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THE AMERICAN STOVE PLATE DRESSING MACHINE.

This machine is designed to obviate a large amount of work upon stove castings, now performed by hand labor, with the cold chisel and file. A well made stove should have every joint nearly perfect, the doors so nicely adjusted that a strip of tissue paper inserted at any point cannot, when the door is shut, be withdrawn, and the edges of the holes smoothly ground over the entire surface. It has also become the practice lately to give a fine polish to the outside edges of the tops and bottoms. It is hardly necessary to point out that all this extra work, when done by chipping with a cold chisel and smoothing with a half round file, necessitates not only an expenditure of tools but of time, rendering the operation obviously an expensive one.

The present device is so constructed that the castings may be at once adjusted in proper position and at any angle against a grinding wheel, which, acting against either their inner or outer edges, speedily removes irregularities and produces a nicely finished surface.

The operation consists in placing the work, after the gate is broken away, upon the table and setting the latter at the proper angle. This last is done by loosening the two hand nuts, which engage with the semicircular braces, B B, as shown in our engraving. The stove top or other piece is then carried rapidly around with its interior edge in contact with the emery wheel, which renders the portions ground smooth and bright. For this work, solid emery wheels are exclusively used.

In order to polish the outside edges, an additional table, A, secured to the front of the main table, is used, and the stove top is laid bottom side up on a small form, made from inch board and having a hole for the pipe receiver. This form is placed on the table, and the work thereon brought in contact with the wheel, as already described. After the edges of the casting are roughed off, the solid wheel is removed, a covered one substituted, and the plate finely polished.

The vertical adjustment of the table, which allows of the work being brought against any desired point on the face of the wheel (so as to insure evenness of wear of the latter) is effected by turning the crank, C, which operates the cams, F, through the pinion, D, the whole being controlled and held in position by the dog, E. By using a shorter spindle and cup-shaped wheel, the machine may be advantageously employed for surface grinding.

Application for patent now pending. For further particulars address the Northampton Emery Wheel Co., Leeds, Mass.

The Swatara.

Owing to the haste necessary in despatching the Swatara, with the transit of Venus observing party on board, it was impossible to give her engines, which were the first of the compound type fitted in a United States man-of-war, the benefit of a trial trip.

It appears, however, that under steam and sail she made the passage from this port to Bahia in 85 days. The official report of the engineer has not yet arrived; but from other sources, the *Army and Navy Journal* learns that with fires under six boilers and with an average speed of six and a half knots, she consumed about fifteen tons of coal per twenty-four hours. The temperature in the engine rooms cannot, it is said, be kept under 130° or steam higher than forty-five pounds.

Nitrous Acid in Plants.

Schönbein first detected nitrous acid in the juices of different plants, by the common reagent for that acid, a solution of potassium iodide, starch, and sulphuric acid, which gives to the liquid containing nitrous acid a fine blue color. Subsequently, however, he was led to attribute this bluing to

the presence of active oxygen and no longer to nitrous acid. In order to determine whether or not Schönbein's second conclusion was a correct one, a series of experiments has been made at the laboratory of the Illinois Industrial University, a paper on which M. P. Genadius contributes to the *American Chemist*. The conclusion drawn from these tests is that very strong evidence is offered of the presence of nitrous acid in plants; for the formation of nitric acid would be preceded necessarily by that of nitrous, the latter being, as it were, a stepping stone to the former. So that the bluing, which the experiments obtained from the juices of the differ-

desired elevation within this limit. The operation is easily performed by one man, as indicated in Fig. 1 of the annexed engravings.

The upper ends of two upright posts are bound with iron stirrups and bolted firmly together. The lower ends are secured by bolts and angle irons to a foot piece. Between the two posts is a back, A, which extends for a suitable distance from the foot piece upward.

Working in metal boxes in the upper part of the posts is an iron shaft, B, one and a half inches thick, to which two chains, carrying a heavy hook, are attached. On this shaft,

and close to the inner side of one of the posts is a ratchet wheel, C, Fig. 2, with which engages a pawl pivoted to the post. Outside of the latter, the end of the shaft is formed into a six-sided nut to receive the wrench lever by which the shaft is turned and the chains wound thereon. On the other end of the lever is formed a steel tamping bar, D, used for tamping the cross ties.

The device is placed close to the rail, under which the hook engages (dotted line, Fig. 1). The lever is then worked until the rail is elevated to the desired height, where it is held by the pawl in connection with the ratchet wheel. The chains have short links and are of $\frac{1}{4}$ inch iron. The weight of the entire machine is from 45 to 50 pounds, and by its aid from 8,000 to 10,000 pounds, it is stated, can be readily lifted by one man. It is adaptable to a variety of uses, is easily adjusted and replaced, and can be made without

difficulty at small expense by any railroad shop.

Patented July 8, 1873. For further particulars regarding sale of rights, etc., address the patentee, Mr. Geo. J. Kinzel, Knoxville, Tenn.

New Electromagnetic Station Indicator.

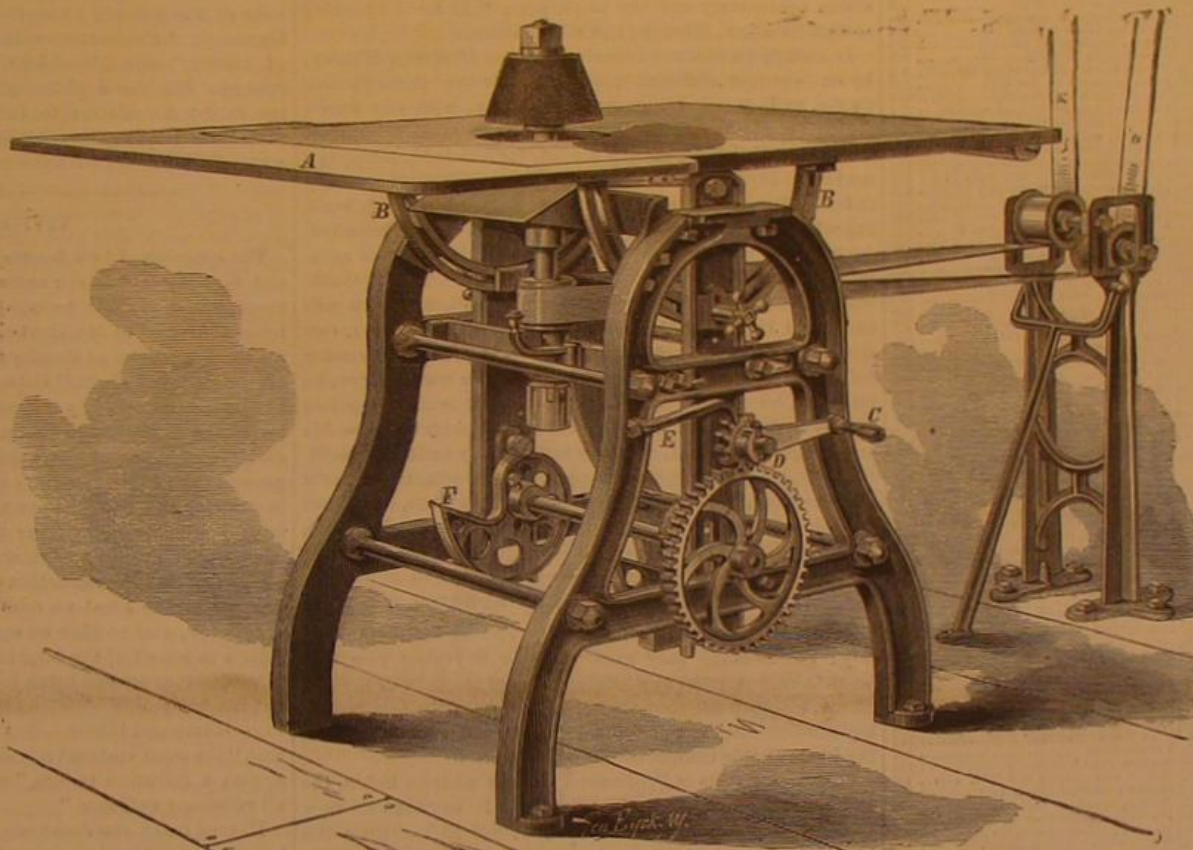
Mr. Charles W. White, of New York city, has patented, August 18, 1874, through the Scientific American Patent Agency, a quite ingenious station indicator, by means of which the names of places printed on an endless band are caused to appear and change by the action of mechanism, controlled by electromagnets. The rollers over which the band passes are geared to each other, and are rotated by a spur wheel, which is itself turned by a ratchet in which a pawl engages. The latter connects with levers vibrated by the movements of the magnet armatures, so as to cause the pawl to turn the ratchet, and so cause the band to move around the rollers. There are two sets of this gearing, in order that the band may be turned in either direction. In addition to this, there is a check pawl, which is lifted when the carrying pawl is operated. This locks a ratchet, so that the band is firmly held at any point until again set in motion by the mechanism. The indicators are placed in any convenient position in the cars, and from each set of magnets an independent circuit is led to the point whence the machine is to be controlled, where a suitable closer is placed in each circuit. Upon one circuit being closed, the indicating ribbon is unwound from the top roll, and wound on the lower one; the other circuit established, the reverse takes place.

The mode of locking the mechanism and the ratchet arrangement for turning the rolls are novel, and embrace efficient improvements in the electromagnetic principle for operating station indicators.

Pacific Ocean Telegraph Survey.

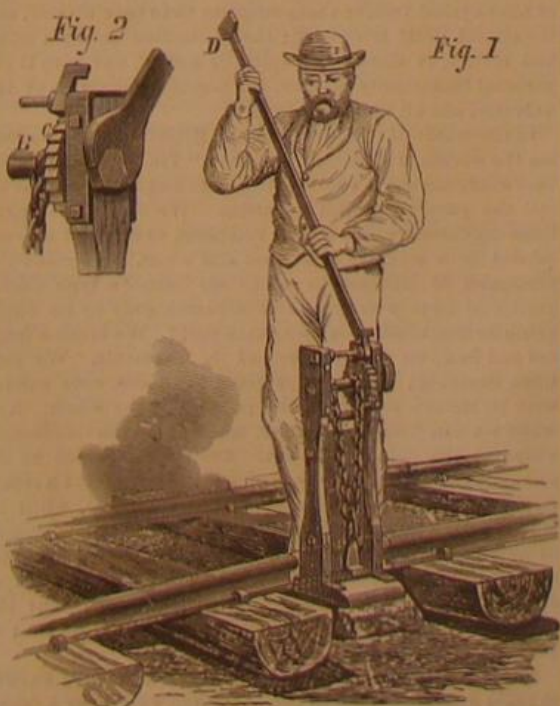
The survey ordered by the United States government, to ascertain the practicability of laying a telegraph cable through the Pacific Ocean, between this country, China, and Japan, has just been successfully completed by Commander G. E. Belknap, of U. S. S. *Tuscarora*. The greatest depth of water measured was 4,037 fathoms or 4½ miles. Nothing to interfere with the working of a cable was discovered.

THE AMERICAN STOVE PLATE DRESSING MACHINE.



KINZEL'S RAILWAY TRACK LIFTER.

This is a simple device for lifting railway tracks which, it



is claimed, will accomplish its work in half the time required with the screw jack or other apparatus, while necessitating scarcely half the power. The track can be raised to any height up to 18 inches, and is held by the machine at any

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ANIMALS ARE AUTOMATA.

One of the most interesting features of the recent meeting of the British Association was the address of Professor Huxley on "The Hypothesis that the Animals are Automata, and its History." This title at once arouses a lively interest, since, among other things, it holds out the promise of a solution of those curious phenomena of sagacity or instinct in the lower animals, which sometimes lead us to question seriously whether the reasoning faculty be totally absent. The beginning of the address is mainly historical, or, more correctly, it is an explanation of the biological propositions of Descartes, and comparison therewith of modern ideas, showing the similarity. By Descartes, the hypothesis above mentioned was evolved, the supposition (reduced to its simplest forms) being that animals are absolutely machines, that—to illustrate—a dog neither sees, smells, nor hears, but that the impression which gave rise to those states of consciousness in a dog gave rise, by a mechanical reflex process, to actions which correspond to those which we perform when we do see, do smell, and do hear.

And this is susceptible of apparent experimental verification. Professor Huxley mentions the case of a frog in which the anterior portion of the brain is destroyed. The animal may live for years, and yet it is certain that it neither sees nor hears. It will sit forever in the same spot; and yet when urged against obstacles, it will turn to avoid them. It will swim in water or balance itself on the hand, as that member is slowly revolved. Something evidently passes through the sensory nerve, acts upon the frog's machinery and the nervous system, and causes it to adapt itself to the proper position.

A still more curious instance cited is that of a French soldier wounded in the left parietal bone. Although he recovered from the lesion, the man leads two distinct lives. For two days in the month he neither sees nor smells, and, in fact, is destitute of every sense except that of touch. Yet he avoids obstacles, eats (though he is utterly destitute of any discrimination in point of taste), performs a large number of actions on mere suggestions, and, stranger still, shows a totally different moral nature; as, while at other times he is inflexibly honest, when affected he becomes an inveterate thief.

With this brief reference to his illustrations we may at once come to Professor Huxley's conclusion, in which, however, he fails to concur wholly with Descartes. He says: "Taking into account the incontrovertible fact that the lower animals which possess brains at all possess (at any rate, in rudiments) a part of the brain, which we have every reason to believe is the organ of consciousness in ourselves; then it seems vastly more probable that the lower animals, although they may not possess that sort of consciousness which we have ourselves, yet have it in a form proportional to the comparative development of the organ of that consciousness, and foreshadow, more or less dimly, those feelings which we possess ourselves." In other words, an animal is, according to Professor Huxley, a sensitive, conscious automaton; its sensations, its volitions, and its thoughts are but the products and consequences of mechanical arrangements. A certain molecular change in the nervous system determines a sensation; the emotions thereby excited leave in the brain, in turn, molecular changes which constitute the physical foundation of memory. These changes give rise to volitions, which, in the animal, will be simply states of emotion which precede its actions; it is a *conscious machine*. And this, Professor Huxley says, "applies in its fullness and entirety to man;" and he expresses no fear of the logical consequences. Yet he does not—indeed, we fail to see how he could—avoid the admission that these very logical consequences of his doctrine, rather than the theory *per se*, will excite controversy and the imputation that he is speeding toward fatalism, atheism, and materialism.

It strikes us as a remarkable fact that Professor Huxley, by an entirely different road—a tunneling through the deities, as it were—brings us face to face with one result which Dr. Hammond, in his discussion of morbid impulse, reached by a surface path. A man, for example, commits a murder. If we turn to the morbid impulse theory, we may defend him on the ground that there is a flaw in his brain organism, which leaves him in a state when "he is impelled, consciously, to commit an act which is contrary to his natural reason and to his normal inclinations." This is "conscious mechanism," pure and simple. There is no will employed in the matter. Huxley's doctrine, however, carries us further, and allows the accused to plead the broader defence of "unconscious cerebration." He was injured, he may say, he struck, he killed; the power which impelled him to strike was the same which caused him to raise his arm to guard himself, a purely involuntary action. Practically, of course, no such defence would be admitted; but it leads us, from both the doctrines above referred to, to a closer investigation of how far man is responsible for his own actions.

PROFESSOR TYNDALL'S ADDRESS.

There are utterances which mark epochs in human history: not because they give voice to anything new, not because they suggest any original line of thought or investigation, but because they strike, so to speak, the intellectual key note of the age, announcing from some high position the irrepressible conflict of the coming years.

Of such a nature is Professor Tyndall's address before the assembled scientists of Great Britain. It contains no new thought, it announces no new truth; yet in asserting the irresistible sweep of Science upon the remaining strongholds of religious dogma, it is calculated to stir up a grand commotion, not merely in the class so neatly described by the senior Draper as the only example, in the fauna of the world, of that non-development which they so loudly affirm, but among progressive scientists themselves. The timid can no longer blink the fact that the drift of scientific thought, certainly in the minds of its highest representatives, is toward the complete subversion of the fundamental doctrines taught by the ecclesiastical world. It is no longer a question of the earth's form, or position, or age which marks the conflict of Science and religion; no more is it a question of man's place in Nature, his relation to other forms of life, or the origin of his physical frame; these outposts have been carried, and the citadel itself is entered; the distinction between mind and matter, or matter and spirit, is denied, and with it the personal immortality of man, the personal dominion of the universe, and all that these involve.

In the words of this spokesman of British Science, we may see the workings of British thought: "Trace the line of life backward, and see it approaching more and more to what we call the purely physical condition. We reach at length those organisms which I have compared to drops of oil suspended in a mixture of alcohol and water. We reach the *protogenes* of Haeckel, in which we have 'a type distinguishable from a fragment of albumen only by its finely granular character.' Can we pause here? We break a magnet and find two poles in each of its fragments. We continue breaking; but however small the parts, each carries with it, though enfeebled, the polarity of the whole. And when we can break no longer, we prolong the intellectual vision to the polar molecules. Are we not urged to do something similar in the case of life? Is there not a temptation to close, to some extent, with Lucretius, when he affirms that 'Nature is seen to do all things spontaneously of herself, without the help of the gods?' or with Bruno, when he declares that 'matter is not that mere empty capacity which philosophers have pictured her to be, but the universal mother who brings forth all things as the fruit of her own womb?'"

In its unexpected frankness, Professor Tyndall's answer to these questions reminds one of the reply given by a canny Scotchman, on being asked by a tourist if he did not sometimes feel sorely tempted to forget the "sawbath day" and go salmon fishing in the river that flashed by his cabin door.

"Na, na," gravely responded Sawney, "I's no temptit; I joost gang!"

So with Professor Tyndall. Where men of less resolution pause and shut their eyes to the inevitable, he "joost gangs." "Abandoning all disguises," he says, with a fearless honesty that will command respect if it fails to command assent, "the confession that I feel bound to make before you is that I prolong the vision backward across the boundary of the experimental evidence, and discern in that Matter which we, in our ignorance, and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of every form and quality of life." In other words, we are what we are, all things are what they are; not because it has been the pleasure of an artificer, "fashioned after a human model and acting by broken efforts, as man is seen to act," to so create us, but because of the potency of what we are wont to call lifeless matter, whose nature it is to evolve all that we see around us or feel within us, all things that have been or will be, through the play of molecular force. We live because matter lives. We think and feel because it is the function of material combinations such as compose us to think and feel, all the phenomena which we distinguish as physical or mental having their unsearchable roots in what he ventures to call a *cosmical life*.

To those familiar with the history of human thought, there is nothing startling in this confession. Precisely the same view of the potency of matter has been widely accepted in Germany. "Consciousness itself is nothing but an attribute of matter," says Moleschott, and others are equally outspoken. But for a philosophically conservative body like the British Association to listen to such assertions from its president is something altogether unexpected, something which will not end with the hearing.

VIVISECTION.

The question of how far we have the moral right to torture and mutilate the lower animals in the course of scientific investigation is again brought to public attention through a letter addressed by Mr. Henry Bergh, President of the Society for the Prevention of Cruelty to Animals, to Dr. Austin Flint, of the Bellevue Medical College of this city. This subject has been in controversy for nearly two centuries, and through its recent agitation in England has elicited the published opinions of many of the ablest British physiologists of the present day; so that we have abundant authority to guide us in drawing the line between that sacrifice of brutes which is both justifiable and proper through the magnitude of the ends which are secured thereby, and the wanton cruelty which impels the destruction of life uselessly.

We have so great an admiration for the philanthropy of Mr. Bergh, and so high an appreciation of the results of his efforts in behalf of the long-suffering animals, that it is with difficulty that we can bring ourselves to the task of pointing out the errors into which he falls through a laudable zeal in his self-imposed labors. But we cannot admit his assertions that "the most eminent physiologists have pronounced vivisection a scientific failure," or that "lifeless bodies furnish all necessary evidence."

Harvey owed the demonstration of the truth of the circulation of the blood to experiments upon living animals—experiments which he details with great minuteness in his famous work. John Hunter studied the terrible disease of aneurism, and perfected the surgical operation for its cure upon brutes. Sir Charles Bell gave us our knowledge of the nature of the sensory and voluntary nerves, and their double origin in the spinal cord; and Marshall Hall demonstrated the equally important discovery of the excitatory action of the nervous system, through the same means. In both of these last instances, it was impossible to use anesthetics, and the agonies of the animals were doubtless terrible; but they sink into utter insignificance beside the weapons which they placed in the hands of the physician wherewith to combat the pain and suffering of millions for ages hereafter. We might continue and adduce scores of cases similar to the above. Majendie's investigations, and the new remedies which they gave to Science; Blake's studies on saline matter in the blood; Gadden's localization of the cerebral function; the labors of Ferrier, Goltz, Michael Foster, Lewis, Hitzig, Fritz, Brown-Séquard, Bert, Dalton, and the recipient of Mr. Bergh's letter, Dr. Flint, are well-known examples which occur as we write.

But while Mr. Bergh is, perhaps, as we have endeavored to show, too sweeping in his wholesale condemnation of vivisection, he is undoubtedly right in inveighing against the infliction of unnecessary torture on the unfortunate brutes; and in this respect we earnestly endorse the ground which he takes. It is a common practice in many medical colleges to sacrifice scores of animals yearly for the repetition of experiments which have proved well settled and thoroughly understood facts. The insertion of a canula into a dog's stomach, in order to submit a bit of meat to the prolonged action of the gastric juice, or the placing of bullets in a pig's leg to show the growth of the bone, are common examples, which, since they are useless, are certainly cruel. Nor is there any necessity of following the practice of a distinguished physiological lecturer in this city, of interrupting the thread of his explanations to seize a wretched cat, cut its throat, and composedly hand the reeking viscera about his class for examination. For such unnecessary torture there is no excuse.

A committee of the British Association, in 1870, considered this subject quite fully, and produced the following report, which we would recommend to faculties of medical colleges throughout the country, and incidentally to the notice of Mr. Bergh.

1. "No experiment which can be performed under the influence of an anæsthetic ought to be done without it.

2. "No painful experiment is justifiable for the mere purpose of illustrating a law or fact already demonstrated; in other words, experimentation without the employment of anæsthetics is not a fitting exhibition for teaching purposes.

3. "Whenever, for the investigation of new truth, it is necessary to make a painful experiment, every effort should be made to ensure success, in order that the suffering inflicted may not be wasted. For this reason, no painful experiment ought to be performed by an unskilled person with insufficient instruments and assistance, or in places not suitable to the purpose, that is to say, anywhere except in physiological and pathological laboratories, under proper regulations.

4. "In the scientific preparation for veterinary practice, operations ought not to be performed upon living animals for the mere purpose of obtaining greater operative dexterity.

"Signed by M. A. Lawson, Oxford; G. M. Humphry, Cambridge; John H. Balfour, Arthur Gamgee, Edinburgh; William Flower, Royal College of Surgeons, London; George Rolleston, Secretary, Oxford."

AMERICAN BEACON LIGHTS.

It might naturally be supposed that the United States, with its immense coast line, and the reputed enterprise of its citizens, would be likely to occupy a prominent position among the nations in respect to the scientific construction and management of its beacon lights. But from all the facts that can be gathered, it would appear that we are considerably behind the age. We hope the members of the Light House Board will read the SCIENTIFIC AMERICAN hereafter, and so keep posted in respect to all new and useful improvements in the production of lighting apparatus.

Major G. H. Eliot, United States Engineers, Secretary of the Light House Board, has recently published a report, which is the result of careful examination of the light house systems of European countries. For this labor the writer was afforded exceptional facilities by and through the English authorities, in return for the same courtesy afforded to a representative of the latter in this country, lately charged with the inspection of our fog signals. Major Eliot points out that, while the English and French systems closely resemble our own, there are points in which we may take them as models with advantage. Among these, he mentions the use of gas and the electric light in positions of importance, the use of azimuthal prisms in certain localities, the use of fog signals and revolving lights on light ships, the character of the lamps, and, lastly, the class of keepers, who are retained in service until superannuated, who are eligible to promotion, and whose lives are insured by the Government for the benefit of their families. The English and French lamps, it seems, are superior to ours, in that their light may be governed by the keeper to suit varying conditions of the atmosphere—whether foggy, more or less dark, etc. It is stated that the first order sea coast lights of England may be raised from an equivalent of 342 (their minimum) to 722 candles, while the maximum power of our first class light is uniformly the equivalent of only 210 candles. While the English and French lights have been in recent years increased in power, the actual consumption of oil per unit of light has been decreased by improvements in the supply of oxygen to the flame; and it is suggested that if the modifications described in detail should be adopted, the illuminating power of our lighthouses would be augmented by more than fifty per cent, thus vastly increasing their efficiency in thick and obscure weather.

Mineral oil is rapidly replacing vegetable and animal oils, and by every nation (with the exception of ourselves) the lamps are being changed for its use. It is more cleanly than the lard oil at present used, and not affected by cold; while the lamps do not require trimming during the longest nights, thus leaving much less to depend upon the vigilance of the keeper. It is estimated that we could import a fine quality of Scotch oil (though there is no reason why our own refiners should not make a sufficiently good article), and save \$50,000 a year, besides gaining more valuable lights, by substituting mineral for the oil now in use.

