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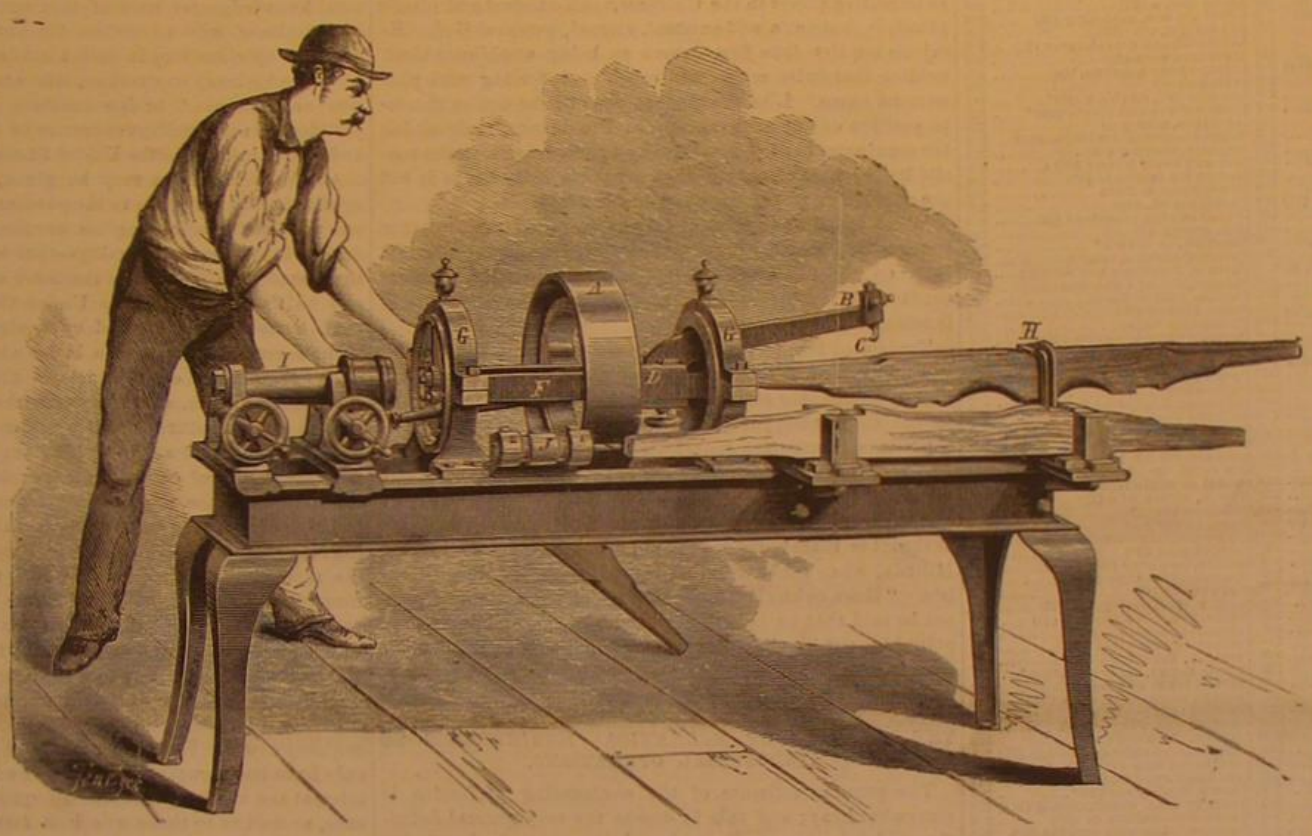
IMPROVED MACHINE FOR TURNING CARRIAGE AXLES.

There are few operations in the manufacture of wagons more trying and tedious than the setting of thimble skeins on the axles, since even the most skillful workman is unable to give to all of the latter the same "pitch and gather." Like very many other jobs, difficult to accomplish by hand labor, this it is now possible to do by the aid of ingenious machinery; and a novel apparatus for the purpose will be found represented in the annexed engraving. The device turns the axle to a pattern, making a perfect fit. Should the shell of the skein be of uneven thickness, the axle is turned to correspond, so that not only to one but to any number of sets of wheels will be imparted a precisely similar pitch and gather. The axle is made to fit the inner surface of the skein throughout its whole length, which cannot be done by hand labor, thus insuring a much more efficient support, while, in addition, the machine will bore the holes and screw in the skein bolts at the rate of forty wagons in ten hours.

A is the driving pulley, which rotates the mechanism supporting the knife in the standard, G. B is a curved cutter bar, to the outer end of which is secured the knife, C, and which enters the sliding block, D, as a fulcrum. Block, D, travels in the ways, F, and is actuated therein by the feed gearing shown at E. At H is the clamp which holds the axle while it is operated upon, and at I is the pattern, just below which is shown the end of the bar, B, projecting, which, terminating in a friction roller, enters the skein, and is held against the inside surface of the same, thereby guiding the knife in its revolution, thus necessarily causing the axle to be turned to an accurate fit. In turning other forms, the pattern is of course changed and other requisite alterations made.

The invention, we are informed, is to be exhibited in operation at the Chicago Exposition. It was patented May 28, 1872, by J. G. Aram, and is manufactured by Messrs. Williams, White & Co., of Moline, Ill., of whom further information may be had.



ARAM'S MACHINE FOR TURNING CARRIAGE AXLES.

To Destroy Rose Slugs.

A correspondent of the *Country Gentleman* reports that nothing will so thoroughly destroy rose slugs as wood ashes. The ashes must be sifted on early in the morning while the leaves are damp, the branches being turned over carefully, so that the under sides of the leaves, to which the young slugs cling, may get their share of the siftings. If the night has been dewless, in order to make the work thorough, first sprinkle the bushes, and the ashes will then cling to the slugs, to their utter destruction. This may be repeated without injury to the roses as often as the pests make their appearance.

School of Millwrights.

Professor Isham Walker, of Lexington, Tenn., suggests that various State organizations of millers and the National Association unite and subscribe funds for the building (at Chicago, Ill.) of a model school flouring mill, at a cost of $150,000. He shows that such an institution, supplied with the best examples of modern machinery, and exhibiting the latest improvements and examples of practical science in milling, would be of immense instructive advantage to millwrights throughout the country, while the stockholders, he thinks, would realize handsome dividends every year.

RECENTLY on the Chicago & Northwestern road the engine Wabansia (No. 22) brought a train from Clinton, Iowa, to Chicago, 138 miles, in 153 minutes. Throwing out the time lost in three stops, the actual running time was 142 minutes—being a fraction less than a mile per minute.

WHITFORD'S IMPROVED POTATO COVERER.

The object of the implement represented in the annexed engraving is first to form two parallel furrows into which the seed potatoes are dropped. Then, by reversing the apparatus and making suitable changes of the handles, etc., it is converted into a coverer, which, traveling over each furrow, molds thereon a uniform ridge of earth. Our illustration represents the device as adapted for cutting the furrows, this operation being effected by means of the furrow guides, A, which are suitably shod on their forward ends. The handles are supported by means of a crotched bar, B, which is hinged to one transverse piece of the frame, and the upper end of which enters a socket on the handle brace, and is secured therein by a screw. The front portion of the handles is attached to the other transverse bar in any desirable way. Also secured to the frame, on the opposite side from the furrow guides are two steel plates, C.

After the furrows are made and the seed dropped, the handles are removed and the thills disengaged. The implement is then turned over, bringing the plates, C, down, and the handle and thills readjusted. The machine being drawn by the horse so as to bring each furrow midway between the ridging plates, the soil is gathered between the latter at their front ends, and delivered at their contracted near extremities, thus forming a neat ridge.

The inventor informs us that the device is excellently adapted for hilling and hoeing, as it works over the row instead of in the space between the plants. It is also recommended for ridging for root crops, sweet potatoes, etc., and for depositing manure previously spread broadcast into the furrows. The guides and plates, being secured to the frame by set screws, may be adjusted so as to alter the width of ridge and space between the furrows. When it is desired to change the direction of the implement, as at the end of a furrow, it is simply necessary to lift slightly on the handles, when the tongue, D, will enter a recess formed in the front end of the handles, and, bearing against it, will enable the horse to assist in lifting the machine clear of the ground, so that it can be turned without difficulty.

Patented August 4, 1874. For further particulars address the inventor, Mr. Leroy Whitford, Harmony, Chautauqua county, N. Y.

Cast Nickel Plates.

For some years back much attention has been drawn to the galvanized plating of metals, especially iron, with nickel, and larger plates of metallic nickel have been much wanted for the anodes of the galvanizing nickel salt baths. The extraordinary refractory nature of pure metallic nickel has been, till lately, a great hindrance to the casting of large plates. Borchert, however, has lately succeeded in casting nickel plates 18 inches long, 14 inches broad, and ½ thick. The nickel hitherto used, Saxon Würfel-nickel of 98 to 99 per cent strength, is fused in crucibles in a simple brazier's furnace, by a coke fire. The fusion requires continual and laborious attention, the metal not becoming fluid till after at least six hours' firing. As soon as it becomes fluid, it must be cast without delay into the sand molds, for as soon as the fire drops a little, the nickel is liable to solidify again into a solid mass, in which case a renewed fusion in the same furnace is impossible.—*C. A. Borchert.*

Pictou Coal.

Mr. Edward Gilpin, F. G. S., communicates to Saward's *Coal Trade Journal* the following interesting details regarding the uses of the above named fuel as applied to steam and gas generation: In domestic grates, the coal burns readily, and remains lit for a long time; but the quantity of light, bulky ash left renders it undesirable for household employment. Coal from the works of the Acadia company gave a percentage of ash of 8·3, which was light, sandy, and with little clinker. The practical evaporative power of each pound of fuel, in pounds of water from 212° Fah., was equal to 7·34. Another trial gave 7·69 pounds. Under more favorable conditions, an evaporative power of 9·6 to 9·7 was obtained for coal from the Albion main seam. Compairing these figures with those denoting the evaporative power of Liverpool, Newcastle, and a Scotch coal, the latter show under the same circumstances 7·84, 8·66 and 6·95 pounds respectively. The steamers of the Allan mail service and the Grand Trunk Railway of Canada are large consumers of the Albion mines coal. The following table exhibits the relative values for gas purposes:

		Cubic feet	Candle power	Coke
Albion Mines	Main Seam	8,000	18	Good
	Deep Seam	7,800	17	"
Acadia "	Stellar Oil Coal*	11,000	36	Worthless
	" " Shale*	8,000	30	"
	Acadia Seam†	7,000	13	Not good
Inter-Colonial	" " †	7,700	15	Good
Nova Scotia	" " †	7,000	16	Fair

* Not worked at present.
† Supposed westward extension of main seam.

Ordinary tests failed to show the presence of sulphur in some seams of the eastern groups, while the average present in the lower seam is not above 0·5, much of which can be removed by careful screening.

THE Chinese rebel against the sewing machine, because they say, it cheapens labor and deprives their tailors of work. At Hong Kong several Chinese tailors, who lately undertook to use machines, were assaulted and expelled from the native community. In America, Chinese cheap labor is opposed and ridiculed. In China, American cheap labor, by machinery, is equally repudiated.

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Contents:

(Illustrated articles are marked with an asterisk.)

CANDLE FLAMES AND STREAKS OF CLOUD.

Professor Tyndall ends his most suggestive address as President of the British Association with a half regret that he must quit a theme too great for him to handle, but which would be handled by the loftiest minds ages after he and his hearers, like streaks of morning cloud, had melted into the infinite azure of the past.

With what had previously been said still ringing in their ears, this simple figure must have carried to those that heard it a deeper meaning than it would seem to bear when standing alone. At another time, or coming from another speaker, the words might be taken to imply no more than the prospect of human forgetfulness, the oblivion in which the names and deeds of so many human generations have been lost: but in Professor Tyndall's system the failing memory of man forms no essential part of the "infinite azure" to which all human kind is hastening. Indeed the immortality of fame is endless in contrast with the speedy dissolution that awaits us when the environment masters the organism which alone determines the activities that make us what we are.

The cloud melts and disappears, not to continue a ghostly existence in another world of immaterial sky and cloud, as savages have imagined, but to cease utterly and for ever as that particular cloud, while its dissevered elements remain to form other combinations, to assume other forms, to perform other functions, in the ever changing sky and earth.

So man, equally the product of molecular activity, "derived in his totality from the interaction of organism and environment through countless ages past," may or may not make himself a connecting link in the chain of organization and thereby impress his personality upon the future; but whether he does or does not, his individuality ends with the physical frame which gave it being: a product of material conditions, he ceases to exist when death puts an end to those conditions, and fades into the "infinite azure," not lost, but no longer an integral part of the Universe.

It is a striking commentory on the limitations of human thought that precisely the same conclusions were arrived at by the path of experimental philosophy in India thousands of years ago by pure contemplation. The theology of India was underlaid with pantheism. In the Vedas—those books of incalculable antiquity—God is the material as well as the cause of creation, "the clay as well as the potter." Later, the "clay" took on the attributes of the "potter" and became the motor as well as the matter of the Universe. Centuries before Democritus conceived the existence of atoms, or Lucretius detected in the potency of matter the sufficient cause of all things, without the help of the gods, the school of Canade had developed an atomic system as comprehensive as that which Professor Tyndall, with the rest of the modern scientific world, holds today. By the unaided concurrence of atoms, those dusky scholars explained every phenomenon, mental as well as physical, animals, men and gods.

But this was not the highest reach of Indian thought. From the contemplation of matter endowed with "the promise and potency of every form and quality of life," to that of pure force without any association of substance, the step is long but inevitable. Faraday took it when he conceived of a body not as an aggregation of substantial atoms but as an assemblage of "points of force." In like manner Gotama, the founder of Buddhism, took it, basing his system wholly on the idea of force. In other respects, his views of man and Nature are in philosophical accord with those which underlie the last results of modern Science. His fundamental principle is the supremacy of force. He asserts an impelling power in the Universe, a self-existent and plastic principle, but not a self existent, eternal, personal God. He rejects inquiry into first causes as being unphilosophical, holding that finite minds are capable of dealing with phenomena alone. Like the modern scientist he denies the interposition of any such agency as Providence, maintaining the omnipotence of law. Equally opposed is he to the possibility of chance, saying that what we call chance is but the effect of an unknown, unavoidable cause.

When called on to account for the spirit of man, whence it comes and whither it goes, the reply, in oriental imagery, calls up the flame of a lamp, and asks in what obscure condition it lay before it was kindled, and what becomes of it when it is blown out?

Translated into terms of modern Science, Gotama's answer is as one with Professor Tyndall's. The flames of our nightly lamps, the streaks of morning cloud which warn us to put them away, are alike fleeting products of physical conditions, temporary manifestations of molecular force. Their end is extinction; but their effects are factors of future events.

"When a fire is extinguished, can it be said that it is here or that it is there?" replies the philosopher Nagasena to King Milinda, when asked whether the All-wise Buddha still exists. "Even so our Buddha has attained extinction. It cannot be said that he is here or that he is there: but we can point him out by the discourses he delivered. In them he lives."

Science has no further word to offer.

THE RELATION OF MECHANICAL ENGINEERING TO INDUSTRIAL OPERATIONS.

The popular estimate of the engineering profession is somewhat hazy; and this is due to the very general definition which is given to the term. Just as one who has facilities for erecting a dwelling house advertises himself as an architect and builder, so every one who has charge of a boiler or an engine calls himself an engineer. From this it follows that many persons do not see any difference between those whom they employ to run their engines, and those who are styled consulting engineers, except, indeed, that the former may be the more reliable of the two, since they are practical men, while the latter are mere visionary theorists. The public is not always right, however, and it may be well to revert to the definition of Mr. Tredgold, who says that "engineering is the art of directing the great sources of power in Nature for the use and convenience of man." What sources of power in Nature are used by man in industrial pursuits? Familiar examples may be found in falling water and the heat generated by combustion, the one being employed to move water wheels, and the other to heat water or air for use in engines. The winds and tides furnish motive power, and electricity is also employed to produce useful work. Now in the application of these powers of Nature, intelligence in design and construction are required, to suit the machinery to the power, and skilled attendance is needed for the operation of the machinery. It is also necessary to obtain the fuel for generating the heat of combustion, and this calls for the employment of skill in designing the plant and superintending the operations of the workmen. It will appear from the foregoing that, in carrying out any engineering project, the duties of the engineer are varied. A design must first be prepared for the work, which design must afterward be carried out in actual construction, and finally, the completed machinery must be managed properly, so that it will fulfil the purpose for which it was designed. Some other facts will be evident in this connection. A man who has acquired sufficient skill and experience to design machinery and superintend its erection has done this generally by gaining knowledge in every branch of the profession by education, supplemented by work in the shop and drawing room, and by practical manipulation of the machines that he is called upon to design. He cannot, however, in general devote himself so much to any special kind of construction as to become a practical manufacturer, because, in modern engineering, manufactures are thought to be most economically managed by attention to specialties, while the consulting engineer is required to deal with all branches. It is difficult, also, for the manufacturer of one class of goods to be entirely unprejudiced, since the mind of man is so constituted that he ordinarily has a pretty good opinion of his own devices. The successful consulting engineer, however, should be surrounded by such influences that he can, in contracting for constructions, always select the best, uninfluenced by personal considerations. If the foregoing propositions are correct, it would seem proper to divide the class commonly called engineers into engine drivers, manufacturing engineers, and consulting, designing, and superintending engineers. This classification, already well established in the profession, is gradually gaining a foothold among the general public. The process is necessarily slow, since it is only of late years that public attention has been directed to the higher branches of engineering as a distinct profession. It will not be difficult, however, to show that the community have considerable interest in a true conception of the matter, and a few simple illustrations may be given.

With the introduction of iron bridges a class of builders arose, who, finding it easy to convince ignorant highway commissioners that a bridge built of iron, however proportioned, must be strong, take contracts at such low figures that representatives of the best bridge-building companies in the country are usually conspicuous by their absence from a highway bridge letting. A railroad company or any large corporation, desiring to contract for structures of this kind, usually pursues a very different course. The directors, good business men but lacking the requisite technical knowledge for work of this nature, employ a competent engineer, who advertises for proposals, taking care to draw his specifications in such a manner as to preclude bids from the highway contractors, who are known in the profession as "tin pan" bridge builders. This action is fully justified by the excellent character of the important railroad and public bridges in the United States.

Another illustration may be given, more general in its application, in reference to the purchase of machinery. Any one who has need of engines or other machinery naturally desires to get the best quality—that which will perform the most economically, require the least attendance and repairs, and be the most durable. Under the competition of the trade, such men are marked by vendors of machinery; and if the representations of the latter are to be believed, each one of them has the best article in the market. This they can honestly claim, as already remarked, from a well defined trait in human nature; but it would require no argument to show that an unbiassed consulting engineer, well acquainted with the merits of each machine, could make a much better selection than the unprofessional purchaser. who is unable to judge of the value of the representation made to him by interested dealers. The engineer, also, after contracting for the machinery, is frequently called upon to test it when completed, and see whether it fulfils the conditions of the contract. Numerous suits between purchasers of and dealers in machinery attest the correctness of this position. Sufficient has been said to show the importance of engineers' work in the various industrial pursuits.

In this brief notice, nothing like a comprehensive view of engineer's work has been attempted. The salient points only have been touched upon; but the hints given may be of interest and value to those who require professional assistance, as well as to those who look forward to entering their names on the list of engineers, and desire to know something of the duties which they will be called upon to perform, and the preparation needed to qualify them for the proper performance of these duties.

CO-OPERATION IN GREAT BRITAIN.

The number of cöoperative trading societies in England and Wales, according to a recent parliamentary return, is 746, with a membership exceeding three hundred thousand, and a share capital of nearly fifteen million of dollars. The annual business of the societies amounts in payment to upwards of fifty million dollars in gold, and in receipts to nearly fifty-seven and a half millions, the net profit from all sources being in round numbers four million dollars in gold.

In a long discussion of the principles and prospects of cöoperation, published in the *Contemporary Review*, Mr. Thomas Brassey, M. P., mentions these enormous sums as convincing proof that the principle is convenient and practicable in its application to the distribution of commodities; and, what is more important, the working of the system is the source of considerable profit.

On the other hand, the fact that the annual withdrawals from the societies are half as many as the additions would seem to prove that the management of cöoperative stores is not without serious difficulties, which will have to be removed before the plan can be pronounced perfectly successful.

Still more difficult are the problems to be solved in the matter of cöoperative production, the societies of this sort being few, and the failures more numerous than the successes. Among the successful are the Paisley Manufacturing Society, the Hebden Bridge Fustian Society, the Eccles Quilt Manufacturing Society, and the Lurgan Damask Manufacturing Society, all small establishments whose success is probably due in great measure to the wisdom of the promoters in not attempting their operations on too ambitious a scale. Still, the flourishing condition of the Manchester Printing Society shows that a large undertaking can be successfully conducted on the democratic system, certainly where the range of production is limited, and individual exertion on the part of the workmen is of more account than of great executive skill at the head. The Cöoperative Printing Society, recently established in London, however, has not turned out so well.

The most important experiment in cöoperative production thus far attempted in England is that of the Ouseburn Engine Works. Its experience has not been favorable to the system when applied to varied and complicated undertakings. Great difficulty has been experienced in dealing with the different classes of workmen, and in the adjustment of rates of wages. Men brought up to one trade naturally find it hard to estimate the dues of those practising an entirely different trade; and when they are required to assign higher wages than they can hope to receive, to men whose superiority they are unable to appreciate, the difficulty becomes all but insurmountable. The practical result in the Ouseburn Works has been a strike for higher wages in one of the departments—one of the evils which coöperation was specially expected to prevent. The society also suffered severe losses through mismanagement, the taking of orders at too low a price, and other errors, due to lack of technical and practical knowledge on the part of their chief adviser, who was more of a philanthropist than a man of business.

As in other countries, so in England, success in coöperation seems to be limited to moderate undertakings. When the business is of a kind that cannot be carried out advantageously on a modest footing, the coöperative principle is best applied to the execution of parts of the work; in this way the system can be made available in the largest undertakings, after they have been suitably subdivided, the general administration remaining in the hands of an individual owner or company.

As Mr. Brassey observes: Where no special personal influence is needed for the purpose of securing clients and customers, and where the internal economy of the establishment can be conducted by a regular routine, there will be no disadvantage in the management of a board or council. But when no transaction can be completed without long and difficult negotiations: when an undertaking is of a kind that cannot be conducted in accordance with fixed rules, and the emergencies which must, from the nature of the case, arise are always unforeseen, and must be met on the spot by an administration upon whose skill and conduct all will depend; in such a case the coöperative system pure and simple becomes impossible, and the attention of masters and workmen wishing to work together in friendly alliance should rather be employed to devise schemes whereby the equable distribution of profits among the workmen may be combined with the necessary concentration of authority in their employer.

Perhaps the most noteworthy alliance of this sort is that in connection with the collieries of Messrs. Briggs. To avoid, if possible, the delays and losses incident to strikes, this firm voluntarily took their miners into partnership some years ago, dividing the profits above a certain amount annually among the workmen, in proportion to their several earnings. Last year nearly seventy-five thousand dollars in gold were so distributed as the workmen's share of the profits, several receiving as much as thirty pounds ($150) each. About half of this sum has been returned to the company in premiums on shares applied for by the miners. Inasmuch as the owners receive as high a rate of interest on their investment as they had ever made in their best years before the workmen were given an interest in the profits, while the risks and annoyances formerly arising from strikes and labor quarrels are entirely avoided, it is clear that the alliance is mutually beneficial to all concerned.

