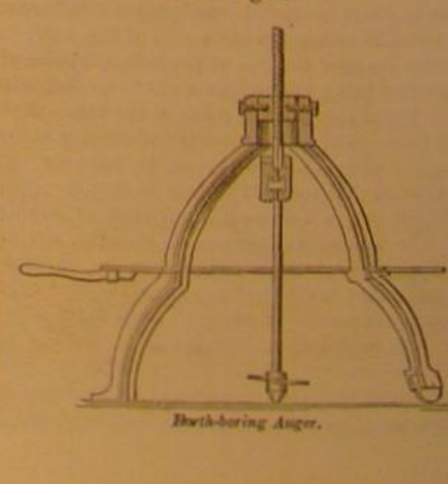
Well-Boring Tools.

Fig. 5.



Well-Boring Tools.

Fig. 8.



Earth-boring Auger.

The Electric Light for Locomotives.

Experiments with the electric light as a head light for locomotives have recently been made in Russia on the railroad from Moscow to Kursk, with successful results. The apparatus consisted in a battery of 48 couples, which produced sufficient illumination to light up the track for a distance of from fifteen to eighteen hundred feet ahead.

A correspondent of *Les Mondes* suggests that a small electric machine would serve the purpose much better than a galvanic battery, liable to injury by agitation. It is proposed to connect the mechanism directly with the front axle, the revolution of which will set the former in operation. The chances of danger usually augment with the speed; but arranged as above described, the intensity of the light would increase in like ratio, up to certain limits. In running slowly, the illumination would be comparatively feeble; but in such case the bell, whistle, and other signals would afford warning in ample time.

THE FINCHES.

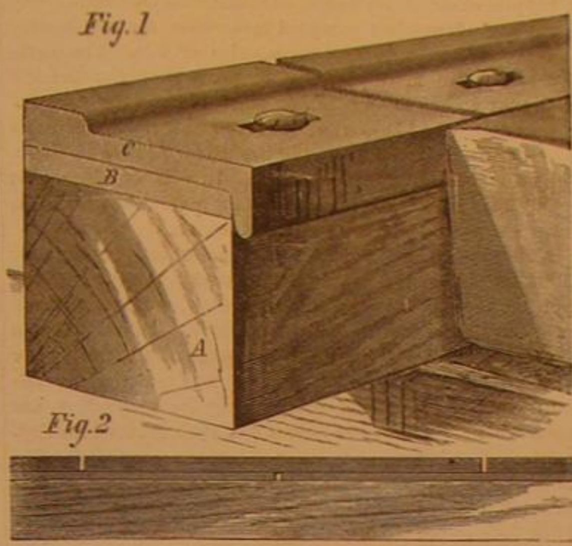
One of the most interesting of the numerous families of birds consists of the various species of finch, of which the canary is the best known in this country. In our engraving the chaffinch, the yellowhammer, the goldfinch, the linnet, and the crossbill are shown, and there are many others, the bulfinch, the greenfinch, etc. The goldfinch and the yellowhammer have very brilliant plumage, and, with the linnet, are excellent songsters. The linnet's note is not so powerful as that of the canary, but it is sweet; and the bird, when brought up near a good singing canary, becomes a very accomplished vocalist. The goldfinch and the chaffinch build nests of exquisite workmanship, the latter's domicile being nearly globular in shape, with an entrance at the side.

Most of the finches are very docile, the bulfinch and goldfinch being susceptible to an advanced education. Mr. Syme, an eminent British naturalist, describes some trained birds of this species, one of which appeared dead, and was held up by tail or claw without moving; a second would stand on its head; a third would walk about with little pails at his side, like a milkmaid; a fourth imitated a girl looking from her casement; a fifth acted as a soldier with his firelock; a sixth would fire a cannon, and go through the motions of an artilleryman. It has been known to live twenty-three years in confinement.

The crossbill has a singular conformation of the beak, the mandibles crossing each other like a pair of scissors; and the facility with which it opens the pine cones, for the sake of the seed, on which it principally feeds, is surprising. It is not found much in the south of England, except in captivity, but it frequents the pine woods of Scotland and the north of Europe. As a cage bird it is very amusing, and from its movements might be called the European parrot. The peasants of Germany have a tradition that its bill was twisted in an attempt to extract the nails from our Saviour's cross—a legend which Longfellow has embalmed in an exquisite poem. The bird being very shy, not much is known of its habits in a wild state.

NESSLE'S STREET RAILWAY RAIL.

In the invention herewith illustrated, the rail is divided horizontally, about through its center. The lower half is first bolted on the stringers, and the upper half is laid on it, so as to break joints with the lower half, the bolt holes being slotted sufficiently to allow for contraction and expansion, making substantially a continuous rail, thereby avoiding the bending and battering which is found to be so destructive to the rails and the rolling stock. The greatest advantage is that, when the upper half is worn out, it can be removed, and thus only these top halves need be renewed.



A, in the engraving, is the timber ordinarily laid down to form the base for the track. On this is secured the lower half rail, B; and on it the upper half, C, is bolted so as to break joints with the under halves, as before explained.

Patented May 4, 1875. For further particulars address the inventor, Mr. John P. Nessle, 23 Frelinghuysen avenue, Newark, N. J.

The Duplexed Telegraph Printers.

The experiment of working the combination printing telegraph apparatus in duplex, between this city and Boston, has proved to be a complete success, and will probably result in the extensive use of printers on the Western Union line. The quadruplex arrangement of circuits is used, although only two circuits are worked by the printers, the other side, which, with the Morse instruments, is used for operating circuits, being utilized for breaking the sending circuit when required. By this arrangement neither circuit interferes with or interrupts the other, as is the case with the quadruplex Morse.

The operators are delighted with the new arrangement, and say they can work faster and more easily than with the old arrangement or single circuits. In one day recently, one thousand messages were transmitted over a single wire between this city and Boston, employing four operators only, and doing as much business as could have been accomplished by quadruplex Morse circuits and eight Morse operators, on the same wire in the same time.

This improvement is likely to open up a new and successful future for printing telegraph instruments, which had been somewhat out of favor of late years, and have heretofore been used only to a limited extent.—*The Telegrapher.*

Singular Explosion.

At the works of Hewes & Phillips, Newark, N. J., a few days since, it became necessary to remove the rings from a steamboat piston, which was hollow, with two sets of packing rings. The rings were found to be rusted and corroded fast, and the piston was placed on a fire in the blacksmith shop to loosen them by heat. In a few minutes an explosion occurred, and the piston was blown to pieces, injuring one man so that he died in a few minutes, and hurting another badly about the face. On a close examination of the pieces, it was believed that marks of an old crack were found. It is thought that, when hot and under pressure, some steam may have leaked through into the piston and subsequently condensed, and the crack may then have been rusted tight. When the piston was heated, this water inside became converted into steam and caused the explosion.

THE following is a good recipe for raspberry vinegar: Pour over 1 pound of bruised berries 1 quart of the best cider vinegar; next day, strain the liquor on 1 pound of fresh ripe raspberries, bruise them also, and on the following day do the same. Do not squeeze the fruit, only drain the liquor thoroughly. Put the juice into a stone jar and add sugar in proportion of one pound to a pint. When the sugar is melted, place the jars in a saucepan of water, which heat; skim the liquor, and, after it has simmered for a few minutes, remove from the fire, cover, and bottle.

PROFESSOR WILLIAM HAGEN, of the Academy of Civil Engineers, Berlin, predicts the failure of the jetty system, now being constructed at the mouth of the Mississippi, and declares that the large amount of money, appropriated by Congress for that work, will be a total loss.

MEMBERS OF THE FINCH FAMILY.

MEDICAL NOTES.

[New York Medical Journal.]

New Remedy for Burns.

There has been in hospital for many months a case of extensive burn, in which different applications have been tried. Every new dressing succeeded well for a time, but soon it ceased to prove of advantage. The last agent that has been used, and is used at present, is salicylic acid. The effect is more beneficial than that obtained by any of the former remedies. The method of using it is to form an emulsion with olive oil, one part of the salicylic acid to sixteen parts of oil. This mixture is painted over the ulcerated surface once or twice a day. It gives rise to a slight smarting sensation when first applied, but that soon passes off.

Compressed Sponge for Abscess.

A patient had been suffering from mammary abscess for three weeks, but without any special benefit from treatment in checking the discharge of pus. It was decided to try the effect of compressed sponge, and for this purpose a sponge about ten inches in diameter was subjected to pressure and then applied by means of a bandage over the breast. After it had been in use forty-eight hours, the abscess was completely cured. No pain was experienced by the patient, and in this case the opening in the breast was three inches above the dependant part of the abscess. In applying a sponge to the breast in this class of cases, it is found of advantage to compress it when dry. After it is applied to the breast and firmly secured in position, a little water is poured upon it to cause expansion and the necessary pressure.

Apparatus for Cure of Fracture of Patella.

There has been recently a patient in hospital who had received a fracture of the patella, which did not unite. As a result of this unpleasant state of affairs, she was unable to extend the leg in walking, and found great difficulty in getting up and down stairs. She has, however, been so benefited recently by an appliance designed by Dr. Carney, of the hospital staff, that when she has it on she is enabled to walk with facility. The principle consists in using rubber as the extending power. The mode of application was to place a plaster bandage below the knee, having incorporated in its folds a loop of strong iron wire, of which the loop is projected above. A similar dressing was placed on the thigh, above the knee, with the loop of wire projecting downward. Folds of rubber were then attached to the two iron loops sufficiently strong to keep the leg extended when in a passive state. With this apparatus the patient was enabled to walk up and down stairs without inconvenience.

Wood Sorrel in Epithelioma.

The dried extract of wood sorrel has been used as a dressing epithelioma, and found to be more serviceable than any thing else in relieving the pain.

Treatment of Fistula in Ano by the Elastic Ligature.

The use of the elastic ligature in *fistula in ano* proves of more service than the knife in the few cases in which it has been employed. The method of applying it is to introduce the ligature by means of an eye probe, and allow it to cut its way out, which it does in from five days to a week. It leaves behind it a granulating surface which soon heals over. In one case the knife was used, and it was two months before the cure was complete.

Salicylic Acid.

In chronic cystitis, the bladder has been washed out with a solution containing one part in five hundred of water. The method of washing out the bladder has been to make four injections of one ounce each every morning and every evening. The acid not only removed the disagreeable odor of the urine, but in a short space of time freed it from pus. In empyema, a solution of the same strength has been employed with valuable results. It is used under the same circumstances as carbolic acid was formerly. In dressing suppurating surfaces, it appears to have a stimulant effect on the granulations, somewhat similar to that of carbolic acid.

Melanosis.

There is at present in Roosevelt hospital quite a rare case of melanosis. The patient is covered over the entire body with a discoloration of a dark slaty hue. There are also tumors beneath the skin, situated on the face, body, and extremities. The disease first appeared about a year ago, and advanced rapidly to the state that it has now reached. Occasionally the melanotic tumors break down and suppurate. There is no history of hereditary cancer, or of syphilis.

Sciatica.

The treatment of sciatica is based on the view that it is usually due to malaria or syphilis, and for this purpose quinia is first given to the extent of sixty grains in twenty-four hours, followed the succeeding day by thirty or forty grains. If this fails to benefit, anti-syphilitic treatment usually proves effectual.

The Birds and the Insect Pests.

The western journals are beginning to wake up to the fact that the idea which we broached some time ago, relative to the wholesale slaughter of the prairie chickens and other feathered game having its result in an increase of the grasshopper infection, is founded on substantial truth. It is admitted that the destruction of the birds has been enormous, and that they have been trapped by thousands and fed to the hogs, on the theory that pork can be salted and sold while birds cannot. Now, let the journals suggest to their readers the necessity of game laws, rigorous ones, which will impose heavy penalties not merely for killing the chickens, but for exposing them for sale, and let local authorities see that such enactments are enforced to the letter. If this be done, and if the western inventors will give more attention to devising exterminating machinery, by next year the hoppers, between the scorching from the machines and the hungry crops of the birds, will find life utterly devoid of pleasure, and perhaps may be induced to migrate out of the United States territory, say to Canada or Mexico.

There is another reason why the birds should be spared, and that is the potato bug. Prairie chickens and quail, it is said, will eat the insects, and other birds are said to feed upon them greedily.

Our Debt to Patents.

Ohio politicians and other individuals who believe that our patent system is of no advantage to the country, but rather a burden, and hence advocate its abolition, will find suggestive food for thought in Mr. Howson's essay on our country's debt to patents. We recently made a brief extract from this treatise, and now add another, in which the writer, in several happily selected instances, demonstrates how completely we are dependent upon patented inventions for not merely the comforts but the actual necessaries of life. The same facts tend even more cogently to prove that the benefits which may accrue to an inventor from his holding a temporary monopoly on his device, no matter how much his gains may be, are infinitesimal beside the advantages which subsequently are secured by the public. It will be clear that scarcely any price is too high to pay for a valuable invention during the years it is protected by a patent.