It would seem that the suggestions made are quite practicable, and if carried out would render our lighthouse system probably the finest in the world. As it is, vessels can cruise for 5,000 miles along the Atlantic and Gulf coast without losing sight of a light; and there is a large number of houses on the remaining 5,000 miles of our seacoast. Our present Lighthouse Board controls 591 lighthouses, 35 fog signals, 363 day beacons, and 2,838 buoys.

ALASKA AND THE ICELANDERS.

When Mr. Seward completed his bargain with Russia for that out-of-the-way corner of this continent now known as Alaska, there was a general expression of opinion that \$7,200,000 of national money, while ordinarily a rather low figure to pay for 580,107 square miles of territory, was nevertheless an excessive price when that territory was, to all appearances, unfit for any but seals and Esquimaux to exist upon. This rather unfavorable impression at the outset was hardly of a nature to engender any widespread public interest in our new acquisition, so that the far-off addition to our domain has heretofore received little attention from any one save from a few hapless government officials who may have been ordered to duty in cold, rainy, and generally disagreeable Sitka. An expedition was sent thither in 1865 to survey a route for a Russo-American telegraph; but the completion of the first Atlantic cable caused the abandonment of the project. Then the territory has been made a military and collection district. Frederick Whympers in England has pub-

lished a book about it, and Mr. W. H. Dall, to whom we are indebted for valuable archeological investigations among the Aleutian Islands, has produced a similar work. From these volumes the public has read all about Alaska that it cares to, has tossed them aside, and has straightway again consigned the territory, with its seals and its bears, its mountains and its glaciers, and its thousands of square miles, explored and unexplored, to further oblivion.

Nevertheless, to a few thoughtful people the question continues to present itself: "What are we going to do with a political division with a population of 29,097 souls, of whom only 1,300 pretend to have fully acquired the blessings of civilization; where there are 150 rainy days in a year at most places, and sometimes 285 days of incessant downpour at Sitka; where the temperature descends to -70° Fah., and averages about +44° throughout the year? The productions are abundance of timber, some coal, a little gold and silver, ditto copper, plenty of sulphur, and furs worth about \$85,000 per annum. In such parts of the country as we know anything about—and that is only along the coast line of 4,000 miles—it appears that there are resources well worth development, but immigrants are very scarce, and capital would doubtless consider any investment in this direction precarious.

It would be an odd coincidence if the inhabitants of one out-of-the-way country, as little thought of as Alaska until the recent celebration of its one thousandth birthday drew the attention of the world to its bleak and rocky shores, should be the means of reclaiming our far northern purchase—should discover its mines, hew its vast forests, and populate its towns—perhaps some day ask for its admission into our family of States. The Icelanders are gazing toward Alaska. Four or five hundred immigrants have arrived in Canada and the United States; and already a petition, signed by fifty Icelandic names, has been forwarded to the President, asking for Government cooperation in exploring the territory with a view to its colonization. The reasons why they thus turn to the most uninviting portion of our domain are cogent, forcible, and convincing. It is too far north and too cold for any civilized person but an Icelander to exist in comfort. Its climate is excellently suited to the raising of hardy Icelandic cattle, allowing of an abundant supply of beef, butter, and cheese to the Pacific coast; its fisheries and timber production would supply a large portion of the country. The Fish Commission tell us that our Eastern fish are getting scarce, while that there is a general feeling of uneasiness at the widespread destruction of our forests is well known. May not the sturdy fishermen and lumbermen of Iceland aid us in supplying the deficiency from sources now undrawn upon? May not shipyards appear in Alaska as well as in Maine? The Icelanders say that their colony would supply seamen for the naval and merchant marine, and thus they offer both ships and men to aid in restoring our now depleted carrying trade.

We think that this proposition should meet with favorable consideration from the Government. The Icelanders are a hardy, brave, loyal people. Education among them is prized to a degree greater than among any other mass of people on earth, and we know of no nation whose emigrants could be incorporated in our own people with greater advantages to ourselves. In case they meet with no encouragement from our Government, the nucleus of the coming colony will probably be formed in Canada, and the advantage of increased population will accrue to England instead of to ourselves. There seems to be little question as to the expedience of affording the moderate national aid asked by these people, when considered in connection with the probability, on the other hand, of leaving our territory virtually in the hands of savages for an indefinite period to come.

QUEER RAINS.

An ant rain recently happened in Cambridge, England. *The Chronicle*, a journal of that city, in detailing the circumstance, says that at about six o'clock in the evening, shortly after a rise in temperature had taken place, a shower of ants in countless millions settled in the streets, covering the pavements. The insects were the small winged male ant (*formica fusca*), together with two other varieties, one large without wings, and another of intermediate size with wings. It appears that the creatures must have taken wing or emerged from ground nests; but how far they had traveled, or by what atmospheric phenomenon they were transported, remains an interesting subject for investigation.

It is said that in the early part of this century similar showers occurred in various parts of England and in the Pyrenees, and a few months ago a dense cloud of the insects was seen passing over Cambridge; but there is believed to be no record of an ant rain of such magnitude as this last one.

In examining into this subject of queer rains, we have found a large number of singular cases of downfalls of fish and other animals from the sky, a reference to which will be of interest in the present connection. Showers of fish have been numerous, and are generally explicable by the occurrence of water spouts, which draw them up into the clouds, whence they are carried by strong gales to the land. In Scotland rains of herrings have frequently occurred, the fish in some instances falling far inland, miles from any body of water. A shower of frogs fell near Toulouse in 1804, and in 1827 an immense number of black insects appeared in the midst of a snow storm at Pakroff, Russia. There is a tradition in Lapland that mice of a particular kind have been known to fall from the clouds. The rat shower of Norway has passed into a historical fact. This was a most extraordinary though perfectly explicable occurrence, since it was traced to a whirlwind, which, overtaking an enormous army

of the rodents during their annual journey from a hilly region to the lowlands, whisked them up and deposited them in a field at considerable distance.

Immense showers of dust have repeatedly happened in the South of Europe, covering, in one instance, the entire surface of Italy and Sicily, or about 100,000 square miles. Darwin states that a rain of this kind, which took place in 1824, covered the enormous area of 1,648,000 square miles in Northern Africa. Ehrenberg has found the dust to consist of infusoria. It is of a reddish color, and upwards of 320 distinct organisms have been recognized in it.

THE FAIR OF THE AMERICAN INSTITUTE.

The forty-third annual exhibition of the American Institute was formally opened on September 9, in the same building (on Third avenue, between 63d and 64th streets, in this city) in which it has been held for several years past. The ceremony consisted in the usual chorus of hammers, mingled with other noises indicating busy labor, with which the voice of Mr. Nathan C. Ely, Chairman of the Board of Managers, endeavored, though somewhat unsuccessfully, to compete for a brief interval in an effort to deliver an address. The latter, which the speaker, evidently in deference to the strain upon his vocal organs, cut as short as possible, was merely a setting forth of the advantages of industrial expositions, followed by the formal declaration of the opening of the Fair. Then the band pitted itself in an heroic struggle against the hammers, and the visitors wandered around and admired the extent and variety of the packing boxes and the broad vista of unoccupied tables.

So far as we are able to judge of the Fair, in its present chaotic condition—and we have long since despaired of ever finding it otherwise on the opening day or during the fortnight following—there are indications that the exhibition will be a very interesting one. The machinery department is again superintended by Mr. John T. Hawkins, a gentleman who won well deserved praises for his ability and energy in the same position last year. This portion of the Fair, mainly through the efforts of Mr. Hawkins, is much the furthest advanced. Both of the main engines—one by Hampson, Whitehill & Co., of 100 horse power, and the other by William Wright & Co., of 75 horse power—started promptly on time, and the shafting throughout the building was in motion at the hour fixed, although not a tithe of the machines were connected therewith. The list of entries in the department shows about the same number as at the Fair of 1873, with not very many novelties. Two exceptionally large and fine displays of machine tools, by the New York Steam Engine Company and Messrs. George Place & Co., respectively, are the prominent features. These include the latest mechanical improvements and refinements, and, as they will be exhibited in actual operation, will be well worthy of study. We shall allude in detail to the new inventions in these collections, in a subsequent article, adding here only a word of credit to both exhibitors for their promptitude in having such heavy goods in position and (with some exceptions) in running order, which is in marked contrast with the tardiness which characterizes the proprietors of the woodworking and other light tools.

Of the numbers and variety of the goods to be exhibited in the main hall, no satisfactory idea is yet possible. The arrangement of the tables, we notice, has been altered from that in previous Fairs so as to render articles more easily found, while affording them a better chance of display. The addition of a very large and elegant fountain in the center of the hall is a marked improvement. As a work of art it is worthy of the highest praise, while it serves as a grateful relief to the eye, which is disgusted at the scenic atrocities which still remain in the arches at each end of the building.

There is an alarming eruption of red, white, and blue paper muslin rags all over the roof, which reminds us partly of the colored tissue paper stuck on the ceilings of lager beer saloons for the benefit of flies, and partly of the festoons on a political stump platform. The taste which dictates the obscuring of the noble arches which span the area by such cheap and ugly so-called decorations is simply execrable; while the presence of such inflammable stuff in such quantities, situated high up above the innumerable gas flames and in close proximity with the thoroughly dry wooden beams, above which is a tar and gravel roof, seems to us to offer a premium on a wholesale conflagration. This part of the Fair will, or at least should, excite the interest of the Fire Department.

For the present, we leave the exhibition to extricate itself from the reigning disorder, deferring our usual comments on the novelties displayed until the show is complete.

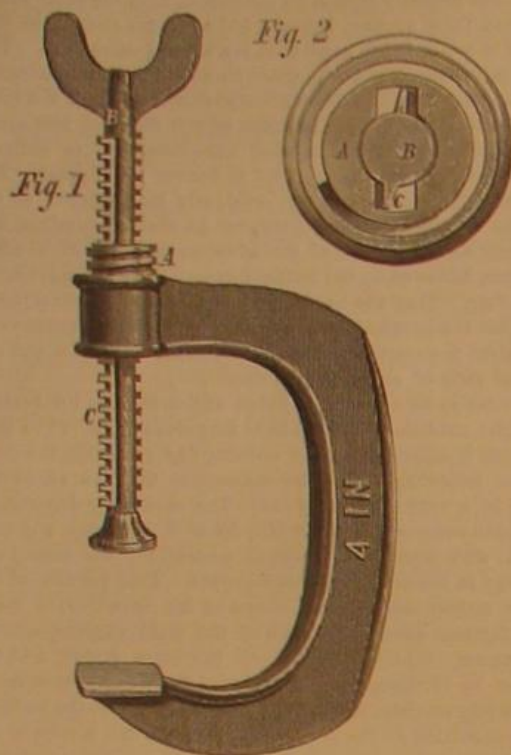
The hay in some parts of Iowa is so very abundant and cheap that it has been found more economical as a fuel for steam purposes than peat or any other substance. One enterprising inventor writes to us to know if he can obtain a patent for the idea of using hay for fuel in steam boilers. He thinks it new in the annals of steam engineering to use hay for firing.

The attempt to export young American shad to Germany for stocking the rivers, has proved a failure. Although abundantly supplied with fresh Croton water, all of the hundred thousand fish died of starvation before the end of the journey.

A CORRECTION.—In the description of the vapor burner of Mr. F. A. Sawyer, page 122 in No. 8 of our current volume, the statement that the burner tubes are provided "with pans to catch the drip" should read "pans to prevent cold air rushing up and chilling the tubes." The error exists in the patent specification.

IMPROVED ADJUSTABLE CLAMP.

This is one of those simple and yet very effective little devices which is sure to meet with a ready application from all having occasion for its use. The shape, clearly shown in the annexed engraving, is such as to insure strength, stiffness, and convenience in handling, and the material used is malleable iron. The socket on the upper extremity of the frame is threaded to receive a screw, A. Through the latter passes the clamping rod, B, along the sides of which are cast a series of projections, as shown at C. These enter grooves at the side of the rod orifice through the screw, so that the rod may be moved up and down through the latter with ease. In use, however, the object to be clamped is



placed between the frame and the enlarged lower end of the rod. The latter is then pushed down against the object and turned to the right. The projections, C, then enter notches made along the sides of the grooves in the screw, and consequently carry the latter around with the rod, thereby forcing the same tightly down upon the work. The sectional view, Fig. 2, will render the arrangement of grooves and projections clearly understood. A quarter turn to the left disengages the projections on the rod from the notches, so that the rod can at once be drawn back.

It is unnecessary to point out the advantages resulting in saving of time in turning down screws, as well as the firmness with which the clamp holds its work. The invention is made in various sizes, and is, of course, applicable to a variety of uses, by cabinet makers, carpenters, and others. A vise for wood workers' use has also been introduced, we understand, constructed on the same principle. The present invention is sold by the trade.

Further particulars may be obtained by addressing Hammer & Co., Branford, Conn.

FURNACES, THEIR CONSTRUCTION AND MANAGEMENT.

READ BEFORE THE EDINBURGH AND LEITH ENGINEERS' SOCIETY BY MR. CHARLES FAIRBAIRN.

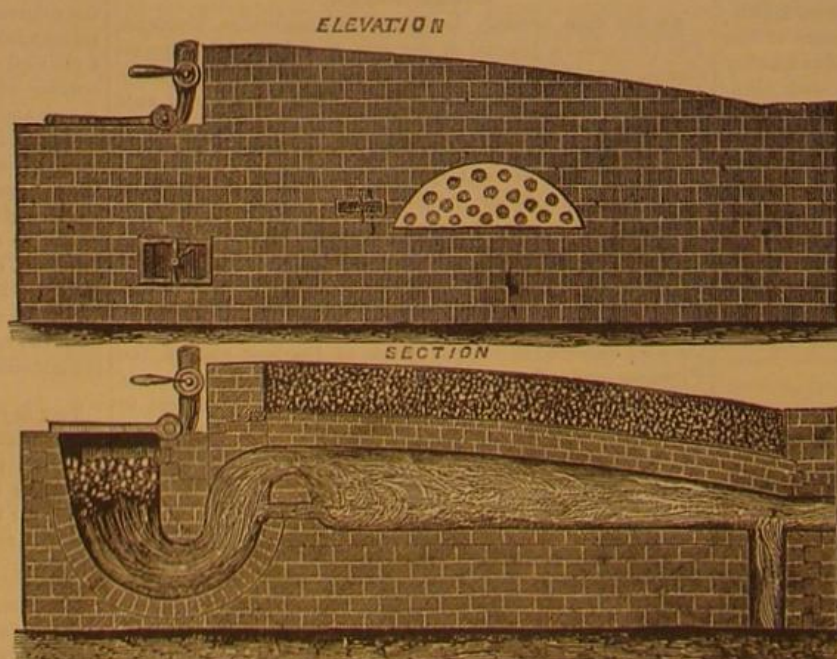
Dr. Joule, in some experiments conducted some time ago, ascertained that a grain of zinc consumed by a galvanic battery generated sufficient power to raise 145 6 lbs. 1 foot high. Now it has been proved that a grain of coal consumed in combustion exerted a power of nearly 1,400 foot pounds. This is nearly ten times the power given out by the zinc. It is said, however, that thermo-electric engines utilize the initial force supplied about four times better than heat engines, which would make a grain of zinc give about two fifths of the power of a grain of coal. But zinc costs from forty to fifty times as much as coal, while it gives only two fifths of the efficiency.

During a number of years I have been trying experiments with furnaces, with a view to the economy of fuel. As opportunity occurred, the furnaces I experimented on have been of various kinds, but lately they have been what are known as reverberatory furnaces, chiefly used for puddling and reheating iron.

I do not suppose that any person who has not had an opportunity of seeing a furnace in operation could believe that the effect would be so powerful; the inner lining actually acquires a white heat, thus serving as an accumulator, which is given out again when the temperature of the fire is reduced (as in the case of a fresh charge of fuel), and at the same time assisting to bring the fresh fuel into active combustion more rapidly; the heat is again returned to the fire bricks, and kept ready for future use.

Doctor Siemens, in his celebrated gas furnace, has been very successful in economizing fuel in very large iron manufacturing establishments. The Siemens furnace requires great care in its management, and is said to be more useful for heating large masses of iron for forgings or long bars

than for puddling or the intricate processes of iron manufacture. However suitable for large establishments where a great number of furnaces have to be supplied with gas, it is clearly too cumbersome and costly for smaller places, and the question arises—can we not effect, approximately at least, a similar result in single furnaces to what is done by the Siemens furnaces? I think so. Regarding the quantity of air required in the ordinary furnace for the combustion of coal, I suppose that very few people have any idea of the magnitude of the demand. It is generally given as 300 cubic feet, or 24 lbs. of air to 1 lb. of coal. Let us place this in another light. In my own establishment in Gateshead I have seven furnaces, each of which uses about one ton of fuel per day, in all about seven tons; therefore $7 \times 24 = 168$ tons of air required. Again, a pound of coal requires about 300 cubic feet of air. If we imagine the 168 tons of air made into a long stream of one square foot in area, the total length will be 21,381 miles in length. Another great cause of the loss of heat, as before stated, is the quantity of heat continually passing away to the chimney. One difficulty—that is, regulating the supply of air to the furnace—can only be overcome by artificial means, either by a fan blast or steam jet. I believe the time is fast approaching when the supply of air to furnaces will be regulated in this way as the most efficient and economical, and as obviating a great many of the faults of our present furnace. The idea is old enough. However, the arrangement of furnace I will describe presently may or may not be new. I never saw it before, nor am I aware that anything of the same kind has been tried, and to it I have added a supply of air by means of a blower. In this furnace, of which the drawing is a longitudinal section, the coal is introduced from the top, and is always on the top of the incandescent fuel, at the side of the furnace furthest from the place where the flame makes its escape. The hearth is of fire brick, and during the meal hours all the ashes and clinkers are removed by the hole in the side of the furnace. The area of the hearth is about two thirds of the area that it was previously; the blast was introduced above the new coals, and passes through them. As the coals begin to ignite, all the inflammable gases are forced through the fire, and at the same time mixed with air. The advantages with this kind of furnace seem to be the following: (1) The whole of the gaseous products are made available; (2) there is entire absence of smoke, in consequence of perfect combustion; (3) there is a smaller quantity of air required, probably about one fourth less, that is, about 18 lbs. to 1 lb. of coal; (4) no increase of temperature above the external air is required in the chimney, and the escaping heat from the furnace can be used for other purposes; (5) a higher temperature in the furnace, and more rapid circulation of heat; (6) the perfect control which the attendant has over the furnace as regards temperature, getting the fire lighted and into operation in less time, when they have not been in use. There is also another very important point in connection with this method of making reheating furnaces—that the air can be so nicely adjusted by means of the blast and damper as to insure that nearly all the oxygen will be taken up by the carbon and gases, in consequence of which the iron is heated with scarcely any loss from oxide or scale. The balance of pressure can be made so that, even where there are unprotected inlets to the interior of the furnace, the flame can be made to come to the edge of the open space. I believe the efficiency of the furnace might be largely increased by using hot air, which might be done by passing it through pipes or brickwork placed in the flues; for if we have the heat of the furnace at 2500° , and the entering air heated to 500° , the result would necessarily be a great saving. On this point we have the experience of blast furnaces as an indication of what might be saved by this means alone.



FAIRBAIRN'S FURNACE.

The application of this method of constructing furnaces is more difficult to existing steam boilers, and this we can only accomplish by constructing a separate combustion chamber, in which the gases could be properly ignited before passing below the boiler.

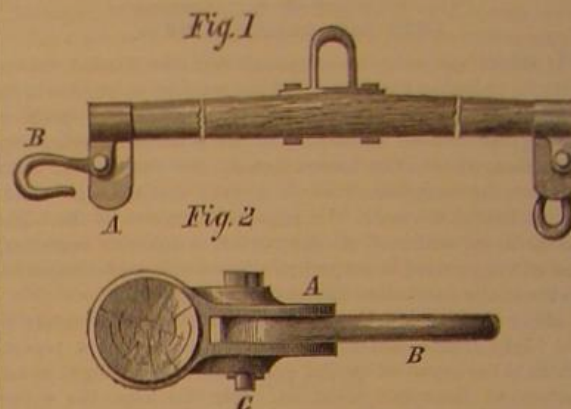
[We are indebted to Engineering for the engraving.—EDS.]

STARLING'S FERRULE AND HOOK FOR WHIFFLETREES.

This is a simple device for attaching lugs or traces to whiffletrees, the operation of which is clearly indicated in the annexed engravings.

The ferrule is fitted to the end of the whiffletree in the usual manner. Upon the forward side is a slotted lug, A, shown enlarged in the end view, Fig. 2, to receive the eye of a hook, B, which is secured by a pin, C. The portion of the lug through which the pin hole is formed, and between the aperture and the ferrule, is constructed thick enough to give sufficient strength. The part, however, in front of the pin hole, and upon its inner side, may be made thin, as said parts serve only as a guard to cover and protect the point of the hook when it is extended forward or swung inward, as shown in Fig. 1. This thin portion does not project along the outer edge of the lug; so that, when the hook is swung outward, its point will be uncovered and the trace readily attached.

When used in plowing, the iron pin may be replaced with a wooden one, so that, should the plow strike an obstacle



the pin may break and thus prevent injury to the plow. Patented through the Scientific American Patent Agency, June 2, 1874. For further particulars address William Starling, Hallock, Peoria county, Ill.

New Prussian Guns.

The Gazette of Cologne, Germany, says, of the new Prussian field guns: They are of the same diameter and caliber as the former pieces, but weigh 391 kilogrammes instead of 260, while the new projectiles weigh 6½ kilogrammes instead of 4½, and have an initial velocity of 500 instead of 360 meters. The trials made with the new gun against the old one were highly satisfactory; at the distance of 1,500 metres, the number of pieces of shells in the target was in the proportion of 25 to 1, and balls and pieces of shrapnel 3 to 1; but these advantages have been obtained at the expense of lightness and handiness. The whole gun, charge, and carriage, weigh 1,725 kilogrammes, instead of 1,575, a diminution of mobility equal to about one twelfth. In order to test the importance of this fact, it has been decided that the horse batteries, attached to cavalry divisions, which are to execute grand manoeuvres toward the end of September, shall be supplied with the new pieces. The manoeuvres are to take place at Frankfurt-on-Oder, Magdebourg, Hagenau, and Brumath.

French Saw Making.

The Paris makers have almost a monopoly, we understand, in the making of ribbon saws, and of late years they have given much attention to the production of all kinds of saws and other articles made of sheet steel. Among others, M. Dugoujon, who has steam works at Paris, has patented a number of improved modes of manufacture. The blades, after being rolled cold several times, in order to render the grain close and the metal homogeneous, are heated in special furnaces, from which the air is carefully excluded, and when at the proper temperature are plunged in a bath of colza oil; this is done in a dark chamber. The tempering is effected with the aid of machines, which cause the blades to pass between cast iron plates, heated to a fixed temperature, according to the nature of the article to be produced. The teeth of the saws are cut by machinery, which require only laborers to attend it. Since the war, which deprived the establishment of some of its best men, M. Dugoujon has effected the planishing and grinding of circular and other saws and many similar articles by machinery, and, it is said, with great advantage with respect to regularity and stiffness.

Another introduction is the mechanical reduction of the joints of ribbon saws. The breaking of the joint is the only inconvenience about this useful instrument. The workman, in reducing the welded part by means of the file, scarcely ever left it of exactly the same thickness as the rest of the blade; thus it either created extra friction or

was liable to break. By the new method the reduction is made by grinding instead of filing; and as that is effected longitudinally, instead of across the blade, the thickness is rendered perfectly uniform. This invention is said to save 60 per cent in wages, besides the cost of files.

IMPROVED RUDDER.

The ordinary balance rudder, as is well known, is pivoted near its middle, and can, with a large rudder area, be easily put over to large angles. But it has certain disadvantages which have prevented its being adopted in any except a few very large steam vessels in the Royal Navy. It stops the way of the ship at slow speeds, and is uncertain in its action when the vessel is under sail. This is supposed by many to be due to the fact that the fore part of the rudder is on one side of the ship while the after part is on the other side; and the idea of Mr. Gumpel's rudder is to retain the advantage of the ordinary balance rudder as to ease of turning with a large rudder area, and to obviate its drawbacks by keeping the whole of the rudder on the same side of the vessel for any degree of inclination.

The means by which Mr. Gumpel accomplishes this can best be described by reference to the engraving, which is taken from a photograph. The fore part of the rudder is kept in the middle line of the vessel by the guide rod at its upper fore corner, which is capable of sliding forward and aft in a groove or slot under the vessel's counter. The inclination of the rudder is obtained by making its axis, which is near its center, move round on a crank on what usually forms the rudder head. A spindle goes down through the rudder center, round which the rudder is capable of revolving, and this spindle, with the arms at the top and bottom, form the crank, which carries the rudder center out of the middle line; and the direction of the plane of the rudder is regulated by the guide rod at the fore end being compelled to slide along the middle line. It will easily be seen that the advantage which this rudder has over the common rudder in point of power is mainly at large angles.