The experience of Messrs. Fox, Head, & Co., who adopted a similar plan eight years ago, has been quite as favorable to this mixed system. Their plan secures to every person employed a pecuniary interest in the success of the business, as far as possible in proportion to his services. Every one engaged, whether as laborer, clerk, foreman, manager, or partner, is paid at the rate customary in the district for his particular work. The capital employed is remunerated by a specified rate of interest. Provision is made out of the profits of manufacture for keeping the works in repair, and to cover renewals and depreciation, and a fund is maintained as a provision against losses by bad debts. This done, the surplus profit is annually divided into two parts; one to be paid to the capitalist, the other to be divided among those employed, in proportion to their earnings. The sums already divided among the workmen amount to between thirty thousand and thirty-five thousand dollars. A superior class of workmen are secured, and they stay longer at the works than ordinarily.

HINTS TO ARCHITECTS AND BUILDERS.

The late Lord Lytton, in "The Coming Race," pictured a condition of society in which mere manual labor was performed by machines, so that the only duties devolving upon men and women were those requiring the use of the intellect. Although in practice we are far from the realization of that idea, it is in strict keeping with the spirit of modern progress, and also agrees with the laws of true philosophy. It will be generally admitted that the reasoning powers of man are his most valuable possessions, and that undue muscular effort is not favorable to their development. It will likewise be generally conceded that the invention of machinery which lessens manual labor and cheapens the operations in which it is employed, contributes directly to the prosperity and intellectual advancement of the human race. The savage carries on commercial affairs by transporting articles of trade on the backs of men or in canoes impelled by oars. Wagons drawn by beasts of burden, and vessels moved by the force of the wind, mark a second stage of progress. Then come railroads and steamers, still further facilitating the operations of trade; and it is not impossible that these modes of transport may be displaced by still greater improvements. With each of these changes the world becomes better and richer, so that there is great encouragement for showing how improvements may be made, wherever it seems possible.

No one can have walked through this city with observant eyes and have failed to notice the tendency, in constructing new buildings, to place the foundations a little lower, and raise the roof a little higher, than in former structures. Another fact will also strike him: that it frequently takes nearly as long to make the foundations (meaning the part below the sidewalk) of a modern building, as it does to complete the superstructure; and he has doubtless often considered whether it might not be possible to devise some method by which this operation could be quickened and cheapened. Of late years many improvements have been adopted in the building trade. The pleasant occupation of the son of Erin, who told his friend that in this "illigant country" all he had to do was to "put some bricks in a little box, and go with them up a high ladder," is fast disappearing. The elevator, which has done so much in increasing the hight of modern buildings, has been introduced to carry up the materials of construction, so that it is now not uncommon to see one or two horses or a small engine doing the work that was formerly performed by a score of men. This is very well as far as it goes; but further improvements are demanded. Take, for example, the case of the basement of a building which requires an excavation to a depth of thirty or forty feet. Ordinarily, the hole is dug in shelves or terraces, so that the workmen can throw the excavated material from the lower part to the shelf above, whence it will be thrown by another set of workmen to the next shelf above, and so on, until it reaches the surface, and is shoveled into carts to be carried off. In this manner the bottom is finally reached, and then, as each successive shelf is cut away, a platform of boards is put up; and upon this the dirt is thrown, to be transferred as before, by different sets of laborers, to the carts. If any one who has a little time to spare will witness an operation of this kind, taking pains to notice the contents of a cart, and the various manipulations these contents pass through before they are ready to be carried off, a very simple sum in arithmetic will convince him that this excavation is a tolerably expensive affair. Take, for instance, the case of a foundation forty feet below the surface, in which the materials will have to be transferred, from platform to platform, at least six times, and then once more into the carts, making seven transfers in all, and requiring seven times as many men as would be needed if the dirt could be shoveled directly into the carts. This mode of stating the problem will doubtless suggest the idea to the attentive reader to let the dirt be shoveled directly into the carts, and avoid all these transfers. It would not be difficult to accomplish this. Usually, in such an excavation, as soon as the bottom is reached in the center, a crane is set up to be used in moving foundation stones, etc., into their places. Now, when the excavation is made to such a depth that a transfer of dirt is required before it can be thrown to the surface, let the crane be brought into requisition. A small steam engine connected with the hoisting gear will furnish the power for raising and lowering weights. Let, then, the cart bodies be so arranged that they can be detached from the axles, lowered to the place where the workmen are excavating, and, when filled, be hoisted and again connected to the wheels. An arrangement of this kind would effect a radical change in the time and cost of deep excavations, and it seems strange that it has not been adopted ere now. Of course, a mere outline is attempted in this article, without much attention to minor details. It might be found better, for instance, instead of detaching the cart bodies, to shovel the dirt into boxes, so that it could be hoisted out and dumped into the carts; or still some other method might be preferable. It is only intended to lay stress upon the principle that it is always better and cheaper to perform work by a single operation and with a single gang of men than by several. It is quite likely that there are many other details of the builder's trade that could be improved. No matter what they are, however, they will be performed correctly if they conform to the principles of using the cheapest power and the fewest number of operations possible. Architects and builders are deeply interested in carrying out these principles, since the cheapening of construction is sure to increase their business. It may be added that the principles given above are equally applicable to all operations in which muscular effort is required; and the most successful business men are those who appreciate this fact.

PNEUMATIC BURIAL.

Graveyards existing in the midst of thickly populated districts have been pronounced by sanitarians the world over a source of disease, and hence a standing menace to the people in their vicinity. In many of the cities of Europe, where burying grounds within the corporate limits are much more common than in the newer towns of our own country, the effect of the promulgation of the above knowledge has been a wholesale removal of the dead to new cemeteries situated far in the suburbs. This proceeding has resulted in a largely increased outlay necessary to defray the expense of a procession and more extensive funeral paraphernalia; while in Roman Catholic countries, where it is customary for mourners to follow the body to the grave bareheaded, it has caused much personal inconvenience, owing to the length of the journey, in inclement weather. Accordingly, various schemes have been suggested to avoid the above mentioned difficulties, among which plans is that of transporting the dead by means of pneumatic tubes. This idea has been ingeniously and ably worked out by Mr. F. Von Felbinger, an accomplished engineer, and Mr. J. Hubels, an architect of Vienna, and by them submitted to the municipal council of that city. We have been favored by Mr. Von Felbinger with copies of the working drawings, and a description of his plan.

It is proposed to erect a great monumental hall or temple, which is to be divided into three portions, a middle hall and two smaller ones, the former to be devoted to the use of Roman Catholics, and the latter respectively for Protestants and Israelites. These apartments will be subdivided into chapels suitably furnished and decorated.

On a funeral taking place, the body in its coffin will be deposited in a sarcophagus in the center of one of the chapels, and the ceremony proceeded with. At the conclusion, the chief mourner touches a spring, when the sarcophagus sinks noiselessly through the floor. This corresponds to the public burial, as, so far as the mourners are concerned, they have nothing further to do with the body. On its arrival, however, in the cellar, men stationed for the purpose attach a check to the bier, showing to which cemetery it is to be forwarded, and place the body, with three others, in an iron car which fits in a subterranean tube, running on tracks placed therein, after the plan described by us as followed in the construction of the experimental section of the pneumatic railway under Broadway in this city. This tunnel in Vienna will be 15,000 feet long, and the carriages will be propelled through its entire length, by means of a blast of compressed air, in about ten minutes.

The tubes are so arranged that the car can be started off to any cemetery by a separate road. On reaching its destination, a small building erected as a terminus, the bodies are removed and buried by officials in the places previously designated by the relatives of the deceased.

The estimated cost of establishing this plan in Vienna is $500,000. This provides for a tunnel about five feet in diameter, a 150 horse power engine, and all the necessary machinery, and buildings of remarkable architectural beauty. The latter it is proposed to locate in a prominent portion of the city, and to surround with a large and handsome garden, so that the gloomy aspect and associations generally peculiar to funereal edifices will be avoided.

COMPRESSED AIR MACHINERY.

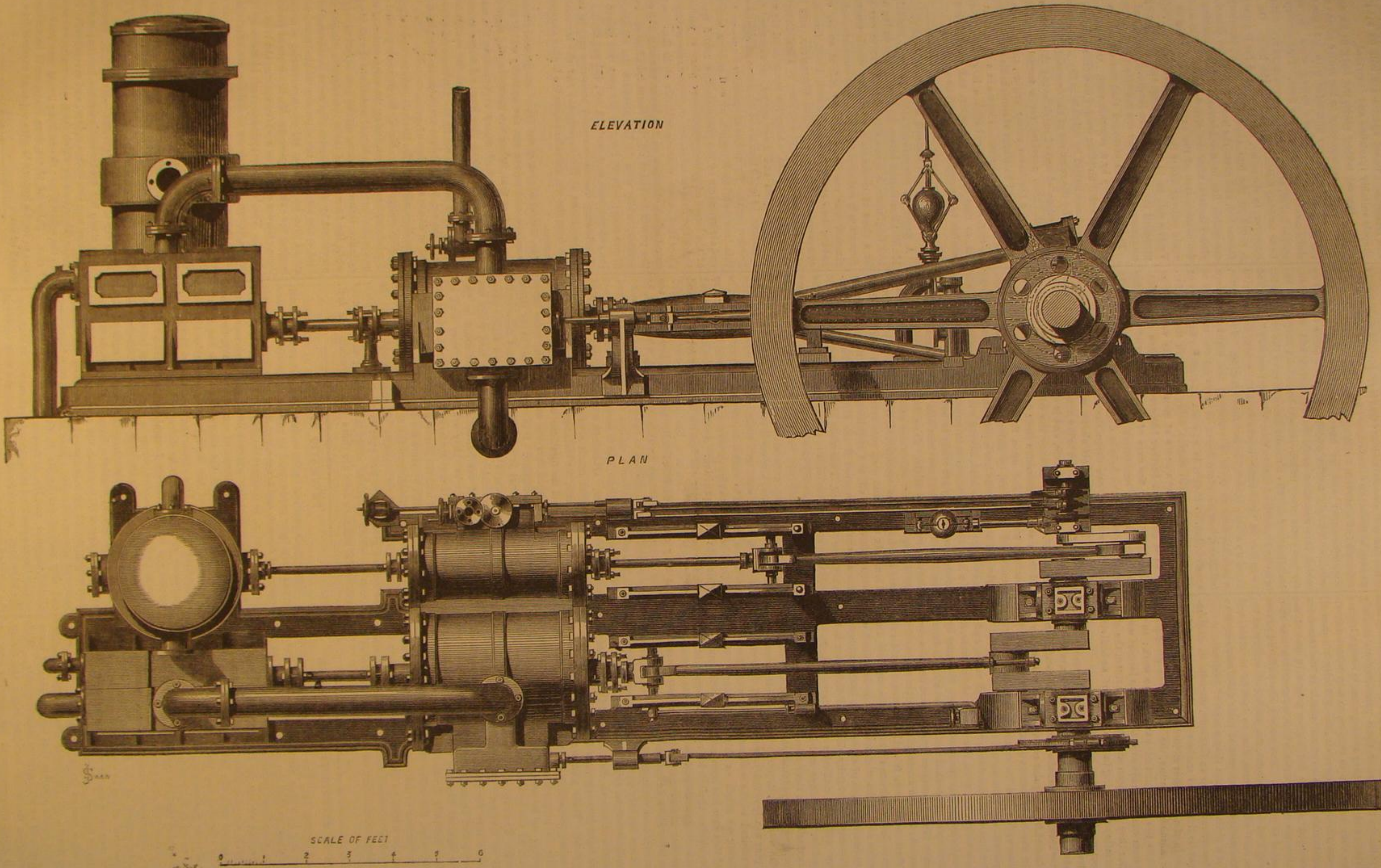
A paper on compressed air machinery, recently read by Mr. William Daniel before the British Institution of Mechanical Engineers, is a valuable contribution to our knowledge of a class of mechanism, regarding which trustworthy information is not abundant. A very complete series of experiments was conducted by the aid of an air compresser having two steam cylinders, each 16x30 inches, working compressing cylinders of like dimensions, and the whole mounted on a receiver 24 feet long by 5 feet diameter, which formed the bed plate. After the compressed air was led to a portable engine and there cooled, it was admitted to two cylinders, 10 by 12 inches, which drove an engine working a friction brake. By means of indicator diagrams, taken from this last mentioned engine, as well as from both the steam and air cylinders of the compresser, a record was obtained of the losses of power which took place at various stages. From the data a table was completed, the results of which show that, when working with air at 40 lbs. pressure, the usual effect obtained on the brake was only 25½ per cent of the power indicated on the steam cylinders of the air compresser, while with 34 lbs. pressure the efficiency reached 27 per cent; with 28 lbs., 28 per cent was gained; with 24 lbs., 35 per cent, and with 19 lbs., 45½ per cent. The loss of efficiency due to increased pressures may be ascribed to the conditions of the experiment and the increased loss of heat from the air, attendant upon the higher degrees of compression.

Mr. Daniel advocates the use of compressed air machinery for mines, and points out the economy which must result from the fact that, when the motor is idle, there is no loss except the interest of money expended on the machinery, which is much less than that incurred where animal power is employed. He also suggests that the ventilation of the mines would be improved by the discharge from the engines, while the air, being always available in the pipes, could be used to dilute an outflow of gas.

The discussion of Mr. Daniel's paper elicited a number of practical suggestions. Mr. C. W. Siemens pointed out that the development of heat during the compression of air might be avoided by the injection of water into the air compressing cylinder, this water taking up the heat as fast as it appeared; while the formation of ice in the engine cylinders might be prevented by similar means, the water in this case giving up heat to the air during the expansion of the latter. Mr. Firth stated that he had got rid of any difficulty with ice by enlarging the exhaust openings. Mr. Brotherhood described his three cylinder engine, as used for working the Whitehead fish torpedo. This had three cylinders, each 1⅜ inches by 1½ inches stroke, driven by a pressure of 450 lbs. per square inch, admitted through a reducing valve from a reservoir of air, stored at 900 lbs. per square inch. This engine had run at 2,225 revolutions per minute, developing 2½ horse power, or 0·28 horse power for each pound of its weight. Mr. Cowper suggested that radiating ribs, cast on the cylinders of air compressers or of engines using compressed air, might serve the purpose of facilitating the emission or absorption of heat.

A CHEAP GALVANIC BATTERY.—Mr. W. M. Symons proposes a cheap but convenient galvanic battery; each of the zinc plates was two inches square, and covered with fustian or other fabric, outside which thick copper wire was wound to form the other plate; the exciting liquid was weak chloride of zinc. Pairs of plates thus made could be arranged in series to form a battery to give out weak currents for a great length of time.

PERU, with three millions of people (a large part Indian) has twenty-six newspapers. These are published at Lima, Callao, Cuzco, Iquique, Tacna, Puno, Arequipa, Trujillo, Piura, Chiclayo, Cajamarca, Tarapacá, Ica, and Ayacucho.

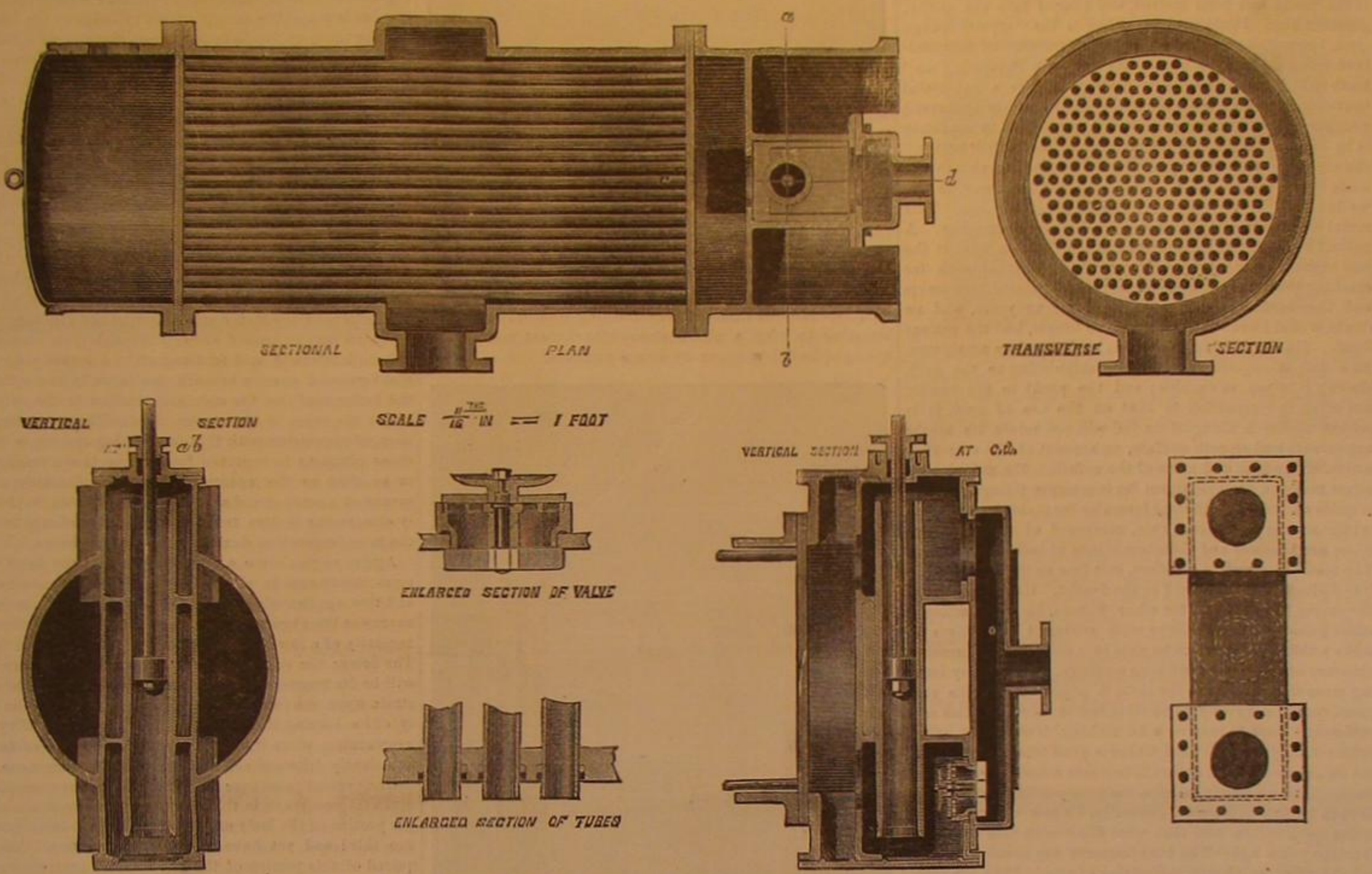


HATHORN & CO.'S HORIZONTAL COMPOUND ENGINE.

HORIZONTAL COMPOUND ENGINE.

Nearly every day we hear of some novel application of the compound principle in steam engine building; and the interest of the engineering profession in this construction induces us to publish (on the opposite page) a plan and elevation of a horizontal compound engine, recently built by Messrs. Hathorn, Davis & Co., of Leeds, England, for use in a large cement factory on the bank of the Thames. We also give herewith complete details (in section) of the condenser.

The Engineer, to which we are indebted for the engravings, says: The engine is of the fly wheel type; the high pressure cylinder is 12 inches in diameter, the low pressure cylinder is 28 inches in diameter, length of stroke is 3 feet. The valves of the two cylinders are outside. The high pressure cylinder has an ordinary main valve and an expansion valve, with a hand wheel adjustment, so that the cut-off can be altered when the engine is at work; the high pressure valves are actuated by a separate shaft worked by a small fly crank. This engine has both injection and surface condensers.



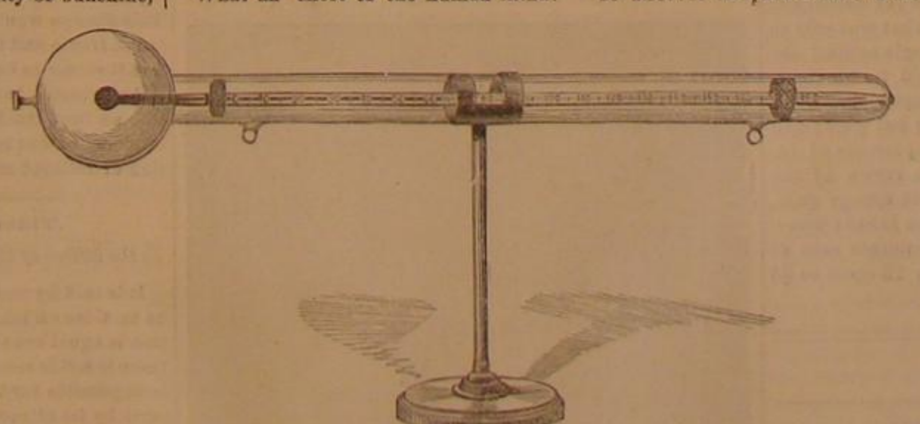
HATHORN & CO.'S COMPOUND ENGINE—THE CONDENSER.

In the surface condenser the tubes and tube plates are of gun metal; the tubes are packed—as shown in the illustration—simply with india rubber rings. This engine has been working for upwards of nine months, with an average consumption of 2¼ lbs. of coal per horse power per hour. The boiler is a 50 horse power Howard, and supplies plenty of steam to drive the engine when indicating 150 horse power.

SOLAR RADIATION THERMOMETER.

For the purpose of measuring the intensity of sunshine, various kinds of thermometers have been, and are still, employed by meteorologists. The thermometric fluid is always mercury for these instruments, because spirit is too volatile at great heat. An ordinary thermometer would merely indicate the intensity of solar heat at the instant of observation; hence, self-registering maximum thermometers, which show the highest degree of heat during the interval of exposure, are generally used.

Notwithstanding the progressive modifications made in solar radiation thermometers, even those *in vacuo* frequently give discordant indications in the same conditions of exposure as regards time and place.



NEGRETTI AND ZAMBRA'S SOLAR THERMOMETER.

In 1873, Messrs. Negretti and Zambra invented a special contrivance, shown in our engraving, taken from *Engineering*, for depriving the instrument of all uncertainty regarding the extent of the vacuum. It consists of a small mercurial tube and cistern gage (a miniature barometer) inserted in the jacket. This gage shows at any time the pressure of any air or vapor which may be left inclosed. As its tube is very small, the mercury will be depressed a certain extent by capillary action, and so it will indicate too little rather than otherwise. Possibly the presence of mercurial vapor in the vacuum may prove objectionable; for, by continual heatings, the mercury will vaporize out of the cistern, and may condense in some other parts of the jacket. Instruments fitted with these gages show, however, that, as the best makers have always affirmed, the pressure is reduced to $\frac{1}{120}$ part of an atmosphere, that is, to a quarter of an inch of mercury, and even less. It is possible to reduce the pressure within one fiftieth of an inch, without resorting to the Torricellian mode of producing a vacuum, which, excepting the presence of mercurial vapor, may be regarded as perfect.

The Lights of the Heavens.

The spectroscope has explored the far-off space of heaven. The light of hundreds of stars has been analyzed, and nebulæ, scarcely visible, have had the quality of their radiations revealed by its aid. The light, in some cases very feeble, with which a number of stars shine, gives a spectrum with dark lines like the solar spectrum, and this fact proves to us that the constitution of these stars is like that of our sun. Aldebaran sends us records of hydrogen, magnesium, and calcium, which abound in solar light, but also those of metals which are rare or absent, as tellurium, antimony, and mercury.