Mr. Howson chooses the simplest articles, in everyday use, to illustrate his assertions. "Let us turn," he says, "to the paper on the wall, a paper of neat design, with ribbed and glazed surface studded with gilt sprigs. This is a home manufacture; for wall paper to the value of $1,000,000 per year is produced in this city alone. The patents for the manufacture of paper, and economizing its production, are innumerable Patent after patent has been granted for drying, glazing, printing, and other operations connected with wall paper; and the result of all this has been the permanent establishment of six large manufactories in this city.

Then look at the stove. Compare this stove with the open fireplaces in which our fathers burnt cords of wood, or tuns of coal, without obtaining a tithe of the heat which that ornamental structure generates. Compare it with the old anthracite stove of but thirty-five years ago. I saw one of these obsolete heat generators the other day, a hideous structure, with metal enough in its composition to make a cannon of small caliber—metal enough to make four modern stoves of equal capacity. There are, perhaps, more patents for stoves than for any other class of inventions.

There is a picture on the wall, a steel engraving—an art of which one of the greatest of American inventors and patentees, Jacob Perkins, was the father. In hanging the picture to the wall, I objected to the driving of nails, even if they were brass-headed, through the handsome wall paper; and I objected to the ridiculous and disfiguring inclined cords, and to the clumsy knot which is usually employed to conceal the nail. I discovered a patent molding which would serve the twofold purpose of a finish for the wall paper at its junction with the ceiling, and of a ledge to which could be adapted a gilt hook; and I found patent plated wire cord, almost invisible, with which to suspend the picture from the hook. By these appliances, I am enabled to slide my picture laterally to any position desired, and I dispense with wall-mutilating nails and clumsy cords. But I have not done with the picture yet. It has a gilt frame, consisting of a wooden molding, to which the composition for receiving the gold is applied by a well known process, forming the subject of an expired patent, and which has reduced the cost of ordinary gilt frames to such an extent that they are now to be found in the dwellings of the comparatively poor: whereas twenty years ago, handmade gilt frames were within the reach of the well-to-do only. It is only within a comparatively few years that sheets of glass, sufficiently large and clear for a picture frame of moderate size, have been produced in this country; and this production may in a great measure be attributed to patented glass furnaces, and hosts of patented appliances connected with glass manufacture.

Immediately in front of me is an ordinary panelled and molded door for a closet. A door like this, if made by hand, would cost just double the money for which a door of the same size and character, but of more accurate workmanship, can now be purchased at a large sash and door manufactory. This economy is attributable, in a great measure, and in the first instance, to Woodworth's patent wood-planing machine, which was succeeded by many valuable improvements in the same class of machinery; but there are many other patented machines which have contributed to this economy of manufacture—sawing machines, tonguing and grooving machines, molding machines, etc., for which patent after patent has been and continues to be granted. Patents for woodworking machinery may, in fact, be counted by the thousand.

There are two very important things, without which the door could not be completed; and these are glue and sandpaper. It may surprise many to know that Philadelphia can boast of the most extensive glue and sand paper factory in the world. It is a factory in which one thousand hands are employed. The foundation of this gigantic establishment was based on a series of valuable patents. It is but a comparatively few years since all the glue and sand paper used in this country were imported; now they are made, owing to patented facilities, so economically that much of the product of the factory in question is exported, while the home market is supplied at a cost less than half that which the imported materials cost a few years ago.

Compare the old costly hand-forged nails with the cut nails of the present day, which cost but little more than the metal plates from which they are made. As immense sums of money have been expended in perfecting nail machines in this country, and hundreds of patents have been granted for improvements, we must conclude that the incentive to the outlay and expenditure of ingenuity is to be found in the protection which patents afford; and hence we may justly reason that these cheap nails of to-day are due to our patent system.

Then, again, the door is furnished with a lock such as is made in the large manufactories in New England and Pittsburgh—a lock that can be purchased at any hardware store at less than one third the price of one of the old handmade locks of equal quality. The art of lock-making has made rapid advances in this country, superiority and economy of construction being the characteristics of our homemade locks. When we take into account the many hundreds of patents which have been granted for locks, it will be evident that the progress of the manufacture is largely due to our patent system. The same remarks will apply to the hinges of the door.

Lastly, we have the screws by which the hinges are secured. The patented machines for producing these screws are numerous, and their production is rapid and economical. Take the patent gimlet-pointed screw: what facilities it affords for the carpenter's operations! What tedious manipulation it dispenses with!

The houses of our artisans and laborers, the comfortable homes of our struggling western farmers, are a source of admiration and astonishment to inquiring foreigners who visit our country. The cheap woodwork and cheap building hardware, which enter into the composition of these dwellings, owe their existence to the thousands of patents which have been granted for the articles themselves, and for the machines for the cheap production of the articles."

Useful Recipes for the Shop, the Household, and the Farm.

The following are freezing powders, which may prove useful in hot weather when ice is not attainable: 1. 4 pounds sulphate of soda, 2½ pounds each of muriate of ammonia and nitrate of potash; when about, to use add double the weight of all the ingredients in water. 2. Equal parts of nitrate of of potash and muriate of ammonia; when required for use, add more than double the weight of water. 3. Nitrate of ammonia and water in equal proportions. 4. Carbonate of soda and nitrate of ammonia equal parts, and one equivalent of water.

The absolute strength of a well glued joint is given as follows in pounds per square inch:

	Across the grain.	With the grain
Beech,	2,133	1,095
Elm,	1,436	1,124
Oak,	1,735	568
White wood,	1,493	841
Maple,	1,422	896

It is customary to use from $\frac{1}{5}$ to $\frac{1}{10}$ of the above values to calculate the resistance which surfaces joined with glue can permanently be submitted to with safety.

The following is a good method of purifying lubricating oil: A tub holding 63 quarts has a tap inserted close to the bottom and another about 4 inches higher. In this receptacle are placed 7 quarts boiling water, 3½ ounces carbonate of soda, 3¼ ounces chloride of calcium, and 9 ounces common salt. When all these are in solution, 45 quarts of the oil to be purified are let in and well stirred for five or ten minutes; the whole is then left for a week in a warm place, at the expiration of which time the clear pure oil can be drawn off through the upper tap without disturbing the bottom.

To remove rust from steel, immerse the article to be cleaned (for a few minutes, until all dirt and rust is taken off,) in a strong solution of cyanide of potassium, say about ½ ounce in a wineglassful of water: take out and clean with a tooth brush, with a paste composed of cyanide of potassium, Castile soap, whitening, and water.

To convert a wooden tray into a useful sink for photographic purposes, coat with shellac varnish. The latter can be purchased prepared; but, for the first coat only, it should be thinned with alcohol.

Microscopists collecting in the fields, who have not a glass slide at hand, will find the glasses of their watches an efficient substitute. If the watch be partially opened, the face forms a "white cloud reflector," and throws a good light through the object on the glass.

To test lubricating oil for acid, dissolve a crystallized piece of carbonate of soda about as large as a walnut in an equal bulk of water, and place the solution in a flask with some of the oil. If, on settling after thorough agitation, a large quantity of precipitate forms, the oil should be rejected as impure.

A varnish has been prepared from mica, which promises to become a useful article in the workshop, though at present it has been applied only to plaster casts and similar articles. Mica, calcined by fire or cleaned by boiling in hydrochloric acid, is reduced to as fine a powder as possible and mixed with collodion, when it can be laid on in successive coats like paint, giving the articles a silvery appearance. It may be colored by carefully grinding in the required pigment. The varnish adheres well to porcelain, glass, metal, wood, and plaster, and may be washed without injury.

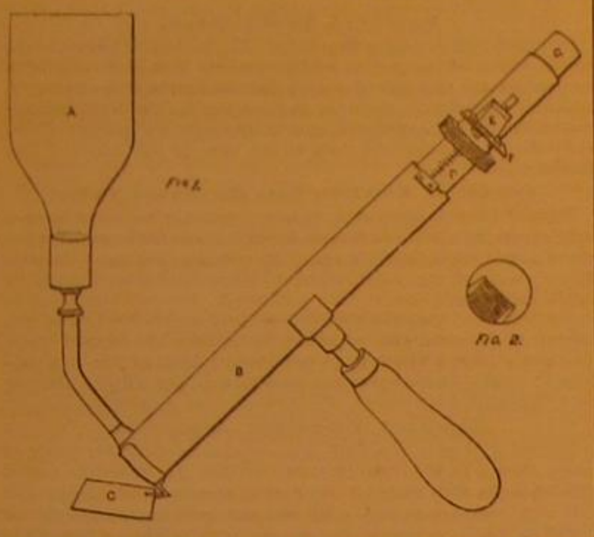
To waterproof fishing lines, apply a mixture of two parts boiled linseed oil and one part good size; expose to the air, and dry.

Artificial grindstones have been made at Worms, Germany, of grit, soluble glass, and petroleum. The proportions are not given. It is said that they will bear a very high speed without becoming soft.

TESTING THE COLOR OF WATER.

Dr. Bowditch has recently devised an apparatus for testing the depth of color of different specimens of water, which is described in a report upon the purity of the different rivers around Boston, etc. (City Document No. 142).

The instrument consists of two tubes, B and D, sliding, watertight, one within the other, the lower end of each tube being closed with a disk of plate glass. Into the large tube, B, just above the plate glass disk, is inserted a piece of small tubing, which terminates in a funnel-shaped receiver, A. Water poured into this receiver will, therefore, pass into the space between the two glass disks, entirely filling the outer tube when the inner tube is withdrawn, and again returning to the receiver when the inner tube is passed down, so that



the glass disks come in contact with each other. Through an opening, near the upper end of the smaller tube, is inserted one end of a rhombic prism, E, in which total internal reflection takes place twice. This prism extends halfway across the inner tube, so that an eye, looking through the eyepiece, sees the field of vision nearly half filled by the surface of the prism (see Fig. 2).

The eyepiece, G, contains a single lens, which is focussed upon the upper surface of the prism. The position and angles of the prism are such that a ray of light, outside of and parallel to the tube, B, is reflected first directly into the tube, D, and then parallel to its axis, thus emerging from the prism and entering the eyepiece alongside of the rays of light which have passed through the two plate glass disks. I will thus be seen that the conditions for comparing the color and intensity of these two sources of light are as favorable as possible.

A piece of white card, C, fastened at the lower end of the larger tube, throws a uniform white light through both tubes, and also along the outside of the instrument into the prism.

In using the instrument, a piece of brownish yellow glass is placed in front of the prism, and the water whose color is to be determined is poured into the receiver.

The inner tube is then withdrawn until the column of water between the two glass disks is sufficiently long to give to the light passing through it a color equal to that imparted by the colored glass to the light passing through the prism. The length of this column of water, which will, of course, vary inversely with the depth of the color, can be determined by means of the scale on the inner tube. By this means the relative intensity of color of various specimens of water may be determined with considerable accuracy. Dr. Bowditch thinks that this instrument might also be of service in connection with chemical color tests.

Gems from the Keely Motor.

"An ordinary steamship can be run so fast with it that it would be split in two."

"With these three agents alone (air, water, and machine), unaided by any and every compound, heat, electricity, or galvanic action, I have produced, in an inappreciable time, by a simple manipulation of the machine, a vaporic substance, at one expulsion, of a volume of ten gallons, having an elastic energy of ten thousand pounds to the square inch."

"It is a vapor of so fine an order that it will penetrate metal. It is lighter than hydrogen and more powerful than steam or any explosives known."

"I found this vapor capable of exerting power infinitely."

"I once drove an engine 800 revolutions a minute, of forty horse power, with less than a thimbleful of water, and kept it running fifteen days, with the same water."

"I produced a pressure of about 28,000 lbs. to the square inch in a shell of a gallon and a half capacity and three and a half inches thick."

"I experimented with a gun. The target was a 4 inch plank placed against a steel plate. My vapor threw the ball with such tremendous force that it went through plank and steel, tearing the bullet in shreds."

"I propose, in about six months, to run a train of thirty cars from Philadelphia to New York, at the rate of a mile a minute, with one small engine, and I will draw the power all out of as much water as you can hold in the palm of your hand. Why, people have no idea of the power in water. A bucket of water has enough of this vapor to produce a power sufficient to move the world out of its course."—*John W. Keely, in Inter-Ocean.*

"You treat the alleged invention of Mr. Keely," says Charles B. Collier, "contemptuously, and speak of him and his confederates as juggling tricksters whose chief purpose appears to be the wriggling of money out of silly people."