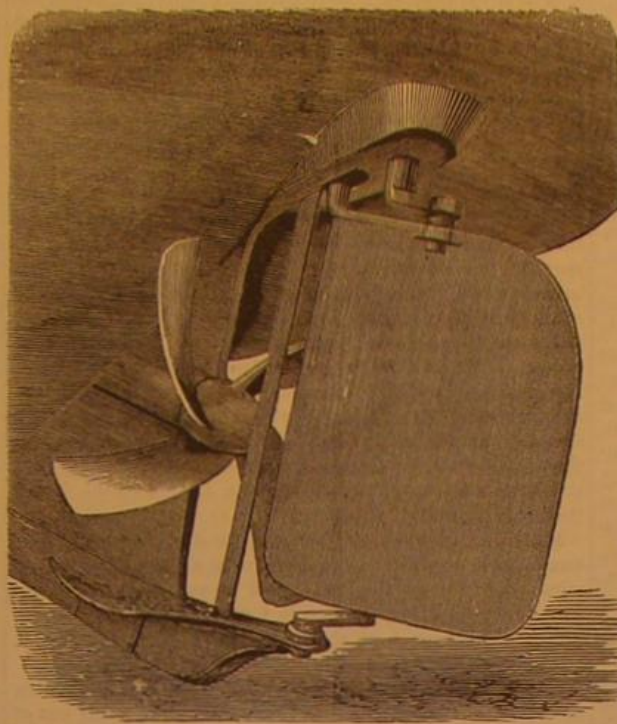
The chief objection, says *Engineering*, from which we extract the engraving, raised to Mr. Gumpel's rudder is that it seems complicated. It certainly does appear more complicated on paper than when seen fitted to the vessel; and the ease with which it could be worked, although the steering wheel was small, and a half turn of it put the rudder hard over, was a subject of much remark on the trial. That it would be of great advantage to river steamers and other craft requiring good steering powers, there can be little doubt; but it would be premature to pass an opinion on it for sailing vessels. The tendency appears to be rather in favor of small rudders for sailing vessels of the mercantile marine, although in yachts they are sometimes of considerable area in proportion to the size of the vessel. It is obvious that the advantage of a balanced rudder of any kind is felt chiefly where large rudder area is required.

ON LIFEBOATS.

Mr. Charles H. Beloe, C. E., recently read before the Liverpool Polytechnic Society an exhaustive and able paper on the above important topic. Excluding such appliances as rafts, buoys, belts, and similar apparatus, he confines himself solely to the single subject in question; and dividing the boats into two classes, namely, those used off shore and those kept aboard ship, he proceeds to discuss the peculiarities and valuable improvements existing in the many types now in use. In general, the qualities which should be present in every vessel of this description are summed up by the Royal National Life Boat Institution as: (1) Great lateral stability or resistance to upsetting. (2) Speed against a heavy sea. (3) Facility of launching or taking the shore. (4) Immediate self discharge of any water breaking into her. (5) Self-righting if upset. (6) Strength. (7) Stowage room for a large number of passengers. From the descriptions which follow, taken from Mr. Beloe's paper, and by the aid of the annexed diagrams, for which we are indebted to the *Engineer*, the reader will be able to examine comparatively the principal varieties of life boats now in use in England:

Fig. 1 represents the north country or improved Great-head plan, and is now nearly obsolete. These are the widest rowing life boats in existence, some of them having as much as 10½ feet to 11 feet beam, with a length of 30 feet. These wide boats require long oars, with two men to each, to propel them, thereby risking a large number of lives in every boat. They do not possess the property of self-righting, and it was in one of them that twenty lives were lost in 1849. The airtight compartments are marked A. These side air cases contribute vastly to the stability of the boat, by leaving a very small space for the water to occupy, when one gunwale is thrown level with the sea, and that space but slightly on one side of the center of gravity, consequently

the water shipped would have but little tendency to weigh the boat down. The continuation of the air cases to the gunwale is objectionable, as they occupy space which is valuable for the stowage of shipwrecked persons. A water tight deck, marked B, extends across the boat, a little above the level of the sea outside; and any water that may be shipped is discharged through tubes into the sea below. Fig. 2 represents one of the Norfolk and Suffolk sailing life



GUMPEL'S RUDDER.

boats, which are nearly as ancient in model as the one just described. The extra buoyancy is obtained by means of cork fenders outside the gunwale and by side air cases, occupying a large portion of the interior of the boat. With regard to stability, these Norfolk boats retain more water when inclined to leeward than some boats, as shown by Fig. 2, but a large portion of it is to the windward or higher side of the center of buoyancy, where it serves the purposes of ballast, and thereby adds to the stability. They are almost entirely ballasted with water. One great advantage of this plan is that the boats are so easily handled in launching or beaching, as they are launched empty; but as soon as they are cleared of the beach, the plugs are withdrawn, and the water admitted to the outside level. In addition, they are

B the relieving tubes, of the same depth as the space between the decks and the boat's floor; C C C C are spaces beneath the deck, placed longitudinally at the midship part of the boat, and filled with cases packed with cork, forming a portion of the ballast; D, scuttle for ventilation, having a pump fixed in it, by which any leakage beneath the deck can be pumped out when afloat. The extra buoyancy is obtained entirely by means of air cases. When the lee gunwale is level with the sea, there is more space inside to leeward of the center of gravity than in Figs. 1 and 2, the air cases having the corners taken off to afford room for the stowage of passengers, and to prevent the side buoyancy being placed too high for the purposes of self-righting. The self-discharge of water is provided for by the relieving tubes, B, for, as the watertight deck is always slightly above the level of the water outside, any sea that is shipped must flow out through these tubes, which are furnished with very simple self-acting balanced valves, that afford no obstruction to the free egress of water, but, closing by the pressure of the sea outside, effectually prevent the admission of any. The actual time occupied by one of these boats in freeing itself from water is about 30 seconds. A large portion of the ballast is composed of cork or wood, as shown at C C C C. The really distinguishing feature of these boats is the property which they possess of self-righting. The best proof of the safety of the boats is the fact that during the last twenty-two years the Institution has only lost from all causes, twenty-nine persons from its own lifeboat crews, and many of these lives were lost by the men being crushed against wrecks, falling overboard, etc. The method by which this peculiar property is obtained is by attaching a heavy iron keel to the boat, and otherwise providing a sufficient weight of ballast, by giving a considerable amount of sheer, and by enclosing the bow and stern by airtight chambers. These chambers have sufficient buoyancy to support the whole weight of the boat when upset, with the keel at a considerable height above the water; it is then floating on two points, with the ballast far above the center of buoyancy, thus forming an unstable equilibrium. In this position the boat cannot remain; and as soon as the keel falls to one side or the other of the center of gravity, the weight of ballast drags the boat round, the water escapes through the relieving tubes, and she is again ready for service. The following are the requirements requisite to insure self-righting: (1) Ballast. (2) Enclosed air chambers at the bow and stern, placed sufficiently above the center of gravity. (3) Limited breadth of beam. (4) Limited side buoyancy.

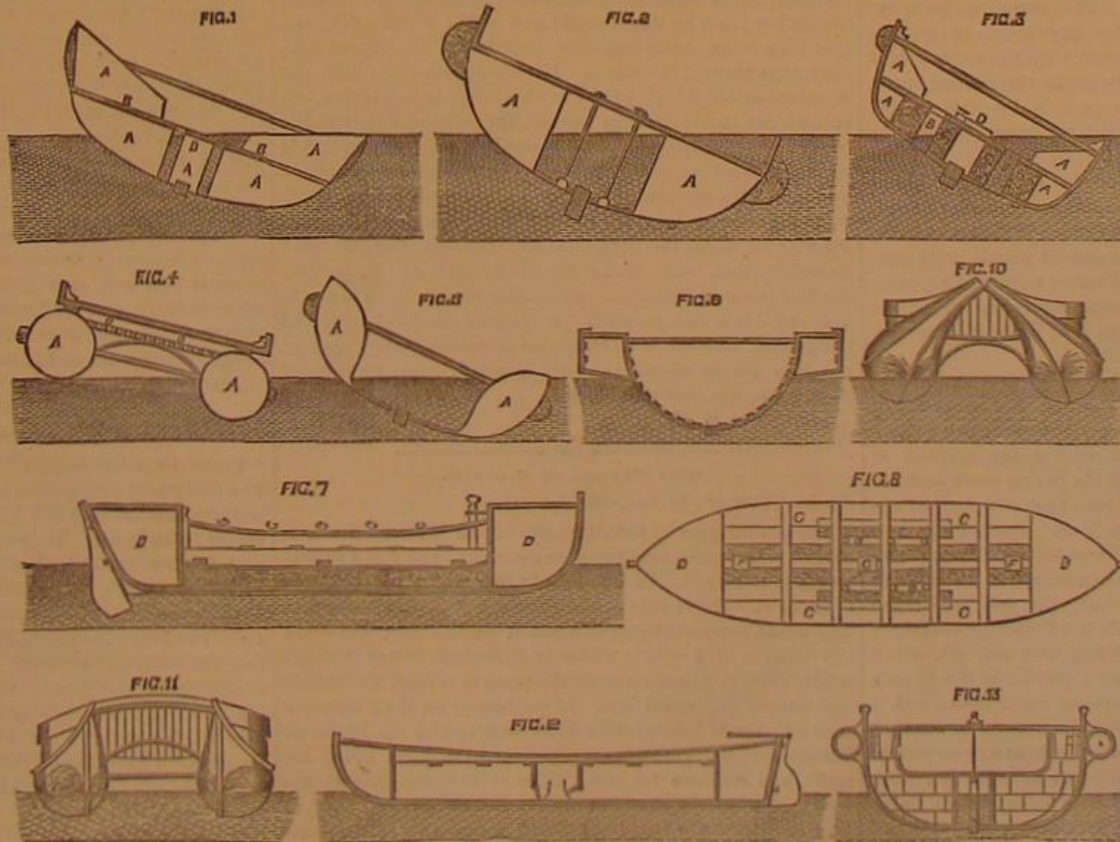
In order to insure strength and elasticity, these boats are now built of fir, on the diagonal principle; formerly they were clinker-built, of oak.

Figs. 10 and 11 represent two boats built on the tubular principle. One is stationed at Rhyll, and the other at New Brighton, both being under the control of the Lifeboat Institution. The latter boat tow and sails admirably, though a trifle heavy under oars. A sectional elevation of her is shown in Fig. 10. Her dimensions are as follows: Length over all, 40 feet; diameter of tubes, 3 feet; distance apart, 3 feet 6 inches. The Mersey Docks and Harbor Board has a boat built on this principle, but with a difference in the mode of construction. The tubes, instead of being circular, are flat on the inner sides, see Fig. 11; the ends of the tubes are not brought together, but the inner sides remain parallel throughout, and have a sort of bow or cutwater at one end. One object of this plan is to prevent the water thrown off by the bows of the tubes being thrown in between them, where the space is confined, and where it undoubtedly retards the boat. By the altered plan, it is contended that all the water thrown off by the bows shall pass away freely outside the tubes. This boat is undoubtedly faster under oars than the New Brighton one, but not equal to her in buoyancy and strength. Her dimensions are as follows:

Length, 36 feet; breadth, 10 feet 2 inches outside tubes; breadth, 9 feet 8 inches outside gunwales; diameter of tubes, 3 feet. The objections to this class of boat are: The prejudices of the fishermen and boatmen respecting a boat so unlike anything to which they have been accustomed; their great weight, the clumsy carriage which they require, their unsuitability for launching off a lee shore, and their great cost.

SHIPS' LIFEBOATS.

In order to improve this most important description of boat, in February, 1870, the Society of Arts offered its gold medal for a ship's lifeboat, suitable for the mercantile marine, under the following conditions, mentioned in the second division of the discourse.] Mr. Beloe said that all ships'



LIFEBOATS.

furnished with iron keels. They are exclusively sailing boats, being nearly unmanageable under oars. They measure from 39 feet to 46 feet in length, and from 10½ feet to 12 feet in breadth. A plan and sections of the self-righting life boat of the Royal National Lifeboat Institution are shown by Figs. 3, 7, and 8. This is the result of all the experience gained by the institution in the management of its large fleet, now consisting of 235 lifeboats.

On the plan, Fig. 8, A represents the watertight deck, B the relieving tubes, C the side air cases, D the end air chambers, E the ballast, F scuttles to admit of a free current of air under the watertight decks when the boat is ashore, G another scuttle for air, and to receive a pump. In the cross section, Fig. 3, A represents the sections of the side air cases;

lifeboats should have these requirements: (1) Buoyancy sufficient to insure that the boat be manageable, when, in addition to the number of persons and additional dead weight (if any) she is intended to carry, she is filled by a sea. (2) The fittings or appliances by which such buoyancy is obtained to remain efficient under all circumstances of climate and temperature, as well as under exposure to sun, weather, and salt water. (3) Fitness for use as an ordinary ship's boat. (4) Strength. (5) Durability. (6) Lateral stability, or resistance to upsetting on the broadside. (7) Relief of water to the outside level. (8) Cheapness. (9) Simplicity of structure. (10) Lightness. It will be seen at once how different are the conditions from those of a shore life boat, and how the ordinary boats of the Institution would fail to comply with them, especially with requirements Nos. 3, 8, 9, and 10. Self-righting is not considered as essential; in fact, boats in an open sea are far less likely to be upset than in the heavy breakers near the shore. The council of the Society of Arts has awarded two gold medals, one to Messrs. Woolfe & Son, for their wooden boats, and one to Messrs. Hamilton & Co., for their iron boats.

Messrs. Woolfe & Son's lifeboat was 25 feet long by 7 feet beam, was built of wood, and had end and side compartments of the proportions recommended by the committee. There is no special peculiarity in the shape of the boat, except that she is very flat-bottomed; the top of the air cases being flat and level with the thwarts, they afford additional accommodation for passengers. With the crew on board and the water admitted to the outside level, this boat has a freeboard of 30½ inches, and with fifteen additional passengers the freeboard is reduced to 12 inches. It takes eight men to stand on the gunwale to bring it awash. The air cases are easily removed, thus rendering the boat available for service as a cargo boat. The seas breaking into her are ejected to the outside level by means of two plug holes in the bottom, the remainder being baled out after the plugs are again inserted.

Messrs. Hamilton & Co.'s metallic lifeboat is a counterpart of Messrs. Woolfe's boat, having the same length and breadth; and the proportions of the air cases are identical. The two points of difference between Hamilton's and Woolfe's are in the material (one being built of galvanized corrugated iron, and the other of wood) and the means of ejecting the water. The two plug holes, 3 inches in diameter, are placed in the center of the boat, and a watertight bulkhead is fixed on each thwart, on opposite sides of the plug hole, see Fig. 12. Each of these bulkheads is furnished with a simple flap valve, opening inwards. In the event of the boat shipping a sea, she is turned head to wind; and as the bow rises to the waves, all the water contained in the forepart of the boat passes through the valve in the foremost bulkhead, but cannot pass the second one, consequently the water is heaped up in the space between the two bulkheads. As the bow falls again the valve closes, and the water in the center would be higher than the outside level if the plugs have been left in; on withdrawing them it would fall to the level of the sea. The same process is repeated as the stern rises, and a few movements of the boat are sufficient to free her from water, with the exception of about one inch in the bottom. The larger the central space, the more rapid will be the discharge of water; but on the other hand, the greater will be the residuum left in the boat.

Messrs. Lamb & White's lifeboat was the first real ship's lifeboat that was ever adopted, and has undoubtedly done a great deal of good service. A cross section of it is shown by Fig. 5. It is built of two thicknesses of plank, with prepared waterproof material of an adhesive nature interposed. The whole of the internal work, comprising the watertight compartments, bulkheads, and decks, is of the same construction.

Combe's cork and cane lifeboat, Fig. 13, is composed of two baskets, placed one inside the other, and secured to a deep wooden keel, the space between the baskets being filled with cork. No provision is required for the ejection of water, which passes freely through the basket work and between the cork, the bottom of the inner basket or floor of the boat being above the outside sea level. One of the best features of this most ingenious invention is the mode in which the stability of the boat is increased by the water being retained on the windward or elevated side, and discharged on the leeward or lower side. This is effected by leaving a central space in the bottom, extending fore and aft, which is not filled with cork, and by lining a portion of the bottom of the boat and the sides of this central water space with a waterproof material, by which means the water is retained on the side which is lifted up, and its weight acts as ballast on the side where it is wanted, and tends to right the boat. One great advantage of this form of construction is its lightness, a boat, 25 feet long, 8 feet beam, and 3 feet 4 inches deep, only weighing one ton.

THE ST. GOTHARD TUNNEL.—It appears, from a recent report made to the Swiss Federal Council, that at the close of June the contractors had completed nearly one seventh of the whole distance of nine miles, 2213 feet. The progress made during July was about evenly balanced, but the advance on the Goeschenen side was rather more rapid than that effected on the Airolo side.

SMOKING BY CLOCKWORK.—A new toy, lately patented, consists of a figure of a dandy with a cigar holder in his mouth. In the pedestal there is a small bellows, operated by clockwork and spring. A small cigar is lighted and placed in the holder; and when the spring is set in motion, the dandy puffs away, as natural as life, until the cigar is consumed.

Correspondence.

Practical Mechanism.

To the Editor of the Scientific American:

I have carefully read Mr. Joshua Rose's essays on practical mechanics, and also the controversy upon hardening and tempering tools. Mr. Rose is elucidating a perfection of workmanship not attained by one experienced mechanic in a hundred. It is an easy matter to run a lathe; but to get the utmost attainable duty out of it is quite another thing, and this Mr. Rose shows exactly how to do. I have worked in shops where the work was let out by the piece, and have found innumerable cases where one man in a particular branch, with the same tools, did much more work than others. How is this? It is done by little, fine points in the manipulation of the work and the tools, which only a few succeed in perceiving. For instance, in one essay Mr. Rose says: "So much side rake may be given a tool that it will feed itself without the aid of any feed motion; for the force required to bend the shaving (in heavy cuts only) will react upon the tool, forcing it up and into the cut; while the amount of bottom rake, or clearance, as it is sometimes called, may be made just sufficient to permit the tool to enter the cut to the required thickness of shaving or tool feed, and no more; and it will, after the cut is once begun, feed itself, and stop itself when the cut is over." Such a tool as is here described is the very perfection of a tool for heavy cuts; there is absolutely nothing beyond it, that is, provided always that it is forged and hardened as Mr. Rose directs. Not a "wrinkle" has he omitted.

Mr. Hawkins says that "if a tool be dipped at the lowest temperature at which it will be hard at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn in temper at all." A tool for ordinary work, such as shown by Mr. Rose in his Fig. 6, treated by either of these methods would be utterly worthless for the work assigned to it by Mr. Rose, that is, running 36 or 27 feet a minute with a feed of 20 or 25. Nine out of ten expert workmen discard the feed motions of small lathes and feed the tool by hand, when doing short work, because the feeds are so fine as to prevent getting out a satisfactory amount of work. The employer of a fine feed is incapable of judging of the merits of a tool, since his practice never puts a tool to a full test. "The temper of a tool, made just hot enough to harden at all," is altogether indefinite, and practically useless. Mr. Rose gives special instructions for taps, etc., and he gives the colors in combination (as patent lawyers say) with the conditions; so that, both being observed, the result is uniform and correct. What result may be obtained by other conditions is another thing. I know of no better plan than Mr. Rose's, and I do not believe there is one in use. Mr. Hawkins appears to have varied his conditions, and his results have therefore become varied and indefinite in consequence. The latter says in one place that a workman may dip a chisel too little, and the chisel will be soft; in another place he may bungle and make it too hard, and that this is an everyday shop practice: "an unprofitable shop experience," he calls it. He afterwards says that the chemical action which produces the colors in tempering is a subject not, in his opinion, beyond the American mechanic's capability to comprehend. The capability to comprehend is as undisputed as the fact that it is foreign to the whole question. No mechanical motive, no fair motive called forth, such a remark. I do not believe that it is American shop practice to make the blunders Mr. Hawkins charges, but I do believe that, were such a deplorable state of things true, the first duty of American mechanics would be to learn to heat and dip a tool properly, so that the chemical action of tempering, whether it be oxidation or carbonization, may be put into proper operation, without which considerations of time, color, etc., are all valueless.

Greenpoint, N. Y.

W. H.

The Plague of Locusts.

To the Editor of the Scientific American:

The grasshopper or locust plague of the Western States is an evil which threatens the entire country, and steps should be taken to stop it. In order to do that, we must get at the cause of it. Every acre of land producing wild or cultivated vegetation supports its equivalent of animal life; and when the balance of power is violently disturbed, it will revenge itself. When a man steps on the teeth of a rake, the handle will rise up and strike him. If we destroy on the plains one kind of animal life, another kind will spring up which we cannot destroy. Millions of buffalo have been killed for sport, and millions for their hides or tongues. Every one who sees a buffalo shoots at it. If it does not fall then, it lingers with the wounds till death relieves it. Every one who has crossed the plains knows that few are the spots which are not dotted over with decaying and decayed carcasses. But the greatest slaughter of animals is done by poisoning the wolves and coyotes. Each hunter spreads poisoned bait over a large track of country, and every morning rides round to take the skins; and each dead animal left to rot is in turn a bait to slay thousands of vultures, crows, ravens, hawks, and birds of all kinds, forming a carpet of their feathers for yards round each carcass. It is no wonder, then, that the hoof of the buffalo and the sharp bill of the feathered tribe disturb not the egg of the locust, as it lies near the surface of the ground, waiting for the warm, dry days to come, that it may be hatched out and fly.

The vast plains, while waiting to be used as the abode of man and his dependents, should not be deprived of their beasts and birds. Every prairie chicken and bird consumes an enormous quantity of insect eggs. The wolf and the

bear feed on the locusts before they can fly. By these agents, clouds of these plagues would be prevented from rising to strike the Western farmer with want and famine. The locust must now be consumed or abolished in some way, or he will possess the land. We must improve the means of gathering them and using them for fuel or fertilizers, and laws must be enforced which will protect the beasts and birds of the wilds. If large brilliant fires were kept burning at night in the line of their flight, they would come to the light, and, getting their wings burnt, would remain.

Chicago, Ill.

JOHN WHITEFORD.

Passage of Gas through Heated Cast Iron.

To the Editor of the Scientific American:

It is generally supposed that the products of combustion will, under some circumstances, pass through heated cast iron. My impression is that experiments, made in Paris several years ago, lead to this conclusion. I remember reading something of the kind at the time, but I have never been able to find an authorized statement of the investigations which lead to this conclusion. Can you put me in the way of finding an account of these experiments? In case you are unable to do this, will you kindly inform me what you think the facts in the case are?

J. W. PINKHAM.

Montclair, N. J.

[ANSWER.—We have heretofore published the reports of experiments to which our correspondent refers, wherein it was claimed that carbonic acid gas, resulting from the combustion of the fuel in cast iron furnaces, will pass directly through the iron plates; and the recommendation was therefore made that wrought iron should be substituted for cast iron in the manufacture of hot air furnaces, stoves, and other domestic heaters. But this conclusion we regard as erroneous, for we think that the quantity of gas that thus passes through the cast iron plates is too small to be ordinarily appreciable. In fact, Dr. Hayes, of Massachusetts, in a note published in the SCIENTIFIC AMERICAN last year, stated that that he had conducted a series of special experiments which fully confirm the above view.]

We are aware that the escape of gas from our stoves and furnaces is a subject of serious and common complaint. But the trouble is principally due to the badly fitted joints of the cast iron plates, to the improper closing of dampers (thus forcing the gas out at the joints), and also to defective draft in the chimney. It would be difficult to find any cast iron stove or heater in use that is not more or less visibly open at some of its plate or pipe joints, through which gas may, of course, freely flow out. Until some method is invented to seal these openings, the subject of the issue of gas through the pores of the plates, as a sanitary question, will be likely to remain in abeyance.—EDS.]

The Small Engine Question.

To the Editor of the Scientific American:

Some years ago I built a small engine, with a cylinder 2x5 inches, and a balance wheel of 3 feet diameter and 100 lbs. weight. The boiler is 15x36 inches and has fifty ½ inch flues. It is set horizontally, with the fire box at one end. The fire returns through the upper flues, superheating the steam. The cylinder is on top of the boiler. Fifteen gallons of water are required to charge the boiler; and when the engine is running at 50 lbs. pressure and 300 revolutions per minute, it evaporates about 2 gallons per hour. The amount of fuel is about the same as required by a good sized cook stove. It runs 12 feet of 2 inch shafting, a 6 inch circular saw and cuts 2 inch lumber well; or it runs a wood lathe to turn stuff 6 to 8 inches in diameter. The engine has been run, more or less, for ten years without repairs of any importance, and is in good order now.