Nebulæ, twenty thousand times less brilliant than a candle at a distance of 13,000 feet, have still given a spectrum; for their light, although feeble, is very simple in its constitution, and the spectrum which it gives consists only of two or three bright bands, one of hydrogen, the other of nitrogen. These nebulæ, which give a spectrum of bright lines, are those which the most powerful telescopes cannot resolve; there is an "abyss" between them and resolvable nebulæ, which, like ordinary stars, give a spectrum with dark lines.

What an effort of the human mind! To discover the constitution of stars of which the distances are unknown, of nebulæ which are not yet worlds; to establish a classification of all the stars, and still more to guess their ages—ah, tell me, is not this a triumph for Science? Yes, we have classed them according to their ages. Stars colored, stars yellow, stars white; the white are the hottest and the youngest; their spectrum is composed of a few lines only, and these lines are dark. Hydrogen predominates. Traces of magnesium are also met with, of iron, and perhaps of sodium; and if it is true that Sirius was a red star in the time of the ancients, it owed perhaps its tint to the greater abundance of hydrogen at that epoch. Our sun, Aldebaran Arcturus, are among the yellow stars. In their spectra the hydrogen lines are less developed, but the metallic lines are fine and numerous. The colored stars are not so hot and are older. In consequence of their age, they emit less vivid light. In them there is little or no hydrogen. Metallic lines abound, but one also finds channelled spaces like the lines of compounds. The temperature being lower, these latter can exist whether they consist of atoms joined to others of the same kind, or whether they contain groups of heterogeneous atoms.

As to matter, it is everywhere the same, and the hydrogen of water we meet with in our sun, in Sirius, and in the nebulæ, every where it moves, everywhere it vibrates; and these movements which appear to us inseparable from atoms are also the origin of all physical and chemical force.—*M Wurtz.—Proceedings of French Association.*

White Opaque Glass.

One of the most interesting and important kinds of colored glass, says Philip Fischer, in the *Glashutte*, is the so-called "bone glass," and yet very little has been said about it in glass literature. Its name hints at its composition and nothing more, especially since cryolite has come to be used in the manufacture of glass. This kind of glass is used for lamp shades and globes to protect the most important organ of the human body, the eye; and formerly it was both rare and expensive. Cryolite, however, has effected as great a revolution in the manufacture of white glass as petroleum has in the means of illumination. What part the chief constituent of the bone, the phosphate of lime, played in the manufacture of the bone glass was not exactly understood, and a still thicker veil is drawn over the action of the fluoride of lime, soda, and alumina, known as cryolite. It is to offer some explanation of this action that Fischer takes up this interesting branch of the glass industry. Phosphoric acid is, at high temperatures, a very powerful acid—so much so that no other acid is able to displace it. Hence we may reasonably suppose that the phosphate of lime remains suspended, as such, in the molten mass of glass. This, too, is indicated by the fact that when an excess of bone dust is added to the glass, or on suddenly cooling it, it is rough on the surface; but if the glass has the proper constitution, it remains perfectly smooth. How may the action of cryolite be explained? The power of hydrofluoric acid to etch glass and render it matt is well known, and depends on the decomposition of the silicates, taking from them a part of the silica, and the soda or potash, so as to form a compound known as fluosilicate of soda or potash, and then flying off in form of a vapor. We all know that this takes place, to a greater or less extent, in every cold, completely formed glass; how much easier and better would this process take place under the ægis of heat? Thus the phenomenon appears to a greater degree in the process of fusion.

DENTISTRY IN THE UNITED STATES.

NUMBER 3.

DENTAL FILLINGS.

Of the various materials used to fill cavities in teeth, the principal ones are gold, tin, amalgams, and cements. Of each of these there are different qualities and makes. Of gold foil filling there are three principal manufacturers, whose goods are so nearly alike that there is but little choice. The dentist prefers the softest metal. Many practitioners, not finding the foil sufficiently soft for their taste when purchased, anneal it over the flame of a spirit lamp before using it. When thus manipulated, it is more easily packed, can be condensed better, and the particles adhere to each other as though welded; thus making a filling almost as solid as if the metal had been melted, and poured into the cavity. Another kind of gold used for filling is the "crystal sponge gold," so called from its having the appearance of a crystalized sponge. This is used principally for "building up" teeth which have the crown destroyed. For a successful operation, this gold must be condensed by either automatic plugger or hand mallet process. Any attempt to condense it by hand pressure will fail, as the particles will "bridge," thus leaving the filling sufficiently porous to absorb the acids of the mouth, which would thus find their way to the walls of the cavity and continue their destruction. This metal can be condensed to a great degree of solidity. A patient who had the six central teeth built down with it (he had broken the natural ones) used the gold front teeth for cracking shell barks, in preference to the natural back ones and they stood this rough usage for four years, and no doubt would have continued to do so longer, had the patient lived. Tin as a filling is used as in foil and in amalgams. As a foil, it requires as much manipulating as the gold, though it is not as durable; and the profit to the dentist not being in proportion to that on the use of gold, it is seldom used. A filling of tin foil will not retain its bright appearance and smooth surface, on account of the corroding action of the heat and acids of the mouth. Tin united with silver makes a good amalgam for temporary fillings. There is quite a number of different formulas for making amalgams, which are, as a general rule, composed of silver and tin. Some are of silver and cadmium, others of cadmium and tin. The metals are melted together, cast into an ingot, and made into filings, which are sold to the dentist. Having prepared the cavity to be filled as for other fillings, he then mixes a small quantity of the filings with sufficient quicksilver to make a thick paste, which he puts in a cloth, and by pressure squeezes out all the superfluous mercury. The silvery looking mass that remains in the cloth is plastered into the prepared cavity as quickly as possible, and in a few minutes sets sufficiently hard to receive a burnishing. This filling, when properly prepared and used, makes a good temporary filling; but unless done by an expert, it becomes a useless, crumbling mass. Though this is called a temporary filling, and is used as such by the profession generally, I know of two lower molar teeth still in use, that were filled with this amalgam fourteen years ago. The bone cements are usually nothing but chlorides, sulphates, and oxides of zinc. They are technically termed "*os artificiel*" or artificial bone, and are put into the cavity like mortar, with a spatula-shaped instrument instead of a trowel. In a short time, the material sets, and, as in the case of amalgams, if inserted by a competent person, it is a success. Otherwise it is a failure, as it will in that case shrink from the walls of the cavity, be acted upon by the secretions of the mouth, and sometimes wash out during the process of cleansing the teeth. There is but a trifling difference in the amount or quality of fillings used in the various sections; the gold being predominant, and the amalgams and cements standing side by side. There are about forty gold fillings to one plastic filling. One dental depot sold of gold foil in one year 957 ounces, which, at the usual rate of $36 per ounce, makes $34,452 paid for gold plugs by the dentist. As each ounce of this mass will average twenty-three fillings, and the cost of fillings averages six dollars, we find that the public paid for useful and ornamental repairs to the teeth (made with what was sold in one year, by one business house, of one single article) the sum of $132,066. About $1,000 was also paid for amalgam and cement fillings, according the usual proportion. Some practitioners utterly refuse to use anything but gold; and if the walls of a cavity will not sustain the pressure of inserting a gold filling, they will cut off the crown of the tooth, and set a pivot tooth, or build up with sponge gold. The plastic fillings are used principally by the lower classes, chiefly on account of the price; the proportionate rate of charges being $1 to $100 for gold, and from 25 cents to $5 for plastic fillings per cavity.

Correspondence.

Locomotives and Steam Cars.

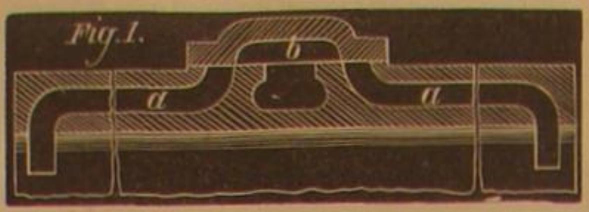
To the Editor of the Scientific American:

In your issue of August 22, it was stated, in an article under the head of "Steam Cars," that the locomotive ought to be more of a guide for builders of steam cars and other steam vehicles, on account of its low center of gravity, its excellent boiler, etc. The great problem, of course, is to so proportion and combine the various parts that the machine shall do the most work with the least possible repairs and fuel. To this end some of the following are essential:

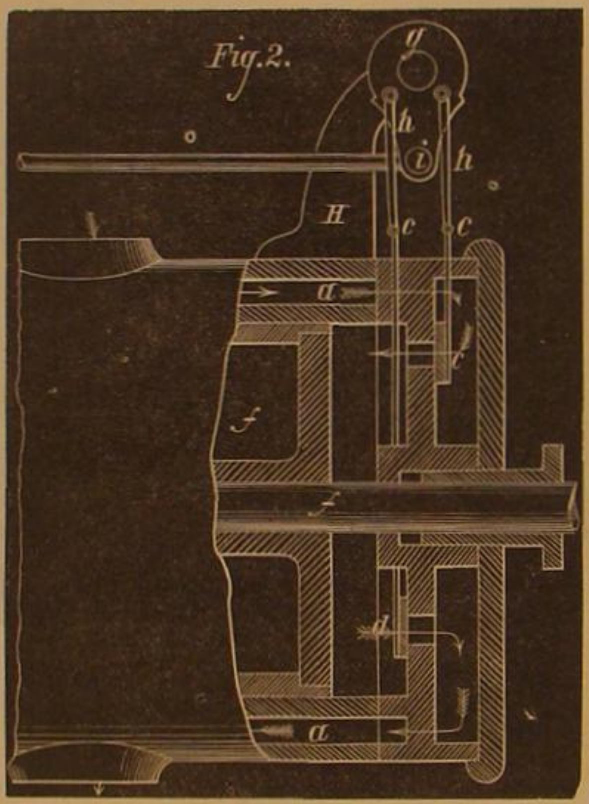
First, and most important, is a low center of gravity, as above stated.

Second: The connecting bar between the piston rod and crank should be as long as the machine will possibly admit—from eight times to ten times the length of crank, if possible—in order to reduce the pressure of the slides upon their guides, and hence their friction and wear, to a minimum.

Third: The length of the piston should equal half its diameter at least; if its length fully equalled its diameter, its durability and economy would be still greater. It should be cast in one piece, and made hollow or in cup form, to insure proper lightness. It should be fixed permanently to the piston rod before the last chip is turned off; then it should

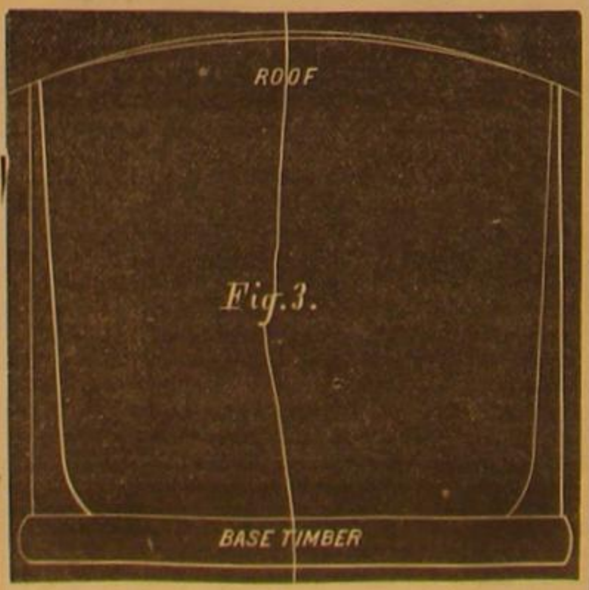


be fitted as snugly as possible to the bore of the cylinder, and yet it must work without chafing. A good practice is to surface such pistons with a shell of hard Babbitt or other composition not liable to chafe, and which may be easily renewed. If packing rings are used, they should be of the simplest possible make: two simple rings of steel or some other hard material, sufficiently elastic to admit, after being cut at one point, of being sprung into a single groove midway of the piston, the rings, of course, being placed so as to break joints. They may be held in position by a single dowel pin set in the piston beneath each ring. The loss occasioned by the escape of steam around a piston of the above description would be far less than the loss resulting from friction in attempting to keep a piston steamtight by set screws and springs (the old way), or by steam pressure.



Fourth: The bearing surface of the slides should be ample. A good rule is to make their combined upper and lower surface equal the piston area. For instance, a piston of seventeen inches diameter has an area of two hundred and twenty-seven square inches; one fourth of this is about fifty-six square inches for each of the four faces of the slides, as usually made.

Fifth: In the slide valves, considerable economy would doubtless result from a slight modification in the valve system. It now takes, to fill the passages, *a* (Fig. 1), between



the valve, *b*, and the ends of the cylinder, about five per cent of the steam used; if the valves were arranged as shown in Fig. 2. this five per cent of steam and fuel would, of course, be saved. (This illustration was drawn from a stationary engine in Worcester, which has this new system of valves.) It will be seen that there are two simple plate valves at each end of the cylinder, the inlet valve, *c*, and the discharge valve, *d*; *f* indicates the piston and its rod, the view being a central section at one end to show the arrangement; the valves, *c* and *d*, are driven by the rockers, *g*, which work in the top of two standards, H, the valve stems being jointed, at *e*, to the links, *h*. The arrangement is simple and perfectly applicable to the link motion of the present locomotive; it would only be necessary to connect tha valve rod to the point, *i*, of one of the rockers, *g*. This arrangement would not only cause a direct saving of five per cent of the fuel now used, but would render the action of the steam upon the piston more direct and efficient; it would also reduce the *steam pressure* upon the back of the valves to less than half its present amount.

Sixth: Much better provision should be made for freeing the boiler from sediment; the narrow water space around the fire box and the bottom of the cylinder of the boiler under the tubes are liable to become so clogged with foul matter as not only to destroy much of the most valuable generating surface, but to cause irreparable damage to the boiler from excessive heat. One or two blow-off cocks are of very little use. Their influence extends but four or five inches either way from their openings; hence it would require at least 8 or 10 two inch cocks around the base of the fire box, and as many more in the cylinder of the boiler under the tubes to insure anything like a tolerable freedom from sediment; and even then, I think that in many localities sediment would still accumulate between the cocks. But as there are serious objections to numerous blow-off cocks, the only safety seems to be in screw plugs judiciously placed and used. Two plugs should be placed at each corner, even with the bottom of the water space around the fire box, so that a scraper may be passed entirely through from corner to corner, both laterally and fore-and-aft. A screw plug should also be placed exactly beneath the tubes in the cylinder of the boiler near the fire end, and another in the tube sheet under the tubes in the smoke chest. The most important item, in connection with this screw plug system, is to cause these plugs to be removed from three to six times a year, or as often as the nature of the water demands, and, by means of a scraper and a powerful jet of water, to thoroughly cleanse the boilers from sediment; this should be one of the most imperative duties of the men in charge.

Again, as you state, a low center of gravity is of the utmost importance in the make-up of a first class steam car, and this applies with equal force to all rolling stock. The narrower the gage of the track, the more imperative is the necessity of a low center of gravity. The reason is obvious: The lower the center of gravity of a car, the more steady will be its progress upon the track; and the less the lateral strain upon the rails and running gear, the less the liability of its leaving the track, and the less the liability of its overturning when it does leave the track. These facts are sufficiently trite and self-evident to need no comment.

Our present passenger and freight cars are susceptible of much improvement in this direction. The roof and the upper portion of the body might doubtless be reduced in weight one third and yet have ample strength for all that is required of this portion of the car, namely, protection of passengers and freight from the weather, and the safe passage of the brakeman from car to car on the roof. The running gear and the base of the body is none too strong or too heavy now, perhaps; but from the base timbers, the weight of the frame ought to diminish quite rapidly to the roof, not by offsets, but by gradual taper. The diagram (Fig. 3) presents this idea to the eye. Our car builders and intelligent railroad men recognize this idea, of course, but they do not carry it out perfectly in their practice. When this point shall be gained, an important economic result will have been attained.

If the body of a car could be dropped so as to bring the floor within two or three inches of the axles, this economic result would, of course, be still further enhanced; the wheels would not project through the floor sufficiently to interfere much with the seats or the loading of freight. A simple iron cap over each wheel would make all safe inside the car. This change would, of course, require some alteration in the truck frame and the housing of the wheel boxes; nevertheless it seems to be an alteration which is perfectly practical.

Any change in our present system which seems to indicate an important improvement in the stability, safety, and economy of our rolling stock is worthy the candid consideration of railroad men.

F. G. WOODWARD.

Tides of Lakes and Lakelets.

To the Editor of the Scientific American:

It is said by most authors on tidal theories that there can be no tides on lakes, for the reason that the moon's attraction is equal over the whole surface of water. I hold that there is a tide raised from every body of water on earth. It is impossible for the moon to raise a body of water from the earth by its attraction, but it counterbalances or neutralizes a portion of the earth's attraction for the water, in consequence of which the water becomes lighter and the lower portion not so much compressed. Hence, on account of the elasticity of the compressed water, the diminution of compression is followed by an expansion which drives the superincumbent water upward. This is a natural principle which belongs to all bodies of water, although the effect is imperceptible if the water be shallow and not connected with very deep water.

By this theory (of my own) I account for the very considerable tide that rises on Eagle Lake in the northern part of this State. The lake is very deep and has never been fathomed.

LA FAYETTE LILLARD.

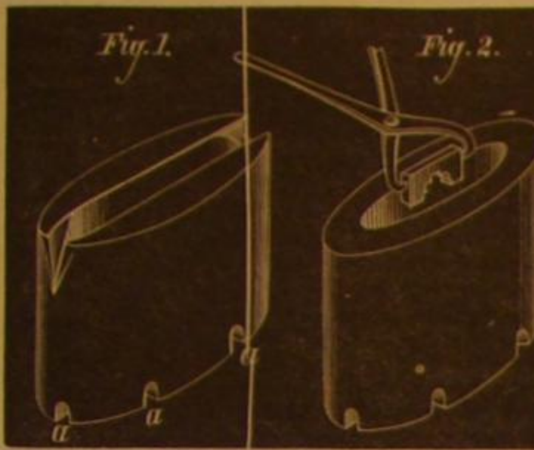
California College, Vacaville, Cal.

Hardening and Tempering of Tools.

To the Editor of the Scientific American:

I have not heretofore objected to any of Mr. Rose's processes, as such, but have stated merely that, in any of the usual methods, the elements of time and access of air are important ones. I do now, however, object to the tube method, the sand bath, and to the heated iron in contact with the piece to be tempered.

A tube heated to redness in an ordinary forge fire, or in fact in any sort of fire, if not long enough to project at both ends beyond where it is possible for the products of combustion to enter, will vitiate a result predicated upon the



color produced by the entrance of these gases. If it be long enough to exclude the gases, and its diameter is in any reasonable proportion to that of the article to be tempered, it will be very inconvenient for observation of the color without withdrawing the piece often. Any one at all accustomed to tempering well knows that, to bring to a nice shade of color any article by a process which requires its repeated removal from the source of heat, is very difficult; as there can be no nicer gradation arrived at than may happen to have been produced by one of the periods during which the piece was subjected to the heat. If the tube be so large in diameter as to permit of the colors being readily observed, there remains the objection (which applies to all processes which require that the color be observed, almost exclusively, under the light emanating from red hot iron or the yellow rays from a fire or a gas light) that the color does not appear the same as it would if observed under white or daylight. The colors dealt with in tempering, being principally of the yellow and blue order, are much modified in appearance by the yellow and red rays from the above mentioned sources. To be sure, an expert at tempering, one who makes it almost exclusively his business, can by continued practice decide what particular shade in the red hot tube would correspond to a required shade as seen by daylight; but our object is, or should be, a method by which any workman may arrive at a color, correct for a given tool as ordinarily seen.

My objections to the sand bath are precisely those which Mr. Rose now admits to be its weak points: the difficulty of determining its temperature, of maintaining it at a given temperature if such could be determined within reasonable limits, and the difficulty of insuring a uniformity of temperature throughout its mass; and, failing to use it successfully because of the three difficulties, the absolute uselessness of attempting to use the color test with it while excluding the air from the tool by immersing it in the sand.

The use of a red hot piece of iron in contact with the tool to be tempered, as advocated by Mr. Rose in tempering dies is objectionable, not only because the surface of the die or other tool in contact with the hot iron is, during contact, excluded from the air, and the progress of the color formation modified thereby, as advocated in my original communication, but there is also the objection which applies very particularly to dies; that the end convolution of the thread, nearest to the hot iron, is liable, and in fact almost certain, to be made hotter than the body of the die, as indicated by the color of the side exposed to view; and as this particular part of the die has to bear the brunt of the work while in use, it is of the last importance that it should not be softer than the workman will be likely to regard it as determined by the color of the body of the die; and this objection applies of course to any article having thin or projecting members.

The process I desire to suggest for drawing the temper of taps, reamers, and similar forms, and which I have used with uniform success, is shown at Fig. 1. It consists of a piece of iron, wrought iron preferably—although cast iron is much cheaper and answers very well—made in the form of a heavy flattened tube 5 or 6 inches in hight, made thin at the curves and cut out as shown in the figure. The opening requires to be in width at least twice the diameter of the piece to be tempered, and in the bottom several channels are cut or cast leading to the inside, shown at *a, a, a*. These channels are for the purpose of admitting air to pass in and establish a current upward through its inside. The channels require to be quite small, so that the upward current shall be sufficiently slow to insure the air being heated to a very high temperature, it, the piece in Fig. 1, being heated to a bright red heat. The tap or other piece may be held in a suitable holder made of soft iron wire, coiled so as to take the shank within it and extended long enough to form a ring-shaped handle at the end; the wire holder is allowed to rest in one of the depressions at the ends of the apparatus, thus supporting the tap or reamer in the center of the opening, in which position it may be rotated, moved endwise, or tilted in or out of the opening, as may be found necessary to establish a uniform color throughout its length; or the tap may be held in the tongs by the wrench end, the shank laid in the V-shaped opening, and the threaded part only tempered, leaving the softening of the shank, etc., to be done afterward. Fig. 2 is simply a thick circular tube similarly grooved in the bottom, with which dies and other short pieces may be tempered. They may be also held in a wire holder, or in tongs (with points turned inward, forming a pair of centers upon which the die may be rotated by a piece of wire in the other hand). Other modifications of these may be used to conform to the tool or piece required to be tempered.

Of course, where a number of similar pieces are to be tempered by this method, it is necessary to have two irons in the fire, or, rather, one in the fire while the other is in use.

It will readily be seen that in this method there is perfectly free access of air, while the operation may always be performed in a situation where the colors may be seen by daylight; and it will be found that, owing to the fact that the heating of the piece to be tempered is effected principally by the heated current of air, it will be very uniformly done; in fact it is superior, even in this respect, to the tube process.

An ordinary flat piece of iron may be used, for many forms of tools, to advantage, as for instance in hastening the drawing of a cold chisel which has been dipped too far or for too long a time, if care be taken to keep the two from contact. If Mr. Rose will give the above methods a trial, as he has promised, I am persuaded that he will thereafter give them the preference over the methods he has illustrated.

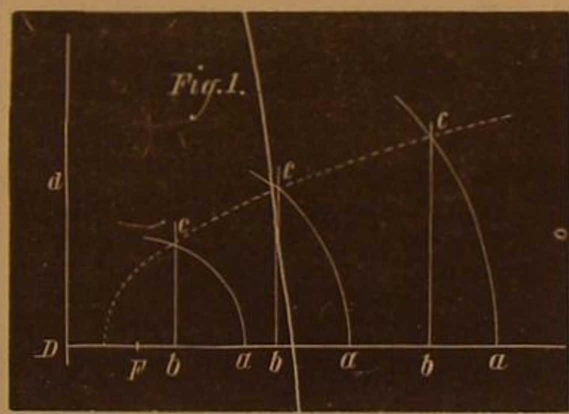
The element of time I have not pretended to be able to control to any considerable extent, as Mr. Rose would seem to infer; but I do insist that, with any process whatever in which the color is taken as a guide, it must be taken into account, and the proper allowance made if the operation be from any cause unduly prolonged or hastened.