"I have given to the development of this invention my almost undivided time, having meanwhile to beg the indulgence of clients for whom I have charge of important causes; my declared policy having been to attest by my actions the confidence I have professed in the genuineness and value of Mr. Keely's inventions, resting content to wait that moderate degree of fame and fortune which shall probably be mine, if the correctness of my judgment shall be vindicated in the future."

HOW THE MONEY WAS OBTAINED.

"The initial step was the procurement of the requisite amount of money."

"I visited your city, called together some of your best known and influential citizens, among whom was Charles H. Haswell, Esq., who himself had visited Mr. Keely's place, seen his receiver charged with this enormous vaporic pressure, and had reported upon it."

"As a result of my interview, the gentlemen present subscribed for $10,000 of the stock. They paid me $3,000. I returned to Philadelphia and gave this to Mr. Keely."

"Mr. Keely was obligated, before any further money was to be called for, to explain the principles of his invention. This he did, giving to me (in the presence of ten other gentlemen) an exhibition on the night of the 10th of November, 1874, the result of which I reduced to writing. This report you have evidently seen."

"Mr. Keely," says the report, "proceeded to make an 'expulsion,' that is to say, to develope a force or pressure from the multiplicator sufficient to exert a pressure of 1,430·36 lbs. This he did by blowing from his lungs, for, say, thirty seconds, into the nozzle upon the multiplicator. He then shut the cock and turned on the water from the hydrant. The operation was completed in about two minutes after the attachment to the hydrant was made, by simultaneously opening two cocks upon tubes connected with the first and second drums, when the lever and weight of the force register were raised. The operation of the engines now took place as follows:

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P. M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P. M., the reaction wheel was removed, and connections applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P. M. the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P. M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplicator was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus."

"After I had written the report," continues Mr. Collier, "I submitted it to Messrs. Rutherford, Boekel, and Bell. They gave it their unqualified endorsement."

J. Snowden Bell says: "I now publicly and emphatically reiterate and reaffirm my endorsement of said report."

W. H. Rutherford says: "This report being submitted to me, I carefully examined it, and gave to it, and to the conclusions therein stated, my unqualified endorsement, and I now re-affirm the same."

"With this report," continues Mr. Collier, "I proceeded again to New York, and submitted it to the parties with whom I had contracted. They paid me the balance ($7,000) of the $10,000 subscribed."

"Under and by virtue of the several contracts, the parties were entitled to an exhibition of this power. This has been given to them, and was witnessed by about 30 gentlemen. As the result of such exhibition, the parties have paid an aggregate of one hundred thousand dollars."

Charles H. Haswell, civil engineer of this city, says:

"I have witnessed the development, by Mr. Keely, of a cold vapor, void of pungency or of temperature in excess of the surrounding atmosphere, having an expansive energy of fully 7,800 lbs. per square inch, as tested by my measurements and computations thereon.

"I have been present when Mr. Keely has applied a like vapor to an Ashcroft gage, and the index pointed to a pressure of 10,000 lbs. per square inch.

"I have satisfied myself fully and conclusively that the instrument of Mr. Keely was operated wholly independent of any external attachment, other than that of a chain suspension and a flexible connection with a water service pipe.

"I have seen a double cylinder engine, 3 by 3 inches, operated by a like vapor from a reservoir, through a conducting pipe eight feet in length, and having a bore of but one tenth of an inch diameter, although it was resisted by a friction load equal to 2,250 lbs. per square inch, and which engine I individually operated for a period of 15 minutes without any visible reduction in its speed, or indication of the exhaustion of the intensity of the vapor in the reservoir from which the supply was drawn."

[Capacity of the above reservoir not stated by Mr. Haswell, but fixed by Mr. Collier at 3½ gallons.]

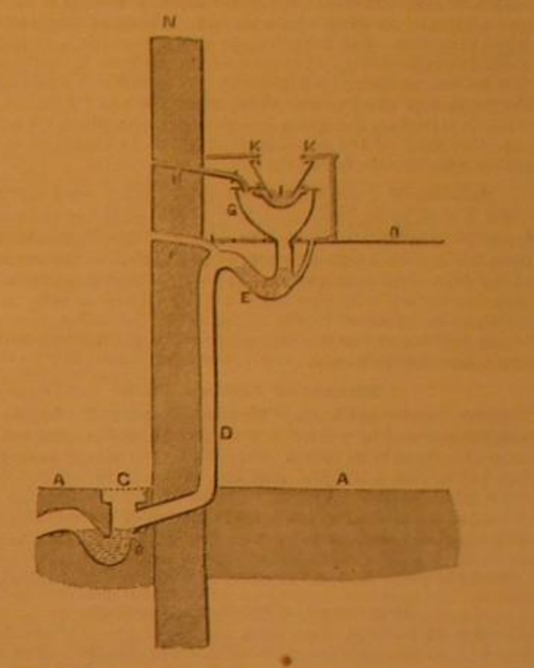
H. C. Sergeant says: "One of the remarkable things about the Keely motor is that it (the new vapor) cannot be transmitted at a lower pressure than 1,000 lbs. (per square inch). It can be used, of course, at a lower pressure, after it is put in action. It can be regulated like steam, but its transmission at less than 1,000 lbs. pressure causes its condensation."

The capital stock of the Keely Motor Company is $1,000,000. Among the New York gentlemen, believers in Keely, largely interested in the stock, and who are at present resident directors of the concern, are J. W. Shuckers, Charles Lamson, Frank G. Green.

"An ordinary steamship can be run so fast with it that it would be split in two."

HOW TO PUT UP A WATER CLOSET.

Our engraving represents sectional views of the water closet in the upper floor of a two story house. A A is the level of the surface of the ground at the back court and of the kitchen floor. B is a 6 inch vitrified fire clay siphon trap,



with an open iron grating, C, at its top, which grating may be hinged. D is a 4 inch soil pipe from the water closet; it is here shown coming down inside the wall; in other cases it may be carried down the outside. One advantage of such pipes being carried down the inside is that they are more likely to be protected from frost. F is an ½ inch or 2 inch lead pipe for ventilating the soil pipe. In this case it is carried through the wall, in other cases it may be carried up through the roof. G is the water closet trunk, made of iron, it being a pan water closet, which is here shown. H is a ¾ inch lead pipe carried through the wall and put in to ventilate the trunk, or that space between the water in the pan, I, or basin, J, and the water in the siphon trap, E. This ¾ inch ventilating pipe, H, is a very important one, and its use ought to be the rule in place of the exception, as is at present the case. It works as follows: When the handle of the water closet is lifted, then any foul air lying in the trunk, in place of coming out into the apartment, is sent outside with a rush through this pipe, H; besides, being open to the air, it tends to prevent the accumulation of such foul air in the trunk.

In order to keep the outer orifices of the pipes, F and H, always open, it is a good plan to solder on one or two pieces of copper wire across them. J is the water closet basin, and the two small circles shown, underneath K K, are the india rubber pipes. L is a 3 inch zinc ventilating pipe carried up through the roof to ventilate the space or inclosure in which the water closet is situated. M is the gas bracket right below it, helping, when lighted, to cause an upward current. The empty space at N is supposed to be the water closet window. O is the surface of the floor of the upper flat. No gas can accumulate in the soil pipe, for the pressure of the atmosphere on the surface of the open grating, C, tends to send a current of fresh air through the soil pipe and out at the ventilating pipe, F.—*W. P. Buchan.*

Recent American and Foreign Patents.

Improved Fire Escape.

Franklin P. Berney, San Quentin, Cal., assignor to Lee B. Matthews, of same place.—A box is built upon the roof of the building, and so placed that its front door may open at the wall of the said building. The box is also provided with doors at its inner side. Within the box is a reel on which a rope or wire ladder is wound. The ladder is made of such a length that its lower end may reach to the ground, where it may be secured to hooks attached to the pavement. When the doors are swung open, an arm pushes a ball from a pin, so that the ball may fall into the street and carry down with it the end of the cord or chain, by which the ladder may be drawn from the reel. The doors are swung open when unfastened by springs. The doors are fastened, when closed, by a sliding catch bolt. The bolt is operated by a rod or chain, which passes down along the wall of the building through a guard pipe attached to said wall.

Improved Running Gear.

Henry Backer, Union Hill, N. J.—By this invention the connection between the head block and the forward axle is made firm and secure without the use of a fifth wheel. The end parts of the axle between the ends of a strengthening bar and the axle arms are strengthened by bars, placed upon them, and secured by suitable fastenings.

Improved Blacksmith's Forging Hammer.

Andrew J. Judson, Hillville, assignor of three fourths his right to Jacob Truly, Catfish, Pa.—This consists of a sledge hammer for blacksmith's use, contrived with a foot treadle for forcing it down and a spring for raising it. It will strike quite light blows, or slower heavy ones, at the will of the operator. The helve of the hammer is pivoted in a yoke of a vertical standard, which is free to turn, and has a lever for the purpose of swinging the hammer laterally along the anvil, whereby the blacksmith may cause the hammer to strike on any part of the anvil at will, and as the work requires. The springs for raising the hammer are also contrived to turn with the helve, so as not to interfere with its turning, and the helve is extensible to lengthen and shorten its range.

Improved Clamp for Grinding Watch Crystals.

Arthur C. Norton, Monona, Iowa.—This invention consists of a pair of rubber-faced clamping disks, arranged in a pair of jointed clamping jaws, having a clamping screw for fastening them to receive and hold between them a watch crystal, and revolve with it. The edge of a crystal is presented to the face of a grindstone, so as to be ground suitably for fitting in the rim of a watch case.

Improved Planing Attachment for Metal-Turning Lathes.

Axel Hoffman, New York city.—The bed plate of the attachment is made to slide on the ways of the lathe. There is an adjustable clamp, by means of which the attachment is applied to the lathe, and a lever, by means of which the slide and tool of the attachment is put in motion. The fulcrum pin passes through a slotted arm made fast in the clamp. The feed screw works in the slide of the tool holder. A spring is attached to the base which bears against the shank end of the tool, which, when the tool leaves the piece which it is cutting, the spring throws back into position for another cut. The feed of the attachment is given by means of another spring, which is attached to the bed.

Improved Combined Baby Tender and Crib.

Mrs. Ariette Baird, Riverhead, N. Y.—This invention consists of a frame work in the nature of a crib, supported detachably on corner posts, and provided with a bottom carpet, applied to the lower part of the frame, and with a stretching part attached at suitable hight above the carpet, to be alternately used as a tender or crib. A canvas sheet is stretched to the upper end of the lower connecting boards, and transforms the tender into a crib, the mattress and bedding being placed thereon.

Improved Lifting Jack.

John B. Fayette and Lorenzo Meeker, Oswego, N. Y.—In using the jack, the free end of a lever is raised, and a step is adjusted to fit under the object to be raised. The jack is then placed beneath the object to be raised, and the free end of the lever is drawn down, which raises the object. When the free end of the lever has been lowered so far as to carry the pivot in the end of the said lever past the straight line connecting the fulcrum of the lever and the pivot in the end of a lifting bar, the said lever strikes a stop attached to the brace bar, and the jack is locked, holding the object raised.

Improved Furniture Casters.

Cevedra B. Sheldon, New York city.—The object of the first of these two inventions is to contrive a stamped spindle socket, so as to bear the weight of the load on the top of the spindle by the bottom of the socket, which, as ordinarily arranged, it is incapable of, because the metal is so soft, to facilitate the stamping, that it will not stand the wear. A bush or washer is secured in the socket, by the spindle end passing through and riveted above it, and a shoulder for the washer or bush is formed in the socket by a contraction of the upper end thereof, the spindle passing through and being riveted above. The second invention consists in the construction of the horn of a single piece of sheet metal with a rolled eye. The horn is much stronger and more durable than when made of cast metal, while its cost is trifling when compared with the cast articles.

Improved Brake for Hay Wagons.

William Harper, Senecaville, Ohio.—This improvement in wagon brakes relates to the construction and arrangement of the operating lever, whereby it operates automatically to hold the brake bar away from the wheel, except when applied thereto by manual force.

Improved Ship's Furniture to Prevent Seasickness.

Joseph Wertheim, Frankfort-on-the-Main, Prussia.—This invention consists of a chair with supporting legs, carrying a universal joint, to which the supporting rod of the seat is connected, to retain the level position of the same during the movements of the vessel. The said parts are so constructed and arranged that the legs may be folded for storage.

Improved Machine for Turning Bobbins.

Luther Bean and James M. Butters, Stratford Hollow, N. H.—This invention consists of a revolving cutter head on a hollow mandrel, having a sliding center, in combination with another sliding center, and a sliding table, all being worked automatically, and so arranged that the blanks, be'ng supplied to the table by hand, will be automatically introduced between the centers, and turned, and discharged rapidly and efficiently.