Brunswick, N. J.

N. T. W.

To the Editor of the Scientific American.

I have a vertical engine, 2½ inches stroke x 2½ inches bore. The feed pump plunger is ½ inch x 2½ inches stroke. The boiler is horizontal, 24 inches x 12 diameter, with 12 flues, each 1½ inches in diameter. Boiler is set in a heavy sheet iron case, with fire box 12x14 inches; the fire passes under the boiler, back through the flues, and over the top of the boiler, and out of smoke stack. No part of the boiler is exposed to the air. The feed pipe passes into the boiler front through the fire, and delivers the water in the back end of the boiler at nearly the boiling point. I have the engine in a boat 16 feet long x 4 foot beam, turning a 14 inch wheel. It makes steam very freely; in fact I run with the door open two thirds of the time. I have run 60 miles in 9 hours with 4 men, burning 48 lbs. of coal. It is the most perfectly working engine I ever saw, large or small.

Manistee, Mich.

N. G. NEEL.

The Speed of the Mary Powell.

To the Editor of the Scientific American:

In your issue of September 5, I see you mention that the Mary Powell ran to Piermont, a distance of 28 miles, in one hour. On investigation, I fail to find your statement of the distance to Piermont confirmed. I make it about 22 miles.

New York city.

L. H. ROSSINI.

J. FRAUENBERGER, of New York city, has recently patented a composition for producing artificial corals, ivory, and similar articles, made of caseine, mixed in the proportions described, and boiled under suitable heat, with a varnish-like solution of copal in concentrated liquid ammonia and alcohol, to be colored and prepared for the various applications in the arts.

PRACTICAL MECHANISM.

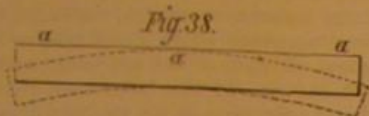
NUMBER IX.

BY JOSHUA BONE.

VICE WORK—PENING.

The operation termed pening is stretching the skin on one side of work to alter its shape, the principle of which is that, by striking metal with a hammer, the face of the metal struck stretches, and tends to force the work into a circular form, of which the part receiving the effect of the hammer is the outside circle or diameter.

Fig. 38 represents a piece of flat iron, which would, if it



were well hammered on the face, *a, a, a*, with the pene of a hammer, alter its form to that denoted by the dotted lines.

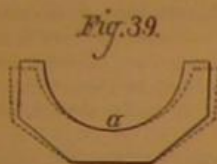
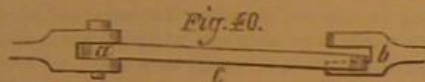


Fig. 39 represents a brass which, if struck with a hammer (along its bore at *a*) or other piece of metal for driving it in while fitting, would gradually assume the form denoted by the dotted lines.

Fig. 40 represents a rod connected at the end, *a*, with a double eye and pin, and requiring to descend true so as to fit into the double eye, *b*, at the other end; if, therefore, it is pened perpendicularly on the



face, *c*, of the rod, the stretched skin will throw the end around so that it will come fair with the eye, *b*. Connecting rod straps which are a little too wide for the rod ends may be in like manner closed so as to fit by pening the outside of the crown end, or, if too narrow, may be opened by pening the inside of the crown end; but in either case the ends of the strap alter most in consequence of their lengths, and the strap will require refitting between its jaws.

Piston rings may be made of larger diameter by pening the ring all round on the inside, and there are many other uses to which pening may be used to advantage, such as setting frames, refitting old work, taking the twist out of work, etc., but it must be borne in mind that if, after a piece of metal has been pened, a cut is taken off it, it will return to its original shape, as the effects of the pening do not extend more than $\frac{1}{8}$ of an inch in depth. When, therefore, a brass or other work requiring to be bored is driven in and out by a piece of metal or a hammer, it stretches the skin; and when the brass is bored, the stretched skin being cut away, it assumes its original shape and hence becomes slack or loose in the strap or block. A light hammer having a round pene should be used; and light blows should be employed for pening, as they are the most effective.

FITTING BRASSES TO THEIR BOXES.

The pattern for a brass which is hexagonal upon the bottom or bedding part should not be made of exactly the same shape as the hexagonal part of the box upon which it beds, because the brass, in casting, shrinks in the direction of the diameter of the bore to such an extent as seriously to alter the angles of the bottom of the brass as compared with the angles on the bottom of the pattern. To compensate for this change of form, the angles on the sides of the pattern should be made more obtuse than those on the sides of the box, as described in Fig. H, the dotted lines being the angle of the



box. The shrinkage referred to is not merely that due to the contraction of the metal in cooling, but is an alteration of form which takes place in all castings of more or less segmental circular form, especially in the case of light castings. In castings of 4 inches or less diameter,

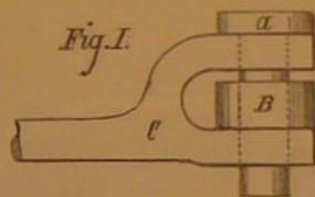
the rapping (given by the molder to the pattern to loosen it in the sand, so as to be able to extract the pattern without damaging the mold) is about equal to this alteration of form; but in larger castings an allowance must be made for it.

In fitting a brass to its box, first fit the sides of the brass to the box, keeping them at an equal angle to the joint or top face of the brass, so as to let the brass down evenly and not with one side or one bevel lower than the other. To find if the brass is level, use inside callipers as a gage, applied from the top face of the brass to the top face of the box. When the brass is let down so that it approaches the bottom of the box, rub upon the bed of the box a coating of marking; and then upon the end of each bevel, and upon the bottom and near each corner (of the bevels and bottom), place some small pellets of red lead, mixed stiffly; then when the brass is driven home upon its bed and again taken out, the pellets of red lead will adhere to the box because of the marking, and (by their respective thicknesses) denote how nearly the angles or bevels of the brass fit to the box; because where the brass touches the bed of the box, the pellets will be smashed; but if the pellets are intact, it demonstrates that there is space between the box and the brass. It is obvious that the brass requires chipping in those places where the pellets are crushed, and in proportion to the thickness of the pellets that are the least crushed. The pellets should be removed and replaced each time before driving the brass home, and

removed when they appear of even thicknesses, the fitting being completed with marking only. All brasses must be fitted to their boxes more tightly than they are intended, when finished, to be, because they go in from the process of boring and are consequently an easier fit after than before being bored.

FITTING LINK MOTIONS.

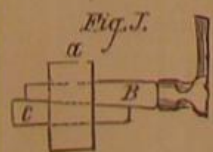
The planing and boring of the link, of the die, and of the eccentric rod double eyes being completed, the faces of the links may be filed up to a surface plate. The slot of the link should then be filed out to a gage of sheet iron of the proper sweep, the sides of the slot being kept square at all parts with the face of the link: each end of the slot at the termination of the stroke of the die should be eased off a little, so that, when the link and the die are hardened, the latter will not bind hard in the ends of the former, as would otherwise inevitably be the case. The die may then be fitted, to a rather tight fit, to the slot of the link, putting a very light coat of marking upon either or both of them, which will serve as a lubricant to prevent them from cutting, and will show the high spots upon both the link and the die, which spots must be eased off until the die fits to a working fit, providing the link and die are not intended to be hardened. If, however, they are to be hardened, the die must be made of a somewhat easier fit to allow for the expansion of the metal, which takes place in hardening. To fit the double eyes (that is, the eccentric rod ends) upon the link (or quadrant), a bolt and washer should be provided, the pin being a fit to the hole in the eye and to the hole in the washer, the head of the pin and the washer being the finished diameter of the outside of the eye. The end of the pin is passed through one side of the eye, then through the washer, and



then through the other side of the eye, as illustrated in Fig. I, *a* being the pin, *B*, the washer, and *C*, the double eye.

The underneath faces of the pin and washer will, if revolved by hand, mark the two faces (against which they bear) true with the hole of the double eye; and when those faces are finished, the pin may be turned end for end, and the other two faces trued in the same manner. The object of making the head of the pin and the washer of the same diameter as the double eye is that they may be used as gages to which to file up the outside of the double eye, for which purpose they should be hardened so that the file will not cut them. The double eyes being filed to fit the link, the washer (having been used, as above described, as a gage to keep the faces true to the hole) must then be clamped to the link, care being taken to make the hole of the link as true as possible with the hole of the double eye, and to slacken the bolt of the clamp if the double eye requires moving to come fair with the hole in the link. If the clamp were not slacked, striking the double eye to move it would probably spring one jaw out of true with the other. A hand reamer may be passed through the double eye, taking out a light cut, and thus making the holes through the link and double eye parallel and quite true with each other.

If, after the link has been hardened, the die is of too tight a fit, place oil and fine emery in the slot, put the die in its place and (with a piece of wood, through the hole of the die) force it back and forth from end to end of the slot, or in such parts only as it may be too tight; this will grind out the tight places. If the link is tight at the extreme ends, as is sometimes the case, a piece of flat copper shaped and used as a file may be used with grain emery and oil to grind out such ends. If, however, the link has altered so much as to make the grinding a long and tedious operation, it may be opened by placing a bolt and nut in such a position in the slot that the head of the bolt will rest against one side and the end face of the nut against the other side of the slot; the head of the bolt should then be held stationary with a wrench or spanner, and the nut, being unscrewed, will force open the link. Another method is to take two keys, such as connecting rod keys, both having an equal amount of taper on them and place them in the slot of the link as here shown,



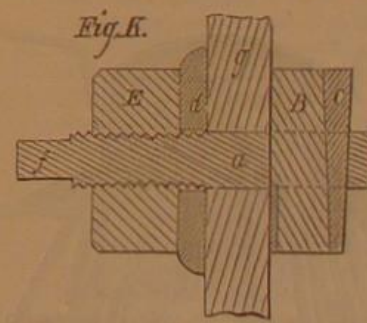
a being an end view of the link, and *B* and *C* the keys referred to. The operation is to place a hammer against the head of one key, as here shown, to prevent it from driving out of the link, and to drive in the other key. The advantage of this method over the screw and nut is this: The link will spring considerably before it will alter its form, so that, when applying the bolt and nut, it is difficult, in the second operation (providing the first has not effected the desired opening of the link), to find exactly how much to unscrew the nut. In using the keys, however, lines may be drawn across the keys to denote exactly how far they were driven in during the first operation, which lines will guide the judgment as to how far to drive them in the second operation. If a link opens, that is, if the slot becomes wider during the process of hardening, it may be closed by clamping, or even by a strong vice.

FITTING CYLINDERS.

A casual cylinder or pair of cylinders (there being no templates for marking the holes, etc.) should be fitted up as follows: If that part of the cylinder cover which fits into the

cylinder has a portion cut away to give room for the steam to enter (as is usually the case), mark a line across the inside flange of the cover, parallel to the part cut away, and then scribe each end of the line across the edge of the flange. Then mark a similar line across the cylinder end, parallel to the steam port where it enters the cylinder, and scribe each end of this line across the cylinder flange, so that, when the cylinder cover is placed into the cylinder and the lines on the flanges of the cylinder and the cover are placed parallel to each other, the piece cut away on the cover will stand exactly opposite to the steam port, as it is intended to do. The cover may then be clamped to the cylinder, and holes of the requisite size for the tap (the tapping holes, as they are commonly called) may be drilled through the cover and the requisite depth into the cylinder at the same time. Concerning the correct size of a tapping hole in cast iron, as compared to the tap, there is much difference of opinion and practice. On the one hand, it is claimed that the size of the tapping hole should be such as to permit of a full thread when it is tapped; on the other hand, it is claimed that two thirds or even one half of a full thread is all that is necessary in holes in cast iron, because such a thread is, it is claimed, equally as strong as a full one, and much easier to tap. In cases where it is not necessary for the thread to be steamtight, and where the depth of the thread is greater by at least $\frac{1}{4}$ inch than the diameter of the bolt or stud, three quarters of a full thread is all that is necessary, and can be tapped with much less labor than would be the case if the hole were small enough to admit of a full thread, partly because of the diminished duty performed by the tap, and partly because the oil (which should always be freely supplied to a tap) obtains so much more free access to the cutting edges of the tap. If a long tap is employed to cut a three quarter full thread, it may be wound continuously down the hole, without requiring to be turned backwards at every revolution or so of the tap, to free it from the tap cuttings or shavings, as would be necessary in case a full thread were being cut. The saving of time in consequence of this advantage is equal to at least 50 per cent in favor of the three quarter full thread.

The cylinder covers must, after being drilled, as above, be taken from the cylinder, and the clearing drill put through the holes already drilled so that they will admit the bolts or studs, the clearing holes being made $\frac{1}{16}$ inch larger than the diameter of the bolts or studs. The steam chest may be either clamped to the cylinder, and tapping holes drilled through it and the cylinder (the same as done in the case of the covers), or it may have its clearing holes drilled in it while so clamped, care being taken to let the point of the drill enter deep enough to pass completely through the steam chest, and into the cylinder deep enough to cut or drill a countersink nearly or quite equal to the diameter of the drill. If, however, the steam chest is already drilled, it may be set upon the cylinder, and the holes marked on the cylinder face by a scriber or by the end of a piece of wood or of a bolt, which end may be made either conical or flat for the purpose, marking being placed upon it; so that, by putting it through the hole of the chest, permitting it to rest upon the cylinder face (which may be chalked so as to show the marks plainly), and then revolving it with the hand, it will mark the cylinder face. This plan is generally resorted to when the holes in the chest are too deep to permit of being scribed. To true the back face, round a hole against which face the bolt head or the face of the nut may bed, (in cases where such facing cannot be done by a pin countersink or a cutter used in a machine), the appliance here



shown may be employed, *a* being a pin provided with a slot at one end to admit the cutter, *B*, which is held fast by the key, *C*, and is also provided with a square end, *f*, by which it may be turned or revolved by means of a wrench, and with a thread to receive the nut, *E*, *d* being a washer; so that, by screwing up the nut, *E*, the cutting edges of the cutter are forced against the cylinder, *g*, and will, when revolved, cut the face, against which they are forced, true with the hole in the cylinder through which the pin, *a*, is passed.

RICH beds of magnetic ore have been developed in the southwestern portion of Bethlehem Township, Hunterdon County, N. J. The ore is of uniform and excellent quality, containing as impurities manganese, alumina, silica, and lime, being free from sulphur and phosphorus. It is well adapted for making Bessemer steel, and is used by the Bethlehem Iron Company, and the Pennsylvania Steel Works at Harrisburg.

LEAD POISONING.—MM. G. Bergeron and L. L'Hôte state that twenty-six persons in the department Seine-et-Marne were attacked with symptoms which were at first ascribed to bilious typhoid fever, but were subsequently traced to lead poisoning. The lead was found in the brine used for salting butter, where it was present as chloride. Two of the cases proved fatal. A notable quantity of lead was found in the intestines, the liver, and the brain of the dead.

Contributions to the Early History of Steam Navigation.

On the 9th of February, 1811, letters patent of the United States, No. 25, were granted to Robert Fulton of New York, for "constructing boats or vessels which are to be navigated by the power of steam engines." The State department at Washington has had occasion recently to make searches among its archives for records pertaining to the early patents, and among the curiosities thus brought to light is a letter from Robert Fulton, bearing date of New York, May 25, 1812, in which he requests Mr. Monroe, then Secretary of State, to give a positive order that his patents for steam boats should not be copied or examined except in case of disputes in law between him and other persons, of which, he says, there were none at the time; and intimates that the doing so enables speculators to contrive, not real improvements, but means of evasion, to the ruin of useful inventions.

Two letters of Henry Spencer have also been found, one bearing date of Albany, August 3, 1798, and the other of Albany, September 3, 1798, both accompanied by drawings and written descriptions of an invention, which he claims to have made, on boats made use of in inland lock navigation, and which may be applicable, he says, to the navigation of the great seas, and of a screw and other means of propulsion to such boats.

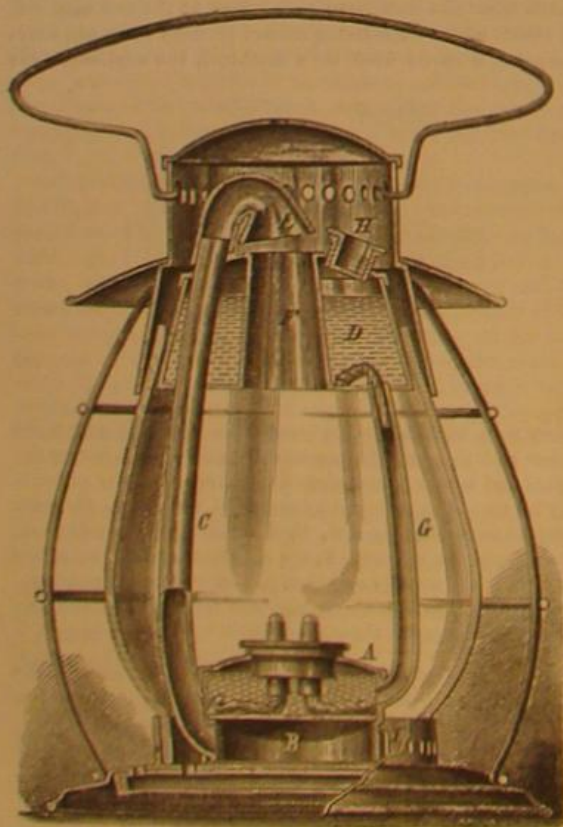
Measurement of the Chemical Action of Solar Light.

Dr. T. L. Phipson, F. C. S., in a note to the *Chemical News*, says: Many years ago I made some experiments on this subject in Paris, and described a method which I believe capable of giving more accurate results than any hitherto obtained. Having discovered that a colorless solution of molybdate of ammonia in sulphuric acid became greenish blue when exposed to the sun, and colorless again during the night, and that the amount of chemical action exerted to produce this tint may be accurately determined by a dilute solution of permanganate of potash, it suffices to operate always upon the same quantity of substance, and to expose it to the light for the same period of time, and in every respect in the same conditions, in order to possess a perfectly accurate process by means of which the problem of the chemical intensity of solar light may some day be solved in a completely satisfactory manner.

LORDON'S IMPROVED LANTERN.

The lantern herewith illustrated is constructed so that the heated air from the flame passed up through an oil reservoir, and thence is conducted down below the wick chamber, the object being to heat the oil in the latter, and thus afford a clearer and brighter light.

The wick chamber is represented at A, below which is another compartment, B, from which extends the tube, C, upward inside the glass globe, through the oil reservoir, D, and finally terminates in a funnel, E, over the pipe, F, through which the hot air from the flame rises. Oil is supplied to the wick chamber by the tube, G, in the upper portion of which is a piece of wick which may be adjusted from the filling orifice, H, to allow the oil to flow to the wick chamber faster or slower, as may be desired. It will be observed that the tube, C, conducts the hot air down under the wick chamber, thus warming the oil in the latter. At the



base of the lantern is a series of holes connecting with the hollow space, I, for purposes of ventilation.

Patented through the Scientific American Patent Agency, July 14, 1874. For further particulars address Daniel Lordon, Fremont Center, Mich.

THE recent eruption of Mount Etna was predicted by Professor Silvestri, who has made a special study of such phenomena.

THE FIRE ON THE HEARTH.

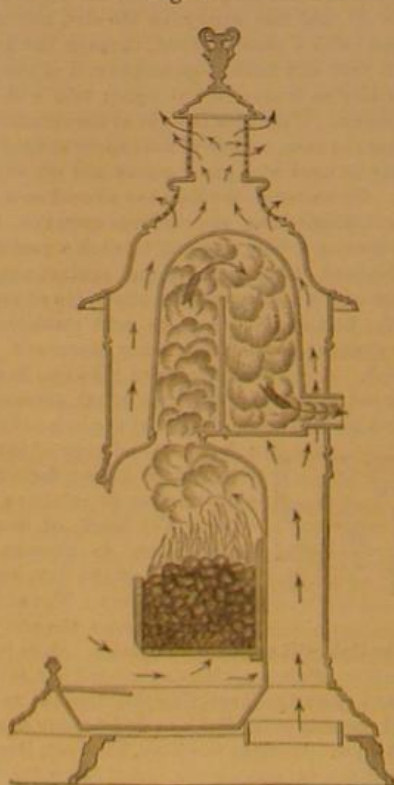
While it has been and still is our general rule to decline the publication of engravings of stoves in our editorial columns, we believe it to be to the interest of our readers that our regulation in the present instance should be suspended. We make this exception on account of both the

Fig. 1.



novelty and the unquestionable merit of the heating apparatus to which the above appropriate name has been given. As regards the mechanical construction of the stove, little need be said, since it is plainly represented in the sectional view, Fig. 2, while the exterior appearance is shown in Fig.

Fig. 2.



1. There is a large drum above the fire, surrounded by a jacket so arranged that a constant supply of fresh air may be continuously brought into contact with greatly expanded surfaces, which absorb the maximum quantity of heat, and impart it rapidly to the inflowing currents, thus preventing overheating, and at the same time supplying the room with an abundant, genial, and invigorating atmosphere. It will be observed from the sectional engraving that two distinct currents pass through the stove. One enters beneath

the grate, ascends to the chamber above, passes over the diaphragm therein, and thence goes to the chimney, furnishing the draft. The other enters under the stove, and becomes heated by contact with the hot surfaces; and rises through the jacket, thus compelling a constant circulation through the latter. The fire is entirely open, so that a large supply of additional heat is radiated therefrom. The construction, evidently, is such that there is no opportunity for leakage of the deadly carbonic acid; nor is there any contact of highly heated plates with the air of the room to generate carbonic oxide. Purity of the air—which is the most important requirement—being thus insured, the maintenance of proper circulation is provided for, as already described, so that the stove becomes an efficient ventilator, constantly changing the atmosphere, while distributing at the same time, throughout all parts of the apartment, a moderately warmed, fresh current. In this last respect its advantage over the ordinary open grate in the mantel will be obvious, not only in point of better utilization of the fuel and consequent economy in the same, but in the fact that the old objection to grates, of "roasting the face while the back is freezing," is effectually done away with.

In addition to the advantages which we have enumerated are those of simplicity, there being no intricate flues to become clogged and foul, no dampers to get out of order, and no grate set far into the interior, to dump or clean which is a constant aggravation. The latter is easily shaken, and clinkers readily removed.

It will not require the complimentary testimonials, which the manufacturers submit, from Mr. Lewis W. Leeds (than whom no engineer has more carefully studied the subject of ventilation and warming) and other excellent authorities to demonstrate the value of the invention. It will be a veritable blessing in schools, churches, factories, and all similar apartments where large numbers of people are confined, for lengthy periods of time, for study or work.

Patented by Mr. W. L. Phillips, July 13, 1874. For further particulars, address the Open Stove Ventilating Company, 107 Fulton street, New York city.

Detection of Fuchsin Adulterations.

It has become quite common for French wine merchants and confectioners to use fuchsin to lighten the color of their wares. The poisonous properties of this substance have been repeatedly demonstrated, so that, in addition to its being a mere adulteration, its consumption in other substances is directly detrimental to health.

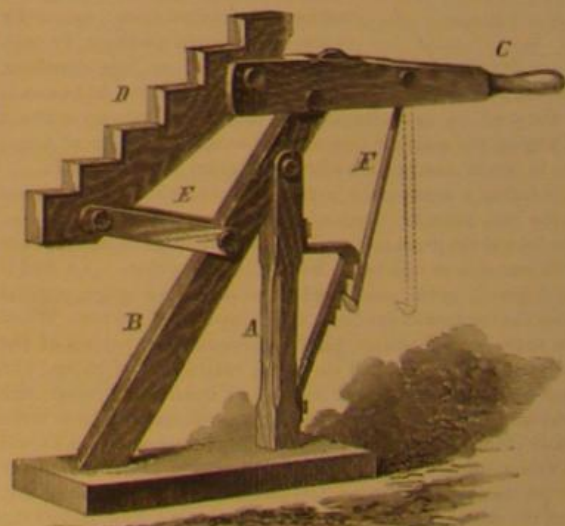
The presence of the substance can be readily recognized in the following manner: Place about 1½ ounces of the suspected compound in a vial, and treat first with 150 grains of subacetate of lead, and then with 300 grains of amyl alcohol. If, after agitating the mixture, the alcohol which separates appears colorless, no fuchsin is present; if the alcohol is colored red, the reverse is the case.

ROWLAND'S WAGON JACK.

The annexed engraving represents a simple and inexpensive form of wagon or lifting jack, which is applicable to all kinds of vehicles.

The upright standard, A, supports an inclined bar, B, both being secured to a substantial base piece. To the upper extremity of the bar, B, is pivoted the lever, C, the forward end of which is similarly attached to the notched bar, D. The lower portion of the latter connects with the bar by means of the pivoted connecting bars, E. To the lever, C, is pivoted the rod, F, the lower end of which is hook-shaped, to engage in the teeth of the bent ratchet bar, shown attached to the rear side of the standard, A.