62 Cannon street, New York. JOHN T. HAWKINS.

To Draw a Parabola.

To the Editor of the Scientific American:

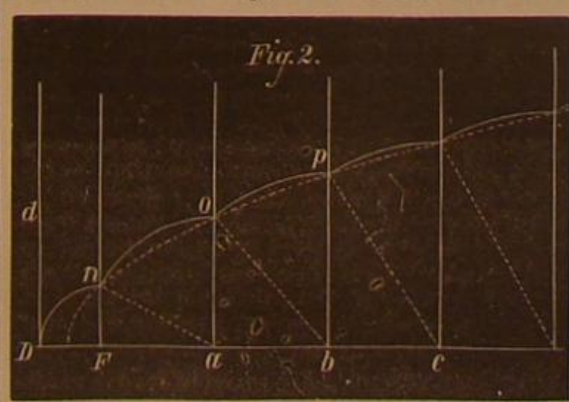
A very convenient way to draw this curve is as follows: On the principal diameter, Fig. 1, lay off the proposed directrix, D *d*, and focus, F. With F as a center describe arcs, *a c*, at convenient distances from each other. From *a*, set off *a b* equal D F, and draw *b c* perpendicular to D F *b*. Then will the intersections, *c*, be points in the required curve.



While geometrically accurate, this method has the advantage of being applicable where the usual methods are not convenient.

Another equally convenient method is as follows:

Lay off D *d*, and F (Fig. 2) as in the first instance, and make the distances, F *a*, *a b*, *b c*, on principal diameter equal to 2 D F. From F *a b c* draw perpendiculars to principal diameter. With F as a center, describe arc D *n*; with *a* as a center, describe arc *n o*; with *b* as a center, describe arc *o p*, and so continue as far as necessary. Then will *n o p* be points in the required curve.



Having determined D F, and drawn the perpendiculars, F *n*, *a o*, and *b p*, the points *n o p* may be determined without drawing the arcs, by taking the root of every fourth number, beginning with one, from a table of square roots, as shown in the following table, in which D F = X is taken as the unit:

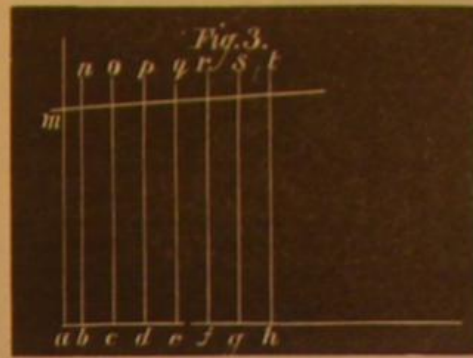
F $n=\sqrt{1}=1$; $a\ o=\sqrt{5}=2{\cdot}236$; $b\ p=\sqrt{9}=3$; $c\ g=\sqrt{13}=3{\cdot}605$; $d\ r=\sqrt{17}=4{\cdot}123$; $e\ s=\sqrt{21}=4{\cdot}582$; $f\ t=\sqrt{25}=5$; $g\ u=\sqrt{29}=5{\cdot}385$.

By the aid of this table, sufficiently extended, and the principle illustrated in Fig. 1, we may readily draw any desired section of the curve, on any scale, as shown in the following example: On the principal diameter (Fig. 3), the point, *a*, is 95 inches from focus, F; and at this point the width of the curve, *a m* = 14 inches. Required the curve beyond (at the right hand) of *a m*.

We first determine the radius F *a* (Fig. 1) by taking from a table of squares:

$$F\ a^2 = 95^2 = 9025$$
$$a\ m^2 = 14^2 = 196$$
$$\sqrt{9221} = 95{\cdot}98 \text{ nearly.}$$

Therefore, D F = 95·98 − 95 = 0·98; and, therefore, the perpendiculars must be 0·98 × 2 = 1·96 inches apart. To determine the position of the first one, divide F *a* = 95 by 1·96 = 48 + a fraction. We now multiply 1·96 by 48 + 1, and obtain 96·04 inches as the distance of the first line, *b n*, from F, or 96·04 − 95 = 1·04 inches from *a m*. This being drawn,



the other lines may be laid off 1·96 inches from each other, as described—

As *b n* is the 49th perpendicular from F, its length will equal $\sqrt{49\times4+1}=\sqrt{197}=14{\cdot}035$ units (not inches) as in this table

$b\ n=\sqrt{197}=14{\cdot}035$; $c\ o=\sqrt{201}=14{\cdot}177$; $d\ p=\sqrt{205}=14{\cdot}317$; $e\ g=\sqrt{209}=14{\cdot}456$; $f\ r=\sqrt{213}=14{\cdot}594$; $g\ s=\sqrt{217}=14{\cdot}730$; $h\ t=\sqrt{221}=14{\cdot}866$.

Proceed in this manner as far as required, bearing in mind that the unit of this table is D F (Figs. 1 and 2). This last method, though requiring considerable calculation, is the most accurate in practice, and therefore the best for such cases as the example given. F. H. R.

New Britain, Conn.

Vesicatory Potato Bugs.

To the Editor of the Scientific American.

In your article on bugs on page 17 of your current volume, you say, referring to the alleged fact that potato bugs are a good substitute for the Spanish fly: "This is interesting but, unfortunately, not authenticated." Begging pardon for putting in my oar where there is no rowlock, I have to say that your error consists in not discriminating between different bugs. That the Colorado bug is valuable for blistering purposes, I am not aware; but any one who has to deal with the long striped bug, somewhat resembling the lightning bug (*cantharis vitatis*), will find to his grief that they are an exceedingly active vesicant. During the war, when ("down South") we were obliged to utilize our home productions, we found this insect to answer all the purposes of its Spanish cousin. Any one who does not believe this can easily test it by visiting Virginia in July, and mashing one of these bugs on his arm. If it does not blister, I will pay his expenses for the trip.

Alexandria, Va. J. B. HODGKIN.

Bees and Honey.

To the Editor of the Scientific American:

I think that H. W. S. (SCIENTIFIC AMERICAN, page 148, current volume) will have very little trouble in finding a market for strained honey, if he will be very clean in all his operations, and, when it is convenient, invite in some of his probable customers to see him manipulate, explaining the advantages of getting clean honey from the comb, with an occasional cell of bee bread in it.

I have kept bees solely for the pleasure of studying their habits, and should keep them if I never got an ounce of honey from them. I am a mechanic; but I have had no trouble in disposing, out of work hours, of a barrel of strained honey in a very short time, to persons who, I afterwards found, were anxious to buy again.

I think that if apiarians considered the value of comb, they would be more saving of it than they are. Probably each pound of comb represents ten pounds of honey, which should not be wasted (to be replaced each year) when it might be saved. I have thought the bees might be saved the trouble of making comb, wholly or in part, by making it of paper and waxing it. If we could not make the whole comb, the partition in the middle might be made by indenting paper, waxing it, and suspending it in the frames. This would ensure straight combs at least, which are very important; and with these, an emptying machine, and good frame hives, I think that bee-keeping would be in its simplest form. WILLIAM G. BARNES.

Bridgeport, Conn.

THE CORRELATION OF FORCES.—Of the various forms of energy existing in Nature, any one may be transformed into any other, the one form appearing as the other disappears. This is what is meant by "the correlation of forces." Thus the rotary power of a wheel, if applied to turn a magnet, is converted into electricity; and this electricity, if employed to drive a wheel, is changed back into rotary power.

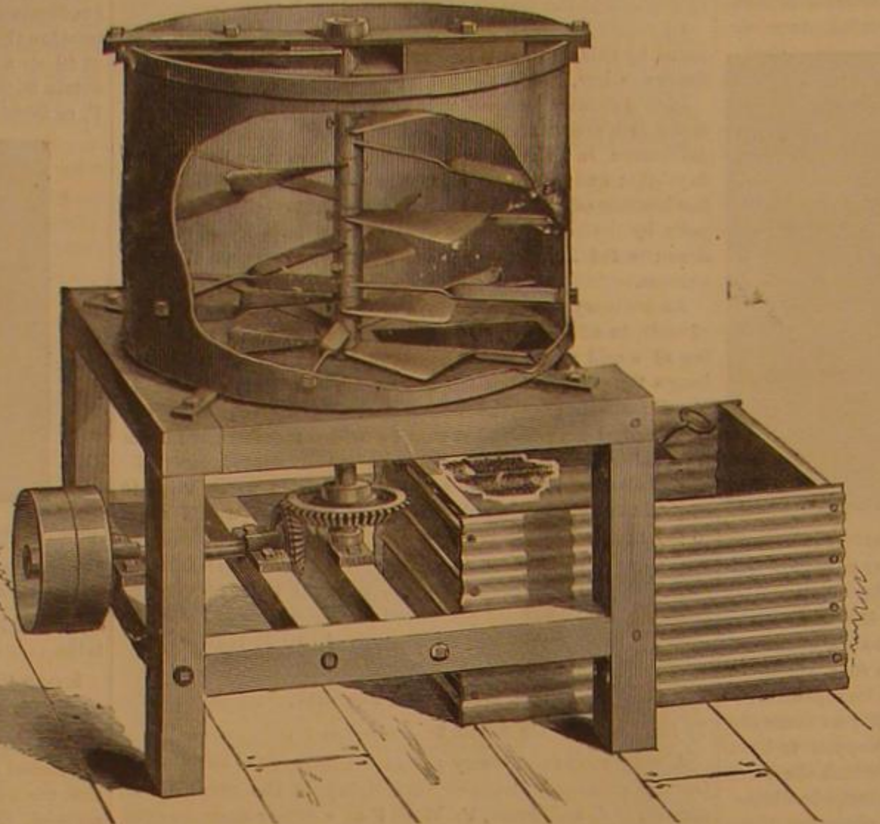
IMPROVED SOAP CRUTCHING MACHINE.

The invention herewith illustrated is an improved machine for mixing or crutching soap. Instead of carrying its contents, a defect which existed in the older apparatus of the same manufacturer, this machine simply crutches, keeping the soap in a body. The vertical wrought iron shaft, which is rotated by the gearing shown beneath, carries a number of cast iron wings, smaller extensions of which project to the inner periphery of the containing vessel. Within the latter are also a number of fixed bars which are rigidly secured, and through sockets in the inner ends of which the shaft freely turns. The wings are constructed in a spiral form and work as a double acting screw, raising and mixing the heaviest material from bottom to top. No air is crutched into the soap, as the stirring is all within the substance, so that it cannot get a spongy appearance or become filled with air holes and blisters. The product, we are informed, looks like the best hand-crutched soap, and is perfectly smooth and firm.

In operation the soap is let into the top of the tank, and run by steam power for from four to ten minutes; the sliding door in the bottom being then opened, the material is conducted directly to the frame, placed, as shown in the engraving, to receive it. All clippings and trimmings can be crutched in with the mass in the tank. The wings quickly cut the pieces up so that they dissolve. This is an advantage of importance, since it saves throwing the fragments back into the kettle.

The machine is of iron, weighs about five hundred pounds, and is made of any size, holding from eight to twenty hundred pounds. It may also be used as a complete mixer for all mineral and liquid compounds.

The apparatus is manufactured under two separate patents, issued to Charles Lehrmann, dated March 29, 1870, and September 29, 1872. For further particulars address Willis Humiston (sole manufacturer), Troy, N. Y.



LERHMANN'S SOAP CRUTCHING MACHINE.

DAVIDSON'S IMPROVED FLOOR CLAMP.

This is a novel and simple form of floor clamp, which will find a ready appreciation from carpenters, builders, and others. The lever bar, A, and the ratchet bar, B, are provided with spurs at their lower extremities, to take against each side of the joist. Between them is a connecting screw, C, having a nut, which is used to adjust the implement according to the thickness of the joist. D is the fastening lever, secured, as shown, to the bar, A, and provided with a slot through which passes the bar, B, a step, E, serving to engage in the teeth of and hold the latter at any desired point. F is a plate for protecting the edge of the flooring, and G a pawl for holding the apparatus after clamping up the same.

In operation, the bars are placed on the joist and fastened The upper end of the clamp is then pressed forward so as to force the flooring together by the plate, F. The device can be made to weigh but little; and judging from a model which we have tested, it appears to be an efficient and handy implement.

Patented through the Scientific American Patent Agency January 6, 1874. For further particulars address the inventor, Mr. Robert C. Davidson, Evanston, Uintah county, Wyoming Territory.

Breeding Terrapin and Freezing Fish.

An establishment has lately been started near this city, for the purpose of supplying to our markets an abundance of that greatest of marine delicacies, the terrapin, the artificial breeding of which is an entirely novel idea, and, from the success thus far encountered, appears to be a very successful one. The animals are caught at various points along our Southern sea coast and shipped directly to a fish dealer at Pleasure Bay, near Long Branch, N. J. Here they are placed in a huge pen, built on the beach. About two thirds of the enclosure is under water and the bottom is sloping so as to leave a depth of some eight feet in the deepest part. As many as 10,000 terrapin are placed in this receptacle at a time. For some years past the proprietor has noticed that large numbers of eggs were laid on the unsubmerged sand, but that very few were successfully hatched, as one terrapin would quickly destroy and devour the eggs of another, while the young were sure to be killed as soon as they appeared. In order to supply an artificial breeding place where the eggs could remain undisturbed, another pen has recently been constructed further inland, one third of the surface of which is dry sea sand. Every day the surface of the larger pen is raked and the eggs (carefully removed) transplanted in the new enclosure in regular rows, at a depth about equal to the length of a good sized terrapin's body. As many as 5,000 eggs were thus placed at one time during the past summer, and left to hatch by the warmth of the sun. At the beginning of the present month, the young terrapin began to appear; every day now adds to their numbers, and all seem to be healthy and doing well. Some difficulty is anticipated in keeping the animals over winter; but this surmounted, and the operation conducted on a larger scale next summer, there remains little doubt but that a new and important source of supply has been established. The food upon which the terrapin subsists, fish, crabs, and clams, is easily and cheaply obtained in the vicinity of the pens, so that the cost of maintenance will be small; while (judging from the fact that terrapin readily command from $8 to $15 in the markets), the enterprize will doubtless prove a lucrative one.

Freezing fish for winter use has almost attained in this city the dignity of a separate branch of trade. During the summer months, the markets are glutted with finny food, which, unless preserved by some means, would engender an immense waste, while causing a dearth of the commodity during the cold months. Salmon especially are very abundant during summer and extremely scarce in winter, so that this valuable fish, perhaps more than any other, finds its way into the great freezing rooms of the dealers.

The operations preliminary to the freezing process are the selection of the finest fish, and their careful cleaning. In large establishments, the entire first floor forms a gigantic refrigerator, having double walls of zinc, and divided into three sections, in each of which are two compartments. Ice and salt, ground together in a mill, are introduced into the spaces between the walls through openings in the floor of the second story, these apertures being so arranged that any number of the compartments can be cooled without affecting others. After the fish are cleaned, they are placed in pans, the latter being piled above each other in layers, packed in ice and salt, and covered up. Here the fish are left until thoroughly frozen, after which they are thrown into the huge refrigerators where they are kept. Within these receptacles the temperature is maintained at about 12°, and the fish are consequently rendered about as hard as solid lumps of ice. In this condition they are kept ordinarily six months and sometimes for eleven months, remaining perfectly fresh and only requiring thawing out to render them ready for cooking. It is estimated by the *Tribune*, from which we extract the above facts, that at the present time fully 250,000 pounds of fish are thus stored in this city, for next winter's use.

Self-Propelling Steam Fire Engines.

Steam engine No. 32, of the New York city fire department, stationed at Burling Slip, is provided with a very simple device which adapts it perfectly for self-propulsion. On one end of the crank shaft operated by the steam cylinders, and outside of the heavy fly wheel, is secured an iron flanged pulley, the periphery of which is corrugated. In line with this, on the rear axle and inside one of the rear wheels, is a similar though larger pulley, to which power is communicated from the one first mentioned by means of a strong endless chain. This is the only point of difference between this engine and that of the ordinary form drawn by horses. In fact, by merely removing the chain and attaching the pole, animals can be at once harnessed to the machine. The working of the steam cylinders of course propels the rear wheels, and a man in the driver's seat governs the ordinary hand steering wheel, and so directs the apparatus.

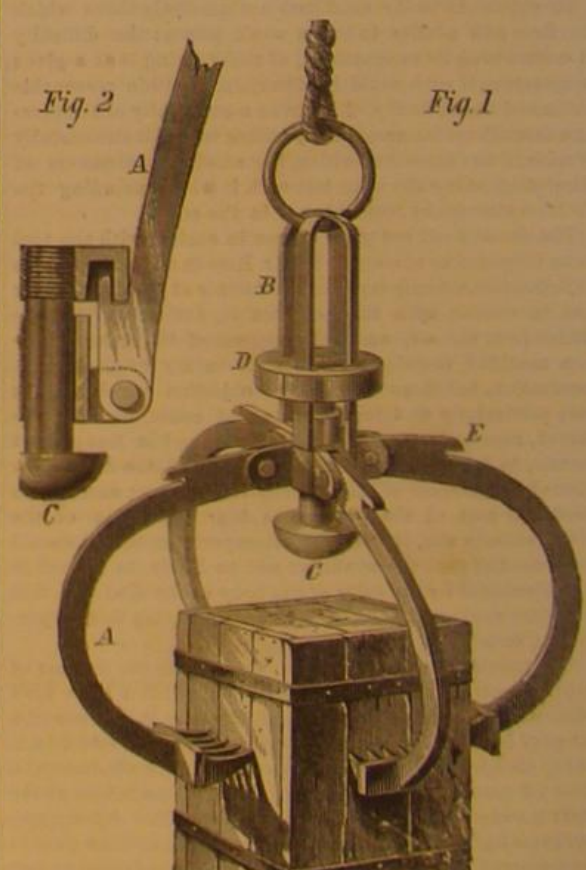
This engine weighs about 8,500 lbs., and is of great power; and since it would be a heavy load for two horses, the device above described has been fitted to it. It travels at a speed about equal to that of the moderate trot of a team.

A NEW GRAPNEL.

A novel and ingenious form of grappling iron has recently been patented through the Scientific American Patent Agency by M. J. B. Toselli, of Paris, France.

The device, which will be readily understood from our engravings, consists in a number of curved arms, A, provided with claws at their lower extremities. These arms are pivoted to lugs on a supporting frame, through the center of which loosely passes a shank, terminating below in a weight, C, and above in a disk provided beneath with a ring, D. These parts are shown in section in Fig. 2.

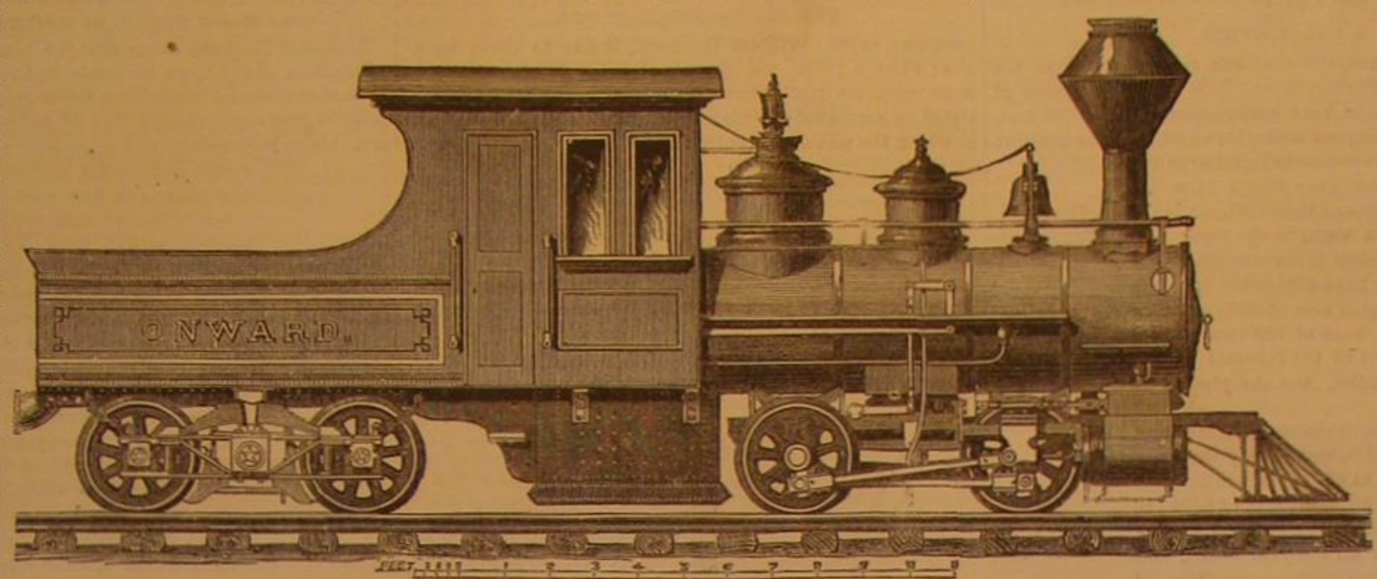
To set the apparatus, the arms are raised, and catches, E, thereon hooked, under the ring, as represented in the last mentioned figure. The grapnel is then lowered until the portion, C, strikes the object to be grasped. The shank is then forced up, carrying the disk and ring, D, so releasing the catches, E, when the arms fall by their own weight and clutch whatever is beneath them. In order to secure specimens of the bottom, in making soundings, the claws may be made scoop-shaped and provided with lids, so that fragments of rock, sand, shell, etc., may not be washed away when the apparatus is raised to the surface; or horizontal ribs may be placed upon the arms, which, when the latter are closed, would form a perfect cage for specimens.



NEW FULMINATE.—M. Prat says: Picrate of lead has the property of detonating when struck, and may serve as a substitute for fulminate of mercury in percussion caps. He also gives an account of an explosion which occurred in his laboratory on triturating together chlorate of potash, picrate of lead and amorphous phosphorus.

DOUBLE BOGIE LOCOMOTIVE.

We illustrate herewith a type of double bogie tank locomotive, constructed on the Fairlie system, which has been introduced with much success by Mr. William Mason, the well known locomotive builder, of Taunton, Mass. In this engine the ordinary form of boiler, with single barrel, is retained, and only one steam bogie is used, the hind end of the engine (at which the tank and coal bunkers are situated) being supported by an ordinary carrying bogie. Mr. Mason has built some of these engines with four wheels and some with six wheels to the steam bogie, and they are well adapted for use in cases where the entire weight of the engine is not required for adhesion, or where the heating surface demanded is not greater than can be advantageously obtained with the ordinary form of boiler.