Improved Throttle Valve.

Reinhard Scheidler and John H. McNamar, Newark, Ohio.—This consists of a valve which is controlled by the sawyer by means of a sector lever and rack placed in the steam pipe, either in combination with or separate from a throttle valve.

Improved Sewing Machine.

George S. Darling and Augustus L. Darling, Watertown, N. Y.—This invention consists of improvements in the construction of the Davis vertical feed sewing machine. The thread tube is made by novel arrangements to serve for the pivot pin of the link, as well as for its own legitimate purpose, being firmly screwed in the top of the needle bar. The cam at the lower end of the tumbler is so shaped that, at the same time that it swings to lift the presser, it will work the take-up as it is required to operate, and there leave it at rest, to be afterward returned by the spring, which is arranged in a volute coil around the stud to which it is attached as being a better and more durable arrangement than the angular form in which it has been heretofore arranged in these machines. To take up the edge wear of the cam bar, an adjusting bar alongside of it is introduced, with adjusting screws, by which it can be shifted along against the cam bar from time to time, as may be needed.

Improved Boot and Shoe Last.

Chas. F. Hill, Baltimore, Md.—This invention relates to certain improvements in lasts for boots and shoes, and it consists in attaching, to the metallic plate upon the bottom of the last, points which receive and hold the lasting sole while the upper is being attached to the same. Said points have a sharp knife edge upon the side next the heel, so that, when the shoe is finished and the last is to be withdrawn, the said point cuts a slight gash in the sole and allows the last to be withdrawn.

Heating Stove.

Alexander Bettes, Warrensburg, Mo.—This invention is an improvement in the class of heating stoves which are circular or oval in cross section, provided with return flues on the sides, and have a damper so arranged that the products of combination may be, at will, diverted from a direct course and caused to take the circuitous one. The patentee aims to secure a maximum exterior heating surface with a cheap, compact form of stove, and to insulate the combustion chamber, at will, by means of a dead air space on the sides, bottom, and rear end of the stove.

Improved Furnace for Manufacturing Iron.

George J. and Samuel J. Skinner, Milton, Pa.—This invention consists in reducing iron ore to wrought iron in one continuous operation, consisting first in subjecting the ore in a liquid or molten condition to the deoxydizing influence of hydrogen and carburetted hydrogen gases; and secondly, in smelting the ore by the subsequent action of the same blast admitted with atmospheric air. The invention also includes the apparatus for carrying out the process.

Improved Press.

Edward Van Gosen, Forest, Ohio.—This invention consists of a press for cheese, wine, cider, and the like, in which there is a hand lever connected with the follower, and another lever carrying an eccentric lever for operating the first mentioned lever when the resistance becomes too great for the direct application of hand power.

Improved Feed Water Heater and Filter.

George F. Jasper, Freeburg, Ill.—This invention relates to improvements in the feed water heater and filter for which a patent was granted to the same inventor under date of December 1, 1874. It consists of a water box in the heating tank, from which the water is conveyed to a double filter receptacle, and back by a return pipe to the sediment pan, from which it is fed to the pump.

Improved Bog Boots for Animals.

Wilhelm Jacobs, Charleston, S. C.—This invention consists of a bog boot for horses and mules, to wear on soft boggy ground to prevent miring. The upper is made in two side and one front pieces, and a back stiffener, together with straps for buckling the boot fast on to the foot. Loop straps keep the fastening straps in place. The said side pieces are to open the top to admit the foot. The side pieces meet together behind, and are cut down on the top to fit the fetlock.

Improved Pump.

William H. Conver, Agnew's Mills, Pa.—This improved pump consists of two cog wheels, running together in a case, to pass the water between them. Leather packing diaphragms are confined against the ends of the wheels, and also leather packings are provided for the faces of the wheels, also held by springs in a manner calculated to afford efficient packings with but little friction.

Improved Picture Exhibitor.

Julius Buechner, St. Paul, Minn.—This invention consists of a picture case with hinged back, having folding side, top, and bottom flaps, that may be closed at the front or back, for inclosing or exhibiting the picture. It is a convenient device for carrying photographs or other pictures in a safe and compact manner, and for exhibiting them at any time by changing the inclosing parts to form a stand or a picture frame.

Improved Paper Bag.

Emil Langgesser, Atlanta, Ga., assignor to Elsas, May & Co., same place.—This consists in so folding paper as to form a bag from one piece. The bag has a seamless or satchel bottom, and, when filled, will stand erect, and will not be liable to draw apart at its seams.

Improved Nut Lock.

Joseph C. Wright, Monocacy Station, Pa.—This invention consists of a notched block sliding in a washer against the nut, to hold it by the corners or broad side. The block is held against the nut by a spring, which is contrived to release the block readily to free the nut when it is to be screwed on or off. The block is fitted in a notch in the washer for operating in this manner by rabbet joints, which are stamped out cheaply, and the spring is a kind of yoke or bow strained against the outside of the locking block.

Improved Insect-Destroying Composition.

Joseph B. Douglass and Elijah S. Green, Columbia, Mo.—This is an improved compound for protecting trees from boring insects, consisting of sugar of lead, alcohol, spirits of turpentine, aqua ammonia, gum arabic, and camphor.

Improved Car Mover.

Milton Woodworth and Jerome B. Fredricks, Conneaut, Ohio.—This consists in a lever so constructed as to adapt it to be applied to the rim of a car wheel, for rotating the same, and thus moving the car on the track.

Improved Scraper.

Elbridge Dickinson, Marshall, Mo.—This is an improved scraper for grading roads and other purposes, so constructed as to take up the dirt without its being previously plowed or loosened. The scraper plate is slightly concaved, and its ends are turned up to act as cutters. It is strengthened and secured by bars, and has attached a grating upon which the dirt slides when the scraper is full.

Improved Former for Bending Sled Frames.

Jacob W. & Eugene W. Karu, Seneca Falls, N. Y.—This invention relates to a device for forming or bending the iron in the construction of sleds, in which a single piece of metal is so bent as to form both the runner and side frame of the sled. It consists of a base plate upon which are mounted segmental plates having dowel pins and handles, whereby the said plates are detachably fixed to the base. The segmental plates are shaped to suit the open spaces between the frame to be constructed, and, when placed upon the base, leave a space between them which constitutes a pattern around which and between which the iron is bent to the required shape.

Improved Bottle Stopper.

Michael W. Shaw, Galveston, Tex.—This invention is an improvement in the bottle stopper of Westel E. Hawkins, patented under date of August 4, 1874, so that the same may be used with greater ease, and without being liable to wash off the dust and fly dirt from the outer cap piece by the liquor running over the same. It consists in providing the sliding cap piece with a circumferential flange or rim to prevent the running of the liquor from the perforated extension over the outside of the cap piece.

Improved Ironing Apparatus.

J. Wright Gardner, Troy, N. Y.—This invention relates to machines for ironing collars and other special articles by power with a cylindrical iron, which is made to roll or slide on the goods and then slide back. It consists of the carriage for the roll or other contrivance by which it is connected to the working mechanism made to slide on ways parallel to the table, the object being to dispense with the overhead device heretofore employed for suspending the roller frame.

Improved Lamp Chimney.

Robert Norris, Anna, Ill.—This invention consists in side glasses tapered to slide in vertical grooves and be removable at the top, and in making an air flue between the outer shell and inner flue.

Improved Saw Gage.

O. T. Gronner, Baltimore, Md.—This invention consists in novel means for gaging the division lengths of lumber on the sawing machine, and in securing the table on which the lumber is fed, so as to take up its own wear and prevent the possibility of tilting. For this purpose, the table is provided with beveled ways, the gage made reversible by tenon and groove on each side, and the guide combined with a sliding gage.

Improved Measuring Instrument.

E. C. Roberts, Broadford, Va.—This invention consists of a pivoted plate, two notched arc plates, two direction bars, and two pointers, one of the direction bars turning in a horizontal plane, while one of the arc plates turns in a vertical plane.

Improved Nozzle for Smoke Stacks.

Wm. Stamp, Susquehanna Depot, Pa.—The invention consists in means whereby exhaust steam may be more effectually utilized in augmenting the up draft of a smoke stack.

Improved Eaves Trough.

Robert Tyburst, Dresden, O.—The invention consists in making the eaves trough for buildings out of burnt clay, the sections being coupled by tongue and groove.

Improved Fire Escape, and Improved Combined Fireman's Ladder and Fire Escape.

David Sanford, Ashton, Ill.—The first invention is a vertical extension ladder, provided with a coiled spring arranged in connection with the windlass of one of the movable sections. The spring winds up when the section descends, and serves to counteract the weight of the moving parts, and assist in raising and lowering them. The movable sections may be swung out against the building, and are provided with a sliding extension. The ladder is in the form of a hollow square. The second invention is an improvement on the above. The ladder is pivoted to the frame of a carriage, and may be raised by a chain connected with a spur wheel. The chain is prevented from slipping off said wheel by suitable devices, no matter in what position the ladder may be placed. The ladder may be adjusted laterally; suitable braces are added for steadying the machine. Finally, the ladder may be turned down and conveniently stowed for transportation.

Improved Smoke Stack.

W. Stamp, Susquehanna Depot, Pa.—The invention relates to the smoke stacks of locomotive engines wherein means are employed to prevent the emission of sparks and cinders; and it consists in utilizing the exhaust steam in augmenting the up draft without materially impairing its force, so as to discharge the sparks and cinders through a spiral conveyer to one side of the outlet of the smoke pipe.

Process of Treating Jute for Paper Pulp.

Edward Conley, Cincinnati, O.—The patentee produces a pure white pulp from jute by a process which depends for its novelty, not upon a new combination of chemical elements, but upon the relative strength of the caustic alkali solution, the degree of pressure while boiling, and certain other conditions. The patentee seems to have discovered the proper relative proportions of chemical agents, degree of pressure, etc., necessary to produce the desired white product, although others have previously subjected jute to a process or treatment analogous in a general way, but without arriving at a like satisfactory result. The process is an economical one.

Improved Exercising Apparatus.

George W. Wood, New York city, assignor to Hetty W. Wood, of same place.—In the ends of a rubber tube are inserted conical blocks, made with rounded outer ends, around which the ends of the tube contract, so that, when the said ends are grasped by the hands, it will be impossible for the said conical plugs or handles to be drawn out. The plugs are perforated longitudinally, and through them, and through the rubber tube, is passed a cord, which has knots formed upon its ends of such a size as to prevent said ends from being drawn through the said handles. The cord is of such a length as to allow the tube to be stretched to any desired extent. With this construction, should the rubber tube break, the cord will prevent the ends of said broken tube from springing around and striking the person using the implement, or those standing near.

Improved Corn Marker.

Miles A. Throckmoton, Andersonville, O.—The side frames may be turned up over the middle frame, for convenience in passing from place to place, and to enable the machine to pass through narrow places. The standards of the plows are slotted longitudinally to receive bolts, by which they are secured to adjustable bars, so that they may be conveniently raised and lowered, to make shallower or deeper marks. To the rear parts of the bars are pivoted wheels to support and carry the machine. The faces of the wheels are made V-shaped, so that, as they follow the marking plows, they may pack the soil in the bottom and sides of the marks, and make said marks distinct, so that they can be easily seen, and permanent, so that they cannot be obliterated by storms that may occur between the marking and planting. Another device makes a small mark parallel with the marks made by the plows and wheels, to serve as a guide to the driver when using the machine, and may be extended and contracted to correspond with the adjustment of the plows and wheels.

Improved Wood Grinder for Paper Pulp.

Anna M. Zimmer, Elkhart, Ind.—The invention consists essentially of a grindstone arranged to run in an oblique plane of about 45° to the horizon, with two grinding faces and two sets of feed boxes and feed pressers, both arranged obliquely to the horizon, so that the gravity of the wood will assist in feeding it, and the water for lubricating the stone will apply to both faces better than it will to one if the stone is arranged horizontally. The invention also consists of certain details of the apparatus for working the feed pressers, and in the contrivances of the feed boxes and their supports.

Improved Wood Grinder for Paper Pulp.

Joseph O. Gregg, Elkhart, Ind.—The invention consists in the combination, with a double elbow lever fulcrumed on different frame posts, of a single central hollow weight, attached to all the levers to prevent jarring, shaking, or quivering of the lever. The fulcrumed double levers swing only in vertical direction, and prevent play in any other direction, while the central weight causes every piston to grind alike, as the pressure is shifted from one to the other in case the wood in one box is softer and easier cut than in the other.

Improved Blind Slat Adjuster and Improved Shutter Worker.