In using the jack, the free end of the lever, C, is raised and the machine is moved forward until the axle of the wagon rests in one of the notches of bar, D. The lever is then carried down until the load is raised to the desired height. The hook, F, is next swung forward from the position indicated by the dotted lines in the engraving, and caused to engage upon one of the teeth of the ratchet bar, thus holding the load



suspended. By slightly pressing down the lever, C, the hook readily drops away from the ratchet, thus lowering the axle or other object supported.

Patented through the Scientific American Patent Agency, June 16, 1874. For further particulars regarding purchase of State and county rights, address (during next two months) the inventor, Mr. James S. Rowland, Cambridge, Ohio.

IMPROVED BRICK-PRESSING MACHINE.

We publish herewith an illustration of this machine, by which its construction will be at once understood. The bricks to be compressed, in order to give them a greater density than they acquire in production, are allowed to harden in the air for a few days before being pressed. The machine consists of a sliding block moved to and fro by a connecting rod driven by gearing from the pulley, as shown, and of a revolving barrel containing four chambers, in each of which is fitted a sliding die containing the marks to be stamped upon the brick. The front of the sliding block is also furnished with a stamper. On the top of the machine is a plunger fitting the recesses in the barrel, and moving up and down intermittently by means of the cam shown in the sketch, which is connected to the plunger by means of the four bars shown bolted to the crosshead of the plunger. The action of the machine is very simple. A brick is laid on edge upon a table between the front of the sliding block and the barrel. The sliding block advances and pushes the brick from the table into the recess in the barrel, which is immediately opposite, compresses it, and then retires, leaving the table clear for another brick to be laid on. Meantime the barrel has advanced a quarter of a revolution, carrying the pressed brick with it until it arrives opposite the plunger before mentioned, and this, descending, forces out the brick, which drops upon the endless traveling band beneath, and is carried forward to the taker off. In this way, says *Engineering*, to which we are indebted for the engravings, 10,000 bricks per day can be pressed.

The machine was exhibited by Messrs. John Whitehead & Co., of Preston, England, at the recent show of the Royal Agricultural Society at Bedford.

NOVEL ENGINE AND BOILER.

The neat little engine which we illustrate herewith requires scarcely any description to make its construction intelligible. The boiler is fitted with internal vertical tubes arranged in groups of three, secured at each end in malleable cast iron caps, and fixed to the fire box by nuts and bolts. The boiler is covered outside by a sheet iron smoke box, so that lagging is not required, and through this casing all the pipes are led.

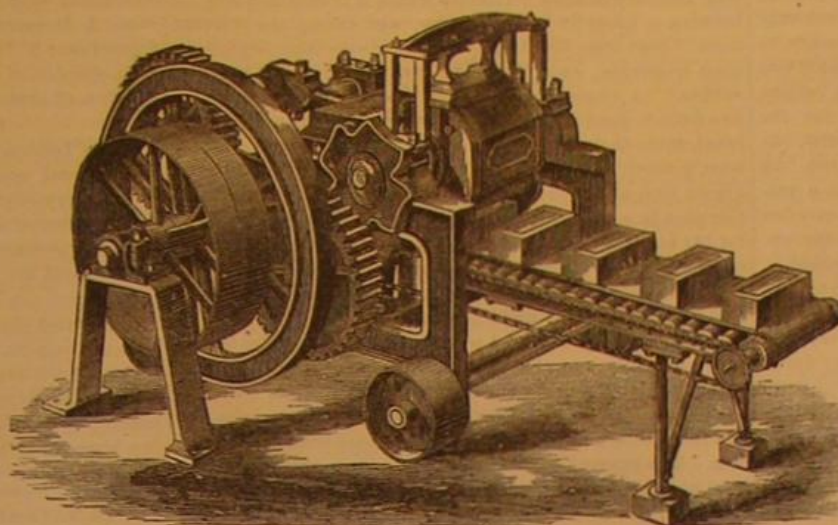
The engine, it will be seen, is bolted directly on to the boiler. This is the first instance (says *The Engineer*, from which we extract the engraving), perhaps, in which a horizontal engine has been secured directly to the boiler and not to the base plate; and the arrangement has a good deal to recommend it for small powers, as the amount of space occupied is reduced to a minimum, as is the quantity of material used; and the cost is, of course, diminished accordingly.

Ways to Success.

Over fifty years ago, a youth, working on a farm, asked his father to give him money enough to buy a gun. The old man could not spare it, but the boy, nothing daunted, found an old piece of iron about the place, and in the course of time contrived to make a gun barrel out of it, with the very meager facilities afforded by a country blacksmith's shop. He had not the materials to make a lack and stock, so he walked to the nearest town and traded for the necessary attachments, and was encouraged by the smith for having made so good a shooter: this gave him the ambition to make another, so he went to cutting out grindstones from the native rock to raise the money for gun materials; in a short time there was a considerable demand for guns of his make. During the French war with Prussia, he was called upon to furnish guns for the army, and in less than eight months he made and delivered to the government of France rifles of a particular pattern, costing five millions of dollars, which amount was duly paid. The same man furnishes rifles now for the United States, South America, Rome, Spain, Egypt, and Japan. The farmer's boy who wanted a gun is Eliphalet Remington, of Ilion, N. Y. His manufactory covers four acres of ground, and he employs twelve hundred men. Not satisfied with this achievement, he has recently completed a sewing machine, which is reported to represent the latest and most perfect advance in the improvements of this important adjunct of domestic economy. This is the type of a boy who, when there is not a way, makes a way for himself.

Many a youth would have sat down and pouted, thinking over what a hard thing it was that he could not get a gun, with hard thoughts against the father for being so stingy. Not so with young Remington; he wanted a gun and was determined to have it; the very necessities of

his situation stimulated him to the exercise and consequent development of his powers of planning and devising; in other words, of thinking for himself. And such are they, the world over, who achieve noted success. Those who think for themselves plan for themselves, and upon themselves lean. So it was with Fitch, and Goodyear, and Howe. Their early history was the history of a struggle with privation, and want, and litigation, and almost despair; and the immortal Morse must be added to the list, owing all to their



WHITEHEAD'S BRICK PRESS.

patience, and courage, and indomitable persistence. If young Remington had been supplied with a gun he would have "gone a-gunning," and fallen gradually into a kind of idle, loafing, aimless life, a burden to himself and a benefit to nobody. The very necessity of effort has been the making of many; while many more, who have had their wants gratified with the asking, have sunk into insignificance, and their name and memory have long since perished from the earth.

Some have been heard to express a wonder that the human family should be permitted by Infinite Benevolence to strug-

Printing without a Press.

A photo-carbon print on glass is first obtained in the usual way, says the *Bulletin Belge*, which is then varnished with rather weak gum dammar varnish made with pure benzine. The print should be surrounded then with an edging of mastic varnish, and in the meantime the following solution prepared by the help of the sand bath:—Gelatin, 1 part; gum arabic, 1 part; glycerin, 2 parts; with the least possible quantity of water. This mixture is poured warm on to the carbon print after slightly heating it to prevent the glass from cracking. It should form a thick coating on the top of the image, and when sufficiently congealed the whole is detached from the glass. The mass of gelatin forming the bed of the separated print, as it were, is then placed upon any plane surface at hand, and the image is ready for being printed from. The usual law governing the action of the gelatin matrix causes the ink applied to its surface to adhere where the insoluble gelatin has retained the pigments, and to be repelled where the soluble gelatin still retains its moisture-absorbing properties.

When wishing to print from this image, ordinary lithographer's ink, slightly thick, is taken and thinned with some oil or oil of turpentine, indeed, with any oil except boiled oil. A ground glass large roller is the best to ink with, the ordinary printer's roller producing a stickiness that causes adhesion to the surface of the image and tends to tear it. The roller is covered with ink in the usual way, namely, by working it over an elastic surface, such as a bed of gelatin would be, until the ink is distributed with perfect uniformity. In almost the same manner it is applied to the image until it is sufficiently inked. If over-inked, the surplusage may be removed by a moist rag.

If the ink used be too thick, it will adhere only to the deep shadows, and must be thinned if half tones are to be included. This peculiarity may be utilized either in order to give a greater depth to the shadows of a picture or to obtain prints in different tints at the same time from the same plate. In the former case rollers with inks of different consistence are used, and in the latter rollers covered with different colored inks, also of different viscosity. The plate is inked first with the thickest of these, and so on, the thinner ink refusing to overlay those first applied, and which adhere to the deeper shadows, and only filling in what they leave out. Pictures on a colored ground can thus be easily produced.

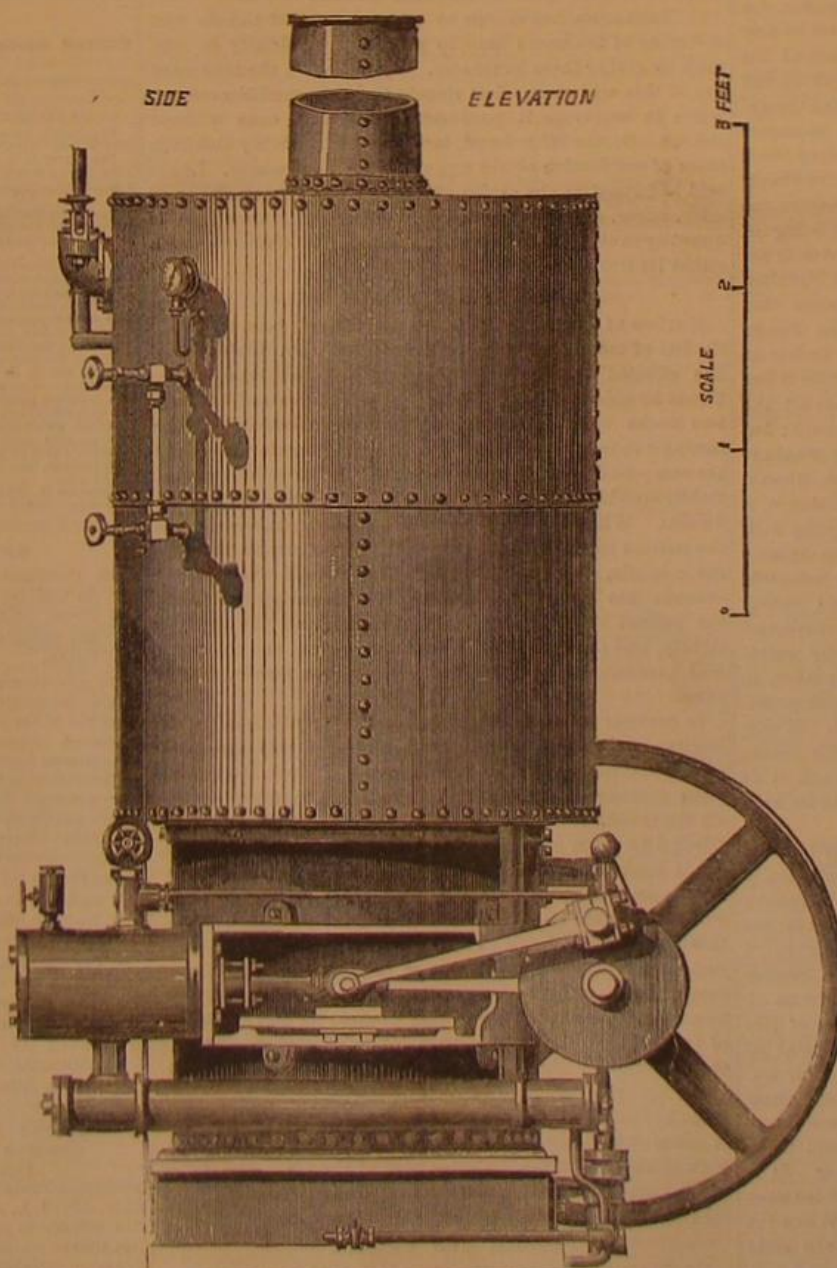
The printing is very simply done. A smooth surfaced paper, either glazed or coated with non coagulated albumen, is laid on the plate and pressed down on to it, either by means of an india rubber scraper or a roller covered with flannel. The impression thus taken is carefully removed, and the printing proceeded with in the same fashion as described, only that the plate must be moistened between each impression.

The negative used should be one on which the image has been obtained through the glass in the camera; and if such a plate be not at hand, the carbon print forming the matrix should be taken on steatite paper. This paper is made by placing a sheet of ordinary albumenized paper on a bath composed as follows:—Ordinary alcohol, 3½ ounces; stearin, 3½ drachms; common resin, ½ drachm. Dissolve the stearin in warm alcohol, and add the resin afterwards. A print developed upon this support is then re-transferred to the glass coated with gum dammar varnish.

The facility with which curved surfaces can be printed upon in this way makes it an admirable plan for printing upon vases, etc., with vitrifiable colors; and it is, in fact, a handy plan, if not for commercial photographic printing, at least for trying all kinds of experiments, and one by which amateurs might amuse themselves without much difficulty and at small cost.

Modern Cast Iron.

The *Philadelphia Trade Journal*, in an editorial on improvement in cast metals, recapitulates the advantages gained by the modern scientific manipulation of cast iron, in a concise and forcible manner. In the past 40 years the gross weight of our cast iron articles has been diminished fully one half. Half a century ago the iron frame of a Washington printing press weighed nearly 1,000 pounds; and although it was an arch of metal 9 inches wide by 3 inches thick, so poor was its quality that it was often broken by the pull of one pressman's arm. Our present smooth light castings show an actual elasticity under strain which approaches the service of wrought iron, allowing a large reduction in weight of metal and in the consequent expense.



HILL AND MASSEY'S THREE HORSE ENGINE AND BOILER.

gle against poverty and want. But as the human mind is constituted, it is better to struggle than to idle, better to work than to wait; better to lean on one's self than on another. It is the men who, as boys, struggled for a foothold in the world, who now wield the world's destinies, and do the most to mold its history.—*Hall's Journal of Health*.

("Old and New.")
DENTISTRY IN THE UNITED STATES.

NUMBER 2.

MOUNTING OF ARTIFICIAL TEETH.

The material used for the bases, or plates, upon which the teeth are attached, are various. The best is gold, after which follow silver, aluminum, continuous gum, and dental vulcanite. The iridio-platinum, whalebone gum, and several other bases, being entirely new, no decided opinion can be given upon them. Gold being the most expensive, not only in intrinsic value, but in the amount of labor necessary to make it up into plates, is not now as generally used as it was before the invention of the dental vulcanite base. A patient having a set of teeth made on gold pays not only for the amount, or weight, of metal received from the dentist, but usually, also, for all that the operator purchases from the dealer. When purchased from the shops, it is cut to a pattern which is made from the wax impression; but after being "struck up," that is, shaped to correspond to the upper or lower jaw, there is a great deal of filing, scraping, and finishing to be done, all of which takes from the weight of metal. Though the patient pays for these scraps, they are never demanded of the dentist; but he takes good care they are not lost. His finishing is done over a leather apron or "jeweller's drawer"; and, as a second "catchall," he has a piece of carpet under his bench. I have frequently imitated the pedler in "Aladdin" by exchanging, not "new lamps for old," but new carpets for old, giving a trifle in addition, much to the satisfaction of the dentist, and more to my own, as I have in one year cleared sixty-five dollars for the trouble of burning the old carpets in crucibles. This amount, of course, is very small compared with what the dentist saves in his apron. The first cost to the operator for gold enough to make an ordinary sized upper plate is about twenty-five dollars; and if the patient should try to sell this same plate after using it only once, or even after it has been "struck up" before using, it would only yield about twelve dollars in currency, which is the difference in weight and price in buying and selling.

Aluminum, the lightest in specific gravity of all the metals, is very seldom used, on account of the inability of the best mechanic to make a perfect fit with it, as the metal will shrink in the casting; and the slightest imperfection in a plate ruins it for service. Experimentally (that is, in making general models, or the like), this metal will answer for base plates; but practically (that is, in fitting a cast to any particular mouth), it is a failure. The manufacture of the continuous gum work is rather a hazardous undertaking, and requires a great outlay for furnace and tools, besides the apprenticeship, which is indispensable for becoming an expert in its manufacture; which facts have been a stumbling block in the way of its general use. Nor is this the only drawback. As its name indicates, in this work the plate which covers the mouth and the teeth is in one continuous piece, all being of the same kind of body; the various colors and enamels necessary to a natural appearance being applied to the biscuit set, after which it is fused. It is during this process that the operator has his "heart in his mouth"; for he knows not whether even one out of the three sets which he has in his muffle will, when cool, fit the mouth for which it has been formed. When successfully made, the set has all the appearance of the natural gum and roof of the mouth; but the patient has in his mouth quite as much as he wants to carry, for the set is a trifle heavier than one on gold. Should it by accident drop, and strike upon a hard substance, it would be useless to pick it up, as nothing can be done with the pieces. Some operators can repair a set when merely cracked; but even when this is done in the most scientific manner, the repairing will show; and the second fusing which it gets in repairing is liable to warp it out of shape, and beyond redemption. For these reasons it is mostly ostracized by the profession. Silver requires as much labor, to swedge, solder, and finish, as gold, without as much profit, or as satisfactory results, as from the use of gold. It corrodes, and produces sores in the mouth if constantly worn; so that it does not answer for permanent sets, though it is frequently used for temporary ones, where gold is to be used for the permanent sets.

The dental vulcanite, or, as it is more commonly termed, "rubber," has for the past few years been almost universally used, and is every day gaining a firmer foothold in the mouth (so to speak) of our people, as well as abroad. This is not from its real merits, but from the dentists' pushing it. I have seen the time when dentists considered it a greater honor to save a natural tooth than to successfully extract it, and replace with an artificial one; but the influence of this "mercurialized gum" has been adverse to the point of honor, and too many of them look only to profit. This material, when purchased from the shops, is in sheets about three inches wide, five inches long, and three sixteenths of an inch thick. It is sold by the pound, each sheet being sufficiently large for one plate and part of another. It is very pliable, and, if slightly heated, can be pressed between plaster molds, and forced into the finest crevices. When the teeth have been placed in the base thus molded, the mold containing the gum and teeth in position is placed in a copper boiler made for the purpose, called a vulcanizer, heated to 320° F., and kept at that point more than an hour and a half; then it is taken out, and the plaster removed. The "gum," now vulcanized, has the appearance of a piece of Virginia pine bark, and can be cut, filed, and fitted to the mouth and cheeks, as easily as a piece of such bark, the difference being that the "plate," as it is termed after the above process, is susceptible of a high polish. As previously stated, this material is not pushed by the dentists on its

merits, but on account of the profit derived from making it up. That this composition is deleterious to the health of those wearing it, there can be no doubt, as many can testify who have tried it. I know two patients who have been unable to wear sets made upon rubber, but who have worn gold with comfort. The rubber plate salivated them, beside "parabolizing" the roof of the mouth. When rubber was first introduced, there was a great deal of controversy among dentists about it. As a class, they condemned it, because there was mercury in it—a statement which it is easy to prove by burning a piece in a spirit lamp, and seeing the "liquid metal" ooze from the mass. But suddenly their objections were overcome; and now they say "there is nothing like rubber." A single set, for which the patient pays twenty-five dollars, does not cost the operator, exclusive of rent and labor, more than six dollars, which pays for teeth, rubber, wax, plaster, varnish, tin, and wear of tools. As it is well known that an active mechanical dentist can make a set on this plan in a short working day, it gives him a good price for his knowledge and labor. I know four cases made by different practitioners, the time of making which varied from five to five and a half hours, from the taking of the impression until the patient was pronounced "fitted."

In kind and quantity of material used for plates in the different sections of the country, there is but a slight difference, the Eastern using about four fifths vulcanite base, the remaining fifth being divided among the other materials, and the Western and Southern holding about the same proportion. The amount of waste in base plates varies with the kind of material used. Rejected gold or silver plates can be remelted, and used over. The continuous gum is made on a platinum plate, which can be used again by re-rolling; but for the vulcanite there is no redemption. A plate rejected is a dead loss. The teeth may possibly be removed by patiently sawing and cutting the vulcanite away from the pins; but this usually costs more than the teeth are worth, and is seldom attempted. The inability of the operator to adapt the plate made for one mouth to another compels him to require a cash deposit, sufficient to cover all expenses, from the patient who orders the set; and by the amount required as a deposit, the patient can generally judge of the cash cost of the set.

MEDICAL NOTES.

Rickets and Softening of the Bones.

C. Heitzmann has shown by experiment that rickets and softening of the bones may be produced artificially in animals by giving them lactic acid. In carnivora, the continued use of this acid causes first rickets and then *mollities ossium*, while in herbivora it produces *mollities* at once without rickets. On the other hand, lactic acid is probably absent in cases of ossification of old age and of some diseases. Lactic acid is formed by the action of nitrogenous food on sugar of milk, sugar, and perhaps starch. It exists in considerable quantity in the juice of muscle, and must be connected with either its formation or action.

Inhaling Sal Ammoniac.

Muriate of ammonia, in vapor, has latterly been added to the list of medicines taken by inhalation. Dr. Liebermann has effected several surprising cures of clergymen's sore throat by this method. The cures were obtained in from two weeks to six months, with four inhalations daily, each lasting five to ten minutes. The clergymen under treatment are compelled to avoid alcoholic drinks, tobacco, and spices. Public speakers and singers were likewise cured of the affliction. When the disease extends to the nasal membrane, the patient should pass the vapor from the mouth through the nostrils, as some do tobacco smoke. If the malady extends into the Eustachian tube (often causing deafness), the patient should close the mouth and hold the nostrils tightly, and then blow as if to blow the nose, and the vapor will pass into the tubes. Deafness is either ameliorated or cured.

In nervous asthma, with no pulmonary emphysema or dilatation of the heart, two cases were permanently cured out of six, and the others had the intervals between the paroxysms prolonged. In bronchitis, the inhalations were taken six times daily. In twenty-two chronic cases, the cure was effected in from seventeen to thirty-eight days. In twenty-six cases associated with pulmonary emphysema, the secretion and cough were greatly benefited, and the cure was effected in from six weeks to two months; the emphysema, however, remained. In twelve cases of pertussis, the paroxysms of cough were much relieved in seven, and the disease cured in from three to five weeks; in the others there was no result. This vapor gives rise to more or less irritation of the mucous membrane, with loss and renewal of the epithelium, and local hypersecretion. Such temporary aggravation of symptoms is soon followed by relief. The pulse is increased, a sense of heat and moisture of the skin is often felt, and there is sometimes profuse perspiration, with increase of urine, improvement of the voice, and relief of the cough and tickling sensations. In severe cases, general treatment should accompany the inhalation.

Croton and Chloral.

Dr. Oscar Liebreich, in the *British Medical Journal*, makes some important observations on the use of this new anesthetic. He says it differs from chloral widely in some of its effects. A drachm of croton chloral, dissolved in water and swallowed, produces in fifteen to twenty minutes a deep sleep, with anesthesia of the head. He has experimented on maniacs during an attack of mania. They remained sitting on their chairs in a deep sleep for two hours together. If anesthesia had reached so high a degree through the use of hydrate of chloral, the patients would have dropped from

their chairs, and their pulses and respirations would have been considerably retarded. In some cases of *tic douloureux*, the remarkable phenomenon is exhibited of pain ceasing before sleep sets in. But the remedy only acts as a palliative in this dreadful disease. However, its action is to be preferred to that of morphia. He has never observed any unfavorable effects of croton chloral on the stomach or any other organ in frequent experiments. The indications for the use of this remedy are to be found: 1. In cases where hydrate of chloral is inapplicable on account of heart disease; 2. In cases of neuralgia in the region of the *nerve trigeminus*; 3. In cases where very large doses of chloral are necessary to produce sleep. He there recommends the addition of croton chloral to hydrate of chloral.

Prurigo and Pruritus.

In the *London Medical Record*, Dr. Rothmund states that the internal administration of carbolic acid in pruritus excels every other method. He has tried also the hypodermic injection of it with marked success, there being no local irritation produced, as one would expect. Solutions of pure carbolic acid are better than those of carbolate of soda.

A Cure for Hydrophobia.

It is stated that this most dreadful and most incurable of diseases finds its antidote in a plant, or rather tree. An infusion of the stems of *notoria grandiflora* has been successfully employed in the East Indies, especially in the neighborhood of Bombay. Major Wheeler cites five cases of mad dog bites cured by this infusion; the sixth would not use it and died. This is from the *Archiv. der Pharmacie*.

KITE NAVIGATION.—Mr. John T. Lacey, of Bridgeport, Conn., has recently made a voyage of twenty-two miles on Long Island Sound, in the space of three and a quarter hours, in a row boat towed by a kite. The boat was twelve feet long and the kite ten feet high by eight feet wide. About six hundred feet of cord was let out. The speed of the boat is stated to have been considerably greater than that of a small sailing craft which attempted a race. This was probably due to the greater velocity of the wind at the elevated position of the kite. The towing of boats by kites is a very old amusement, but it is a slow method of navigation. The boat and kite can only travel in one direction, directly before the wind; whereas the ordinary sail boat can move obliquely, in various directions.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT CORSETS.—MORITZ COHN vs. THE UNITED STATES CORSET COMPANY & CO.