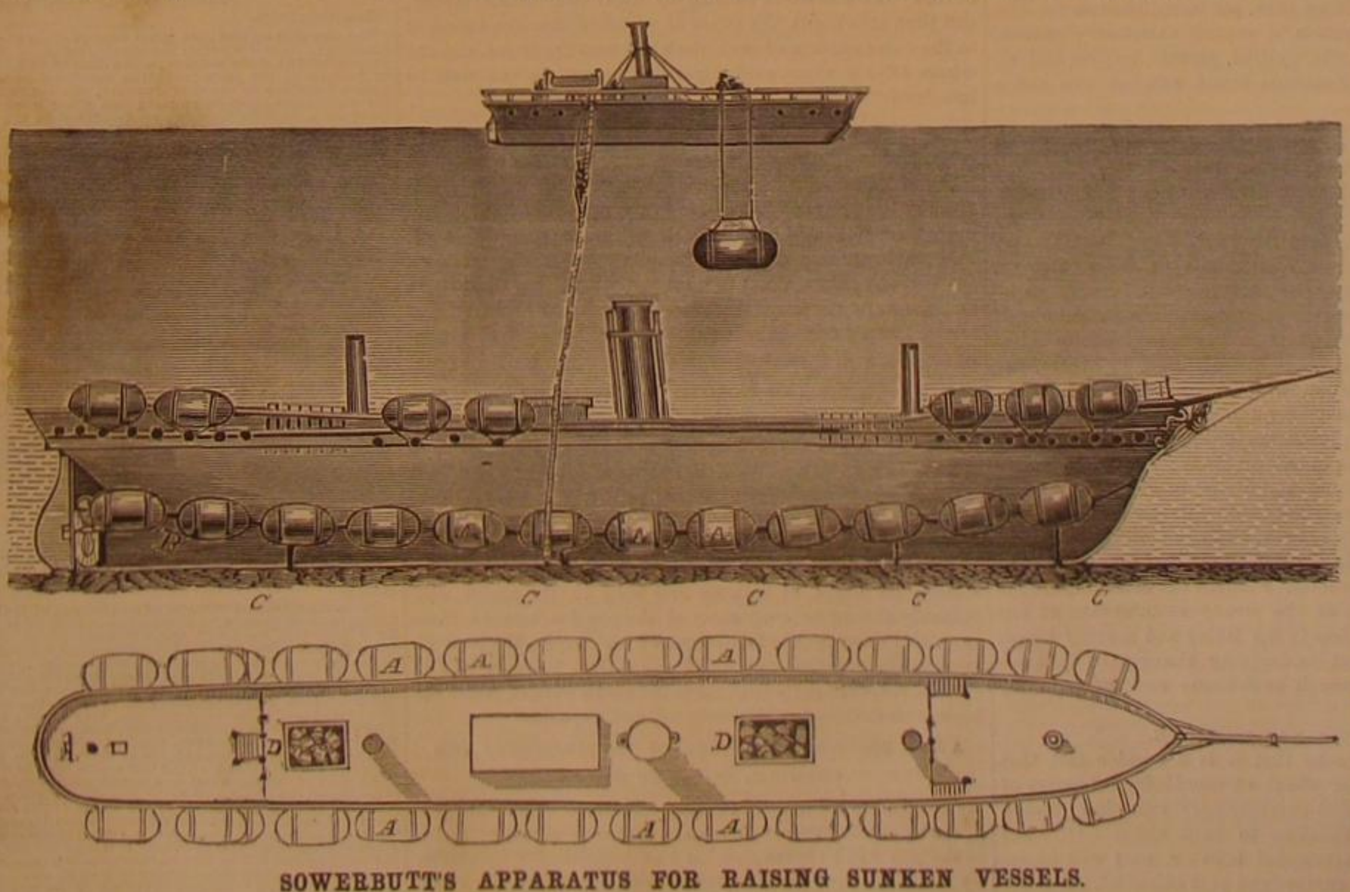
MASON'S DOUBLE BOGIE TANK LOCOMOTIVE.

We have now before us, says *Engineering*, from which we extract the engraving, reports on the working of some of the engines constructed according to the arrangement we illustrate; and their performance is spoken of in high terms, it being especially stated that they are very easy on the road, as might indeed have been expected. On the Howland and Aspinwall Railway, a line of 3 feet 6 inches gage, engines of this type are doing good work on a gradient of 296½ feet per mile, or about 1 in 17·7; while others are in use on the American Fork Railway (the gage of which is 3 feet), on a line of 4 feet 1 inch gage belonging to the Calumet and Hecla Mining Company; on the Utica, Ithaca, and Elmira Railway, and the Toledo, Wabash, and Western Railway, both of 4 feet 8½ inch gage; and on the Virginia and Tennessee Railway, the gage of which is 5 feet. Altogether the type is a very good one, and we expect to see its use largely extended.

APPARATUS FOR RAISING SUNKEN VESSELS.

We illustrate herewith Sowerbutt's patent system for raising sunken vessels and their cargoes, for working which a company has just been formed in England.

The principle upon which sunken ships may thus be raised is easily explicable by the simplest principles of hydrostatics. The ship and its loading is the exact weight of as much water as is expelled by its water draft, and when it becomes heavier than that it sinks. Again, so many pounds as the cubical contents of the timber of a wooden vessel is heavier than an equal cube of water, will she buoy up, even though full of water. Heavy non-buoyant bodies are also much lighter in water than in air. On these principles the practice has been, by means of divers, to attach pontoons or casks to sunken vessels, being first filled with water that they may be more easily sunk down to the wreck.



SOWERBUTT'S APPARATUS FOR RAISING SUNKEN VESSELS.

The water is afterwards displaced and air substituted. This has been effected in several ways, but all of them involve trouble, delay, and risk of miscarriage. The simplicity and self acting character of the apparatus about to be described gives it a great superiority over all the methods previously employed. In blowing up wrecks, the charges are laid by the divers, and exploded by electricity. The apparatus at present under consideration may be described as follows: A number of pontoons and casks (A A), from 3 feet to 20 feet long, and from 3 feet to 12 feet in diameter, strongly made and sufficiently heavy only just to sink when filled with water, are attached to the sunken ship by a strong chain (A A A). Each of the pontoons contains a metal receiver filled with compressed air, sufficient when expanded to fill the pontoon at a pressure to be regulated at will. The pontoons, having been lowered to the wreck from a tug, are attached by divers to the ship, as shown in the diagrams. If necessary, other smaller pontoons or casks, constructed on the same principle, may be stowed in the hold or cabin of the ship (D D). In each of the pontoons there is a tap—which may either be turned by the divers or by self-acting mechanism—by means of which a valve is opened in the receiver, and the air thus set free expels the water from the pontoon; and the required buoyancy having been obtained, the ship rises to the surface, whence it may be towed into harbor. There are several obvious advantages in this system. The invention brings into operation a natural principle, simple and certain, and the water is expelled from the pontoons without employing pumping apparatus at the surface; and the pontoons being filled on shore, all that remains to be done is the arranging them about the wreck, which, from their extreme lightness under water, is a matter of little difficulty.—*Iron.*

Prospective Profits of English and American Railways.

The *Springfield Republican* says that the English roads seem destined to eat themselves up. Their earnings have increased 100 per cent since 1860, their working expenses 135 per cent. How many decades it will take for the expenses to catch up with the earnings is an unsolved problem. The English roads have cost three times as much per mile as the American, largely on account of the heavy land damages, and their gross receipts are from two to three times as much per mile and their working expenses twice as much. The proportion of net earnings to capital is nearly equal in both countries, and less than 5 per cent.

Hay Fever.

From the best statistics that can at present be collected, there appear to be over fifty thousand persons in the United States who are annually subjected to this distressing complaint. In the opinion of the most intelligent physicians, it is to be classed among the nervous diseases, such as neuralgia, rheumatism, etc. An effort is being made in medical circles to obtain particulars from sufferers, and thus promote the study of proper remedies. For this purpose, Dr. George M. Beard, of New York city, has prepared a printed series of questions for answer by patients, the results of which are expected to be of value. All who are troubled with hay fever, and all who are personally familiar with the disease, should send for this series and supply such information as they can.

New Magneto-Mechanical Separator.

A new form of magnetic separator, for the removal of fine particles of iron that become mixed with turnings and filings of copper and brass from workshops, has recently been devised by M. Varin, of Paris.

Two superposed hollow cylinders turn in the same direction, and upon them the material to be separated is scattered through a hopper. The surface of the cylinders consists in bands of soft iron which are kept in a magnetic state. The particles of iron are attracted to these cylinders, and at a certain period of revolution are brushed therefrom into a receptacle, while the scraps of other metal fall to the bottom of the apparatus. The machine is said to be capable of separating 1,100 pounds of material per hour. It has also recently been employed by M. Mangon, for detecting titanic iron in arable earth, with remarkable precision, the iron, in such small quantities as 15 or even 7 grains in 22 pounds of earth, having been readily separated.

The Utility of Machines.

The following, translated from a volume recently published in France by M. Menier, entitled "The Tax on Capital," furnishes some suggestive facts for the consideration of those conservative individuals who cling to the sophism that labor-saving machinery is on the whole a misfortune to the skilled workman, since its supersedes the manual labor (of which he has, through experience and practice, obtained a kind of monopoly) by work with which in point of cheapness and accuracy he can never compete. "Homer," says the author, "mentions 12 female slaves as crushing, between stones, sufficient grain for bread for a day for 300 people. These twelve women, badly fed as they were, consumed themselves a large portion of the corn which they ground, while one woman's labor, at the most, could not prepare flour sufficient for more than twenty-five persons. There was evidently then an enormous absorption of circulating capital to produce this small result. To-day, a single mill in France, containing twenty stones, attended by twenty workmen, produces sufficient flour to support 72,000 men, or, in other words, each workman feeds 3,600 bodies. In the time of Homer, the same labor would have required 144 men, so that each modern mill hand has the power of 144 millers of ancient Greece."

Again, if it should be attempted to spin by hand all the cotton which England manufactures in a year by machines carrying 1,000 spindles at a time, it would require 91,000,000 men, or the total population of France, Austria, and Russia combined. A woman can knit about 80 stitches per minute; by a circular loom she can make 480,000 stitches in the same period; thus the machine gives her the power of 6,000 persons.

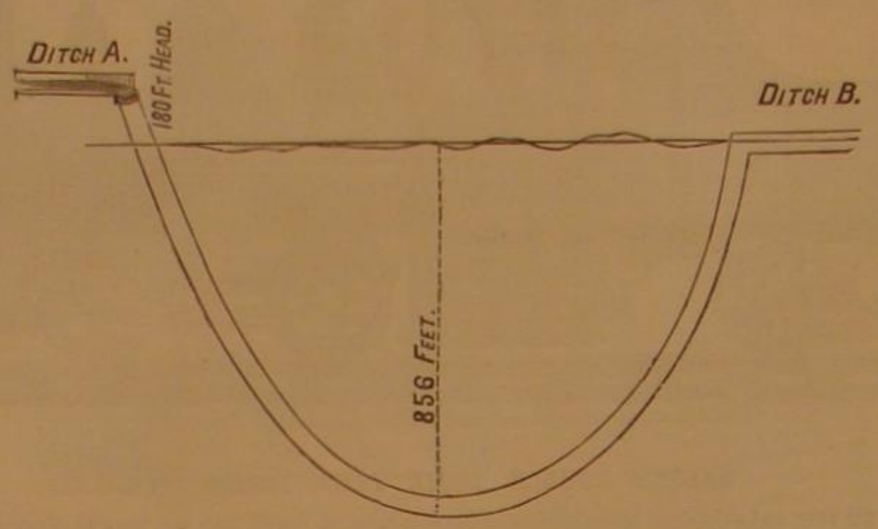
The French Association for the Advancement of Science meets next year at Nantes, France, under the presidency of M. D'Eichthal.

HYDRAULIC MINING.

An excellent example of the hydraulic system of mining for gold, consisting in the washing of gravel deposits, may be seen at the works of the Spring Valley Mining and Canal Company, at Cherokee Flat, Butte county, California. The claim comprises 1,500 acres of ground, containing pay gravel to an average depth of 300 feet. The company has expended, in the works, flumes, ditches, reservoirs, and water privileges, over $1,000,000. They have on the line of their ditch about four miles of iron pipe, 30 inches in diameter.

A GREAT SIPHON.

One section of this pipe conducts the water across the west branch of the Feather river. It is laid in the form of an inverted siphon, and has a vertical depression of 856 feet. The accompanying diagram will give an idea of the position of the pipe, which is somewhat similar to the pipe used by the company which furnishes water to Virginia City and Gold Hill. A is the ditch which leads the water to the pipe; B is a ditch on the opposite mountain which receives it. This pipe has a depression from the level of the discharging arm of 856 feet. The receiving arm has a head of 180 feet vertical pressure. The length of the inverted siphon is two and a half miles, and the pipe is 30 inches in diameter.



GREAT SIPHON OF THE SPRING VALLEY MINING COMPANY.

There are ten miles of sluices, varying from four to six feet in width, and twenty-three undercurrents from 10 to 40 feet in width. For the year ending July, 1874, the sum of $476,112 in gold was washed out and shipped. They employed 160 hands all the year round, and expended $125,000 during the same time, of which $85,534 was for labor. The quicksilver alone used by the company for the year cost $13,309. For iron pipe they paid out $8,839.

The *Mining and Scientific Press* says that the water used is brought by two ditches, 60 miles in length, from Butte Creek, and from the head waters of the west branch of the Feather river. The ditches are six feet wide at bottom and eight feet wide on top. They are four feet deep and run a constant stream of 2,200 inches of water.

The mine turned out last year the largest gold bar ever made, being valued at $71,273.15, and it has been said that they will send a bar worth double this amount to the Centennial Exhibition.

A rather peculiar feature in this claim is the fact that diamonds are found in the washings; most of them, however, by the primitive method of rocking. One diamond, worth $250, was cut in Boston in 1864, and last year several were tested in Amsterdam and Paris, and pronounced diamonds of the first water. Professor Silliman has examined these sands carefully, and enumerates the mineralogy of the Cherokee washings as yielding gold, platinum, iridosmine, diamonds, zircon, topaz, quartz in several varieties, chromite, magnetite, limonite, rutile, pyrites, garnets, epidote and almadine. One of the diamonds found weighed two and a half carats.

THE PROCEEDINGS OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The following are abstracts of the various subjects discussed:

LIVING DEATH.

A paragraph in Professor Redfern's paper on biology, read before the above Association, furnishes a curious confirmation of the axiom, "we die daily." Referring to the blood, it is said that the duration of life in any of its particles is but short; they die and their places are occupied by others, and so continues a substitution which only ends with death. After every meal an amazing number of white corpuscles are added to the blood; breakfast doubles their proportion to the colored corpuscles in half an hour; supper increases their proportion three times, and dinner makes it four times as great. They come from such solid glands as the spleen. In the blood going to this organ, their proportion is one to two thousand two hundred and sixty; in that returning from the spleen, it is as one to sixty. Perhaps the most stupendous miracle of organization is the steady maintenance of but slightly variable characters in the living and moving blood, which is every moment undergoing changes of different kinds as it circulates through each tissue and organ in the body.

EXTRAORDINARY REFLECTION.

Professor Curtis remarks that it is a notable fact that while so much is written about extraordinary refraction of light, nothing is said about extraordinary reflection, though Huggins' theory is applicable to both alike. Of light falling upon a crystal surrounded with air, part will be reflected at the bounding surface and part refracted, the latter portion being split into two rays, whether the crystal be uniaxial or biaxial, each of which rays will suffer double reflection at the point where they again reach the bounding surface of the crystal. In the case where the bounding surfaces are parallel, the planes of polarization are the same as those of the other. This is not true of the intensities, as one of the four intensities may be zero while the others remain finite. When the incident light is not polarized, the number of reflected rays will pass from four to three, and from three to two, as the crystal is turned around a vertical axis. With polarized light, the reflected rays may be four, three, two, or one.

PYROMETERS.

It appears from a report of a committee charged with examination of the above instruments, that, by means of the Siemens electric pyrometer, changes of resistance amounting to about $\frac{1}{1000}$ of the quantity of heat to be measured can be detected without much difficulty.

IMPROVED TELESCOPIC LENSES.

Professor Stokes says that, if opticians can manufacture glass containing terborate of lead or titanic acid, lenses made therefrom will greatly decrease secondary dispersion. Phosphatic glass might answer the same purpose, but it has the objection of being too perishable and too soft.

THE DECOMPOSITION OF EGGS,

according to Mr. William Thomson, is due to three agencies: First, a putrid cell capable of being developed within some eggs, no matter how effectually their shells are protected by varnished coverings. This is generated in the yolk, in which the minute granules assume a morbid vitality, absorb oxygen, and liberate carbonic acid gas. The second germ is a vibrio. If the shell of the egg be allowed to get wet, the dried bodies of these animalculæ existing in the atmosphere develope in the water, assume vitality, enter the shell, and set up putrefaction. The third cause is a fungus, also derived from the atmosphere, which, settling on the shell, sends myriads of filaments through the same, converting the white into a strong jelly. It is strange that this fungus acts on the air like animalculæ, absorbing oxygen and liberating carbonic acid gas.

HASH.

At last Science grapples with this mysterious compound. The attention of the average New York boarding house keeper is directed to the words of Professor Redfern, who condemns "the process of cutting up meat into small blocks, and then stewing it, the effect of which is that the albumen in the outer surface of each block becomes firmly set, and the whole affords about as indigestible a mass as can well be imagined."

RECENT EXPERIMENTS AT HIGH PRESSURES,

conducted by Professor Andrews, show that the compressibility of liquid sulphurous acid (unlike that of water) diminishes as the pressure increases. In a mixture of three volumes carbonic acid to four volumes nitrogen, even at 2° Fah., carbonic acid cannot be liquefied under any pressure. In short the critical point (a term introduced into this branch of Science by Professor Andrews) of carbonic acid becomes lowered many degrees when that gas is mixed with a non-liquefiable gas, such as nitrogen.

THE FLIGHT OF BIRDS.

Professor Guthrie, in relation to the hovering of birds, states that, when the bird desires to hover over a given spot, it moves by an expenditure of muscular force until it finds a region where one layer of air is moving, say, from right to left and another from left to right. Then placing its body and most of its right wing in the lower stratum, it tilts its body so that some of its left wing is in the upper layer. By altering its hight, by turning one wing in its socket, and probably also by turning some of the pen feathers on their axes, and altering the inclination of its wings, the bird so governs the pressure on the two wings that the sum of the vertical revolved parts is equal to the bird's weight, while the horizontal revolved parts are equal and opposite.

A SELF-REGISTERING APPARATUS FOR MEASURING THE CHEMICAL ACTION OF HEAT

is described in a paper by Professor Roscoe. The tint produced by the exposure of a certain prepared sensitive paper to the sun can be measured on a self-registering principle. By this means can be determined, with a great degree of accuracy, the relative amount of chemical action falling upon the earth's surface from the sun and the variations which take place from hour to hour, day to day, and season to season in that action.

Ether.

Physicists recognize heat as a mode of motion, and that it comes under the cognizance of our perceptions by the vibrations of atomic matter or ether: of ether, that fluid material, perfectly elastic, incoercible, imponderable, which fills all the immensity of space and the depth of all bodies. It is in this fluid that the stars describe their orbits; in this fluid atoms perform their movements and describe their trajectories. Thus the ether, the radiant messenger of heat and light, conveys and distributes their radiations through all the Universe; and that which it loses in vibratory energy when it penetrates a cold body, which it warms, it communicates to the atoms of this body and augments the intensity of their movements; and that which it gains in energy by contact with a warm body, which it cools, it withdraws from this body and diminishes the intensity of their vibratory movements. And this kind of light and heat which comes from material bodies is transmitted across space to other material bodies.—*M. Wurtz.*

The Block System of Railway Signals.

Professor Thomson states that the latest development and application of the block system is one which has been made in Scotland, on the Caledonian Railway. It consists mainly in arranging that, along a line of railway, the semaphore arms are to be regularly and ordinarily kept up in the horizontal position for prohibiting the passage of any train, and that each is only to be put down when an approaching train is, by any electric signal from the cabin behind, announced to the man in charge of that semaphore as having entered on the block section behind, and when, further, that man has, by an electric signal sent forward to the next cabin in advance, inquired whether the section in advance of his own cabin is clear, and has received in return an electric signal meaning: "The line clear; you may put down your debarring signal, and let the train pass your cabin." The main effect of this is that, along a line of railway, the signals are to be regularly and ordinarily standing up in the debarring position against allowing any train to pass; but that just as each train approaches, and usually before it has come in sight, they go down almost as if by magic, and so open the way in front of the train, if the line is ascertained to be duly safe in front; and that, immediately on the passage of the train they go up again, and by remaining up keep the road closed against any engine or train whose approach has not been duly announced in advance, so as to be known at the first and second cabins in front of it, and kept closed, unless the entire block section between those two cabins is known to have been left clear by the last preceding engine or train having quitted it, and is sufficiently presumed not to have met with any other obstruction by shunting of carriages or wagons, or by accident, or in any other way.

DECISIONS OF THE COURTS.

United States Circuit Court---Eastern District of New York.

PATENT STONE BREAKER.—ELI W. BLAKE *vs.* JOHN ROBERTSON *et al.*

[Decision rendered July 8, 1874.]

[Benedict, Judge.

The decision of this case must depend upon the determination of two questions. One is whether the patent issued to Eli W. Blake for an improvement in a stone breaker, dated June 15, 1858, is void for want of novelty, because of the prior invention described in letters patent issued to James Hamilton on the 3d of January, 1854, for improvement in machinery for crushing and grinding quartz and other hard substances. The other question is whether the machine described in the specification of letters patent issued to Austin H. Smith, No. 120,784, dated November 7, 1871, for improvement in stone-crushing apparatus, is an infringement upon the Blake machine above mentioned.

The first of these questions has been heretofore determined in favor of the Blake patent by Judge Shipman, by Mr. Justice Nelson, by Judge Drummond, and by Judge Shepley, in other actions which have come before these judges; and as it does not appear that the Supreme Court has been called upon to reverse any of these decisions, it would seem a fair inference that those decisions are acquiesced in as correct by the parties to those actions. It is nevertheless true that these decisions do not bind this court, and the parties to this action have the right to a determination of the question by this court in this action. It is, however, incumbent on the party asking this court to differ upon such a subject from the learned judges above mentioned, to point out indisputable ground upon which such differences may be based. The argument presented to me based upon the Hamilton machine, although not without force, does not appear to me to justify a different conclusion from that arrived at by the other judges who have determined the same question in other cases. It may be that, with the light derived from the operation of the Blake machine, the idea embodied in that invention can now be in some sort carved out of the Hamilton machine; nevertheless, I have been unable to come to the conclusion that the patent of Blake should be declared void, as being in principle identical with the Hamilton machine; on the contrary, I incline to the opinion that the Hamilton machine was devised and constructed to operate according to a method substantially different from that found in Blake's machine. It would be a waste of time to spread on paper the grounds of my opinion, in the presence of the opinions of so many other judges learned in this branch of the law.

The remaining question is that of infringement.

The difference between the defendants' machine and that invented by Blake is that in the defendant's machine a column of water is used as the medium of communicating motion from the revolving shaft to the movable jaw. To this a safety valve is attached, and so weighted that, in the event of a substance of unusual hardness dropping between the jaws, water will escape through the valve, and breakage of the machine thus be avoided.