William M. Lanphere, Waterloo, Iowa.—The first invention consists of tubular shafts arranged on the shaft of the blind opener, to open and close the slats by wheels at the outer end gearing with racks on the blind, which operate the slats by levers and connecting rods. A set of the devices is employed for each section of slats, to work them independently of each other. The second invention consists in the provision of a hinged angle plate, which is carried by a push rod, employed for starting or dislodging the shutter when bound by frost or any slight obstruction, said plate serving to fasten the shutter, when closed, by engaging with its lower edge.

Improved Hopple.

John Shive, Center Hill, Ark.—The invention consists of a hopple formed by one unjointed arc piece with a shoulder and three links, so arranged that all liability to unfasten is removed, while facility of manipulation is still retained.

Improved Grain Drill.

James C. Daman, Elk Point, Dakota Ter.—The machine embodies an improvement in the class of grain drills having a reciprocating or shaking hopper; and the invention relates particularly to an arrangement for simultaneously elevating the seed coverers and throwing the seed box or hopper out of action.

Improved Folding and Sliding Ten-Foot Pole.

Stephen W. Blatchly, Dickson City, Pa.—This rod is made of four sections of wood. The two middle sections are hinged together. To keep this hinge rigid when the rod is opened, there is a slide, which is slotted and held in place by two screws. A bar plate receives the slide when the rod is opened. When the rod is closed or folded the slide is pushed back. The outer sections are confined each by bands, and slide up to shoulders, in which condition the rod is readily carried from place to place. The rod is marked off into feet and inches in any convenient manner.

Improved Corn Sheller.

Frelinghuyson H. Hunter, Heltonville, Ind.—The invention relates particularly to a chaff box, which is formed of a sheet metal plate applied beneath the ribs or bars of the sheller.

Business and Personal.

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

Notes & Queries

A. J. C. and B. B. L. should consult a physician.—R. F. will find a good recipe for burnishing liquid for the heels of boots and shoes on p. 347, vol. 31.—F. K. will find a recipe for cement for china on p. 348, vol. 24.—J. C. T. should consult an engineer.—A. K. will find a recipe for root beer on p. 138, vol. 31.

(1) H. J. R. asks: How do you suspend the the sheet of zinc in the galvanic battery, mentioned in a recent issue? A. Suspend it upon any insulator. Wood will do.

(2) G. F. H. asks: 1. Is there any better insulator than gutta percha or glass for the key of a telegraph instrument? A. Yes. Bone or rubber. 2. Do operators ever lose the use of their arms, by electricity passing through gutta percha insulators? A. No. 3. Is there anything that will counteract the effect of electricity on the nerve? A. No.

(3) E. L. G. asks: What is the best battery for making an electric light? A. Fifty cells of Bunsen.

(4) P. Q. S. asks: 1. In the following battery, what is the least number of cells that will give a perceptible shock? It consists of a glass jar 5x4 inches, covered by a piece of wood, suspended from which are two pieces of coke 5 inches long by 2 wide; between these is a piece of zinc of the same size. The liquid is bichromate of potash, 2 parts, dissolved in 20 parts hot water and 1 part sulphuric acid. A. One hundred cells would give a slight shock. 2. Should the zinc plate be amalgamated? A. Yes. 3. How many cells would be necessary to nickel plate buttons, etc.? A. One cell. 4. Which is the positive plate? A. The zinc. 5. In a recent issue of your journal, you published a recipe for amalgamating zincs. I tried it, but it was a total failure. I could not dissolve the mercury. What is the trouble? A. You need not dissolve the mercury. Clean your zincs with muriatic acid, and the mercury will adhere.

(5) J. S. F. asks: 1. If a plate electric machine is arranged with metallic disks and points on both sides of the plate, for conducting the electricity to the prime conductor, would it conduct more of the fluid with the same friction of the plate than it would if there were disks on one side only? A. Yes. 2. If the points are a quarter of an inch apart instead of half an inch, would it catch more of the electric fluid with the same friction of the plate? A. Yes.

(6) R. S. says: I have constructed a line of telegraph to connect my store and house, distance half a mile, and have found it impossible to make any circuit by the ground. I commenced with 4 cells of Daniell's battery; then I increased to 7 cells, and carried ground wire at each end into the cellars; these I connected with a piece of gas pipe 8 feet long, driven the whole length into the ground and surrounded with a quantity of scrap metal of different kinds, yet it does not work, and I had to put up a return wire. It works splendidly with the second wire, but I wish to make it work with the single wire. Can you inform me how it can be accomplished? A. Bury two copper plates, six feet square—one at each end of the line—in earth which is always saturated with water, and solder the ends of the wire to the plates.

(7) W. S. H. asks: What should be the members of a saline battery for constant action, the solution to be similar to sea water? A. Zinc and copper.

(8) B. P. D. says: In a recent issue you say that the resistance in the pencil of charcoal develops heat, producing incandescence. Is any effect produced by this intense heat where the carbon comes in contact with the glass cylinder? Or, more to the point: Is heat generated at all in this partial vacuum, I mean of course to any considerable extent? A. Machine electricity is not sufficient in quantity for the production of light with carbon pencils.

(9) A. asks: 1. How can I make a Leclanché battery? A. See p. 73, vol. 31. 2. How many Léclanché cups are required to make an electric light? A. Seventy-five, of large size.

(10) C. S. W. asks: Am I correct in claiming that light travels faster than galvanic electricity? A. Yes, as a general statement of fact. Galvanic electricity could travel as fast as light if it had a conductor without resistance, but that is difficult to secure.

(11) M. M. asks: Has there been in this country any practical application, to the artificial lighting of buildings, of the electric system of the Russian inventor, M. Ladiguin, described on p. 373, vol. 32? A. No.

(12) R. H. S. asks: 1. What does the following mean, in relation to lenses: "$\frac{1}{20}$ inch, angular aperture 175°," and "$\frac{4}{10}$ inch, angular aperture less than 90°, without adjustment"? A. These questions relate to compound microscopic objective lenses; $\frac{1}{20}$ inch means that the magnifying power of the combination is equal to a single lens of $\frac{1}{20}$ inch focus, or $\frac{20}{1}$ x 8=160 linear, when it would be used alone without an eyepiece. Angular aperture 175° means that the extreme rays which can converge in the axis of the lens from the edge of any object, and reach the eye, make in that axis an angle of 175°. Four tenths of an inch means that the magnifying power is equivalent to that of a single lens of $\frac{4}{10}$ inch focus, or $\frac{10}{4}$ x8=20 times linear. Angular aperture less than 90° means that the lens does not admit rays more oblique than those which make ½x90 or 45° with the axis. Without adjustment means that the lens has not the adjustment required for high power, by which the relative distance of the achromatic lenses, of which the lens is composed, can be shifted so as to adapt the lens to different thicknesses of glass crossing the object. 2. What are an immersion lens and a dry lens? An immersion lens is one of which the curves are calculated in such a way as to be only adapted to be used with a drop of water between the lens and the object. Dry lenses are the ordinary lenses.

(13) S. M. says: I have run my lightning rod into my well as a ground connection. As water is a good conductor, I supposed this would be the best possible way. Is this correct? A. Yes.

(14) W. M. Q. asks: 1. Is there a telegraph insulator in use that the wire simply passes through? A. Yes. 2. Would a glass tube passing through the cross bar be as good as the common insulator? A. No.

(15) W. O. C. asks: 1. Will a battery consisting of two 1 quart cells (copper and zinc) be of sufficient power to silver plate small articles? A. Yes. 2. How can I construct such a battery? A. See p. 26, vol. 32. 3. Can electricity be felt by taking hold of wet sponges attached to the wires? A. No. 4. What is the least number of cells required to plate small articles, coins, etc.? A. One cell. 5. How much and what kinds of wire should I use to make an induction coil two inches long with? A. Use 500 feet No. 40 and 50 feet No. 16 wire.

(16) O. C. says: 1. I have had an electromagnet made of ½ inch iron, U-shaped (the arms 4 inches long), wound with 650 feet No. 23 cotton-covered copper wire; with two cells of Léclanché battery it attracts the armature ($\frac{1}{16}$ of an inch from the poles) with a force of about 4 ozs. Is that as much as I ought to expect of it? A. The Léclanché battery is not well adapted for power. You would get much more power from a single cell of Bunsen than from a dozen of Léclanché. 2. How shall I connect the cells together to get the greatest attractive power of the magnet, carbon of one cell to zinc of the next, or all the carbons together and all the zincs together? A. Connect all carbons together and all zincs together.

(17) E. C. says: I have made two Morse sounders, ½ inch cores, 2x1½ inches spools, with 500 feet No. 26 wire. How many cells Callaud battery shall I want for 600 feet No. 12 iron wire? A. Six.

(18) C. H. W. says: 1. In a recent article on electro-metallurgy, you stated that lead articles should be electro-coppered before silver would deposit. Is the solution for this purpose the same as that for electrotyping? A. Yes. 2. You also gave the proportion of ingredients for silver bath, using cyanide of silver. What would be the proportion in using nitrate of silver? A. Nitrate of silver will not answer. 3. How many Minotti cells with 2½ inch disks should I use for plating in a ½ gallon bath? A. One.

(19) G. A. C. says: I tried to make a battery by taking a glass jar and putting sulphate of copper in the bottom, and water on top, with a piece of copper in the bottom, and a copper wire leading from it, and zinc above with copper wire leading from it also. I cannot feel any electricity going through the wires. Is the battery too weak? A. A single cell would not have force enough for you to feel the electricity.

(20) J. W. W. asks: Is there a method of creating a vacuum, however small, by means of an electric current? A. We do not know of any.

(21) E. F. M. asks: What effect will heat lightning have on a balloon if the air is hot? A. We have no positive data to guide us upon this point, but should think the heat lightning would not affect the gas.

(22) S. E. P. says: In melting ore in a small crucible, can I put in anything to make silver flow freely and separate from the other matter? A. Melt your silver with a small quantity of lead in an ordinary cupel.

(23) C. W. H. says: If a piece of glass is placed between the heat of a fire and the hand, the heat will not be felt. But if you place the glass between the hand and the sun, the heat will be felt as if the glass were not there. Why is this? A. Heat radiations are classified under two heads, luminous and obscure. A plate of glass, while it freely transmits all the higher heat vibrations or luminous heat rays, wholly arrests the obscure ones. The rays from the stove are possibly all obscure, or of slower vibration, and are therefore completely arrested by the glass plate, while the sun's heat radiations are mostly of the luminous kind (the obscure rays having been sifted out in their passage through the aqueous vapor in our atmosphere), and pass with little loss through the glass.

(24) K. H. asks: How can I color the hair on a buffalo robe, so as to make it a dark brown, nearly black? A. It will be necessary to first thoroughly cleanse the hair of all dirt, etc., as it is impossible to get any satisfactory results until this has been done. For the above purpose, the following has been used with advantage: Sufficient aqua ammonia is added to a pint of water to make the whole pungent. Afterwards wash with clean water. Then use the following dye: To a saturated solution of sulphate of copper, add ammonia until the precipitate which falls is wholly redissolved. For a mordant, to be first applied, use a saturated solution of ferrocyanide of potassium.

(25) J. F. W. says: A jeweller recently had several watches in his front window, and at a flash of lightning he felt the glass in his window move. On taking down a watch, on the face of which was a small compass, and laying the watch down face upwards, he noticed the compass out of order. It would first start and turn rapidly to the right for a good many revolutions, then poise for a second, and then revolve rapidly to the left, which it continued to do for two days, when the owner took it out. Was the watch electrified by the lightning? A. You should have stated whether the working parts were in motion or not. If in motion, the phenomenon is easily explained; some of the movable steel parts of the mechanism have, from some cause or other, become magnetized (possibly from the cause mentioned), and at every change of position they alternately attract and repel the opposite poles of the compass needle.

(26) A. S. says: I have about 300 bottles of Burgundy which has turned slightly sour. Can you tell me how to cure it? A. Try the old German method of putting into the wine a small quantity of charcoal, shaking it, and, after allowing it to stand 48 hours, decanting from the sediment.

(27) H. S. F. says: 1. On my barn there is a metallic vane. The vane is higher than anything else in the vicinity, though there are plenty of trees about. The soil is very dry. Knowing that lightning rods are seldom put up properly, is the barn safer without or with them? A. If you follow the advice given on p. 145, vol. 31, on constructing and placing the rod, there will be no doubt of its efficient protection over your property. 2. Why do trees tend to protect a building from lightning? A. Tall oaks and elm trees sometimes offer some protection to low buildings; but in most cases this protection is rather uncertain.

(28) O. C. L. asks: How many revolutions of Robinson's cups are equivalent to one mile traveled over by the wind? A. Dr. Robinson concluded himself warranted in laying down, as a general law, that the cups on a horizontal windmill of this description move with one third the wind's velocity, except so far as they are retarded by friction.