(In equity.—Before Blatchford, Judge.—Decided June 26, 1874.)

This suit is brought on letters patent granted to the plaintiff, April 1871, for an "Improvement in corsets."

The claim is in these words: A corset having the pockets for the reception of the bones formed in the weaving and varying in length relatively to each other, as desired, substantially in the manner and for the purpose set forth.

The principal defence relied on in this case is that the invention of the patentee is found in the Johnson provisional specification, regarded not as a patent, but as a publication printed in England prior to the patentee's invention.

Held by the court: An English provisional specification regarded not as a patent, but as a printed publication.

Such a specification, in order to be sufficient to invalidate a patent in this country, must describe what is claimed in the patent in a manner so distinct and clear as to leave no reasonable doubt that the thing described is the same.

Under the first section of the act of July 8, 1870, which provides that it may be set up as a special matter of defence to a suit for the infringement of a patent, that the invention covered by it had been previously described in a printed publication, such defence must be established affirmatively by the defendant before judgment can be rendered in his favor.

Cohn's patent of a corset, woven of a shape to fit the person of the wearer, and with woven pockets for the whalebones, varying in length relatively to one another, to accommodate the desired shape of the corset, held invalid, in view of English provisional specification, Johnson, No. 148 of 1854.

(Charles M. Keller, for the plaintiff.
George Gifford and W. C. Witter, for the defendants.)

NEW BOOKS AND PUBLICATIONS.

THE PSYCHOLOGICAL AND MEDICO-LEGAL JOURNAL. Conducted by W. A. Hammond, M.D., assisted by T. M. B. Cross, M.D. New Series, Vol. I, No. 1. Five dollars per annum. New York: F. W. Christern, 77 University Place.

The preëminence of Dr. Hammond as an authority on neurology and mental disease gives interest and value to this publication, which is a continuation of the *Journal of Psychological Medicine*, some time since discontinued. It contains Dr. Hammond's recent address, as President of the Neurological Society, on "The Effects of Alcohol on the Nervous System," a document of great value on a difficult subject, usually discussed with more acrimony than sense. The opinions of Drs. Lente, Willard Parker, Peters, and Clymer are reported; and some able and exhaustive criticism on current literature germane to the subject, with an address to the reader, closes the book.

GAZETTEER OF RAILWAY STATIONS IN THE UNITED STATES and the Dominion of Canada. Price \$1. Philadelphia: National Railway Publication Company, 233 South Fifth street.

This compendious volume gives the telegraph, express, post and money order offices, and their locations as to county, State, and line of railway, with the population, and the name of the express company delivering at each railway station. It is a useful volume.

BULLETIN OF THE MINNESOTA ACADEMY OF NATURAL SCIENCES, with the Reports of Committees, etc. Minneapolis, Minn.: Johnson and Smith.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From August 14 to August 22, 1874, inclusive.

ATTACHING PICKS, ETC., TO HANDLES.—C. A. Hardy, Philadelphia, Pa., et al.

BOOT, ETC.—J. L. Joyce, New Haven, Conn.

CAR SPRING.—G. Godley, New York city.

CAR WHEEL.—R. N. Allen, Hudson, N. Y.

FLASK FOR CASTING.—J. F. Whiting et al., Boston, Mass.

GAGE COOK.—T. A. Weston, Ridgewood, N. J.

MAKING CAST IRON.—G. G. D. L. Byron (of New York city), London, Eng.

MOLDING CEMENT PIPES, ETC.—J. M. Stockwell, Portland, Me.

PLATING MACHINE.—O. M. Chamberlain, New York city.

REGISTERING FAKES, ETC.—E. Chesterman, Philadelphia, Pa.

ROLLER COMPOSITION.—J. H. Osgood, Boston, Mass.

ROLLER SKATE.—W. P. Gregg, Boston, Mass.

SEWING MACHINE.—J. Hayes et al., New York city.

SEWING MACHINE.—J. T. Jones, Ilion, N. Y.

SUSPENDERS.—B. I. Greely, Boston, Mass.

TOOL-HOLDING CHUCK.—F. Armstrong, Bridgeport, Conn.

VENTILATING REDS, ETC.—E. L. Roberts, Plainfield, N. J.

Business and Personal.

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

Matson's Combination Governor—Sold under full guarantee. Address Matson Bros., Melrose, Ill.

For Durkee Saw Mills, address the Manufacturers, T. B. Bailey & Vail, Lockport, N. Y.

A. R. Houghton, Jefferson, O., wishes to communicate with manufacturers of kerosene lamp burners.

Wanted, the Management and Manufacture in England of American Inventions that have been introduced in America and are patented in England. Machinist and Engineering Tools preferred. Address Wm. Horstall, 123 Atlantic Ave., Brooklyn, N. Y.

Johson's Universal Lathe Chuck. Address Lambertville Iron Works, Lambertville, N. J.

Auger that bores a hole two sizes at one time wanted. Address, with description, Jos. Baker, Norfolk, Va.

The Whitmore Patent Engine—4 to 10 H.P. Cheapest, best, and safest. Send for Price List. Lovegrove & Co., Philadelphia, Pa.

Three Patents for Sale—Gate and Door Bolt, Harness and Shoe Maker's Clamp, Revolving Painter's Pail. Address Josiah Smith, Southold, Long Island, N. Y.

Double Belts and Rubber Springs specially for Centrifugal Machines. Greene, Tweed & Co., 15 Park Place, New York.

For Sale, \$2,500—Two Patents, saleable. Address H. S. Hall, Spartanburg, S. C.

E. H. Jones, Milwaukee, Wis., desires to communicate with parties who supply Machinery, and know how to make Matches, especially the "parlor matches."

For Sale—Tools of Machine and Boiler Shops. Walter McCollum, 333 Pearl St., New York.

The Lane Mfg. Company, Montpelier, Vt., will exhibit Circular Saw-Mill, Rotary Bed Surfer, and Clapboard Planer, at Fair of the Mass. Char. Mech. Association, Boston, Sept. 16 to Oct. 7. Sample machines may also be seen at W. L. Chase & Co., 95 Liberty St., New York City.

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(35) F. W. asks: 1. Will you give me a rule for determining the pitch of a propeller screw? A. It must be ascertained by measurement. 2. What sized wheel is suitable for an engine with cylinder of 8 inches bore and 10 inches stroke? A. One about 30 inches in diameter. 3. What sized boat is such an engine capable of driving? A. One 40 feet long.

(36) C. W. M. says: I send you a piece of a fine taken from our engine for you to give your opinion as to the cause of its being eaten away in the manner shown. All the flues and the boiler are more or less injured in the same way. A. We have seen similar action in marine boilers where fresh water from surface condensers with copper tubes was fed into the boilers. You do not send enough particulars to enable us to give an explanation of your case.

(37) L. & V. say: We have a boat 18 feet long by 13 feet wide, with full oval bottom. We wish to run her by steam, in swift water. Can you give us proportions of engines to run her well? A. The boat is too small to make a very efficient steamer.

(38) J. S. W. asks: Can a telescope be constructed to magnify as you draw out the two sections, commencing with the telescope closed and looking at a 50 cent piece 200 yards distant? It will at first appear very small; but if I draw one section out, will the object appear the larger the further it is drawn? A. Such a telescope has the parabolic eyepiece; the pair of eye lenses recede from the inner pair, thus increasing the magnifying power.

(39) J. W. says: I made a telescope on the plan given in the SCIENTIFIC AMERICAN, p. 7, vol. 20. 1. My meniscus is $\frac{1}{4}$ inch in diameter, of 48 inches focus. The eyepiece is $\frac{1}{4}$ inch in diameter, and $\frac{1}{4}$ inch focus, and is made to slide. 1 use a 6 inch double convex lens, but I am disappointed, as it does not in any way answer. Would an achromatic objective improve it at all? Is the object lens too small? A. A 3 or 3½ inch achromatic about 4 feet focus is recommended. The best eyepieces do not screw in, but slide into the rackwork tube or sliding tube, as the case may be, and cost \$1 each. Powers from 80 to 150 or 200. The foot of the two lenses, in a simple instrument, should meet as you describe. 2. I have a mind to make another telescope; but before I begin, I would like your opinion in regard to lenses. What should be the focus of a 3 or 3½ inch achromatic objective to obtain the best result? Also what is the best kind for an eyepiece, and what should be the focus? A. See our remarks to G. J. J., No. 77, on this page.

(40) A. W. H. asks: Can you give me a recipe for something to mix with plaster of Paris to make it non-porous? A. There is nothing we know of that will render plaster non-porous without injuring at the same time its hardening properties.

(41) J. T. M. says: I have a small refracting telescope, a good one for its size. Could I use the eyepiece (consisting of 4 glasses) in connection with an object glass of longer focal distance, and make a good serviceable glass of it with a longer or larger tube? A. An eyepiece which is adapted for a short telescope may be used for a long one. The converse, however, is not the case.

(42) P. J. K. asks: I propose to make a telescope, and I think that a $\frac{1}{4}$ inch meniscus lens, with about 12 inches focus, with a $\frac{1}{4}$ inch eyepiece, will make a good instrument. Do you think this would answer? Would an object glass (double convex) of same size and focus, with double concave eyepiece, be better? Would such an instrument show Jupiter's moons and their eclipses, Saturn's rings and moons, and the planets Venus and Mercury? A. You would have to place a cardboard screen over the lens with a hole in it an inch and a quarter in diameter. Get an achromatic spy glass instead, and unscrew the two front lenses of the eyepiece.

(43) C. W. S. asks: I made one of those cheap telescopes that you gave instructions for in your paper last winter, and I now wish to make one with an object glass of, say, 4 or 5 inches in diameter. What would the glasses for such an instrument cost, and what should be the inside diameter of the tube, length of the same, and length of focus? Could I make the tube of wood, as done in the smaller one? A. A fine American instrument in our possession, made in 1866, is 4 inches aperture, 60 inches focus. It is equatorially mounted on hollow cast iron axes, and is adjustable for latitude on a tripod of black walnut 5 feet 2 inches high, with 3 inch circles. The hour circle is divided to minutes, and the declination circle reading, by vernier, to two minutes of arc. Object glass cell is provided with collimating screws. The tube is conical, of polished black walnut in 3 strips glued together, and is 4 feet 3 inches long. Length from cell to end of rack tube, closed, a little less than 5 feet. There is a parabolic terrestrial eyepiece, and five Huyghenian ones, whose powers are 80, 96, 160, 240, and 320; 96 is the power most in use. A diagonal prism, and a finder telescope, one inch aperture, are also attached. The cost was \$25.50. The necessary parts would cost: Lens \$100, and 2 eyepieces \$4, for a skillful mechanic; for the type, the tube and rackwork, \$80, and tripod with ironwork, \$25, should be added.

(44) S. L. G. says: In Spencer's "Psychology," vol. 1, p. 225, he speaks of the "vast catastrophe of which the star Epsilon Coronæ was lately the seat," etc. What was the catastrophe referred to? A. Very hot and therefore dissociated oxygen and hydrogen, suddenly cooled in large quantities, unite to form water, with evolution of heat and light. At one period of its evolution, a star consists of a more or less continuous liquid film surrounding a bubble of glowing gas. If this film be suddenly ruptured by pressure from within or by collision from without, the splash of gas expands, cools down to the combining or burning temperature, and explodes. Such explosions constantly take place in the sun. Tongues of flame dart 100,000 miles from its surface with a crash that may be dimly imagined by those who have set fire to oxyhydrogen soap bubbles.

(45) W. S. asks: 1. When in what constellation, and by whom was the comet lately visible discovered? A. It was discovered by M. Coggia, at Naples, April 7, 1874, to the breast of Camelus. 2. Has it ever appeared before? A. No. 3. What is its inclination to the ecliptic? A. 66°. 4. Where does it cross the ecliptic? A. It crossed the ecliptic on July 24, between Gemini and Cancer. 5. Did it pass through its perihelion before or after crossing the ecliptic? If so, where? A. Its perihelion passage was on July 8, 60,000,000 miles from the sun. On November 4 it will be near the star Alpha Chamaeleontis, in the southern hemisphere, and about as bright as when it was first discovered.

(46) F. D. H. asks: 1. What form of battery is used in exploding powder, gun cotton, etc.? A. The Grove, in connection with a small coil. 2. What is the arrangement of the wires, etc.? A. By arrangement of the terminal wires in such a manner that the spark leaps through the discharge thus igniting it.

(47) M. B. says: 1. I have a telescope which, besides the objective, has four lenses. These lenses are arranged in couples, in two small cylinders. Please tell me the respective names of each of these lenses. A. The glass nearest the objective is the object lens, the next is the amplifying lens, then comes the field lens, and, finally, the eye lens, next the eye. 2. When the instrument is open as far as possible, the first lens is $\frac{1}{4}$ inch from the objective. The eye piece has its focus $\frac{1}{4}$ inches distant. Please describe the objective which would give the greatest power, and tell me the required power. The lens should be $\frac{1}{4}$ inch in diameter. How can I estimate the power of a telescope? A. As we have before stated in answers to correspondents, the magnifying power of telescopes is equal to the stellar focus of the objective divided by that of the eye piece, the focus of the common negative eyepiece being equal to half the focus of the field lens. 3. Which is the best way to find the focus of the lens? Is it by getting an inverted image? A. Practically the principal focus is the distance at which the lens gives the sharpest image of the sun.

1. Can surveying and engineering be better learned in college than in an office? A. For civil engineering, both kinds of training are necessary. A knowledge of Gillespie's "Land Surveying" will enable you to survey, with good instruments. Send to Cornell University, Ithaca, N. Y., or to Sheffield Scientific School, New Haven, Ct., or to Rensselaer Polytechnic Institute, Troy, N. Y., for catalogue. 2. What are the requirements of a good civil engineer? A. From 4 to 6 years mental training (with subsequent practice), costing, including board, etc., from \$500 to \$1,000 per year. 3. Are surveying and engineering generally practised by the same person? A. Yes. 4. What are the wages of a good civil engineer? A. From \$2,000 to \$6,000.

(48) G. W. L. and others ask: What is an easy way of making mirrors of different sizes? A. The process, improperly called silvering mirrors, is rather a delicate operation; and inasmuch as the chances of failure are so great, as also the amount of time consumed, few amateurs will have their first efforts crowned with success in this direction. The process consists in applying a layer of tin foil alloyed with mercury to the posterior side of the glass plate. To do this requires a perfectly smooth level table (marble is usually employed). The foil is placed perfectly flat on the table, every wrinkle smoothed out. The plate being in readiness, perfectly clean and polished, a little mercury is at first poured on the foil, and carefully spread with a wooden roller. Mercury is then poured on the foil to a depth of about $\frac{1}{32}$ of an inch. The plate is now slid on to the table in such a manner that the superfluous mercury is carried off, thus preventing air bubbles from destroying the coating; at the same time great care must be taken not to disturb the foil. After this, a weight is carefully placed on the plate, and the table slightly tipped so as to allow the superfluous mercury to run off. The plate is then covered with cloth, and very heavy weights placed on it, in which position it is allowed to remain for 24 hours. The weights are then gradually removed and the angle of the table gradually increased, until the glass stands almost vertical, with the amalgam still adhering to it. The edges are then trimmed. Many days are consumed in these operations, especially with large mirrors; in some cases a month is required before the mirror is ready for use.

(49) M. E. L. says: In your answer to G. F. P., July 25, you say that the moist air in the hollow copper lightning rods amounts to nothing. So do I; but is not the copper rod $\frac{1}{4}$ inch in diameter, with an outside surface of 1½ inches and the inside surface nearly the same, superior to the $\frac{1}{4}$ inch solid iron rod recommended by you? If not, why do you crown your solid iron rod with a copper point? A. Copper is a better conductor of electricity than iron, in about the ratio of its increased cost. The large surfaces you speak of are undoubtedly desirable, but the iron rod referred to fully answers all requirements, at the same time being superior for strength and stiffness. The placing and connections of the rod deserve as much attention as its composition and conductivity. It is desirable to have the rod's connection with the earth as intimate as possible, for, if partly insulated by sticking its end into the surface a few feet, the fluid not finding a sufficient avenue to the earth in this direction, will find its path through the building and its metal work, thereby rendering the rod a danger rather than a protection to the building.

(50) T. C. P.—Steam canal boats are in common use.

(51) G. B. S. asks: 1. Are creosote and paraffin made from paraffin oil? A. Creosote is made from wood tar, from which paraffin is also obtained. 2. What is paraffin oil used for? What is its thickness compared with lard oil? A. Paraffin oil is one of the products of the distillation of Boghead canal coal. It is extensively used for lubricating machinery, for which it is admirably adapted, since it does not become oxidized or thickened by exposure to air, and it evaporates but slowly.

(52) W. P. W. asks: If an underground wooden tank or cistern is filled with common spring water by a force pump from a neighboring pond, how long will it keep good, for stable and barnyard use? Will it spoil under these circumstances quicker than rain water? A. It can be used for your purpose, and it will not spoil more quickly than rain water.

(53) W. L. B. asks: Can I have the same power with my zinc cup by coating it with quicksilver? I have to use the battery so frequently that it is very troublesome to keep it clean, and the sulphate consumes the zinc so fast that it soon eats a cup away. A. Yes. The zinc should be always kept properly amalgamated.

(54) J. A. L. asks: 1. Is it necessary to have a coil and secondary current of electricity to get a spark sufficient to light gas? A. It is not always necessary; but this depends upon the number of cells employed. 2. Is it best to have the secondary current? A. Yes.

(55) N. C. asks: How are carbon plates made for electric batteries? A. They are made either of the graphitoid carbon deposited in the gas retorts, or by calcining in a carbon mold an intimate mixture of coke and bituminous coal, finely powdered and strongly compressed.

(56) J. N. B. asks: What sort of metal can vessels be made of, so as not to be acted upon by sulphurous acid gas and its aqueous solution? A. Vessels made of pure lead can be used for your purpose.

(57) C. M. N. asks: How can I wind a spring and have it tapered to a point at each end? A. Cut a thread upon a lead mandril tapered at each end, wind your spring upon it in the usual way; then, when you heat the spring to harden it, the mandril will melt out.

(58) S. W. asks: In the winter when vegetation is not active, what becomes of the carbonic acid gas which is expired into the air? A. It is retained in the air. Analyses made of the air, during both the summer and winter, show neither increase nor decrease of carbonic acid, the total variation being inappreciable when compared with the incredible bulk of the terrestrial atmosphere.

(59) H. P. asks: What will harden or toughen the skin of the chin, to make it less sensitive when shaving? A. This is due to a very thin and sensitive skin. There is no application of which we are aware that will be of benefit.

(60) G. R. B. asks: Can you tell me of a paint or varnish of a dead black color, which will not glister in the brightest sunlight? Hunters are often discovered to game by the glistering of their guns, which such a varnish would prevent. A. We know of nothing that will answer your purpose so well as lamp black and turpentine.

(61) H. L. C. asks: If a rubber bag, containing common dry air, be sealed airtight and placed under water, will it be compressed by the water to a smaller bulk than it had before it was immersed? If so, to what extent? A. It would; and the compression depends upon the depth of immersion. 2. Would the uplifting power of air contained in a like bag be greater at a depth of 10 feet than at a depth of only 1 foot? A. No.

(62) J. B. T. asks: If we weigh the materials of which a vessel (containing 60 gallons) is made, then weigh the vessel full of air, what would be the difference in weight? And would not the vessel weigh less if the air was exhausted from it than the materials would weigh before the vessel was made? A. There would be no difference in weight.

Why do springs afford more water in the summer or hot months than they do in the winter? A. They do not.

Are not never failing springs produced by the heat from the central fire, passing through subterranean aqueducts and bringing the water to the surface of the earth? A. No.

Is not the atmosphere produced by the central fire, the heat or cold on any particular part of the surface of the earth being governed by the vertical or oblique rays of the sun? A. No.

1. How long will it take an iron ball 2 feet in diameter, brought to a white heat, to cool down? A. This would depend upon the temperature of the surrounding atmosphere. 2. Is it not the water that it gets from the air and surrounding objects that cools it down? A. Only partially. 3. How long will it take an iron ball 2 feet in diameter, brought to a white heat, to cool down if kept in a furnace where the atmosphere (to use an illustration) is kept to a white heat? A. Under these conditions, the ball would not cool at all.

(63) A. H. K. asks: What will prevent peaches from decaying and falling off just previous to becoming fully ripe? A. The dropping of your fruit is due to the curculio, or more properly speaking, *canotrochilus nemophar*. The best remedy is jarring the trees, catching the larvae in sheets, and burning them. See Packer's "Guide to the Study of Insects," pages 439 and 490.

By what means or marks can I distinguish the male from the female mocking bird at the age of about 7 or 8 weeks, fully fledged? A. We cannot tell you how to distinguish them at that age.

(64) R. W. C. asks: If a machine for aerial navigation should be invented, what do you think would be the moral result upon our race? Do you think it would tend to the advancement of light and truth, or that the good would be overcome by the perpetration of crime and misery? A. We think that the result could not be other than elevating.

What is a perpetual motion? Is it a machine that will never wear out, or one that will run until it wears out? A. The latter is probably the better definition.

1. What is the best chemical composition for sensitizing paper for the reception of photographic images? A. The paper is steeped in a solution of chloride of sodium in water, dried, and immersed in a solution of nitrate of silver in water, and dried in a darkened room. 2. What time is required for the impression? A. This is dependent upon the quality and intensity of illumination.

(65) W. D. C. asks: Is a bed, lounge, or chair, standing on glass casters and in the center of the room, a perfectly safe place for a person during a thunderstorm? A. No. The lightning seeks a pathway to the earth through the best conductors; and as the human body is a better conductor than chairs or other ordinary articles of furniture, a person sitting as you suggest will be likely to be struck if the electrical fluid enters. The glass insulators offer no protection. The only real security is a good arrangement of lightning rods upon the exterior of the building to prevent the electricity from entering.

(66) H. L. D. asks: How is the phosphorescent safety lamp, used in powder magazines, etc., in France, constructed? A. Take a piece of phosphorus not larger than a pea, place it in a phial of the whitest and clearest glass, with enough boiling hot sweet oil upon it to fill a third of the bottle; put a cork in and hermetically seal it. To use it, remove the cork and allow the air to enter the phial, then cork it again, and the part of the vessel not filled with oil will become as luminous as a large lamp. It can be used for six months without replenishment. Use white phosphorus and pure oil.

(67) T. S. says: A hot metallic teapot was placed upon a waiter. In consequence of it, the paint or other composition with which the waiter is covered was discolored and blistered. How can I restore it to its original color and brightness? Shall I use ordinary lead paint mixed with boiled linseed oil? What kind of varnish must I add that will neither peel off nor stick upon it? A. First clean thoroughly with soap and water and a little rottenstone; then dry by wiping and exposure to the fire. Mix a quantity of good copal varnish with some bronze powder, and apply with a brush to the denuded parts. After which set the tray in an oven, at a temperature of 212° to 300° Fah., until the varnish is dry. Two coats will make it equal to new.

How can I make labels adhere to tin? A. Use flour paste, with two table-spoonfuls of coarse sugar in every quart.

(68) C. M. H. asks: Can you mention any substance having the following properties: Light in color, soluble or slightly soluble in water, hard at atmospheric temperatures, and capable of liquefaction by a heat from 300° to 350° Fah.? You can perhaps mention some gums or resins, salts or alkalies, etc., possess log those properties. A. Borax, sodic carbonate, potassic carbonate, phosphate of soda and ammonia, gum arabic, etc. all have these properties.

(69) A. G. asks: 1. What is the composition of the tin foil in which tobacco is put up? A. Tin foil is made from tin which is first cast into an ingot then laminated to a certain extent, and afterward beaten out with a hammer. 2. How can it be made into solder? A. The alloy of tin and lead in equal parts forms the plumber's solder. The soft solder is composed of tin 3 parts, bismuth 5 parts, and lead 2 parts.

(70) W. H. H. T. asks: 1. Are there any authenticated cases of petrification (of either animal or vegetable matter) which have taken place in historical times? If so, where can some of the specimens be found? A. Such cases are daily occurring. On certain of the Caribbean Islands petrifications on a large scale have occurred during historical times. 2. In the case of the man who was said to be petrified (mentioned on p. 81 of your vol. 31) would not the weight of the body (if it had not increased in bulk after burial) exclude all idea of it having been turned to lime, silica, or alumina? A. We do not see that it would.

(71) J. F. A. asks: Will an induction coil of $\frac{1}{4}$ inch spark do for giving shocks? A. Yes.

(72) L. A. G. says: The *Science Record* for 1874 (p. 254), describes a portable field camera, and now to make one. I have tried to make one after the method described, but fail to get an image on the paper unless it is held within about 5 inches of the mirror. I want it to cast an image from 15 to 20 inches away from the mirror. The dimensions of my instrument are: Box 12½ inches; lens $\frac{1}{4}$ inch in diameter with a 1 inch focus, made to slide in and out of the box distance of box from table, 20 inches. Why do I not get an image farther away from the mirror? What is there wrong about the instrument? A. The distance from the lens to the table, measured along the path of the rays, should equal the conjugate focus of the lens (when it is focussed upon the foreground). Your lens should be of 24 inches focus.