By the introduction of water as an element of their combination, the defendants claim to have invented a new combination different from Blake's. They insist that, used with water as described by the defendant, the function of the revolving shaft in their machine is different from the function of the revolving shaft in the Blake combination, because, in the Blake machine, the revolving shaft necessarily deprives and limits the movements of the jaw, while in the defendants' machine the revolving shaft simply imparts power without limiting or defining the movements of the jaw. The defendants' machine, therefore, they insist, presents the feature of irregularity of movement in the jaw, both in range and limit, accomplished by the use of hydraulic power. But this theory is not supported by the facts. I do not discover any irregularity of movement in the jaw of the defendants' machine produced by the use of a column of water instead of an iron rod. The revolving shaft in the defendants' machine, by the aid of the plunger and the column of water, imparts a motion to the jaw which is as certainly defined and limited by the action of the revolving shaft as it is in the Blake machine, and it is a movement not irregular but regular. Both machines present the same definite vibrating movement produced by substantially the same combination. It is true the use of a column of water in place of a rod of iron may have some advantage, and that a safety valve attached may enable the machine to stop its motion in a certain contingency, and so avoid breaking; but stopping the movements of the jaw is not giving to it an irregular movement. The character of the movement imparted to the jaw is the same in both machines. But the defendants say that water is not mechanism, and that water, as used in defendants' machine, is not a mechanical equivalent for the iron rod in Blake's machine. If this be so, then the defendants' machine without the safety valve attached would be a different machine from Blake's. And yet, as the defendants seem to concede, a column of water closely confined without a safety valve, substituted in place of an iron rod for the purpose of communicating power, would act in the same way, produce the same definite limited motion, and accomplish the same result as does the iron bar which, in Blake's machine, transmits the power from the revolving shaft to the movable jaw. It seems clear, therefore, that water so used is a mechanical equivalent. And it is none the less so when a safety valve is attached, which will in a certain contingency release the water from its confinement and thereby stop the machine. Such a machine may be an improvement on the Blake machine, but my judgment is that it contains the idea which Blake conceived and secured, and is an infringement upon his patent.

The plaintiff is entitled to a decree in his favor and for an injunction. He cannot recover damages, for he has proved no licence fee. The profit realized on the machines he sold does not fix the amount of damages here sued for, for those machines contained other patents than the one sued on, and the profits so realized may also, for anything that appears, embrace a manufacturer's profit.

Furthermore, there is no proof that the complainant stamped his machines with the word "Patent," or that he gave such notice as is required by section 38 of the patent act of July 8, 1870.

[*H. T. Blake*, for complainant.
B. F. Valentine, for defendants.]

Recent American and Foreign Patents.

Improved Hay and Cotton Press.

Evilee T. Armstrong, Baker City, Oregon.—The case cover is arranged to slide over the press head and under a pressure roller. The follower is also the front portion of a movable frame, which slides forward and backward in the case, and carries a windlass. The windlass moves the frame and the follower by winding ropes on it, the ropes being attached to the press head. It also turns the tying cord reel to wind the tying cords and take up the slack caused by the moving of the follower and the reel toward the press head, the cords being adjusted before the operation begins. The top of the press case is detachably connected to the follower in a groove, so that it can be taken off readily after the bale is pressed, for tying the cords and detaching the bale. When the cover is removed and the bale tied, the hooks are detached and the head turned down to allow the bale to be discharged, by pushing forward in the same direction that the follower is moved to press the bale. The frame and the windlass are then moved back, and the windlass turned backward to unwind the cords. The press, being arranged in this manner, is adapted for use as a portable machine, and is mounted on truck wheels.

Improved Weft Stop Mechanism for Looms.

Thomas Isherwood and William Nuttall, Westerly, R. I., assignors to the National Fancy Woolen Loom-Stop Motion Company, of same place.—This invention relates to looms having one or more wires to be presented to the weft and comb it against the weft fork or latch to insure the proper action when the weft is present, and so prevent the shipper from being thrown off. It consists of a new arrangement of devices for causing the tripping of the shipper lever when the weft is not present, by which an apparatus arranged in front of a cloth roll is dispensed with.

Improved Mode of Compressing Cotton.

John T. Burr, New Orleans, La.—This invention consists in the combination with the plain faced platen and follower, belonging to a cotton press, of a suitable device pivoted to the sides of the follower, and adapted to hold the bale bands.

Improved Instrument for Measuring Distances.

James B. Thomas, Montgomery, Ohio.—This invention consists in a very simple and efficient instrument for measuring distances, the same being easily portable, and yet enabling the work to be performed with greater accuracy than usual and with much less labor.

Improved Pianoforte Sound Insulating Attachment.

William R. Miller, Baltimore, Md.—This invention consists in novel means for connecting a musical instrument with its legs so that the transmission of sound to the floor shall be arrested and effectually prevented.

Improved Bee Hive.

Thomas Robinson and George W. Robinson, Lumberport, W. Va.—This invention consists in a sectional bee hive that entirely dispenses with the usual honey frames, has a slatted base, slatted sections, and cover, provided with a ventilator and cap, so that the bees, through the slats and ventilator, have always a circulation of pure air, while the honey is readily taken without destroying the bees.

Improved Rail Drilling Device.

John S. Lane, Falls Village, Conn.—This invention consists in constructing the sliding head of a drill clamp for railroads so that, by reversing its position, the clamp may be applied to either the head or flange of the rail.

Improved Sash Fastener.

Samuel W. Couch, Cold Spring, N. Y.—A lever pawl has a notch formed in its upper end, to take hold of the teeth of a bar let into the sash, and is held forward against said toothed bar by a spring attached to the window frame. The pawl is operated by a key which is inserted through a notch in the inner side of the window casing. A bolt, placed in a case, is let into and secured to the top bar of the lower sash, and is made with a shoulder, against which rests the end of a coiled spring, the other end of which rests against the case to hold the bolt out. The forward end of the bolt enters a hole in the side bar of the upper sash. The bolt is pushed forward by the lever pawl, the upper end of which rests against its outer end.

Improved Car Coupling.

William Clendening, Van Wert, Ohio.—When the pin is raised ready for coupling, the same rests on a sliding top plate, and drops as soon as the approaching drawhead strikes a projecting arm, by which the plate is carried back and the entering link coupled. On raising the pin, the weight carries the top plate back into the forward position, ready for coupling again.

Improved Feed Water Heater and Condenser.

Erik G. Frykberg, Gilpin's Point, Md.—This invention consists in separators and guiders for causing the contact of the opposing elements of heat and cold as the substance to be heated or cooled passes along the separators and guiders through the shell containing them. The shell is made in two parts, bolted together, one part having its end closed by a head bolted on the head of the other. The separator consists of a series of pipes fixed to each other at the ends by doubling the arc of different sizes and shorter than the shell. The guiding part consists of a series of hollow cases, bolted to both ends of the shell, arranged in the spaces between the different parts of the separator.

Improved Bottle Stopper.

Edward Clark, Newark, N. J.—This invention consists of a stopper for still liquors, made of a ball of cast metal, having a wire spring passing transversely through the upper portion, and a packing disk, of elastic material, with a hole in the middle, stretched over the lower portion, into an annular groove a little above the bottom. This is pressed down airtight into the nozzle by the spring being jointed at one end to a wire fastened to the neck of the bottle, and at the other end sprung under a hook of said wire. The wire has twisted projections on opposite sides of the neck, extending upward suitably for so connecting the spring. The ball is made of soft metal, and is cast on the spring.

Improved Means for Propelling Canal Boats.

Charles Howard, New York city.—A cable is placed on the bottom of the canal, near one side, extending the whole length of each level and firmly secured at each end. When the commerce is large, two such chains can be used, one at each side of the canal. These chains are kept in position around curves by spars shackled at the banks, and by other suitable means. The propelling wheel is placed on the side of the boat, near the bottom. The periphery is grooved to fit the chain cable, so that, when the wheel is turned while the chain is lying in its groove, the boat is propelled by the traction of the wheel on the chain. The wheel is also so constructed as to allow the boat to pass the spars and guy chains without hindrance. A binding wheel is used whenever great traction is needed. For steering, a regulator, to which the tug line is attached, is fastened on the side of the deck over the propelling wheel, so that the boat has perfect freedom to swing around on this center of power, and to be quite easily governed by her helm. There is also attached to said regulator a lever, by means of which the end to which the tug line is attached may be moved to right or left. This motion pulls the boat's head around to right or left when desired. In order to apply (to the side of a boat that is so wide as to fill the lock) a projecting wheel, the wheel is made to slide in automatically flush with the side of the boat while going through the locks, and to move back to its projecting position without any attention of the crew. The shaft is in two pieces. The inner piece is hollow, and contains a spring which pushes the outer piece outward and allows it to be pressed in by a shifting lever. To render it self-acting, when struck or pressed from the outside, the driving wheel is placed in a case. The wheel is secured to the shaft, but the case is loose thereon. On the periphery of this case is a cam entering a groove in the boat, thus keeping the case from turning while the wheel is in motion. Whenever the flange is pressed on its outer edge, by going into a lock or otherwise, the wedge-like form of the flange shoves back the case and wheel into the circular recess and flush with the outside of the boat.

Improved Medical Compound.

Shadrach Dixon, San Marcos, Tex.—This invention consists of a composition formed of alcohol, assafœtida, tincture of camphor, laudanum, tincture of yellow jessamine, oil of sassafras, and soft water. It is said to be a cure for cholera, cholera morbus, and kindred complaints, such as diarrhœa, flux, etc.

Improved Sewing Machine.

Edwin D. Smith, New York city, assignor to Howe Machine Company, of Bridgeport, Conn.—This is a graduated scale, applied to the adjusting device by which the head is adjusted for setting the needles of different sizes in proper relation to the shuttle race. The mark on the adjusting device corresponds to the size of the needle in the bar requiring to be adjusted to the race, and is so placed that, when it stands at the index point, the needle will be in its required position relative to the shuttle race.

Improved Sulky Plow.

William Starling, La Prairie, Ill.—One wheel may be adjusted to keep the machine level while the other wheel runs upon the surface of the ground, or in a furrow of a greater or less depth. The tongue may be readily altered as required, for the attachment of two or three horses. The plow may be adjusted to take more or less land, or to cut a wider or narrower furrow, as may be desired. The cutter may be adjusted to work deeper or shallower in the ground. A jointed lever enables the rider, with his foot, to hold or lock the forward end of the plow beam down or to raise it.

Improved Manufacture of Whips.

Dexter Avery and Charles C. Pratt, Westfield, Mass.—A tapered mold is used, consisting of a tube of sheet metal somewhat larger than the complete body of the stock is to be, with overlapping edges not fastened together. The material of which the body of the stock is composed is placed into said tube, and the latter is then pressed to compress the material, which consists of the vegetable fibers built on the core, either in the form of loose fibers of jute, flax, or hemp, laid lengthwise, or a triangular piece of woven cloth rolled on and prepared with cement to stick the body together in a solid mass when dry.

Improved Mitering Machine.

Edwin Everett, Andover, N. Y.—A strip slides in grooves in the slide bars of the machine frame, and is moved to and fro by a screw and nut. To its forward part is attached a square block placed diagonally. To the forward corners of the frame are attached triangular blocks, the inner edges of which are exactly parallel with the forward edges of the square block. To the upper side of the square block are attached two parallel strips, parallel with, and equally distant from, the central line of the sliding strip. The strips thus form a deep groove directly above the central line of the device. The strips of molding are clamped, while being sawn, between the forward inclined edges of the square block and the inclined edges of the triangular blocks, by tightening the nut upon the screw, and, when sawn, the two inclined ends of the molding are brought together and clamped in the same way. They are thus held securely, while being nailed, rendering the use of a vise unnecessary for this purpose.

Improved Churn.

George Shoup, Williamstown, Mo.—This invention consists in inclined plates, made convex upon their outer edges, concave upon their inner edges, and provided with holes and channels, fastened to a cross bar attached to the lower part of a dasher shaft. Upright flanges are attached to the upper ends of these plates. In using the churn, the latter are carried around, the lower end forward, which causes the milk to pass up the plates to the flanges, by which it is projected against the cover and sides of the churn, and thrown into violent agitation. A portion of the milk that falls back, and a part of that that is passing up the plates, pass through the holes in the said plate into the space behind them. The milk is also carried outward, so as to leave a clear space around the shaft down to the bottom of the churn through which space, when raised by the plate, it passes back to the bottom of the said churn, to be again raised.

Improved Lamp Trimmer.

Daniel B. Altenderfer and Joseph C. Wright, Monocacy Furnace, Pa.—This is an extension wick tube, to be temporarily applied to the permanent tube of a lamp, to extend it above the cone. The tube has its edges split for a short distance down from the top, so that the sides can be pressed together. The wick is raised through the tube so as to project above the top about as much as it is required to be cut off. It is firmly compressed between the sides to hold it for trimming by another shorter tube, with converging inside walls, so adjusted that, when put on the top of the extension tube and pressed down, it will spring the sides firmly on the wick, and thus hold it securely for trimming.

Improved Construction of Hulls of Ships, etc.

Carl G. E. Hennig, Paterson, N. J.—This invention is based on the principle that weight acting on an inclined plane promotes locomotion. The vessel is provided with a series of inclined projections below the water line, placed in such a manner as to bring the same in a position to receive the pressure of the waves, and thereby cause a forward motion, and so that these projections shall not add much to head water resistance.

Improved Car Coupling.

Bernard Almonte, Great Barrington, Mass.—This invention is a ball, by means of which the link is supported at any desired hight, usually in a horizontal position, but higher or lower, according to the hight of the opposing car. The ball is confined to the drawhead, and is adjusted to the desired hight by means of the ratchet blocks on the two sides of the drawhead, with which hooks engage. When the link is supported, the cars will couple automatically. Previous to coupling, the pin is drawn up and is supported on a lip of the bumper. When the cars come together, the bumper is pushed back by the link, which allows the pin to drop. At the same time the ball is pushed back on pins, which disengage the hooks from the ratchet block, and thus allow the ratchet blocks to drop to nearly a vertical position. The ball, when disengaged from the ratchet blocks, is supported by the pins until it is again raised for the adjustment of the link.

Improved Stamp Case.

Paul J. Lefebvre, Opelousas, La.—This consists of a number of light frames, of the size of a sheet of postage stamps, hinged together at one side, and having cross bars crossing the interior space, at suitable intervals apart to hold a sheet of stamps between the frames. The object is to provide post office officials and others requiring to keep large quantities of stamps on hand with means of preserving them from damage by sticking together.

Improved Thrashing Machine.

William Christie, Hackensack, N. J.—This is an improvement on the flail thrasher for which letters patent No. 104,503 were granted to William Schnebley, June 21, 1870. To the framework of the machine is attached a floor or table, upon which the grain is laid to be thrashed, and which should have holes formed through it for the grain to escape through. To the frame, at such a distance above the floor as to give sufficient space for the passage of the unthrashed grain and the straw, are pivoted two rock shafts, to which are attached cranks to which power is applied. Spring bars, the rear ends of which are attached to the floor near its rear edge, are so formed as to stand up a little from the floor. Flails, which are rigid bars, are so formed as to strike squarely upon the grain as it lies upon spring bars, and are actuated to come down upon the straw with a whip blow. The grain may be thrashed when thin as well as when thick, and the straw comes straight and whole from the machine, and may be readily bound into bundles.

Improved Addressing Machine.

John Blocher, Franklin Grove, Ill.—After a rocking galley is set with addresses, it is inked and rocked over a stiff strip of cardboard two inches wide and twenty-four inches long. This operation prints the addresses on the gage strip. This strip and galley are then numbered with a corresponding number, and always used in connection with each other. In mailing, the gage strip is slipped into grooves on the side of the mailing board, the papers to be addressed folded into quarters and placed on the board, and the top edge of each paper placed to a name on the gage strip. This leaves about half an inch of the top margin of each paper exposed. The galley corresponding in number with the gage strip used is then taken and rocked over an inking cushion, then placed on the papers and rocked forward over the papers, and the operation is finished. About six seconds is all the time required to ink a galley and address each fifty papers.

Improved Carriage Curtain Eyelet.

William H. Stickle, Miamisburg, O.—In this invention an apertured elastic disk is secured between annular metal plates applied to opposite sides of the curtain. The annular metal plates are secured by staples which pierce the curtain so that by the elastic washers moisture is perfectly excluded.

Electro-Magnetic Governor for Steam Drying Apparatus.

Julien M. Bradford, Portland, Me., assignor of one third his right to Zebulon K. Harmon, same place.—This invention comprises an engine for working a cut off valve and a throttle valve of steam heating apparatus, with automatic apparatus for opening and closing the valves, also for reversing and stopping and starting the engine, controlled by electric currents. The latter are closed and broken by the variations of the heat through the medium of thermometers in the heated room, the arrangement being adapted to ensure a uniform temperature of any required degree.

Improved Rotary Engine.

August Dietz, New York city.—This invention relates to improvements in rotary engines with variable cut-off, and consists of a cylindrical casing with radial spring slides which are suitably packed and acted upon by the elliptic piston, rotating tightly therein by means of combined spring and steam-packed strips. The piston is keyed to the hollow shaft through which the steam enters, and provided with variable cut-off and distribution valve at one side, and with an exhaust valve at the opposite side, both being closely pressed against the cylinder heads by spring and steam packing devices. The ports of this distribution valve conduct the steam through entrance ports of one cylinder head into the interior of the engine, where it causes the rotation of the piston in connection with the spring slides exhausting the steam simultaneously therewith by perforations of the piston at opposite sides from the parts acted upon, and is then conducted through the exhaust valve and ports of the opposite cylinder head to the exhaust pipe.

Improved Car Mover.

Noah A. Lewis and Eli Overton, Utica, N. Y.—A lever and stud are hinged together at the fulcrum. When the implement is applied to the car the stud is inclined forward from the stem, while the long end of the lever is raised from the horizontal to any desired angle. A jaw projects from the under side of the lever, to which is affixed a point. On the end of the lever is a fixed point. When the implement is applied for moving a car, the fixed point is forced into the wood and holds fast, while the pressure is on and the car is moving, at which time the other point attaches itself and assists in holding the mover and prevents it dropping when the operator is getting a new point of leverage with the stud.

Improved Ash Sifter.

Alfred A. Liscomb, Jersey City, N. J.—This invention consists in a sifting drum rotating in a box. The latter has a stationary wing plate connecting with the side tube of the drum, and an inclined wing plate pivoted near the circumference of the drum. This allows the passage and sifting of the ashes when the drum is turned in one direction, while producing upon reversing the direction of rotation, contact with the stationary wing plate. The unburnt sifted coal particles are then conveyed along the latter to the side tube, whence they issue to the outside by an inclined connecting perforation of the casing.

Improved Furniture Spring.

William T. Doremus, New York city.—This is an improved spring for furniture and other uses, so constructed as to be elastic under a heavy or light weight. It will take the lighter springs out of pressure before they are compressed enough to injure their elasticity, and may be adjusted to regulate the elasticity, as may be required. There is a tubular rubber block the base of which rests upon a rigid disk, upon which, around the base of the rubber, is formed a tubular case. A nut in the latter is screwed up so as to regulate the compression of the rubber. The disk has a tubular projection to enter the rubber block, and it rests upon the upper end of another tubular rubber block similarly entering the same. A rigid disk forms a ring seat for the said rubber tube, and in turn rests upon another rubber block. The lower end of the latter rests upon another rigid disk which serves the same purpose as the disks before mentioned. A guide bolt may pass up through the center of the spring, to connect the two objects between which the spring is placed.

Improved Combined Harvester and Thrasher.

Alfred Collins and Arad Maynard, Janesville, Iowa.—The concave of the thrasher is secured to the frame so as to be adjusted as required. The concave is provided with spikes, and its forward edge is grooved longitudinally to receive a rod which is provided with fingers to raise bent or broken stalks, and bring their heads into proper position to be operated upon. The thrashing cylinder consists of a series of radial wings, to the edges of which are attached teeth bent backward, to prevent thrashing the grain before it has come upon the concave. The wings of the wheel are made wide to cause them to act as the wings of a fan wheel for causing a blast for clearing the grain. The wheel is partially covered with a hinged lid to enable the blast to be more readily controlled. The rear part of the wheel is enclosed by a box, the back board of which may be adjusted also for controlling the blast. The thrashed grain and the chaff pass from the concave to a screen which is jarred by a lever actuated by the drive wheel.

Improved Pianoforte Attachment.

M. Waldo Hanchett, Syracuse, N. Y.—This is a mechanical attachment suited to all pianofortes, whereby it is designed to enable a performer to sustain or permit the continuance of the sound of a single one, two, or more strings or unisons after a key or keys by which the vibrations were produced have returned to their place of rest. The attachment consists of a bar suspended near the ends of the dampers, so as to swing forward and from them, and having a series of any desired number of tongues attached to it. These tongues project toward the dampers, and are placed the same distances apart as the latter, the bar being connected with a pedal, so that after the dampers have been raised they may be caught by the tongues and held off the strings after the keys go back. This is effected by causing the bar to swing forward by the pedal and swing the tongues under the dampers. When the bar is allowed to swing back, the tongues will withdraw, and leave the dampers unaffected by them. The tongues are also hinged to the bar so as to swing upward and allow the dampers to rise and fall under them without obstruction, while holding other dampers up. By this improvement, the sound produced from a single unison of the pianoforte may be prolonged after the key has returned to its normal position, and the key by which the sound is thus prolonged may be struck repeatedly without interrupting the tone; thus rendering possible a smooth *crescendo* of the same tone similar to that produced by the swell of an organ. The sustaining of the sound of a single unison, we are assured by the inventor, interferes in no way with the use of the remaining tones of the instrument, which may be played with or without the damper pedal, producing the same effect as before. The ordinary damper pedal may be used in connection with the *sostenuto* pedal, producing the same effects as at present upon all the unisons of the instrument, except such as are affected by the *sostenuto* pedal, which will continue independent of the damper pedal. By the application of the *sostenuto* attachment, the piano is claimed to approximate the advantages of the pedal brass of an organ and the pianist is enabled to sustain a fundamental tone, while both hands and the damper or harp pedal are still at liberty to produce melodies, changing harmonies, *legato* and *staccato* passages without the necessity, as at present, of mixing the various tones into unintelligible discords. We hope to illustrate, by engravings, at some future time, this novel invention.

Improved Process for Treating Copper Ores.

Francis Zwickl, Jersey City, N. J.—This invention is an improved process by which argentiferous, auriferous, or other copper ores may be treated either independently or in auxiliary manner to other processes for the extraction of gold, silver, and copper therefrom. It consists of a combination of operations, namely, smelting of the ores in a reverberatory furnace to a mat, with admixture of sulphate of soda, for the purpose of disintegration; oxidation of the disintegrated mat in a furnace similar to a common roast furnace, suitably adapted to prevent the heat from rising above the desired degree; repetition of this oxidation after the first is finished, and the product of it has been soaked with water; dissolving the sulphate of copper formed during said oxidation in a tank with water, and, after removal of the solution, dissolving the copper still left in residue with a solution of sulphate of iron, this latter process to be repeated as long as any copper is left in the residue, and the copper in solution to be precipitated with iron. The residue, containing peroxide of iron and all the gold and silver, being much reduced in bulk, can be treated by any known method for the extraction of the gold and silver, or used as flux for smelting the ores, and to accumulate the bullion as far as desired.