1. What is the simplest method of determining when it is exactly noon at New York, so as to regulate time pieces? A. The methods of determining true local time by observation are several. (1) By equal altitudes of a star or opposite sides of the meridian. Observe the time when the star has equal altitudes before and after passing the meridian; the middle point between these times is the time of the star's passing the meridian. By comparing this time with the known place of the star, we may obtain the error of the clock. (2) By equal altitudes of the sun. Since the declination of the sun changes from morning to evening, the time of the sun's arriving at a given altitude is affected by this motion, and we must compute the correction to be applied to the mean of the times observed. (3) By means of the transit instrument. The instant of the sun's passing the meridian is the time of apparent noon; and hence, if we compare the sun's passage over the meridian with a chronometer, we shall obtain the deviation of the chronometer from apparent solar time. If to this we apply the equation of time with its proper sign, we shall obtain the error of the chronometer in mean time. 2. Will a sun dial serve this purpose, and if so, how can I make one? A. Sun dials are not very accurate chronometers.

How can I make a self-registering rain gage? A. A graduated bottle with a small funnel placed in its mouth is the simplest of the various pluviometers in use, and is, perhaps, as accurate as any of them. We do not know that any self-recording instruments of this kind have yet been constructed.

(29) A. L. F. B. says, in reply to S. L. G., who asks if violin tops and bottoms are sawn thin and then bent, and also if there is a block or anything of the kind inside the violin, to glue the neck to, or is the neck simply glued to the outside: I give some extracts from the "Practical School for the Violin," by U. C. Hill: "Wood for the belly or sound board should be split so as to have a full inch thickness toward the bark or outer side, and a quarter of an inch towards the heart of the tree. Sycamore, for the back, must be cut in the same manner, with this exception: It should be split, in pieces not less than 6 inches wide, and 2 inches in thickness, at the back edge. It is then sawn in two, breadthways, or sliced into two pieces. These two pieces are then glued firmly together, with the edges nearest to the bark of the tree inwards. The under side is planed flat, and the upper or outside is, in the first instance, planed down, somewhat in the form of the roof of a house, that is, higher in the center, and sloping down gradually towards the edge. The form or model is then scooped or worked out according to the taste of the artist. It should be observed that the end blocks, which are placed one at the extremity of the neck, and the other at the bottom of the instrument, immediately under the tailpiece, are never omitted even in the commonest violins. It may not be amiss to remark that, in the oldest instruments, the upper end block is not a detached piece, but, in fact, a continuation of the neck, the ribs being let in on each side; but this system is now exploded. The neck is merely glued, and not fastened on with either a nail or a screw."

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

H. J.—It is flint.—H. S.—It is a poor quality of hematite.—J. R.—Nos. 1 and 2 are mica schist. No. 3 is quartz rock, containing iron pyrites. No. 4 is quartz rock, containing arsenopyrite.—E. N. L.—It is not plaster, as you suppose, but calcite or carbonate of lime—$CaCO_3$. Several small crystals were found in the calcite, but there were not enough of them for us to determine what they were.—J. O. B.—The dark red material, No. 1, is shale. No. 2 is a limestone containing marmolite. —J. A. H.—It is hematite.—I. L.—It is the cocoon of the *attacus cecropia*. "The cocoon is fastened longitudinally to the side of a twig. It is, on an average, three inches long, and one inch in diameter at the widest part. Its shape is an oblong oval, pointed at the upper end. It is double, the outer coat being wrinkled, and resembling strong brown paper in color and thickness; when this tough outer coat is cut open, the inside will be seen to be lined with a quantity of loose, yellow brown, strong silk, surrounding an inner oval cocoon, composed of some kind of silk, and closely woven like that of the silkworm. The insect remains in the chrysalis form through the winter. The moth, which comes forth in the following summer, would not be able to pierce the inner cocoon, were it not for the fluid provided for the purpose of softening the threads; but it easily forces its way through the outer cocoon at the small end, which is more loosely woven than elsewhere, and the threads converge again, by their own elasticity, so as almost entirely to close the opening after the insect has escaped."—*Harris*.

COMMUNICATIONS RECEIVED.

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

On the Keely Motor. By T. P. W., and by O.
On the Weight of the Earth. By J. F.

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

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells lenses for telescopes? Is there a good and cheap microscope for student's use to be found in the market? Who sells the best bookbinders' boards? Whose is the best gear wheel cutter?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending June 22, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, burglar, J. A. Weed 164,888
Bale tie, Du Bose & Charles 164,817
Bale tie, A. Eichholz 164,821
Bale tie, J. H. Hardman 164,835
Bath tub showering attachment, W. H. Rowe 164,768
Battery, galvanic, T. Chutaux 164,807
Bed bottom, spring, J. A. Reeds 164,693
Bedstead fastening, G. Suppert 164,883
Bedstead, invalid, G. Pence 164,760
Bee hive, E. Gerry (r) 6,499
Bell pull, W. Richardson 164,874
Belt fastener, J. B. McElroy 164,855
Belt shifter, W. H. H. Steum (r) 6,496
Belt twisting apparatus, M. P. Wilmarth 164,702
Billiard register, electrical, Russell & Sax 164,661
Blank book, I. Reynolds 164,873
Body brace, H. R. Allen 164,706
Boiler plates, punching, Carroll et al. 164,673
Boiler, steam, M. W. Shapley (r) 6,501
Boiler, wash, J. Rieth 164,875
Boiler, feed water heater, S. W. France 164,826
Book clasp, N. Harlan 164,646
Boot and shoe, Meyer & Freiburgh 164,860
Boot and shoe crimper, C. Heller 164,680
Boring apparatus, earth, O. Martin 164,689
Bottle stopper or cork, J. Schrink 164,879
Box girder, compound, A. Hay 164,734
Boxes, machine for making, J. W. Bowers 164,798
Bridge fastening, draw, C. J. Atkins 164,708
Brush, fountain, F. McDaniel 164,853
Building composition, A. T. Lyon 164,850
Burner, argand gas, E. P. Gleason (r) 6,491
Burner, hydrocarbon, J. W. Neeley 164,655
Butter tube, fastening for, H. C. Carter 164,717
Cake cutter, J. H. Winslow 164,667
Calves from sucking, preventing, S. Tilton 164,665
Can vent and stopple, E. M. Crandal 164,818
Canal boats, construction of, W. Ball 164,709
Car coupling, C. Bowman 164,671
Car coupling, W. S. Burton 164,803
Car coupling, J. Jacobson 164,841
Car coupling, Misso & Warner 164,753
Car coupling, N. Nilson 164,866
Car coupling, J. B. Stamour 164,886
Car track, C. W. Mansfield 164,651
Carding machine, Bianfres & Marsden 164,796
Carpet cleaner, D. B. Scofield 164,773
Carriage and chair, Tenney & Hobbs 164,782
Cartridge box, M. V. B. White 164,890
Cartridge, shot, B. D. Wilson 164,894
[illegible] handle, C. Strong (r) 6,497
Chair, spring, A. W. Coates 164,811
Chuck, C. H. Powers 164,658
Cigars, case for freshing, Chandler & King 164,806
Cloth steaming machine, J. Shinn 164,697
Clothes dryer, C. Hauser 164,733
Clutch for power presses, A. H. Merriman 164,690
Coffin handle, M. H. Crane 164,812
Comb cutting machine, J. W. & I. S. Hyatt 164,648
Cooler and condenser or heater, C. H. North 164,757
Cotton gin, W. Koehl 164,844
Cradle and bedstead, C. W. Chamberlain 164,639
Curtain fixture, W. H. Sparks 164,882
Dental forceps, A. Engel 164,820
Dental rubber dams, clamp for, D. Palmer 164,870
Dominoes, spotting, I. S. Hyatt et al. 164,840
Door check, W. H. Willis 164,701
Door securer, L. Marks 164,688
Drill ratchet, J. M. Koeberle 164,686
Drilling mechanism, rock, A. E. Allen 164,705
Drop lights, friction slide for, J. T. Bruen 164,802
Electrical timing apparatus, R. J. Sheehy 164,696
Elevator, water, W. Walter 164,887
Embroidering machine, Michalet & Bourget 164,751
Engine governor, steam, F. M. Merrill 164,859
Engine, pneumatic, F. M. Conolly 164,809
Engine, steam, H. F. Case 164,804
Engine, steam fire, W. Knaust 164,813
Engines, valve gear for steam, J. L. Hewes 164,736
Envelope, A. N. Lewis 164,847
Escutcheon, seal, E. J. Brooks 164,800
Etchings on glass, producing, E. Dailliene 164,720
Excavating apparatus, C. G. Force, Jr. 164,643
Excavator, G. W. Gonce 164,829
Fan leaves, machine for cutting, P. Hufeland 164,838
Fans, manufacture of, P. Hufeland 164,839
Fare box, A. E. Hovey 164,695
Fats for rendering, cutting, P. L. McDowell 164,854
Faucet, L. Chaize 164,805
Fence, farm, L. M. Wheelock 164,788
Fence, iron, P. Haffa 164,830
Fifth wheel, J. Hodge 164,738
File blanks, bending circular, Beyer and Heunsch 164,710
Files, tempering, W. T. Nicholson 164,656
Fire arm, breech loading, B. Fasoldt 164,642
Fire extinguisher, chemical, A. E. Hughes 164,837
Fishing rod, J. L. Graves 164,828
Flooring clamp, J. T. and G. J. Moss 164,754
Fruit can, S. W. McComber 164,857
Fruit jar, Stevens and Lumley 164,663
Fuel, etc., compression of, F. J. Hamel 164,834
Furnace, W. E. Haxton (r) 6,503
Furnaces, supplying gas to, W. Rogers 164,876
Game table, N. W. Moulton 164,654
Gas and air, etc., carbureting, L. E. Fish 164,825
Gas extinguisher, L. Boore 164,711
Gas, illuminating, F. H. Eichbaum 164,822
Gate, automatic, H. Hammond 164,831
Gate, lifting, W. Lundy 164,849
Glass annealing oven, T. B. Atterbury 164,632
Governor, W. D. Marks 164,745
Grain conveyer, H. W. Caldwell 164,715
Graining wood, G. F. Mehling 164,858
Grate bar, hollow, W. L. Gregg 164,729
Grate for cooking ranges, drop, J. E. Baum 164,670
Grinding wheel, Putnam and Esty 164,692
Hame fastener, H. J. Wilson 164,893
Harrow, C. Brodrick 164,713
Harvester, H. N. Bridenthall, Jr. 164,799
Harvester finger bar, V. N. Collins 164,676
Harvester reel, J. F. Black 164,795
Hay rack, J. Hall 164,731
Heel shave, N. A. Sweet 164,885
Hinge, sheet metal, S. Scott 164,774
Hog catching implement, W. R. Ames 164,707
Horseshoe, die for spurs on, Clarke and Chase 164,808
Horseshoes, machine for bending, H. Levy 164,649
Hose coupling, E. Dayton 164,816
Hydrant, G. Hillegass 164,737
Hydrant, W. H. McMillan 164,856
Hydrant, J. G. Murdock 164,864
Hydrocarbon burner, J. W. Neeley 164,655
Ice breaking attachment for vessels, J. T. Martin 164,746
Incubator, A. Corbett 164,810
Inkstand, S. Darling 164,721
Ironing apparatus, N. Hall 164,832
Knife, shoe, H. S. Cushman 164,675
Knife, tobacco, E. T. Shelton 164,880
Ladder, fire escape, D. Sanford 164,769
Ladder, step, E. G. Hildreth 164,683
Lamp, J. S. and T. B. Atterbury 164,669
Lamp and oil can, combined, W. Roberts 164,766
Lamp, street, J. Henrich 164,681
Laster, foot power, F. J. Davis 164,722
Latch for door, O. W. Stow 164,780
Leather, bronze dressing for, E. H. Fennessy 164,678
Life preserving apparatus, H. A. Duc, Jr 164,818
Limekilns, W. S. Sampson (r) 6,494, 6,495
Links, machine for forming, J. H. Helm 164,682
Liquids, preserving, J. G. L. Boettcher 164,797
Lock, bag, F. W. Mix 164,752
Locomotives, increasing traction of, J. W. Murphy 164,863
Loom harness, J. Sladdin 164,777
Mail bag catch, H. M. Dick 164,677
Measure, speed, S. F. Minton 164,861
Medical compound, J. Cooper 164,674
Meter, liquid, E. Marsland 164,852
Mill, cider, Galt and Tracy 164,644
Mill, cider, S. Males (r) 6,504
Mill, rolling, I. Hahn 164,679
Mill spindle, J. A. Hafner (r) 6,492
Molding machine, J. R. Locke 164,650
Monument, J. Sharkey (r) 6,507
Motion, device for converting, G. Turner 164,783
Musical game apparatus, E. Draper 164,641
Nut lock, O. B. Latham 164,816
Nut lock, W. F. Marthens 164,747
Nut lock, W. P. Olden 164,868
Oils, refining, A. T. Schmidt 164,694
Organ tremolo, W. D. Parker 164,871
Organ tremolo, reed, R. W. Pain 164,869
Paint, compound, A. T. Lyon 164,851
Paper barrels, making, W. G. Pennypacker 164,761
Paper boards, making, B. F. Field (r) 6,502
Paper box, L. A. Kettle 164,742
Paper clip, Pack and Vanhorn 164,657
Paper, compound for sizing, J. Hogben 164,684
Paper cutting machine, W. I. Reid 164,660
Paper machine, C. L. Crum 164,814
Paper, cutting and delivering, W. Scott 164,695
Paraffin, etc., purifying, F. X. Byerly 164,672
Photographic dark trunk, F. Robbins 164,765
Photometer, portable or hand, W. W. Goodwin 164,728
Piano tuning pin lock, G. P. Reeves 164,763
Pianos, stringing, A. Moeller 164,862
Pickles, preparing, Beckhow and Stafford 164,639
Pipes for buildings, steam, C. C. Walworth 164,700
Plane, bench, L. Bailey (r) 6,498
Planing machine, E. Benjamin 164,634
Planing machine, H. C. Holloway 164,739
Planing machine, C. R. Tompkins 164,666
Planking set for ship carpenters, E. Sloan 164,881
Plow, O. J. Glasoe 164,727
Plow, A. Griggs 164,730
Plow colter cleaner, Wallis and Case 164,784
Plow die, C. H. Thompson 164,664
Polishing wheel, H. Hard 164,732
Postage stamp holder, P. W. Hall 164,833
Press, baling, J. C. Stokes 164,779
Press, hay, cotton and wool, W. H. McBurney 164,748
Press, screw, J. H. Clapp 164,637
Presses, clutch for power, A. H. Merriman 164,690
Printing in colors, W. H. Holmes 164,647
Propeller, chain, E. R. Austin 164,633
Pulleys, machine for grinding, A. Wood 164,897
Pump, Arndt & Ayres 164,631
Railway crossing, E. J. Patterson 164,759
Rail support, C. B. Sheldon 164,776
Railway signal, electric, H. W. Spang 164,778
Railway switch, J. Walker 164,886
Railway track, R. Banolas 164,793
Ranges, drop grate for cooking, J. E. Baum 164,670
Refrigerator, Mason & Sinclair 164,653
Refrigerator building, T. Krausch 164,744
Regulator and alarm, automatic heat, S. A. Day. 164,815
Road rammer, A. Q. Ross 164,877
Roofing material, D. McDaniel 164,749
Saddle, harness, A. V. Sargeant 164,772
Sash fastener, C. B. Gardiner 164,827
Sash fastener, P. Meyer 164,750
Sash fastener, W. B. Swallow 164,884
Sausage machine, D. J. Howenstine 164,741
Saw jointer and gage, R. E. Poindexter 164,762
Sawing machine, Scroll, Wescott & McGregors 164,787
Scaffold, J. E. Sanders 164,771
Screw driver, I. C. Cowles 164,638
Screw heads, die for forming, F. Rhind 164,764
Sede drill, J. R. Symmes 164,781
Seeding machine, J. B. Bushnell 164,635
Sewing machine binder, G. Wissler 164,895, 164,896
Shawl strap handle, L. Loeser 164,848
Sheet metal rings, making, S. R. Wilmot 164,892
Ship carpenters, planking set for, E. Sloan 164,881
Shoe knife, H. S. Cushman 164,675
Shoe nail, H. F. Whidden 164,889
Signal, electric railway, H. W. Spang 164,788
Signal operating device, F. Culham 164,719
Sled, bob, J. J. Sandgren 164,770
Smoke drum, J. Bowman 164,712
Smoke stack, J. L. Mason 164,652
Soap holder, J. P. Bryan 164,801
Spark arrester, W. Stamp 164,662
Speed measure, S. F. Minton 164,861
Spike, G. N. Sanders 164,878
Spinning machines, top roll, E. Card 164,716
Spoke tenoning machine, Coleman & Myers 164,718
Stamp canceler, M. Lewis 164,687
Stone, artificial, Osborn et al. 164,758
Stove, A. Hamilton, (r) 6,500
Stove, H. J. Wintherlich 164,789
Stove, camp, H. L. Dunckiee 164,725
Stove, coal oil, J. L. Sharp 164,775
Stove pipe elbow, J. F. Piehl 164,872
Stove, reservoir cooking, R. M. Hermance 164,735
Sugar cutting machine, F. Rochow 164,767
Swing, child's, G. A. Fanjoy 164,726
Table, folding work, B. Fairchild 164,824
Table, ironing and kitchen, A. Aitken 164,704
Tanning hides, Baldwin & Holcombe 164,792
Telegraph and circuit, duplex, J. B. Stearns (r) 6,508
Thill coupling, G. W. Ladd 164,845
Tobacco knife, E. T. Shelton 164,880
Toy, C. A. Bailey 164,791
Toy, bell, F. Arnold 164,790
Toy, electric, W. J. Decker 164,723
Transom for doors, J. Berndt 164,794
Trap, fly, J. M. Harper (r) 6,493
Trap, hog, J. M. Kimball 164,743
Type casting machines, J. A. T. Overend (r) 6,505, 6,506
Valve for water tanks, J. Hadfield 164,645
Valve gear, W. L. Newsham 164,865
Vehicle bodies, corner for, Acker & Robinson 164,703
Veneer cutting machine, G. W. Swan 164,699
Ventilator, side wall, W. G. Creamer 164,636
Wagons, brake block for, Wieterhold & Oak 164,891
Wardrobe, M. B. Coburn 164,640
Warp holder, piercing, H. S. Houghton 164,740
Washing machine, M. Newton 164,755
Washing machine, cylinder, S. and A. F. Wekey. 164,785
Watch key, J. C. Dueber 164,819
Watch wheels, pivoting, F. R. Bucklin 164,714
Water closets, disinfecting, G. Jennings 164,832
Water tank valve, J. Hadfield 164,645
Water wheel, J. Erikson 164,823
Water wheel, turbine, G. Arrowsmith 164,468
Water wheel turbine, J. M. Denson 164,724
Wells, pumping, Nickerson & Streeter 164,756
Window sash, L. P. Haradon 164,835
Window screen, S. Parker 164,691
Wood preserving compound, P. Wernl 164,786
Wrench, J. Norton 164,867