(73) T. A. H. asks: 1. Which is best for a celestial telescope, a lens of 4 inches diameter and 48 inches focus, or one $\frac{1}{4}$ inch diameter of 48 inches focus? Would there be any difference except in field? What should be the diameter and focus of the eyepiece? A. The toy you mention is useless if over 1 inch aperture, as the aberrations impair distinct vision. See p. 7, vol. 30, and read our answers to correspondents since. 2. Would such a glass show Saturn's rings? A. Not distinctly.

(74) R. asks: What is meant by north, south, east, and west, as applied to the stars? For instance, you say in your last number that Borelli's comet may be found 7° east of Gamma Ursæ Minoris; and when I look for this star, some book tells me that it is so many degrees east or west of some other star. A certain star is said, in Burritt's "Geography of the Heavens" to be the westernmost star in the Dipper. Now the Dipper is changing its position relatively to an observer all the time, and the same star which is the westernmost one, when the constellation is low down in the horizon, appears to me to be the easternmost one when it gets to be nearly over our heads. A. The points of the compass should not be used in referring to celestial objects. Right ascension, expressed in time from 0 to 24 hours, indicates distance of a star from the first meridian or vernal equinox, that is, its longitude. Declination, expressed in + or - degrees, minutes, and seconds of arc, indicates the distance of a star north or south of the celestial equator, that is, its latitude. The figures following the letters, R. A. and D., thus define the exact place of a body in the heavens or upon the map.

(75) W. W. E. says: I have noticed that you state that a certain star was moving in the direction of the earth at 54 miles per second. Is the course of that star across the orbit of the earth, or is it in a line with its orbit, or at a tangent, or on a radial line, with its orbit? In six months, the earth will have passed half of the distance around the sun; what direction then to the earth will the falling star have? Will it still be toward the earth? A. All stars are drifting about in space, the sun (at the rate of 4 miles every second) toward Lambda Herculis; so that at the very remote arrival of Arcturus, we shall be traveling elsewhere.

(76) T. P. says: A friend of mine positively asserts that no human being can see a cloud 5 miles distant. Will you please give me good authority on the fact? A. The mean height of clouds is much less than 5 miles, but Dalton says that they have been seen at full 5 miles above the surface, passing over the highest peak of the Andes.

Has a balloon ever ascended to a height of 10 miles? A. The greatest height on record is that attained by Mr. Glaisher, who, in 1862, made an ascent to an altitude of 7 miles. At this height it was difficult to sustain life.

(77) G. J. J. says: 1. I have a meniscus of 48 inches focal length. Which will be the better for an object glass, this, or a double convex lens of 4 or 5 inches diameter? What would be the focal distance of such a lens, and would its magnifying power be much greater than that of the meniscus? A. Both would be useless as object glasses. 2. What kind of an eyepiece would such a lens (double convex) require? A. With a double concave eyepiece, it would form the Galilean telescope. 3. Does the focus of an object glass fall before, behind, or on the eyepiece? A. The focus of an object glass falls in front of the Ramsden or positive eyepiece, within the Huyghenian or negative eyepiece, and behind the Galilean or double concave eyepiece. 4. Can you recommend me to some treatise which explains the subject of the foregoing? A. See Dick's "Practical Astronomy."

What preparation or starch is used to give a fine gloss to shirt bosoms? A. A lump of paraffin is melted in with the starch.

Can you give a recipe for bleaching skeleton leaves and flowers? A. Bleach with chloride of soda, after macerating the leaves in water, until the epidermis is readily displaced.

(78) T. C. K. says: I have tried the cheap telescope described in your paper. I could see distant objects in the daytime very well, and the moon at night but for the stars it was a complete failure. All that I could see was a little round ball, colored red or blue. Can you tell me the cause? An optician says that a double convex lens would be better than the meniscus. What should be the size and focus of two double convex lenses, which will show to a certainty Jupiter's moons, Saturn's belt, etc.? A. An achromatic object glass of 50 inches focus and $\frac{1}{4}$ inch diameter, with a power of 50, will show sun spots (on a white surface), Jupiter's moons, the rings of Saturn, and bright stars and planets in the daytime. A double convex lens of 4 feet focus must not be over 1 inch in aperture. If we increase the aperture to 2 inches, we must lengthen the focus to 14 feet to obtain an image free from prismatic colors. We therefore buy achromatic telescopes exclusively.

(79) R. W. says: I have about 4 gallons of sulphate of nickel and ammonia that I spoiled by putting in a vat lined with pine pitch. The cyanide and ammonia seem to be affected, which spoils the conducting power of the solution. When I put articles in the bath to be plated, they all turn black. Is there any way in which I can recover that solution? A. Various methods have been tried, but they are so tedious and require so much labor that you could not recover the nickel and convert it again into the double sulphate economically, on the small quantity of 4 gallons.

(80) W. H. says: You once gave a recipe for waterproof glue as follows: 17 ozs. glue with sufficient water to dissolve it. Add 3 ozs. resin, melt down in a carpenter's glue pot, and then add 4 ozs. turpentine or benzine. It does not mix well. I also tried softening the glue in water, then dissolving in kerosene oil; but it curdled and is too slow in drying. I should like to have a glass nearly colorless as possible. A. A glue which is said not to be affected by moisture may be prepared by dissolving 1 oz. sandarac and 1 oz. mastic in half a pint of alcohol, and adding 1 oz. white turpentine. A very thick glue is then to be made, to which some isinglass is to be added. The alcoholic solution is to be heated to boiling in a vessel, and poured gradually, with constant stirring, into the warmed glue, until the whole is intimately mixed together. The mixture is finally to be strained through a cloth, and is then ready for use, and is to be applied hot. It dries quickly, becomes very hard, and pieces of wood united with it do not separate in water.

(81) J. H. J. asks: Is there any process by which small iron castings can be changed into malleable iron after they are cast, so that they can be welded or hammered like wrought iron? A. Malleable castings, as made at present, cannot be worked like wrought iron. They are only rendered less liable to crack.

How much coal do ocean steamers, from 3,000 to 4,000 tons, burn in a day? A. From 40 to 60 tons.

(82) H. S. asks: How is the brown imitation of bamboo on fishing rods made? A. By charring the wood, and then polishing.

(83) J. E. E. of Pa. says, in answer to A. A. J.'s query as to filtering water for boilers: Build a circular well of very soft-burnt building brick in the center of your water tank; lay the brick (on edge) in water cement (Portland preferred). Select bricks that are sound, having no holes or cracks through them. Fill your tank outside the well; it will readily soak through the brick. Take your water from the inside of the well for your boilers. Should the pores of the brick occasionally fill up so that the water will not soak through fast enough, use a scrub brush to clean off the outside. This makes a cheap filter for almost any impure water.

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

C. W. J.—Your impressions are very imperfectly made, especially the Roman coin. The one of the date 1811 is a Spanish coin, but doubtless not as old as the Roman. Their age shows nothing very important. Coins older than these are to be found in circulation at this day. They were doubtless brought over long after Columbus discovered America, and obtained in traffic by the Indians; and, being considered of value by them, were buried with them, as was their custom.—J. W. H.—The specimens are magnetic oxide of iron, mixed with some quartz, etc. The pure magnetic oxide of iron should contain over 72 per cent of iron. What it does actually contain, whether it has any constituent which would unfit it for iron-making, and what is the value and extent of the ore, must be ascertained by a technical chemist.

W. W. says: In the locality of Binghamton, N. Y. (lat. 42° 06' N., long. about 76° 14' W.) I prove conclusively that, for a long series of years previous to 1806, the declination of the magnetic needle was eastward, at the average rate of 2° 12' per annum, that at that period (variously and indefinitely stated by authors) the eastern motion ceased, while the directive tendency of the needle was 2° 49' west of the pole. Subsequent to that, the declination has been westward, at about the same rate, showing now an accumulated secular variation of 7° west, as deduced from my last astronomical experiment. Now what I wish to learn is this: Whether the period of revolution of the needle, from east to west and vice versa, is a regular or uniform period. I mean of about the same number of years? If it is, what is the extent of that period? For your scrutiny and criticism, allow me to state that the diurnal westerly motion of the needle is only to be discovered in full force between the vernal and autumnal equinoxes; and that this variation amounts to about half as much in winter as in summer (as several authors of celebrity have stated) seems to be doubtful; as from the most minute observations I have been able to make during the time I have mentioned, the diurnal variation has been found to be 12° or 14°; while between the autumnal and vernal equinox, variation has been nil, or scarcely appreciable. [Will some of our readers who have investigated this subject in particular or have made it a study, please answer this question?—Eds.]—M. V. H. asks: What do sign painters use to produce that brilliancy in gold letters or gold leaf which they apply on shop and store windows?

COMMUNICATIONS RECEIVED.

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

On Tender Bones. By Z. M. P. K.

On Railroad Rolling Stock. By F. G. W.

On Measuring the Width of a Stream. By W. H.

On Creeping Rails. By A. S. M.

On a Novel Projectile. By C. R. S.

On Practical Mechanism. By T. W. P.

Also enquiries and answers from the following:

S. E. E. E. L. F. C. G. X. Y. N. F. P. D. T. W. L. M. B. Q. F. H. S. M. A.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good rea-

sons, the Editor declines them. The address of the writer should always be given.

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

Hundreds of enquiries analogous to the following are sent: "Please to inform me where I can buy a machine for turning broom handles, also for cutting barrel heads? Where can I purchase the best water wheel? Which work on modern architecture is considered the best? What are the prices of best German silver instruments? Where can I obtain printed sheets of playing cards?" All such personal enquiries are printed as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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FOR WHICH

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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:

30,719.—PAPER FOLDING MACHINE.—C. Chambers, Jr., November 11.

31,280.—COLLARS FOR CARRIAGE WORK.—M. Seward, January 20.

EXTENSIONS GRANTED.

29,917.—DRAW BRIDGE.—L. Schneider & J. A. Montgomery.

29,920.—MORTISING MACHINE.—H. C. Smith.

29,923.—PLANING MACHINE.—H. D. Stoyer.

DESIGNS PATENTED.

7,329.—HARNES ROSETTE.—J. V. Waldron, N. Y. city.

7,710.—STOVES.—T. F. Hamilton, Genesee, Ill.

7,711 to 7,714, inclusive.—TASSEL DROPS.—R. E. Slough-ter, Brooklyn, N. Y.

TRADE MARKS REGISTERED.

1,945.—BAKING POWDER.—Cloud & Co., Evansville, Ind.

1,946.—MEDIKINE.—Frese & Co., Hamburg, Germany.

1,947.—CLOCK.—F. Kneber, Hoboken, N. J.

1,948.—GUN.—M. Leman & Co., New York city.

1,949.—FLOWS, ETC.—A. Speer & Sons, Pittsburgh, Pa.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
AUGUST 22 TO 31, 1874.

3,776.—T. A. D. Forster and E. L. Stowell, Philadelphia, Philadelphia county, U. S. Improvements on tooth paste, called "The Sphinx Tooth Paste." August 22, 1874.

SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 14.
(NEW SERIES.)

NEW YORK, OCTOBER 3, 1874.

\$3 per Annum.
[With Postage, \$3.20.]

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.

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.

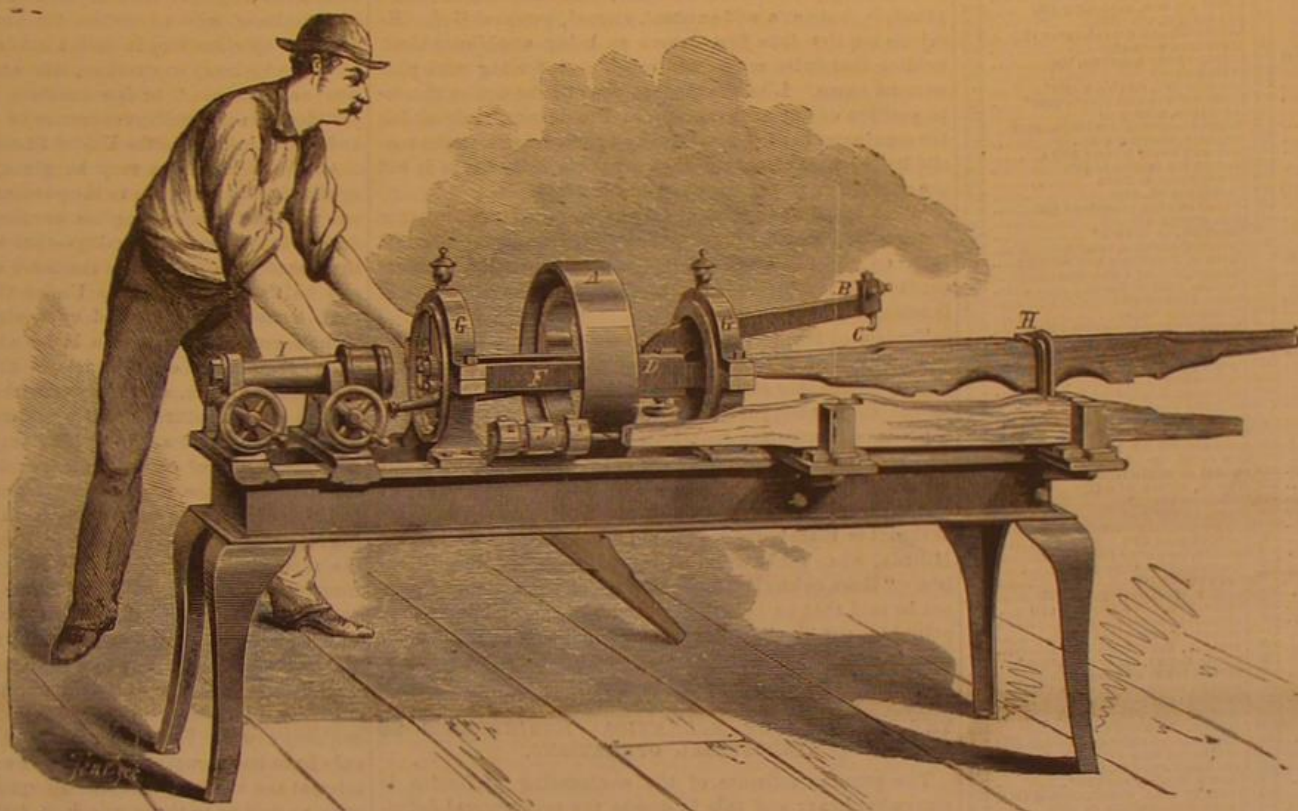
School of Millwrights.

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 Wabasha (No. 23) brought a train from Clinton, Iowa, to Chicago, 188 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.

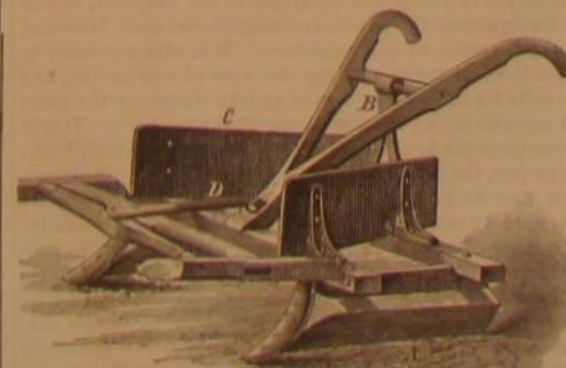
The object of the implement represented in the annexed engraving is first to form two parallel furrows into which the seed potatoes are dropped. Then, by reversing the apparatus and making suitable changes of the handles, etc., it is converted into a coverer, which, traveling over each furrow, molds thereon a uniform ridge of earth. Our illustration represents the device as adapted for cutting the furrows,



ARAM'S MACHINE FOR TURNING CARRIAGE AXLES.

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 crocheted 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 rear 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 $\frac{1}{4}$ 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. Comparing 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	"
Inter-Colonial "	Acadia Seam†	7,000	13	Not good
	" "	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.

Scientific American.

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VOLUME XXXI, No. 14 [NEW SERIES.] Twenty-ninth Year.

NEW YORK, SATURDAY, OCTOBER 3, 1874

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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 falling 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 commentary 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 underlain 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 Canada 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 unbiased 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 coöperative 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 coöperation, 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 coöperative 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 coöperative 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 Coöperative Printing Society, recently established in London, however, has not turned out so well.

The most important experiment in coöperative 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 undertak-

ings. 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 practicing 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 equitable 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 Jypton, 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 Eris, 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 height 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. Hubetz, 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 funeral edifices will be avoided.

COMPRESSED AIR MACHINERY.

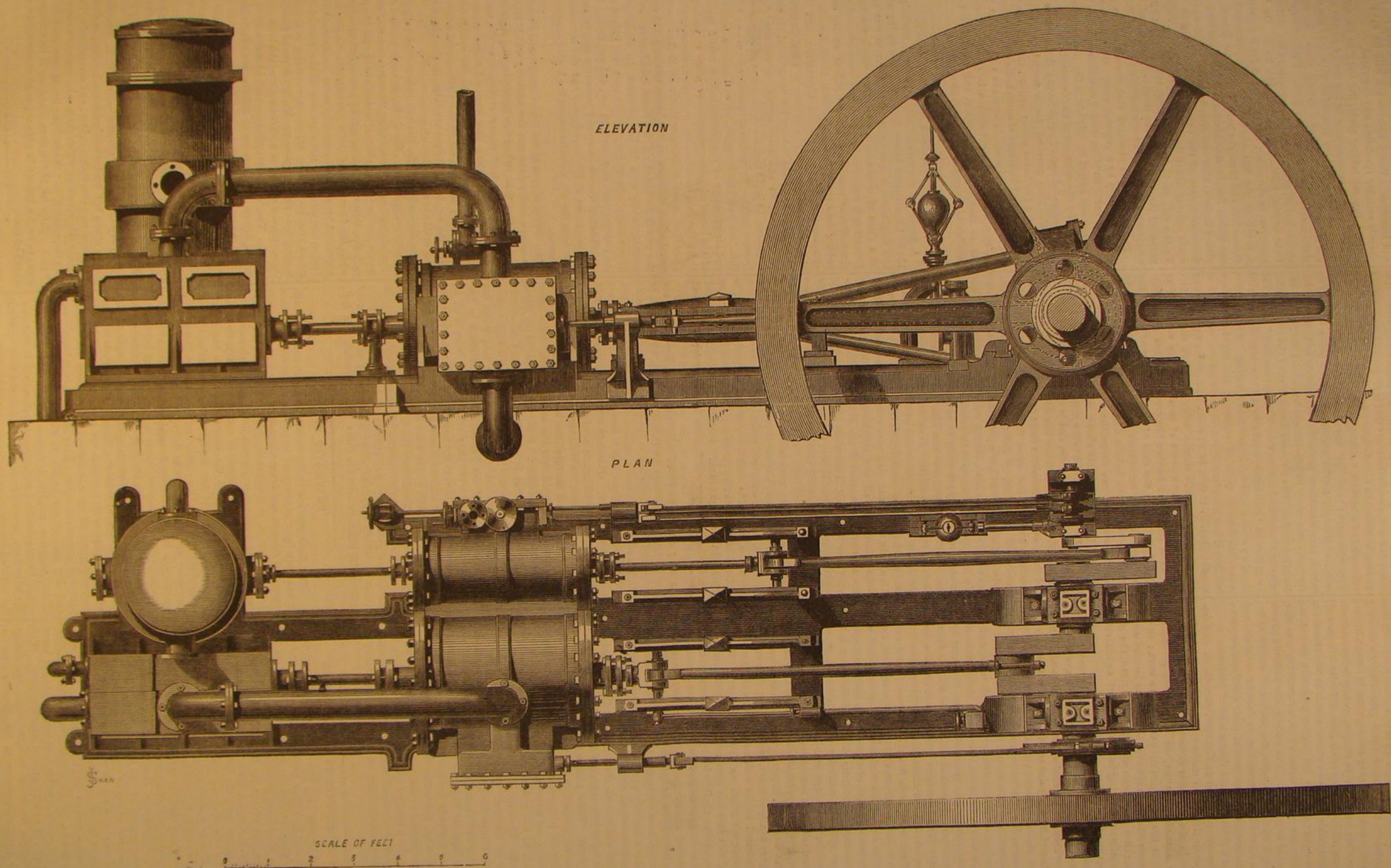
A paper on compressed air machinery, recently read by Mr. William Daniel before the British Institution of Mechanical Engineers, is a valuable contribution to our knowledge of a class of mechanism, regarding which trustworthy information is not abundant. A very complete series of experiments was conducted by the aid of an air compressor having two steam cylinders, each 18x30 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 compressor, 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 compressor, 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 1½ 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 compressors 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

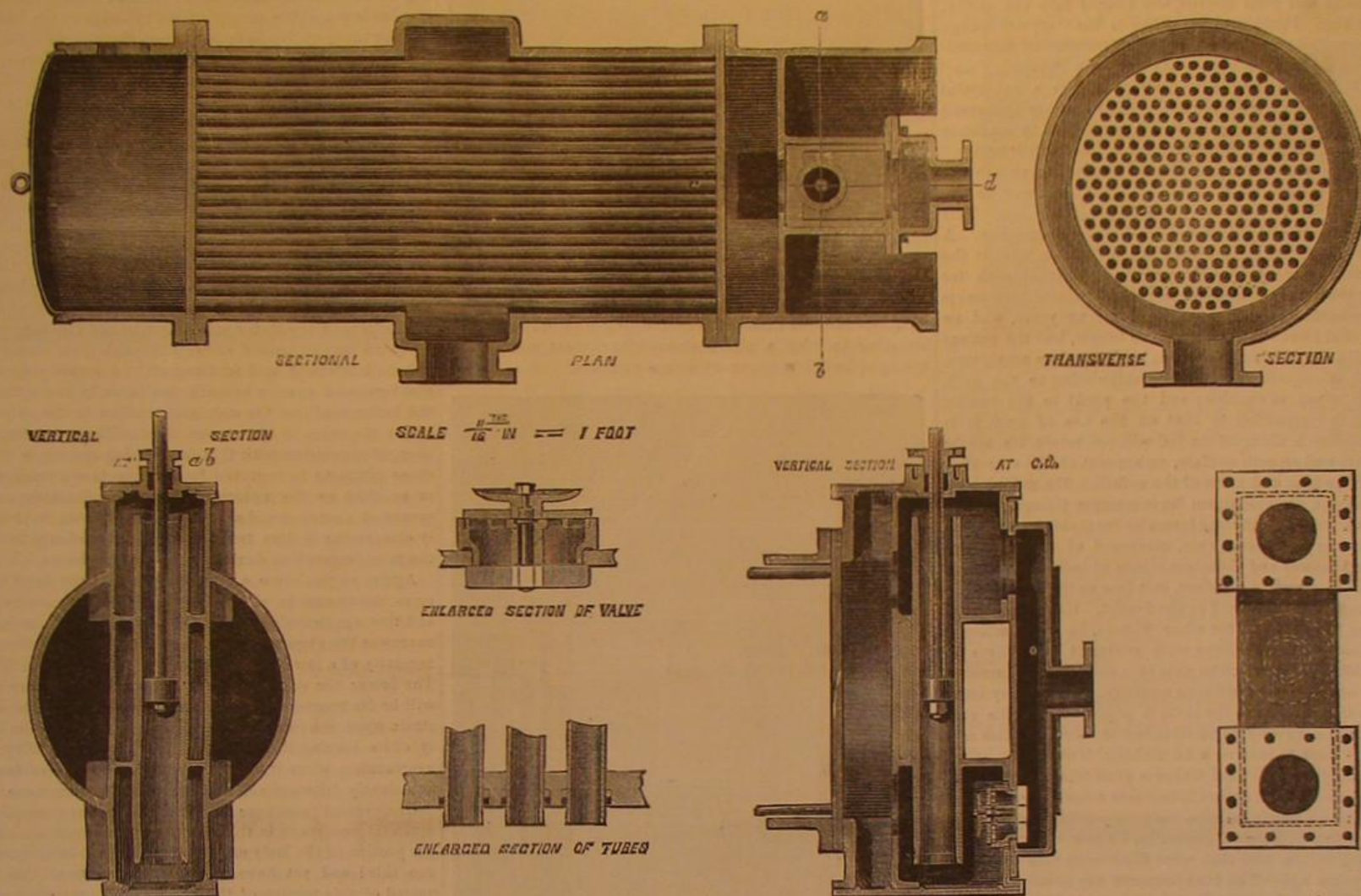
with these gages show, however, that, as the best makers have always affirmed, the pressure is reduced to $\frac{1}{15}$ part of an atmosphere, that is, to a quarter of an inch of mercury, and even less. It is possible to reduce the pressure within one fiftieth of an inch, without resorting to the Torricellian 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 nebulae, 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

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 nebulae, everywhere it moves, everywhere it vibrates; and



HATHORN & CO'S COMPOUND ENGINE—THE CONDENSER.