ANSWERS TO CORRESPONDENTS

C. H. B. is informed that liquid glass is silicate of soda, the preparation of which is described on p. 225, vol. 23.—J. L. H. will find directions for polishing black walnut on p. 315, vol. 30.—J. A. F. will find directions for cleansing cotton waste in No. 7, p. 202, vol. 31.—E. F. C. will find full particulars of induction coils on pp. 215, 218, 363, 373, 379, vol. 30.—D. C. R. will find instructions for destroying trunks of trees in answer No. 72, of this issue.—S. W. C. does not send sufficient data as to the cut-off of his engine.—J. C. D. can make a phosphorescent lamp by following the instructions on p. 203, vol. 31.—B. F. G. should consult an engineer who can inspect the engine which he desires to alter.—J. M. will find a recipe for dissolving rubber on p. 353, vol. 30.—E. B. S. will find directions for making malleable castings on p. 138, vol. 29.—W. T. H. will find directions for repairing rubber garments on p. 203, vol. 30, and for gilding picture frames on p. 90, vol. 30. Bookbinders use glue, sometimes tempered with a little molasses.—H. R. R.'s query as to the proportions of all the parts of a steam engine is too comprehensive to be answered in these columns. Working drawings of engines and boilers can be purchased.—A. will find information as to the use of the square in any work on stair building.—J. D. H. can polish his wooden handles by following the method described on p. 315, vol. 30.—A. P. W.'s difficulty can only be settled by experiment. The device he speaks of is patented.—W. A. should apply to the publishers who advertise in our columns, for catalogues.—C. W. will find directions for marbling in Spon's "Workshop Receipts." M. J. H. will find that bronzing is described in the same work.—An anonymous correspondent can produce a black finish on brass by following the methods described on p. 296, vol. 30.—W. M. B. will find directions for making pickles on p. 181, vol. 27.—P. C. H. can prevent paint from blistering by following the directions on p. 133, vol. 31.

(1) W. T. W. says: The water for use in my engine has failed to supply the boiler. There is a branch 800 yards off, which is 50 feet below the boiler. How can I get the water to the boiler more economically than by hauling it? A. You must use a pump, which might, perhaps, be worked by a windmill. You can obtain the tools you speak of at a ship chandler's store.

(2) J. H. E. says: I want to run a wire along the rails of a railroad, and make a connection between this wire and each rail. I propose to drill a hole in the flange of each rail and make the connection between wire and rail by fastening the wire to a brass plug and driving this plug through the hole drilled in the rail. Would the rail, where it is in contact with the plug, always keep bright, so as to make a good electric connection? If not, do you know of any metal that would answer better for this plug? A. You can easily make an airtight joint between the plug and the rail by brazing this connection.

(3) S. E. J. asks: Is it a common practice for machinists to put bits of tin, small pieces of iron, etc., under their turning tools when the tool post is not adjustable, or only partially so? A. It is a common practice, generally approved by good workmen.

Is it common for foremen and other superintendents of machine shops to determine first what kind of a tool a man shall use on a lathe or planer, provided it performs the work it was intended to do in a good and proper manner? A. It is not usual for a superintendent to give such orders when the men use tools that do good work. The right of the matter seems to be as follows: If the men are engaged on piecework, they can use such tools as they think proper, provided that their jobs are properly finished. If, on the other hand, the men are paid by the time they work, the superintendent can direct the manner in which work is to be performed, and the tools to be used. The propriety of exercising this arbitrary right over skilled workmen is, however, very doubtful.

(4) F. H. W. says: Suppose a red rubber balloon, such as we see children playing with, to be of equal texture and elasticity throughout; and the balloon to be inflated with the gas commonly used for balloon inflation, and the balloon set free. Would the balloon rise to a position where it would remain suspended, on account of the approximate densities of the gas and the extreme atmosphere, or would the gas expand until the internal pressure would cause the balloon to burst? Or would the balloon rise until the low temperature would cause moisture to condense upon the balloon and the balloon to fall, until it reached a point where it would begin to re-ascend? Please inform me, which, if any, of these results, would follow, and which if any, of them is usual with the ordinary balloons, which are of unequal texture. A. If the gas in the balloon does not become heated, the tendency to burst by expansion will not be great. The balloon will rise until the external air becomes too light to carry it up further. If the gas is cooled, the balloon will sink again. Meanwhile, some of the gas will constantly be escaping, so that after a time the balloon will fall to the ground.

(5) H. W. S. says: As to the speed of the teeth of a large and a small saw, both being firmly fastened to the same shaft, I claim that the teeth of the large one go very much faster than those on the small saw, because they move in a larger circle and both saws must make a revolution in the same time. I believe this is a fair statement of the case, and I have but one comment to make: To deny this principle is to deny the principle of multiplying speed by large and small pulleys. D. E. W.'s version is this: If I have a saw arbor that turns 400 times in a minute, and I put on a saw that is 24 inches on one end of it, and a saw that is 12 inches on the other end, will the teeth in the 24 inch saw go any quicker than the teeth in the 12 inch saw? A. H. W. S. is right. A matter of this kind is easily settled by experiment. Secure a pencil to a tooth of each saw. Hold two boards so that one will bear against the pencil, and revolve the saw arbor once. Then measure the path described by each tooth, as traced on the boards, multiply each distance by 400, and the result will be the velocities of the teeth of the two saws.

When a wagon wheel rolls on the ground the top goes faster than the bottom, and the reason why is that the ground is the fulcrum, not of the wheel but of the wheel's motion. Is this so? A. Yes.

(6) C. F. says: I am somewhat at a loss to reconcile two statements, which appear on your p. 138, current volume, in answer to B.'s question concerning the asymptote. You say: "The straight line is continually dividing the distance between itself and the curve so that, between two successive equal lengths of the straight line, the distance between the curve and the straight line is only a fraction as great as it was before: but as there will always be some distance to divide, the two lines will never meet." And on p. 133, in an article on "Specific Heat:" "Experience teaches that every known substance is divisible, but it seems reasonable to suppose that, if the division be carried far enough, the ultimate particles will at last be reached, which cannot be subdivided without losing their properties as parts of the given substance." Now, as substance and distance are terms which denote actual and concrete quantities, I fail to comprehend why in the one case we may reach an ultimate division, and in the other we must fail so to do. A. There is no contradiction in the two statements. It is not difficult to conceive of the infinite subdivision of a quantity. The researches of chemists, however, lead them to believe that, in making this division in practice, a particle or molecule will at last be reached which, if again divided, will cause the substance to be resolved into its constituent elements. Thus, if the ultimate particle of water were reached, the drop, when again divided, would be resolved into hydrogen and oxygen, and the last division would give products which did not possess the properties of water.

(7) C. F. T. says: A saw file or three cornered file is sometimes called three square. I say that nothing with only three corners can be square. A. You are right.

What preparation is there that I can put on an opera glass to make it stronger and clearer? A. Good lenses.

How can I prevent ants from getting into cellars, etc.? A. By stopping up all cracks.

(8) F. A. McG. asks: What is the cause of a mill burr getting out of a true face? It was in true face and in true balance when last put down. What is the cause of a burr getting in wind? A. A mill burr will get out of true from various causes, the most common being that the hub is not a close fit to the shaft, or that the key does not bed properly, in which case driving up the key will throw the stone out of true. It will also wear out of true if there are unusually soft places in the stone. If the burr is properly fastened to the shaft and still gets out of wind, the cause probably arises from a defect in the bearings.

(9) J. H. says: In reply to S. F. you say that one of the earliest flying machines had four sheet copper balloons attached to the corners. 1. Was the air pumped out of them, or were they inflated with gas in the usual way? A. We believe that they were filled with hydrogen. 2. Which would produce the greatest degree of rarity, pumping out the air or inflation with gas? A. The former method. 3. Would it be possible to construct a balloon of any considerable size of thin sheet metal (corrugated or otherwise) that would not collapse when the air was exhausted? A. It would be too heavy to ascend.

(10) W. C. asks: Can an ice boat go faster than the wind that drives it? A. Yes. See explanations heretofore published by us.

(11) J. W. P.—There are several feed water heaters in the market that are said to remedy trouble from sedimentary deposits.

(12) T. G. asks: What are the principles involved in an injector on a steam boiler, and how does it overcome the pressure in the boiler? A. The steam enters the injector at a high velocity, and, being condensed on mingling with the water, imparts its momentum to the latter, so that it is forced into the boiler.

(13) W. C. A. asks: If a machine at 50 revolutions per minute requires 50 horse power, what power is required to run it 100 revolutions? A. It is impossible to answer a question expressed in such general terms; and in most cases the answer would have to be determined by experiment.

(14) L. H. P. asks: How can zinc be precipitated from its solution, or what is the simplest way of obtaining zinc flour? I know that evaporation is one way, but that takes too long. A. Metallic zinc has never been thrown down from its solution, because of its highly electro-positive character, for which property it heads the list. Its value as the positive element in galvanic batteries is due to this property.

(15) D. H. P. Jr. asks: What is the weight of cast iron? A. One cubic inch of cast iron weighs at 60° Fah. about 1767 2 grains.

How are magnets made? A. You do not state what kind of magnet is required. A simple way of magnetizing a bar consists in placing the bar on its side and bringing down, on one of its extremities, either of the ends of a bar magnet. If the north end be brought down on the steel bar, it must be drawn slowly along towards the extremity of the bar which it is intended shall possess south magnetic force; this operation must be repeated three or four times in the same direction.

(16) N. J. R. says: I propose making an electric machine, using a cylinder of wood covered with tin foil for a prime conductor, and a ball covered with same for the negative conductor, insulating the same by the use of common bottles. 1. How can I bore holes through the bottoms of bottles so as to use bolts for fastening them to the stand? A. Wet an ordinary drill with petroleum or benzine; turpentine will answer, but not so well; it will then bore common glass nearly as rapidly as steel. The sand blast is now used for this purpose. 2. What can I use to stick the tin foil to the cylinder and ball, which are made of wood? I intend driving plugs into the necks of the bottles by which to fasten on the conductors and journals for glass wheel; what kind of glue can be made to fasten these wooden plugs to the glass bottles so that they will hold? A. Try ordinary glue. 3. Can you tell me how to make a Leyden jar? How is the baked wood, used as a lid, obtained? A. The ordinary form of the Leyden jar consists of a bottle of thin glass, with a wide neck. A coating of tin foil is pasted upon both the inner and outer surfaces, to within 3 or 4 inches of the neck. A wire surmounted by a brass knob, and supported by a smooth plug of dry wood, serves to convey the charge to the inner coating, with which it is in contact. Any ordinary light wood will answer; but it must be perfectly dry.

(17) A. V. K.—The London Underground Railway tunnels are about 26 feet wide and 18 feet high. They run under the streets in all directions. Total length, 13 miles. The cars are operated by the heaviest class of steam locomotives. We have not the back numbers.

(18) J. W. D. E. asks: What is the cause of heat in a compressed atmosphere? Is it not owing to the heat contained in several atmospheres being condensed into the space of one, together with the heat generated by the piston of the air pump? A. It is due to the work of compression. 2. Is the amount of heat present in any given number of compressed atmospheres the same at all seasons? A. The temperature of compression varies with the initial temperature of the air. 3. How many compressed atmospheres would be required to boil water? A. Air at 60° Fah., compressed to 21 lbs. above atmospheric pressure without loss of heat, has a temperature of about 215°.

(19) B. C. & C. ask: What is there that can be put on polished iron that will not change the color, will dry quickly, and not be too expensive, to prevent rust? A. Use a transparent shellac varnish.

(20) A. M. C.—You cannot gain power by the use of a machine: but you may gain force or pressure at the expenditure of distance passed through by the force in a given time. If we understand your sketch rightly, you should have the same pressure at the rack as you apply to the lever, less the friction of the parts.

(21) M. & F. ask: What is the fastest time ever attained by any steamer in the United States? Has 25 miles *per* hour been made? A. We have seen it stated that the speed mentioned has been attained by steamers on the Hudson River.

(22) H. M. L. asks: I have a boiler, 26 feet long by 40 inches diameter, with two 12 inch flues. I take steam from a drum 18 inches from back end, and it is very wet and the power poor. What should I gain if I take steam from front end? The feed water goes in at back end. A. We could not answer this question without knowing further particulars. Possibly the steam drum is not large enough. We advise you to consult an engineer.

(23) A. B. C. asks: 1. Is not water raised in a siphon by means of atmospheric pressure? A. Yes. 2. Can water be raised in a siphon above 34 feet? A. No.

(24) J. E. P. says: I have a barn 100 feet long and about 40 feet high. In the rear, within 100 feet, rises a hill, the top of which is half the hight of the building. Can I protect the building from lightning by erecting an upright pole (on the top of the hill, higher than the building) and attaching thereto a lightning rod, having the rod terminate well in the ground at the base, in connection with a ton or two of iron buried beneath the surface, and thereby draw the effect rather from than to the building? A. The method you propose would not be likely to give you protection. The safer way will be to place conductors on the building, and connect them with the deposite of iron.

(25) J. McI. asks: What is the proper way of replacing a level glass on an old stock, so that it shall be correct? A. Place the new glass in adjustment as nearly as possible by the eye, put the level on a plane surface, and bring the bubble to the center of the tube, by raising or lowering one end of the surface. Then turn the level end for end, and if the bubble runs away from the center, bring it halfway back by moving the glass and the other half by raising or lowering one end of the surface. Continue this operation, turning the level end for end and adjusting, until the bubble will remain in the center of the tube.

(26) T. & D. ask: Please tell us the necessary thickness for boilers of 30 inches diameter, of steel and of best iron, drilled and double riveted, to stand with safety 600 lbs. hydraulic pressure. A. The thickness of plate should be about ¼ of an inch, to have the boiler just strong enough to withstand the pressure. Using a factor of safety of 4, the thickness should be 1 inch, of 6, 1½ inches, and so on.

Can you give me any account of the trial of steam boilers at Pittsburgh last year? A. See p. 97, vol. 30.

(27) H. W. J. asks: What is a lathe dog? A. A clamp, to make the work turn with the face plate.

What book shows how to use a lathe? A. "The Lathe and its Uses."

What kind of wood is used in making models for small castings? A. Mahogany is the best.

Would a small kitchen boiler, about 3 feet high, answer the purpose of boiler for a small engine with a cylinder 4 inches diameter by 6 inches stroke? A. It would not be large enough.

What are students in the German colleges examined in, for admittance and graduation in chemistry? A. You should write for catalogues.

(28) E. B. Jr. asks: Can the degree of "Master Mechanic" or "Mechanical Engineer" be acquired at any school or university, or is it necessary to have practical experience in the workshop, or both? A. There are several technical schools in the United States that confer the degree of "Mechanical Engineer" upon their graduates.

(29) T. F. says: A friend of mine recently contended that there is a gun in the United States, which weighs 100 tuns, manufactured at the Fort Pitt works, Pittsburgh; while I contend that the 81 tun gun now in course of construction at Woolwich will be the largest in the world. We agree to abide by your decision. A. We think that T. F. is right.

(30) W. M. B. asks: How can I make sand paper and emery paper? A. The usual method is to coat the surface of the paper with glue, upon which the grade of sand or emery required is immediately sifted.

I have a supply of gutta percha buttons, too thin for my use. By boiling them in water they thicken a little, but very little. Will some one tell me how I can melt 3 or 4 of them in a solid mass, so they will remain sound and hard when cold, and ready to receive a high polish, as they are now? A. Your best method would be that of softening them by means of heat, and while in this state molding them to the required form.

Is there any process of making peach brandy? A. The peaches are mashed with pestles in a trough, the juice pressed out, collected, fermented, and distilled. The pomace still contains considerable juice; it is therefore covered with water, and, after fermentation, distilled.

(31) W. G. M. asks: What degree of heat s required to decompose water or steam? A. We believe that this has never been determined.

What degree of heat is caused by burning hydrogen? A. This depends wholly upon the supply of oxygen, also upon the amount of gas burned in a given time.

A lecturer heated a spoon; and while it remained at a high temperature, the water dropped upon it floated on a coat of steam; but upon being allowed to cool a little, the globules exploded with considerable noise. He also said it was a noted fact that in England boilers far more frequently burst on Monday, after having been idle on Sunday, than at any other time. I don't understand the explosion. A. What you speak of was an illustration of what is known as the spheroidal state. Not only does the water not boil, but its evaporation is only about one fifth as rapid as if it did boil. As the spoon cools, a point is reached at which it is not hot enough to keep the water in the spheroidal state; it is accordingly moistened by the liquid. When this happens the water, before quiet, bursts into steam with almost explosive violence. Many steam boiler explosions have been attributed to this cause.

(32) W. B. B. asks: How can I make grease and concentrated potash or lye unite, so as to make soap? Boiling them together will not do it. It always leaves so much grease in the soap as to make it unfit for use. A. Hard soaps are made by boiling oils or fats with a lye of caustic soda. In soft soaps, the lye is potash. Resin is used in yellow soaps, as it saves fat. Silicate of soda is now frequently used instead; it gives a white soap which has no offensive smell, and has not the stickiness of resin soap. Castile soap is made from olive oil, and is mottled by iron. We would recommend using a larger percentage of lye.

(33) G. L. H. asks: Can water be dissociated into hydrogen and oxygen at the rate of 100,000 cubic feet of hydrogen per minute? Will galvanic batteries do the work? A. It can be done by galvanic current, but the cost will prevent its being readily accomplished. We would recommend you to read some good elementary work on chemistry and chemical physics.

(34) G. R. P. asks: How is potassic sulphocyanate formed? A. If a mixture of dried prussiate of potassa is fused with sulphur and carbonate of potassa in a covered crucible, and the heat gradually raised to redness, until the mixture is in quiet fusion, there is obtained a mixture of sulpho-cyanate of potash and sulphuret of iron. The salt is dissolved out by boiling water, and crystallizes on cooling. The best proportions are 46 parts dried prussiate, 17 dry carbonate of potash, and 32 sulphur.

How can I preserve eggs from October to March? A. Various experiments have been made in France on the best method of preserving eggs, a subject of much importance there. Among the different processes, the best, and at the same time one of the simplest, was found to consist in rubbing vegetable oil (linseed especially) on the egg, thus preventing any alteration for a sufficient time, and proving much more satisfactory than any other plan hitherto recommended.

Can you give me a recipe for making a good quality of sewing machine oil? A. We think pure olive oil would answer your purpose best.

(35) J. W. P. asks: How should I make application for, and how far advanced ought I to be in mathematics to hold, a position as engineer in the navy? A. We think that those entering the engineer corps of the navy are oblige to commence as cadet engineers at the Naval Academy. You can obtain full information by addressing the Chief of the Bureau of Steam Engineering at Washington.

(36) N. B. G. says: As so many of your readers are endeavoring to navigate the air, would it not be well to spend a little time in perfecting the first model of an air ship, the hot air balloon of Mongolfier and De Rosier? It seems, being open at the bottom, to provide for a slow descent; and the heating apparatus provides for ascending and descending without the discharge of ballast. With the fuel used by the first experimenters, there was of course great danger; but with condensed fuel (petroleum, or some of the carbon oils, for instance) could not gas be made and used cheaply for heating purposes, and the apparatus be supported long enough for extended voyages? A. The plan is deserving of consideration, and we are glad to receive your letter. Perhaps our readers can suggest some further steps toward a practical result.

(37) E. A. D.—Venus' mean distance from the sun = 69,000,000 miles, and that of Jupiter =496,000,000 miles. The two planets are therefore more than 427,000,000 miles apart.

(38) R. asks: 1. Is there any back pressure in the high pressure cylinder of a compound engine? A. The back pressure in the high pressure cylinder is generally a little more than the initial pressure in the low pressure cylinder. 2. What is the receiver, between the high and low pressure cylinders? A. It is the reservoir into which the high pressure cylinder exhausts. 3. Where can I get any information about compound engines? A. Consult modern works on the steam engine, and scientific periodicals.

(39) A. H. W. G. asks: What is the best wood to use in the construction of wheels for a wooden clock? A. We think that boxwood or dogwood will answer.

What is the meaning of the word "balloon framing," and what is the difference between it and common framing? A. A balloon frame is made of light studs, nailed instead of being framed in the old way, with mortise and tenon.

On a wire tramway, 2½ miles in length with large curves, what would be the least grade at which loaded cars descending on one side would raise empty ones on the other? A. You do not send the weights to be hauled and the weights available for hauling them; and the term "large curve" is very indefinite. Hence it is impossible for us to answer this question.

(40) J. J. H. asks: What will harden Babbitt metal? A. The addition of more antimony.

(41) B. B. B. B. asks. 1. What sized engine and boiler will propel a vessel of the following dimensions at 14 knots per hour: Hull 26 feet long and 6 feet wide, with 30 inches draft, and propeller 28 inches in diameter and 3 feet pitch? Would an engine with a cylinder 3½ inches in diameter, 5 inches stroke, 100 lbs. per square inch pressure, boiler 36 inches diameter and 46 high, with a heating surface of 90 square feet do for this boat? Would said vessel be obliged to be licensed and have a licensed engineer and pilot? A. The engine you describe would not be large enough; indeed, it is doubtful whether the boat could carry the machinery for such a speed. Every vessel propelled by steam must carry a licensed engineer and pilot.

(42) I. G. asks if small steamers for the owners' use only are required by law to carry licensed engineers and pilots (*citing* that we answered the question some time since to the effect that if the boat is used by the owner alone it is not necessary to employ a licensed engineer. But if passengers are carried or the boat is let to other parties, the case comes under the United States law). "I showed your decision to the government inspector, but he says that the SCIENTIFIC AMERICAN, which I consider such good authority, is mistaken. A. Our answer was based upon the practical working of the law in this district, at the time the question was asked. The laws are very precise in requiring all steamers to carry licensed engineers and pilots, and to be subject to government inspection, under heavy penalties for a violation. The Secretary of the Treasury, however, has power to remit all fines.

(43) T. T. G. asks: 1. I am building an engine of 1¾ inches bore by 3 inches stroke, and would like to get a safe boiler for it; what kind would be best? A. A plain cylinder boiler will answer very well. 2. Would copper do for a boiler, or would galvanized iron be cheaper and as good? A. The iron would be cheaper, but not so durable. 3. You say in a previous issue that the burning of small boilers depends greatly upon the setting. How should it be done to make it last? A. It might be placed with the fire underneath, and a casing around it. 4. In testing a boiler by filling it with water and then heating it, how would it act if the pressure were raised higher than the boiler could stand? A. There would be a rupture of the weakest part of the boiler. 5. Can a boiler that leaks slightly not be tested that way? A. Not very conveniently. 6. How high should the pressure be raised in testing a boiler that blows off at 85 lbs., and is run at from 40 to 70 lbs. on the square inch? A. To about 100 lbs. per square inch.

(44) O. H. P. asks: How are ferrotype plates sensitized and developed? A. The plate is first perfectly freed from dust, coated with a thin film of collodion, and placed in the silver bath for a few minutes. It is then placed in the camera for a short time. It is then removed and flooded with a solution of sulphate of iron in water, until it is fully developed. when it is thoroughly washed and placed immediately in the bath of hyposulphite of soda for a few minutes. This latter operation is termed fixing. The picture is then washed, dried, and varnished. For further information we would refer you to one of the numerous works on photography.

(45) W. K. of Bork, Germany, asks: Is it better to run a turbine water wheel below the level of the backwater, or just above it? A. Above it.

(46) F. H. S. asks: I hear that the seeds of okra and gumbo (*hibiscus esculentus*) are used as a substitute for coffee. Are they roasted like coffee? Are they injurious to health? A. It is stated by Edward Dugdale, of Griffin, Ga., that a substance resembling coffee in appearance and taste may be made by separating the seeds from the pulp of persimmons, cleansing them, and afterward roasting and grinding in the same manner as coffee. Imitation coffee has also been obtained from grape seeds, but we have never heard of coffee from the source you speak of.

What is essence of petroleum, and how is it manufactured? A. It is a trade name; we can give you no information on the subject.

(47) T. J. S. asks: I saw in Paris coal bricks made of slack pressed into squares. How is it made? A. The Parisian or molded charcoal, introduced about 15 years ago by Popélier Ducarré, is an artificial fuel composed of charcoal refuse with coal tar. The small lumps and dust of charcoal are mixed with 8 to 12 per cent of water, then ground to powder, and to 200 lbs. of the powder are added 33 to 40 quarts of coal tar. This magma is thoroughly incorporated, and next molded into cylinders. These are dried and finally carbonized in a muffle furnace. This fuel is far less fragile than charcoal, better fitted for transport, burns better than coke, and, even when slightly kindled, continues to burn in air, which is not the case with coke.