DESIGNS PATENTED.

8,406 to 8,408.—BREASTPINS.—L. S. Beals, Astoria, N. Y.
8,409.—SCARF RING.—L. S. Beals, Astoria, N. Y.
8,410.—PICTURE FRAME.—E. Beck et al., Lockport, N. Y.
8,411 & 8,412.—EMBROIDERY.—E. Crisand, New Haven, Ct.
8,413.—COMB.—G. G. Miller, Philadelphia, Pa.
8,414.—BORDER.—C. Osborne, North Attleboro, Mass.
8,415.—VASE.—C. F. Pike, Philadelphia, Pa.
8,416.—DESKS.—C. Richter, Dedham, Mass.
8,417.—BOTTLES.—J. Trusx, Mt. Union, Pa.
8,418.—CASSIMERES.—E. C. Clark, Rockville, Ct.
8,419.—PRINTING TYPE.—J. M. Conner, Greenville, N. J.
8,420.—TYPE.—P. A. Jordan, Philadelphia, Pa.
8,421.—THERMOMETERS.—C. Kitschelt, New York city.
8,422 to 8,425.—OIL CLOTHS.—C. T. Meyers, Bergen, N. J.
8,426.—STOVE DOORS.—J. Wormer et al., Albany, N. Y.
8,427.—BIRD HOUSES.—J. White, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

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

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
June 15 to June 18, 1875.

4,864.—D. J. Topley, Brooklyn, N. Y., U. S. Fire extinguisher. June 17, 1875.
4,865.—J. H. Morrell, New York city, U. S. Floodway for warehouses, etc. June 17, 1875.
4,866.—G. H. Longmore, Portland, Me., U. S. Matting roller. June 17, 1875.
4,867.—E. B. Dodge, Peterboro, N. H., U. S. Spring bed. June 17, 1875.
4,868.—G. H. Greenough, Brooklyn, N. Y., U. S. Producing artificial light. June 17, 1875.
4,869.—A. Crabtree, Bacup, England. Middlings separator. June 17, 1875.
4,870.—A. Bedford, Boston, Mass., U. S. Bell target. June 17, 1875.
4,871.—J. P. Sharp, Birmingham, England. Steel process. June 17, 1875.
4,872.—A. Cummings, New York city, U. S. Pouring lip for sheet metal measures. June 17, 1875.
4,873.—R. S. Van Zandt, Williamsburgh, N. Y., U. S. Extension step ladder. June 17, 1875.
4,874.—A. S. Walbridge, Mystic, P. Q. Horse hay rake. June 17, 1875.
4,875.—G. M. Mowbray, North Adams, Mass., U. S. Frictional electric machine. June 17, 1875.
4,876.—G. R. Prouse, Montreal, P. Q. Steam mangle. June 17, 1875.
4,877.—A. L. Davis et al., Port Crane, N. Y., U. S. Vehicle spring. June 18, 1875.
4,878.—F. Van Patten et al., Auburn, N. Y., U. S. Fifth wheel for carriage. June 18, 1875.
4,879.—S. Duck, Victoria, British Columbia. Hub and bevel mortising machine. June 18, 1875.
4,880.—F. Van Patten et al., Auburn, N. Y., U. S. Fifth wheel for carriage. June 18, 1875.
4,881.—F. H. Date, Niagara, Ont., et al. Combined gas retort. June 18, 1875.
4,882.—E. A. Beers, De Kalb Center, Ill., U. S. Gang plow. June 18, 1875.
4,883.—N. E. Smith, Richford, Vt., U. S. Milk cooler June 18, 1875.
4,884.—H. Ragot, Pittsburgh, Pa., U. S. Glass furnace. June 18, 1875.
4,885.—C. W. Hunt, West New Brighton, N. Y., U. S. Automatic railway. June 18, 1875.

THE
TRADE ENGINE.

Noiseless in operation—Perfect in workmanship—all light parts of Cast Steel.

Every Engine indicated, and valve corrected to give the highest attainable results.

Warranted superior to any semi-portable Engine in the market.

Send for Price List and Circular.

HERRMAN & HERCHELRODE M'F'G. CO., Dayton, Ohio

Catalogue for 1875,
FREE.

FOOT LATHES, $15 and upwards.—Keystone Portable Forges, Fleetwood Scroll Saws, Machinist's, Blacksmith's, Model Maker's, and Carver's Tools and fine Hardware.

A. J. WILKINSON, & CO., Boston, Mass.

☞ Headquarters for any thing in the Hardware line.

A. S. GEAR, BOSTON, furnishes all kinds of Machinery & Mechanical Supplies at popular prices.

The Myers Portable Engine, 4, 5, 6, 8 h.p. Something new, best for price. Circulars, CHAS. PLACE, 103 Reade St., N. Y.

THE
Bigelow Engine,

The Cheapest and Best Portable Engine offered to the Public.

Price, 4 Horse Power........$300
" 6 " " 400
" 7 " " 475
" 8½ " " 540
" 12 " " 725
" 15 " " 800

Price of Stationary Engines:
4 Horse Power..............$150
6 " " 175
7 to 8½ Horse Power........ 225
12 to 15 " " 300

Send for Illustrated Circular and Price List.

H. B. BIGELOW & CO., New Haven, Conn.

Machinist's Tools.

Engine Lathes, Planers, Upright Drills, Hand and Chucking Latches, Boring Machines, and other tools of heavy weights, first class stock and workmanship. Prices to suit the times. Send for Illustrated Catalogue.

LATHE & MORSE TOOL CO., Worcester, Mass.

Patented 1868—1874.

BOLT CUTTERS.

Dies open and close and Bolt thrown out automatically.

One pattern, holds finished bolts on centres and threads them with greater accuracy and uniformity and ten times as fast as a chaser in a Lathe. Highest award of American Institute, 1869 & 1874.

Wood & Light Machine Co., Worcester, Mass. make all kinds of Iron Working Machinery. Also, Shafting, Pulleys, &c.

TO ELECTRO-PLATERS.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for GOLD, SILVER, OR NICKEL PLATING. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

WHIPPLE'S Patent Door Knob.

Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.

THE PARKER & WHIPPLE COMPANY, West Meriden, Conn., or 97 Chambers St., N. Y.

Machinery of Improved Styles for making
SHINGLES HEADING, AND STAVES

Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE AND HEADING SAWING MACHINE. For circulars address TREVOR & CO., Lockport, N. Y.

GLASS MOULDS, for Fruit Jars, Lamps Bottles, Ink Stands, etc., made by H. BROOKE 15 years COR. WHITE and CENTRE STS., N. Y. For any thing new in glass, you will require a mould (or die).

Every description of moulds for glass, rubber, zinc etc. Send model or drawing; inclose stamp.

FOR SECOND HAND MACHINERY—Apply to S. C. HILLS, 51 Cortlandt Street, New York.

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

☞ Send for Pamphlet and Sample of work.

Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the

B. C. MACHINERY CO., Battle Creek, Mich

Asbestos Boiler and Pipe Covering,
PATENTED BY US.

Save 20 per cent in fuel. ROOFING IN EVERY STYLE.

ASBESTOS FELTING COMPANY, 316—322 Front St., New York, Near Gouverneur Street.

PLANING AND MATCHING MACHINES

UNIVERSAL WOOD WORKERS

TRADE MARK

WOOD WORKING MACHINERY.

BENTEL, MARGEDANT & CO.

HAMILTON, OHIO.

Send for Catalogue and Price List.

FIRE PROOF SHUTTERS.

CLARK & CO'S SELF-COILING ROLLING STEEL SHUTTERS (Burglar Proof), For Store Fronts and Rear Windows, require no machinery or balance weights, and can be applied to any opening; also Rolling Wood Shutters for Stores and Dwellings. Thousands are in daily use, and are acknowledged the best shutters in the world. Send for Catalogue to JAMES G. WILSON, Manager, 218 West 26th St., New York, and at London, Paris, Vienna, and Berlin.

1845. The Harrison Portable Mill Machinery. 1875.
FAST GRINDING. SMALL POWER.

Thirty Years' Experience in this Specialty, covered by Twenty Patents.

French Burr Stone Mills, run by hand, horse, wind, water or steam power. **Flouring Mills and Bolters,** combined or separate; **Vertical** and **Horizontal Corn Mills, Feed Mills** and **Universal Pulverizers**—will grind all Grains and Mineral and Vegetable substances.

Send stamp for Illustrated Catalogue containing cut of each design and price-list.

EDWARD HARRISON, Manufacturer, No. 135 Howard Ave., New Haven, Conn.

STEAM PUMPS.

FIRST PRIZES, VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON.

Send for circular of recent patented improvements.

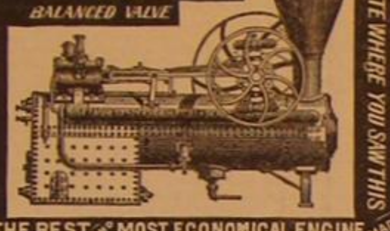
THE NORWALK IRON WORKS, South Norwalk, Conn.

BLAKE'S PATENT
Stone and Ore Breaker

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

The HOADLEY PORTABLE STEAM ENGINE.

WITH AUTOMATICAL CUT OFF REGULATOR AND BALANCED VALVE



STATE WHERE YOU SAW THIS

THE BEST AND MOST ECONOMICAL ENGINE MADE

SEND FOR CIRCULAR.

THE J.C.HOADLEY CO. LAWRENCE, MASS.

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

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

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

OTIS' SAFETY HOISTING Machinery.
OTIS, BROS. & CO

No. 348 BROADWAY, NEW YORK.

Planing & Matching,

Moulding, Re-sawing and Tenoning Machines. Scroll Saws and General Wood-Working Machinery.

JOHN B. SCHENCK'S SONS { Matteawan, N. Y. 118 Liberty St., N. Y. City

Send for Catalogue.

10 DOLLARS PER DAY AGENTS WANTED to sell THE IMPROVED HOME SHUTTLE Sewing Machine Address Johnson, Clark & Co., Boston, Mass.; New York City; Pittsburgh, Pa.; Chicago, Ill.; or St. Louis, Mo.

Machinists' Tools.

All sizes at low prices. E. GOULD, Newark, N. J.

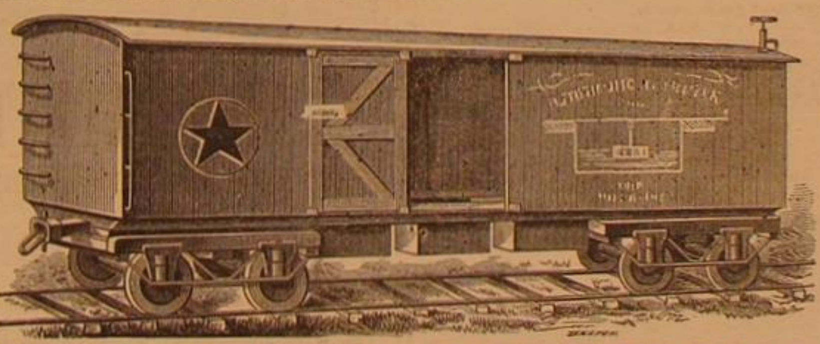
$50 to $10,000 Has been invested in Stock Privileges and paid 900 per cent. profit. "How to do it." A book on Wall Street, sent free. TUMBRIDGE & Co., Bankers, 2 Wall St., N. Y.

EAGLE FOOT LATHES,

With Scroll and Circular Saw Attachments, Slide Rest, Tools, &c.; also Small Engine Lathes, Metal Hand Planers, &c. Neatest designs, superior finish. **Low Prices.** Our new Catalogue describes these and every tool necessary for the Amateur or Artizan. Send for it.

WM. L. CHASE & CO., 95 & 97 Liberty St., New York.

The Engraving given herewith will render clear the arrangements of a novel automatic churn, the particulars relative to the disposal of the patent for which will be found in the following lines. The idea of the invention is to utilize the jarring and oscillating motion of the cars to agitate dashers in cream receptacles placed below the flooring of the vehicles and between the sets of trucks, as represented in the engraving, in which three boxes are shown on the car. The dasher is merely suspended by springs in a way that will be readily understood from the sectional view of the invention supposed to be painted on the side of the car.



TO INVESTORS!!

The above invention was patented through the Scientific American Patent Agency, May 18th, 1875. The churn is intended in its use for a railway car. Butter can be made and sold during the journey. The value of the invention consists in that it can save time and labor, and can supply the best markets in the country in advance of the ordinary method by transportation. The churn is worked by the motion given by the car to a dasher attached to a spring. It is intended that three or four churns can be used on a single car-wagon. The description of how the churn can be applied will be found in the copies of letters patent No. 163,365, for which remit $1 to Messrs. MUNN & Co. for the copy of drawings and claims. The patent is offered for sale from the copy of letters patent to the party who will offer the highest cash payment in gold, to be paid October 20th, 1875; at which time the patent will be assigned, in case of a suitable offer. The value of the patent will not be specified; its value will depend on the offers made. Offers will be received till September 20th, 1875. Notice after that date will be given to the party whose offer is accepted. Parties having offers to make will please address S. N., under the head of Business and Personal in this paper, giving their names or initials, with address. It is the object of the patentee to have the offers appear in this paper in place of written communications, in order that parties making later offers than the first bid may estimate the surplus amount required for a chance to purchase; and those having made their bids in advance may make them higher, if they are desirous of securing the patent. Parties are requested to bear in mind that the offers they propose are to be ready for payment October 20th, 1875.

Barnes' Foot-power Scroll Saws and Lathe.

An entire REVOLUTION in the construction of foot-power machines! The old style thrown aside when these are known! Thousands now in use! $1,500 to $2,000 per year made using them. One person out of every three who send for catalogues of these machines buys one. Say what paper you read this in, and address

W. F. & J. BARNES, Rockford, Winnebago Co., Ill. Box 2044.

DITCHING AND DRAINAGE MACHINES furnished at a moderate cost, cutting ditches of any width and depth in ground free from stumps and rocks. Machines worked by from four to six horses, and two men will do the labor of fifty men a day at least. State and County Rights for Sale. Address RANDOLPH BROTHERS, 111 Broadway, New York City.

Small Tools of all kinds; also GEAR WHEELS, parts of MODELS, and materials of all kinds. Castings of Small Lathes, Engines, Slide Rests, &c. Catalogues free. GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

AGENTS WANTED.—$40 a Week and Expenses or $100 forfeited. All the new and standard Novelties, Chromos, &c. Valuable Samples free with circulars. ORIENTAL NOVELTY CO., 111 Chambers St., N. Y.

Water Wheels.

More than four times as many of Jas. Leffel's Improved Double Turbine Water Wheels in operation than any other kind. 24 sizes made, ranging from 5⅝ to 96 in. diam., under heads from 1 to 240 ft. Successful for every purpose. Large new pamphlet, the finest ever published, containing over 30 fine illustrations, sent free to parties interested in water power.

JAS. LEFFEL & CO., Springfield, O., & 109 Liberty St., New York City.

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

PATENT
Planing & Matching

and Molding Machines, Gray and Wood's Planers, Self-oiling Saw Arbors, and other wood-working machinery.

S. A. WOOD'S MACHINE CO., { 91 Liberty St., N. Y. 67 Sudbury St., Boston.

Send for Circulars, etc.

IMPROVED MACHINERY for STAVE Heading, Shingle and Handles, Cabinet Maker's Machinery, Bailey Gauge Lathe, Durkee's Automatic Saw Mill (Improved), Key Seat Cutting, Pulley Boring, and Milling Machines, Radial Drills, Steam Engines, and Bailey's Veneering Machines, Cable and Sheaves for transmitting Power, etc etc. T. R. BAILEY & VAIL, Lockport, N. Y.

MAGNETS—Permanent Steel Magnets of any form or size, made to order by F. C. BEACH & CO., 246 Canal St., New York. Makers of the celebrated Tom Thumb and Miniature Telegraph Instruments.

12 Beautiful French Oil Chromos, size 9x11, mounted ready for framing, sent postpaid for ONE DOLLAR. Grandest chance ever offered to Agents. For particulars send stamp. Address F. P. Gluck, New Bedford, Mass.

YALE
IRON WORKS,

New Haven, Conn., Builders of the YALE VERTICAL the *best* and most *Economical*, either for land or marine use; also HORIZONTALS, with or without the *Rider* Cut-off.

SPECIAL TOOLS made to order, all at prices that defy competition. Send for Circular.

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

MACHINERY.

IRON & WOOD WORKING MACHINERY OF EVERY DESCRIPTION.

Cold Rolled Shafting.

HANGERS, PULLEYS, COUPLINGS, BELTING, &c &c. Send for Illustrated Catalogue and Price List.

GEORGE PLACE, 121 Chambers & 103 Reade Sts. N. Y. City

THE IMPROVED
NIAGARA STEAM PUMP,

93 to 97 Pearl St. Brooklyn, N. Y. Agency at 40 John St., New York.

Hubbard & Aller.

SOLE MANUFACTURERS, ENGINES AND BOILERS, *Pulleys, Shafting and Hangers a Specialty.*

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

TENTH INDUSTRIAL EXHIBITION, UNDER THE AUSPICES OF THE
Mechanics' Institute of San Francisco.

Manufacturers, Mechanics, and others are advised that the above EXHIBITION will be opened in San Francisco on the 17TH DAY OF AUGUST next, and continue open at least one month.

The Board of Managers invite all who desire to exhibit to send in their applications for space, without delay, to Mr. J. H. CULVER, *Secretary*, 27 POST ST., SAN FRANCISCO, CAL., who will promptly answer all inquiries.

700,000 persons, from all parts of the Pacific, visited the last Exhibition, to see what could be learned or purchased in San Francisco and the United States.

San Francisco, with its population of a quarter of one million, is in intimate relations with Japan, China, Australia, Mexico, Hawaiian Islands, British Columbia, the various Islands of the Pacific, and contiguous domestic Territory. There is no charge for Exhibition Space; and power for driving machinery, etc., is furnished free.

By order of the Board. A. S. HALLIDIE, *President.*

WANTED AGENTS—everywhere to canvass for our great Centennial Book, *worthy the special notice* of experienced agents. For particulars, address the publisher, B. B. RUSSELL, Boston, Mass.

PROSPECTUS
OF THE
SCIENTIFIC AMERICAN,
FOR 1875.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTIETH YEAR.

VOLUME XXXIII.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the third day of July, 1875, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

TERMS.

One copy, one year (postage included)	$3.20
One copy, six months (postage included)	1.60
One copy, three months (postage included)	1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"	10.00
One copy of Scientific American for one year, and one copy of "Science Record" for 1875	5.20

Remit by postal order, draft, or express.

Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.
37 PARK ROW, NEW YORK