(48) J. F. L. asks: The following mortar for building furnace walls has been recommended: Leached wood ashes, 1-6, slacked lime 1-6, sand 4-6. I want your opinion on the above, and to know if you are aware of any better composition. A. There is very little difference between the mortar you name and common lime mortar. Furnace brick are set with fire clay, which is a well known article of commerce and may be ordered of any dealer in firebrick.

(49) J. L. says: I have driven a pipe well, of which the pipe is 1¼ inches, 49 feet from the surface, and I have 5 feet of water in the pipe. I dug down 16 feet, and put on an ordinary pump with no result. I then put on a force pump with no result. What is the reason? Any ordinary pump is said to lift 33 feet, but neither of these would lift 28 feet, and yet the valves are in good condition, and there is no leakage in any of the joints. A. Ordinary pumps do not lift more than from 24 to 26 feet, on account of imperfections. It is possible, also, that you may have some leaks in the connecting joints. By going down a few feet more with the pump, you will probably overcome the trouble.

(50) F. G. B. asks: Will a boiler 12x36 inches do to run a small engine (cylinder 2x3 inches) with, set into an ordinary stove instead of having an independent fireplace of its own? A. Yes. 2. How much power could I get from the engine? A. You might get half a horse power with such an arrangement.

(51) J. C. asks: As there are so many ways of calculating the power of a high pressure steam engine, you will greatly oblige me by telling me your mode of making the calculation. A. Multiply mean effective pressure on the piston in pounds by twice the length of stroke in feet, and by the number of revolutions per minute, and divide the product by 33,000.

(52) J. C. S. asks: Is there any invention by which I can find buried gold and silver? A. There is no such machine on record, except in ancient legends. If such an invention ever existed, its construction is certainly one of the lost arts.

(53) R. L. says: I have directions for making an achromatic astronomical telescope with an achromatic object glass of 30 inches focus and an Huyghenian eyepiece of half an inch focus, thus giving a magnifying power of 60. I wish to increase the magnifying power to 120. Would it be best and cheapest to do this by increasing the diameter and focus of the object glass, or the focus alone of the object glass, or by decreasing the focus of the eyepiece, or by doing all of these? A. A set of eyepieces made to fit a tube, one inch inside diameter, is most convenient. Either plan would do. High powers can only be used with good objectives to view double stars on the finest nights.

1. In what place is the best telescope in the world situated? A. At the Naval Observatory, Washington, D. C. It is of 26½ inches clear aperture. 2. What is its magnifying power? A. Perhaps 1,500, or more, in good weather.

(54) H. M. P.—The trouble was probably caused by the accumulation of air in a high point of the pipe.

(55) W. H. H. asks: How can I make crimson rocket stars? A. Take chlorate of potassa 29·7 parts, sulphur 17·2; charcoal 1·7; black sulphuret of antimony 5·7. According to MM. Designolles and Castelhaz, most brilliant colored flames are obtained from picrate of ammonia in the following proportions: For yellow, picrate of ammonia 50 parts, picrate of peroxide of iron 50 parts. For green, picrate of ammonia 48 parts, nitrate of baryta 52 parts. For red, picrate of ammonia 54 parts, nitrate of strontia 56 parts.

(56) S. A. N. says: Please give me a good recipe for sympathetic ink. A. Letters written with diluted prussiate of potash become visible when moistened with a solution of sulphate of iron. As to the power of your engine, you do not send sufficient data.

(57) J. F. McC. asks: 1. What kind and how much oil is there in 48 lbs. of unbolted white corn meal? A. According to late determinations, the average composition per cent of American corn meal is as follows: Water from 11·5 to 13·2, starch from 50·1 to 54·8, fat or fatty oils from 4·4 to 4·7, cellulose from 14·9 to 20·4, gum and sugar 2·3 to 2·9, nitrogenous substance 8·7 to 8·9, ash 1·6 to 1·8. 2. What are some of the harmless chemicals that will neutralize it while baking into bread? A. We do not understand this question.

(58) J. T. McK. asks: What force is required to exhaust the air from a vessel to which is attached a pipe ⅛ inch in diameter, standing in water 10 feet below, and will it require more force if the water be 30 feet below, to cause the water to rise into the vessel? A. The work of raising the water will be that of lifting the weight through the hight. In a given time, of course, more power will be needed if more water is lifted, or if it is lifted higher. To this work must be added that used up in overcoming the friction of the water in the pipe, in giving the water velocity, and in overcoming the friction of the moving parts of the pump.

(59) C. B. asks: Which furnishes the lightest draft, the vehicle with wooden axles and thimble skeins, or the one with iron axles, all other things being equal? A. If all the other conditions were the same, there should be no difference of axle friction in the two cases, as friction is proportional to the pressure, and depends upon the nature of the rubbing surfaces. The work required to overcome friction, however, increases as the diameter of the axle is increased; and if the iron axles are the smallest, and are strong enough, there would be an advantage in their use.

(60) W. J. B. says: I have one 12 × 30 cylinder (geared two to one) on a small steamboat, and the boiler is 40 inches by 22 feet. It makes plenty of steam, but we want to dispense with the gearing and attach another 12x30 cylinder, direct. Will the boiler make steam enough for the two cylinders, running at half the speed? A. It will probably take a little more steam, after the change is made, but not a great deal more if the machinery is well designed.

(61) C. T. S. says: A mechanic of Cleveland, O., was trying to secure a better draft for a sluggish fire; and the thought occurred to him to try the effects of steam. A small pipe was made to conduct dry steam from the top of the boiler to the upper part of the furnace, where it entered in two small jets striking downward on the burning fuel. No soon was the steam injected into the furnace than the sluggish, smoky fire sprang up into a clear, bright, yellowish and intensely hot flame, filling the whole furnace with a loud roar. The man found he had not only secured a strong draft, but something much more important, a smokeless fire. What do you think of this plan? A. We have not much faith in it, and we think it probable that the application of the steam was made in some other way. Still, if any of our readers feel inclined to test the method, we hope they will communicate the results to us.

(62) J. B. F. asks: Is there anything that will kill the smell of pine tar without killing or destroying its essential properties? A. We know of no method of accomplishing the result without destroying the properties of the tar, as tar.

(63) J. H. B. asks: What acid will dissolve or burn iron quickly? A. If desired for analytical purposes, the iron should first be pulverized, and then dissolved in hydrochloric acid.

(64) J. P. asks: Can you give me the method of distilling essential oils (especially wintergreen) and how to separate the oil from the condensed steam? A. The quantity of volatile oil yielded will depend upon the part of the plant employed, the season and the period of growth. The dryer the season and the warmer the climate, the richer are the plants in oils. They should be gathered, as a general rule, immediately after blossoming, and distilled, if possible, while fresh. It is better to macerate the plant one day before distilling. Roots, barks, etc., should be coarsely powdered. Parts which yield no oil, as the stems of mint, sage, etc., should be detached. The larger the quantity acted up on the better; the quantity of water employed should be sufficient to thoroughly cover the plant; too much water causes loss by dissolving a portion of the oil. When the plants are abundant the distillate should be returned to a fresh portion of the plants in a retort. It is a good plan to use the water of a previous distillation for the same plant, as it is already saturated with the oil. If the oil is heavier than water, use a saturated solution of salt. If lighter, the Florentine receiver. The oil of sassafras is obtained from the sassafras root; 24 lbs. will yield 9 ozs. of the oil.

(65) C. A. G. asks: Is there a compound from which odorless matches can be made? A. We do not think there is a match that is absolutely inodorous.

(66) J. N. asks: Can a 1 horse engine and boiler turn a grindstone that requires two strong men to turn it, or can it do more? A. More.

(67) M. E. J. asks: What is the process or method of tempering anvils? A. The faces of anvils are hardened by heating and quenching, the metal being brought to a very low red and quenched in tepid saline water.

(68) G. W. M. asks: 1. What kind of fabric is best for waterproofing with paraffin, for making wearing apparel, such as capes, overcoats, leggings, etc.? A. Any kind of very close woven cloth will answer. 2. How is it applied to the cloth? A. There are various methods. The cloth may be prepared by steeping it in a strong solution of paraffin in naphtha. 3. Can coloring matter be mixed with it without impairing its waterproofing quality? A. Yes, it is possible to use several of the colors.

(69) G. C. D. asks: Can you give me a simple process of making bluing, used in washing clothes? A. A mixture of powdered starch and indigo (finely pulverized), in such proportion as to give the requisite color, is made into a stiff dough with starch paste, formed into lumps or cakes, and dried.

How is stove polish made and how is it made into a cake? A. Use finely powdered graphite, which can be pressed into a solid mass.

(70) S. K. H. asks: How can I make oxygenized oil? A. We know of no oil by this name. A certain class of oils known as drying oils, of which linseed oil is a type, have, under certain circumstances, the property of absorbing oxygen from the air or becoming oxidized, which causes the siccative or drying properties of these oils. This property may be much increased by heating them with about one twentieth of their weight of litharge, which becomes completely dissolved by the oil. Oxide of manganese may be used for the production of a similar effect; linseed oil which has been thus treated, is technically known as "boiled oil."

(71) L. S. asks: What is the botanical name of witch hazel? A. The botanical name of witch hazel is *hamamelis virginica*.

What is biology? A. Biology is the science of life that part of physiology which treats of life in genera and the different forces of life.

(72) C. W. J. asks: 1. Suppose I were to put a 1½ inch auger hole into a pine stump, and put therein ½ pint of chemically pure sulphuric acid, and securely stop up the hole. What effect would the acid have on the wood? Some contend that the stump and every root thereof will be totally rotted. Is it true A. No; although a part of the stump would undoubtedly be destroyed. 2. Is there not an effectual method of getting stumps out of your way by means similar to the above? A. Try the following method: In the autumn bore a hole 1 to 2 inches in diameter, according to the girth of the stump, vertically in the center of the latter, and about 18 inches deep. Put into it from 1 to 2 ozs. saltpeter; fill the hole with water, and plug up close. In the ensuing spring, take out the plug, and pour in about ½ gill of kerosene oil and ignite it. The stump will smolder away, without blazing, to the very extremity of the roots, leaving nothing but ashes.

(73) X. L. R. says: An old man has informed me that he noticed that, when lightning struck trees in a forest that had been partly cleared, it almost always struck trees bordering on this clearing. Is there any scientific reason for such an action? A. We believe no such phenomenon has been before recorded.

(74) J. E. J. asks: Will any acid dissolve rosin without destroying its natural qualities? A. We know of nothing that will dissolve it without entering into chemical combination with it at the same time.

(75) C. H. C. asks: Is water from the bottom of a well (drawn by a chain pump, for instance) just as healthy to use as water taken from the top with a bucket? A. We think there is very little difference.

(76) G. W. S. asks: If glass is a non-conductor of electricity, would a bolt of lightning go through a glass house? A. Yes.

Have carrier pigeons ever been taught to carry messages both ways? A. This has never been accomplished.

What is the meaning of the word turbine, and whence is its origin? A. The turbine is a horizontal water wheel, and is similar to the hydraulic tourniquet. But instead of the horizontal tubes, there is a horizontal drum, containing curved vertical walls. From the Latin *turbo, turbinis*, that which whirls around like a top.

(77) J. L. D. asks: Some wine makers draw their wine into new casks in February, after the vintage. I think I have heard that it is a moot point whether to do that or let it remain on the lees till it is bottled I have some on the lees (vintage of 1872) and I think it is improving. Please give your views. A. The principal fermentation converts or separates the sugar of the must into alcohol and carbonic acid. Unless the temperature is considerably decreased, a fresh fermentation is likely to arise, known as the after fermentation. Should this continue too long, vinegar is formed. To prevent this the wine, after the disappearance of the bubbles of carbonic acid upon the conclusion of the principal fermentation, should at once be "spigotted off" from the lees into casks, the object being to cut off communication with the atmosphere as much as possible The casks at first should be nearly filled and loosely bunged, but after a few days they should be filled completely. Wines casked in December will often continue fermenting till February or March. Strong wines, rich in alcohol, can be kept in casks until they become quite clear; but weak wines must soon be bottled, as the oxygen of the air is liable to convert the hydrate of the oxide of ethyl or alcohol into trioxide of acetyl or vinegar.

Is it the best ground connection for a lightning rod to attach it to a railroad track? I have been told that lightning strokes are less numerous in the city of Berlin since a number of railroads center in it. A. No.

(78) L. F. says, in reply to I. S., who asked there were any instrument by which the correct distance of an object could be ascertained: I have a prismatic field glass (of French invention) with a fixed stadia, which gives the most accurate measurement of distance, when the hight of the object is known, or the hight of that object when the distance is known; the rule for calculation is: As 1 is to 100, so is hight to distance. This instrument was invented by a French army officer, and used during the Crimean war.

(79) B. W. says, in reply to R. G. R., concerning combustion: Tap the smoke stack twenty feet above the boiler, with an eight inch sheet iron pipe; lead the pipe so that it will discharge under the fire grate; leave no sharp angles in it; insert a fan blower about six feet from the lower end. Give the fan 800 revolutions per minute, and it will consume the smoke, save a large percentage of fuel, and give a good draft. [This plan is certainly a novel one, and we would be glad to hear something on practical experience with it.—EDS.]

(80) J. S. S. says, in reply to E. H. H., who asks: Is there any machinery for cutting files in use that is working successfully, and what has been the principal trouble with machine-cut files? There are several machines in use cutting files successfully. The principal trouble with machine-cut files is prejudice. I once called at a machine shop; and the conversation turned upon files, when I asked if they used a certain machine-made file. The answer was "No. We have tried them but have given them up. Machine-cut files are a failure; but we are using now a file which is the best we ever had in our shop." He handed me a half-dozen package of files, and I found that they were marked with the name of a firm whose files were cut by machinery in the very room that I was foreman of. You state that "machine-cut files are not equal to hand-cut either in regularity of cut or quality of the cutting edge of the teeth." I will cut a file by machinery that will compete with any hand-cut file in the world for regularity. As for the cutting edge of the tooth, that is determined by the shape of the chisel which cuts the file; and if the tooth is not sharp and of the right shape, it is the fault of the operator and not of the fact of its being machine-cut. A badly shaped chisel will make a bad file, whether in the hands of a skillful hand cutter or in a machine.

(81) S.T. says, in reply to G.H.M., who asks: What part of a horse power is an eight day clock spring? Find, by single pulley and cord, how many pounds your spring will raise one foot high in one minute. The number will be the numerator of a fraction whose denominator is 33,000 or 1 horse power. Any two springs of same size and workmanship will have different lifting forces, and therefore this question must be decided by the particular spring.

(82) J. S. G. says, in answer to several correspondents, who ask how to temper cast steel: Heat the piece of steel to be tempered to a bright red; throw it into a tub of clear cold water and let it cool; then take a loaf of hot bread of the required size to hold the tools thus cooled, stick them into the loaf, and let them cool; and you have one of the finest finished tempers that has yet been discovered.

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

F. X. L.—It contains no silver.—T. H. P.—It is marcasite, commonly called white iron pyrites. It is composed of iron 46.4, and sulphur 53.6, in 100 parts.—B.S.S.—It is talc, and is composed of silica 62, magnesia 33.5, and water 3.7.—W. E. H.—The amount of hardened clay sent is too small to enable us to decide by practical or other test whether it could be used for brick-making, etc.—J. A. G.—No. 1 is galena, a sulphuret of lead. No. 2 is iron pyrites, or sulphuret of iron.—W. W. B. Jr.—It is carbonate of iron. No chromium was detected in the sample sent.—J. S. K.—It is iron pyrites.

C. A. asks: How can I stain poplar wood the color of red cedar for the manufacture of cigar boxes?—H. K. asks: How is the word boiling or bubbling translated into the Winnebago (Indian) dialect?—J. S. McK. asks: When the sun and moon are both on the same side of the earth, what causes the tide on the opposite side?—F. A. McG. asks: Why does a belt run to the highest point?

COMMUNICATIONS RECEIVED.

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

On Electric Railway Signaling. By W. R.

On Small Printing Press Engines. By F. C. S.

On the Spiritual and the Material. By E.

Also enquiries and answers from the following:

J. E. M.—E. N.—A. G. F.—J. J. S.—G. W. E.—H. B.

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.

We have some queer correspondents: One writes to know if we will not be so good as to send a messenger to an address which he gives—distance two and a half miles from our office—to make certain inquiries for him. It would require one and a half hours' time to do the errand, and not a stamp inclosed. Another wants us to write a letter and tell him where to get a combined thermometer and barometer. Another: "Will you be good enough to give me the names and addresses of several of the makers of the best brick machines"; another wants water wheels; another threshing machines; each writer desires our written opinion as to which is the best device, with our reasons, and not one is thoughtful enough to inclose a fee, or to reflect that to answer his request will consume considerable of our time. Another party wishes us to write to him the recipe for making ornaments out of coal tar, where he can buy the mixture ready for use, and how much checkermen will sell for in the New York market. For this information he sends us the generous sum of three cents in postage stamp. Mr. C. wants us to tell him of some valuable invention, of which he can buy the patent cheap, that would be suitable for him to take to sell, on his travels out West, by towns, counties, etc., three cents inclosed. Others want us to put them in communication with some person who will purchase an interest in their inventions, or manufacture for them, or furnish this or that personal information, our reply to be printed in the SCIENTIFIC AMERICAN. We are at all times happy to serve our correspondents, and when they present enquiries which we consider of general interest to our readers, we give space for them in the above columns; but if replies to purely personal errands are expected, a small fee, say from one to five dollars, should be sent.

[OFFICIAL.]

Index of Inventions

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WERE GRANTED IN THE WEEK ENDING

September 1, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,802.—CLOTHES WRINGER.—G. J. Colby. Nov. 18.
30,850.—PHOTOGRAPHIC CAMERA.—S. Wing. Nov. 18.
31,001.—STRAW CUTTER.—W. Gale. Dec. 2.

EXTENSIONS GRANTED.

30,023.—ROCK DRILLING MACHINE.—L. M. Gilmore.
29,980.—STEAM ENGINE.—W. Wells.

DISCLAIMER.

26,018.—GIRTH BUCKLE.—L. C. Chase.

DESIGNS PATENTED.

7,715 to 7,721.—CARPETS.—R. R. Campbell, Lowell, Mass.
7,722.—COOKING STOVE.—J. V. B. Carter, Detroit, Mich.
7,723.—SPICE MILL.—W. Haslam, Philadelphia, Pa.
7,724 to 7,726.—CARPETS.—W. Kerr, Philadelphia, Pa.
7,727 and 7,728.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
7,729.—CARPET.—W. Kerr, Philadelphia, Pa.
7,730 to 7,732.—STOCKING FABRICS.—W. Martin, Phila., Pa.
7,733.—CARPET.—D. McNair, Lowell, Mass.
7,734 and 7,735.—OIL CLOTHS.—C. T. Meyer et al., Bergen, N. J.
7,736.—STOVE.—J. V. B. Carter, Detroit, Mich.
7,737.—FIRE SHOVEL.—A. W. Hirschfeld, W. Meriden, Ct.
7,738 and 7,739.—CARPETS.—H. S. Kerr, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,950.—CARPET WARP.—E. W. Holbrook & Co., Troy, N. Y.
1,951.—PLOWS, ETC.—Lawrence et al., Kalamazoo, Mich.
1,952.—FERTILIZERS.—W. W. Leman, Macon, Ga.
1,953.—WHISKY.—Shields & Co., Cincinnati, O.
1,954.—PAPER BAGS.—Chatfield et al., Cincinnati, O.
1,955 to 1,957.—CLOCKS.—F. Kroeber, Hoboken, N. J.
1,958.—WHISKY.—B. M. May, Cincinnati, O.
1,959.—AMMONIA MANURE.—J. J. Turner & Co., Baltimore, Md.
1,960 & 1,961.—MEDICINES.—A. Vogeler & Co., Baltimore, Md.
1,962.—PLASTER.—A. Vogeler & Co., Baltimore, Md.

SCHEDULE OF PATENT FEES.

On each Caveat $10
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On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

AUGUST 31 TO SEPT. 12, 1874.

3,800.—E. P. Hildebrand, Indiana, Indiana county, Pa. U. S. Improvements in coal stoves, called "Hildebrand's Improvements in Coal Stoves." Aug. 31, 1874.

3,801.—J. Brown, Brantford, Brant county, Ont. Improvements on a device to protect the person from the effects of the sun and rain, called "Brown's Excelsior Sun Shade." Aug. 31, 1874.

3,802.—G. M. Seymour and J. C. Haight, New York city, U. S. Improvements in horse powers, called "Seymour & Haight's Improved Horse Power." Aug. 31, 1874.

3,803.—J. Fowler, St. John, New Brunswick. Improvements on springs for carriages, wagons, coaches, cars, and other vehicles, called "Fowler's Patent Carriage Spring." Aug. 31, 1874.

3,804.—I. Abell, Woodbridge, York county, Ont. Safety cover for couplings of revolving shafts, called "Abell's Cover for Shafting Couplings." Aug. 31, 1874.

3,805.—F. Seegmiller, Seaforth, Huron county, Ont. Machine for drying grain, called "Seegmiller's Grain Dryer." Aug. 31, 1874.

3,806.—T. McBride, Philadelphia, Philadelphia county, Pa., U. S. Improvements on hydraulic railroad car brakes, called "The McBride Hydraulic Brake." Aug. 31, 1874.

3,807.—F. A. Balch, Hingham, Sheboygan county, Wis., U. S. Improvements on a machine for separating cockle from wheat, called "The Badger State Cockle Separator." Aug. 31, 1874.

3,808.—R. H. Earle, St. John's, Newfoundland. Improvements in ice creepers, called "Earle's Ice Creeper." Aug. 31, 1874.

3,809.—G. Dunning and C. B. George, Waukegan, Lake county, Ill., U. S. Improvements on horse shoes, called "Dunning's Horse Shoe." Aug. 31, 1874.

3,810.—W. D. Farrand, New York city, U. S. Improvement on spark arresters, called "Farrand's Spark Arrester." Aug. 31, 1874.

3,811.—P. Mutter and T. Evans, Hamilton, Wentworth county, Ont. Improvements on car couplings, called Mutter & Evans' Self Acting Shuttle Coupling." Aug. 31, 1874.

3,812.—J. B. Armstrong, Guelph, Wellington county Ont., assignee of J. McFarlane, Otterville, Oxford county, Ont. Reissue of No. 1,115, a new and useful carriage spring, called "The Improved Elliptic Solid Cast Steel Carriage Spring." Sept. 12, 1874.

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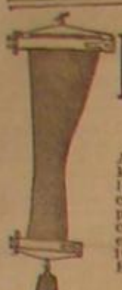

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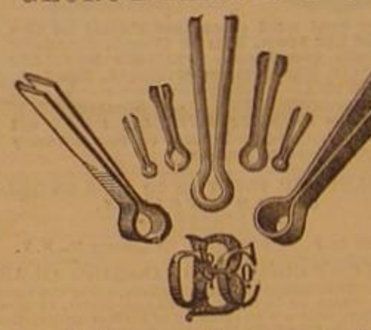

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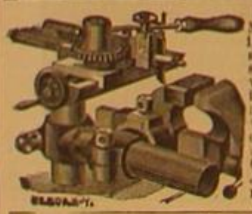

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