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.

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 $2\frac{1}{2}$ 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.

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

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.

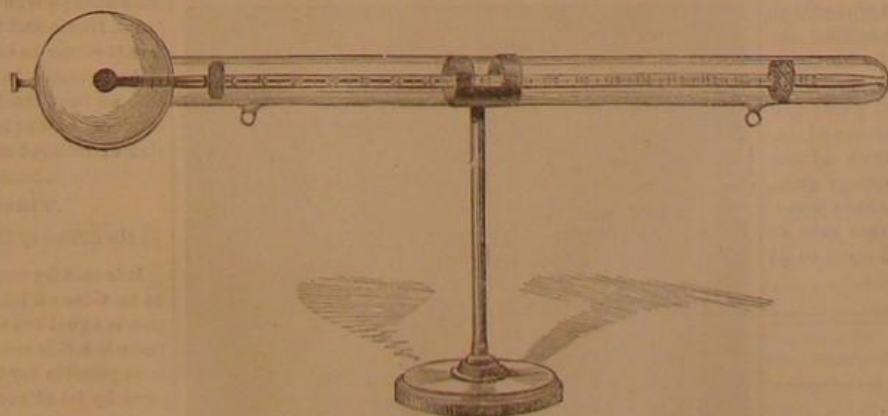
Nebulae, twenty thousand times less brilliant than a candle at a distance of 13,000 feet, have still given a spectrum; for their light, although feeble, is very simple in its constitution, and the spectrum which it gives consists only of two or three bright bands, one of hydrogen, the other of nitrogen.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

What an effort of the human mind! To discover the

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 *Glashtutto*, 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 action of heat? Thus the phenomenon appears to a greater degree in the process of fusion.



NEGRETTI AND ZAMBRA'S SOLAR THERMOMETER.

constitution of stars of which the distances are unknown, of nebulae 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

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 crystallized 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 plunger 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 fillings, 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 fillings 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 artificial" 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 to 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:

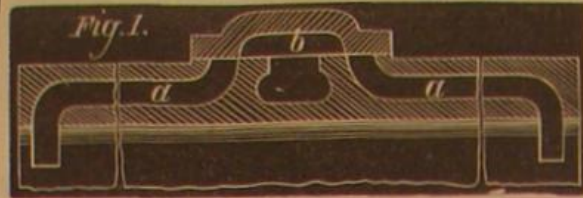
In your issue of August 22, it was stated, in an article under the head of "Steam Cars," that the locomotive ought to be more of a guide for builders of steam cars and other steam vehicles, on account of its low center of gravity, its excellent boiler, etc. The great problem, of course, is to so proportion 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.

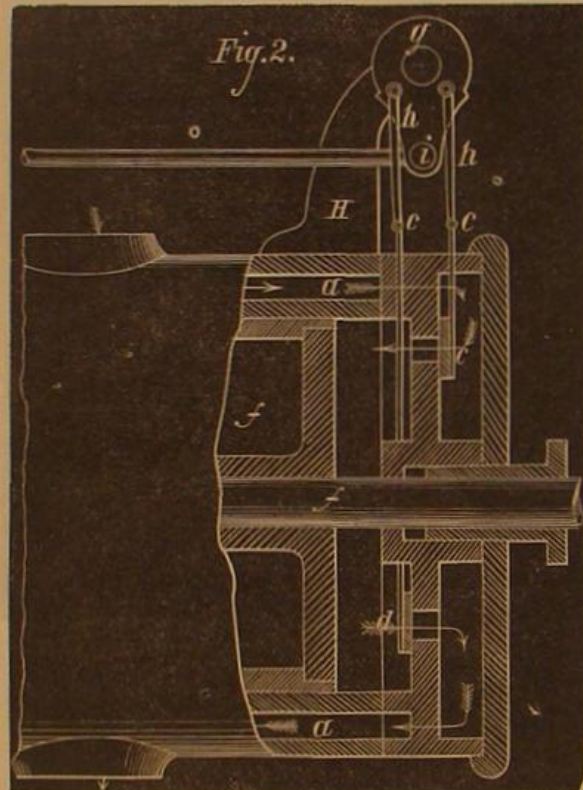
Second: The connecting bar between the piston rod and crank should be as long as the machine will possibly admit—

rom 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

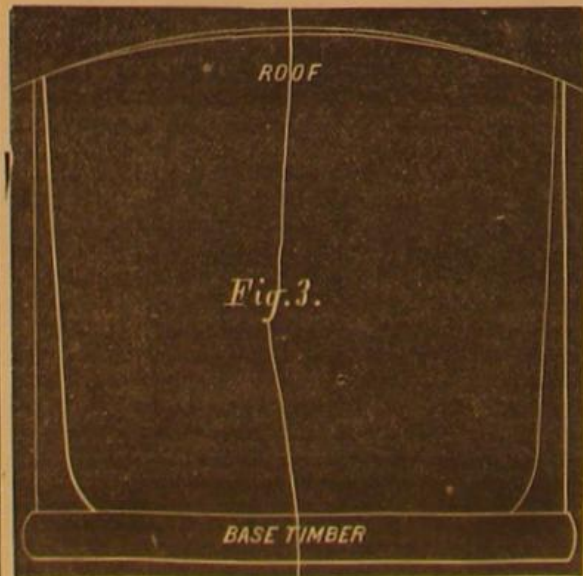


be fitted as snugly as possible to the bore of the cylinder, and yet it must work without chafing. A good practice is to surface such pistons with a shell of hard Babbitt or other composition not liable to chafe, and which may be easily renewed. If packing rings are used, they should be of the simplest 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 *c*, 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 the 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.

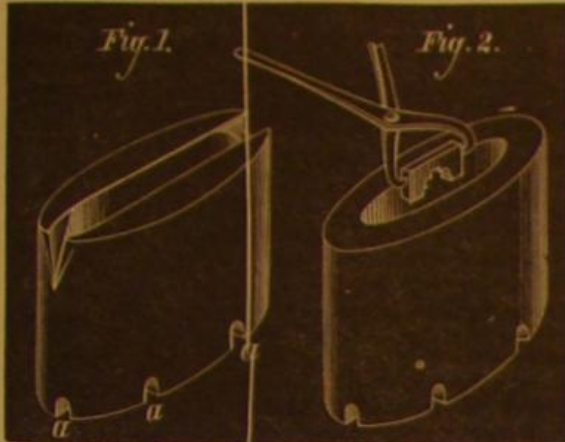
California College, Vacaville, Cal.

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 secure, 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 height, 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 estab-

lish 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.

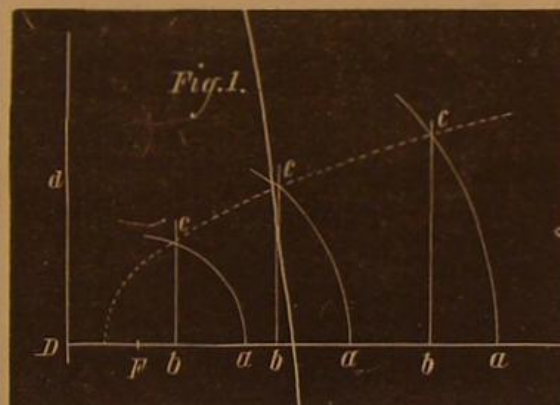
62 Cannon street, New York.

JOHN T. HAWKINS.

To Draw a Parabola.

To the Editor of the Scientific American:

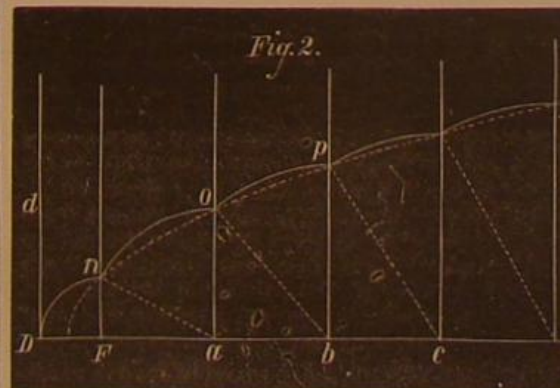
A very convenient way to draw this curve is as follows: On the principal diameter, Fig. 1, lay off the proposed directrix, *D d*, and focus, *F*. With *F* as a center describe arcs, *a c*, at convenient distances from each other. From *a*, set off *a b* equal *D F*, and draw *b c* perpendicular to *D 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 $\frac{1}{2} D F$. 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 ne-



cessary. 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:

$F n = \sqrt{1} = 1$; $a o = \sqrt{5} = 2.236$; $b p = \sqrt{9} = 3$; $c q = \sqrt{13} = 3.605$; $d r = \sqrt{17} = 4.123$; $e s = \sqrt{21} = 4.582$; $f t = \sqrt{25} = 5$; $g u = \sqrt{29} = 5.385$.

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*.

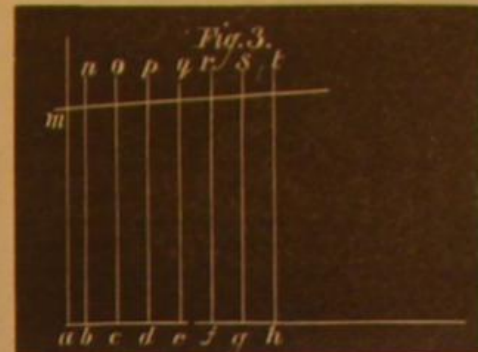
We first determine the radius *F a* (Fig. 1) by taking from a table of squares:

$$F a^2 = 95^2 = 9025$$

$$a m^2 = 14^2 = 196$$

$$\sqrt{9221} = 95.98 \text{ nearly.}$$

Therefore, $D F = 95.98 - 95 = 0.98$; and, therefore, the perpendiculars must be $0.98 \times 2 = 1.96$ inches apart. To determine the position of the first one, divide $F a = 95$ by 1.96 $= 48 + \frac{1}{2}$ a fraction. We now multiply 1.96 by $48 + \frac{1}{2}$, 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 $\sqrt{49 \times 4 + 1} = \sqrt{197} = 14.035$ units (not inches) as in this table

$b n = \sqrt{197} = 14.035$; $c o = \sqrt{201} = 14.177$; $d p = \sqrt{205} = 14.317$; $e q = \sqrt{209} = 14.456$; $f r = \sqrt{213} = 14.594$; $g s = \sqrt{217} = 14.730$; $h t = \sqrt{221} = 14.866$.

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.

New Britain, Conn.

F. H. R.

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 citatis*), 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.

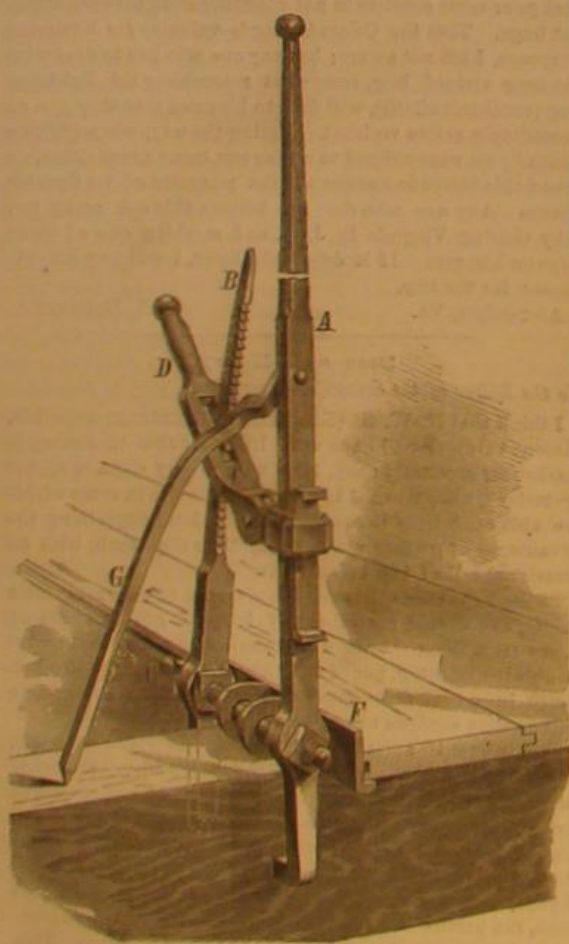
In operation the soap is let into the top of the tank, and run by steam power for from four to ten minutes; the sliding door in the bottom being then opened, the material is conducted directly to the frame, placed, as shown in the engraving, to receive it. All clippings and trimmings can be crutched 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.

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 accord-



ing 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.

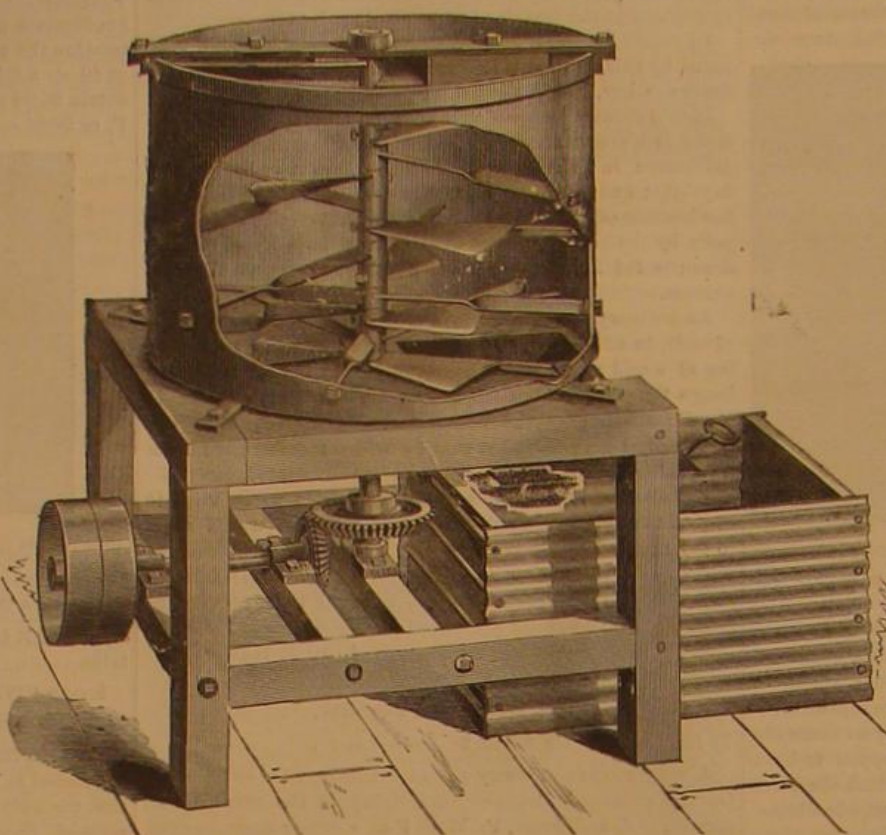
In operation, the bars are placed on the joist and fastened. The upper end of the clamp is then pressed forward so as to force the flooring together by the plate, F. The device can be made to weigh but little; and judging from a model which we have tested, it appears to be an efficient and handy implement.

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



LERHMANN'S SOAP CRUTCHING MACHINE.

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 enterprise 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.

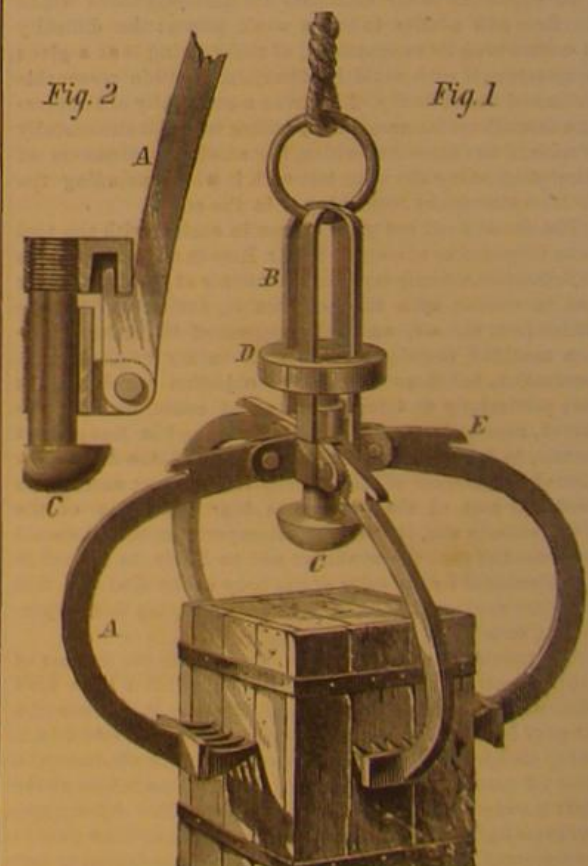
A NEW GRAPNEL.

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 speci-



mens 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.

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 296 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.

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

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 73,000 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.

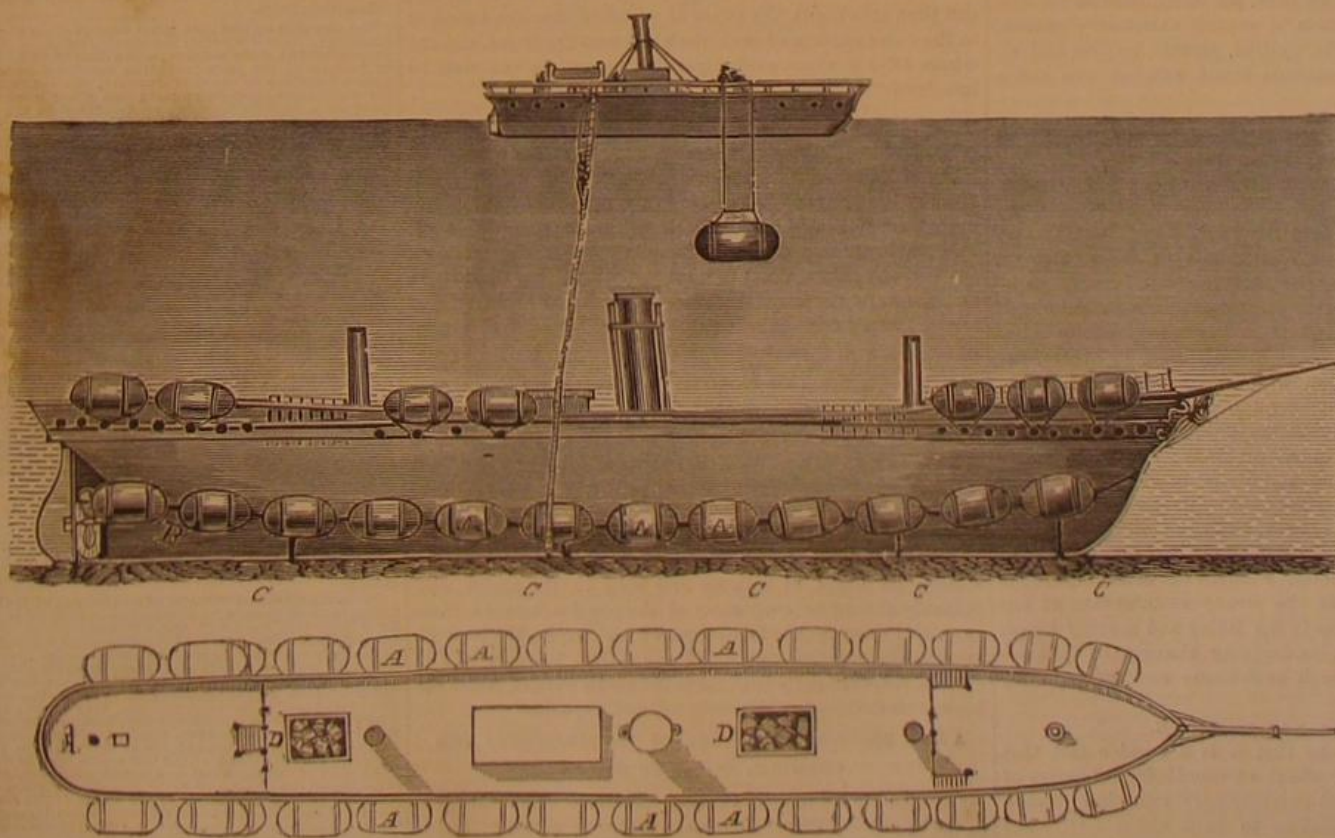
MASON'S DOUBLE BOGIE TANK LOCOMOTIVE.

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



SOWERBUTT'S APPARATUS FOR RAISING SUNKEN VESSELS.

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

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.

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.

This 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 \$350, 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 almandine. 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 Sie-

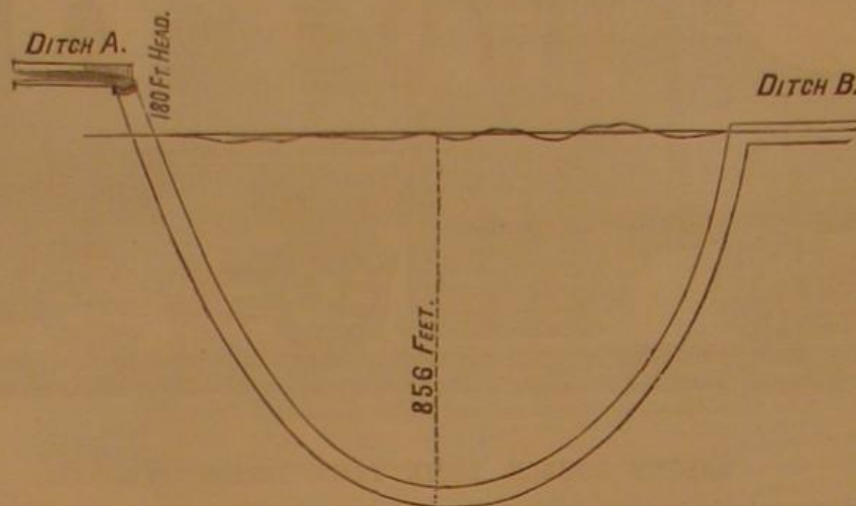
mens electric pyrometer, changes of resistance amounting to about 1/1000 of the quantity of heat to be measured can be detected without much difficulty.

IMPROVED TELESCOPIC LENSES.

Professor Stokes says that, if opticians can manufacture glass containing terborate of lead or titanate 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 effectively their shells are protected by varnished coverings. This is generated in the yolk, in which the minute granules assume a morbid vitality, ab-



GREAT SIPHON OF THE SPRING VALLEY MINING COMPANY.

sorb 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 animalcules existing in the atmosphere develop 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 animalcules, 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 light, 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 valid 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. 120,781, 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 grounds 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 the 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 defendants' 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 plungers 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 the 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 has 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 he is entitled to, for those machines contained other patents than the one sued on, and for those machines he realized no profit, 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 35 of the patent act of July 8, 1870.

(H. T. Rink, for complainant.)
(H. A. 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 Woollen 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 slipper from being thrown off. It consists of a new arrangement of devices for causing the tripping of the slipper 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 H. 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, Lumberton, 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. Conch, 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 Clendenen, 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, Gips's Point, Md.—This invention consists in separators and guides 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 guides 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 cables can be used, one at each side of the canal. These cables 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, assafetida, tincture of camphor, laudanum, tincture of yellow jessamine, oil of sassafras, and salt water. It is said to be a cure for cholera, cholera morbus, and kindred complaints, such as diarrhoea, 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, Monaca 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 height, usually in a horizontal position, but higher or lower, according to the height of the opposing car. The ball is confined to the drawhead, and is adjusted to the desired height 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 stall thrasher for which letters patent No. 104,535 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 inked 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 thereon 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. Loremus, 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 an other 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.

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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 cleaning 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, 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. 303, 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. 333, 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. 303, vol. 30, and for gilding picture frames on p. 30, vol. 30. Bookbinders use glue, sometimes tempered with a little molasses.—H. B. 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 make, 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 tem-

perature 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 this 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 wheels; 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 perfect dry.

(17) A. V. K.—The London Underground Railway tunnels are about 25 feet wide and 15 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 15 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 height 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 tin or two of iron buried beneath the surface, and thereby draw the effect rather 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 deposits of iron.

(25) J. McL. 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 3/4 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, 1 1/4 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 tons, manufactured at the Fort Pitt works, Pittsburgh; while I contend that the 81 ton 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 marked 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 is 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. Sillate 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 potash is fused with sulphur and carbonate of potash 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 35 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 (labeled 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 obliged 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 Rozier? 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—49,000,000 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, 3½ 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 Bab-bit metal? A. The addition of more antimony.

(41) 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 2½ 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 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 1½ 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 perispermous, 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 Popellier Ducarré, is an artificial fuel composed of charcoal refuse with coal tar. The small lumps and dust of charcoal are mixed with 5 to 12 per cent of water, then ground to powder, and to 200 lbs. of the powder are added 35 to 40 quarts of coal tar. This magma is thoroughly incorporated, and text 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 kinked, 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, 1-4, slacked lime 1-4, 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 1½ inches, 19 feet from the surface, and I have 5 feet of water in the pipe. I dug down 15 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 35 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 34 to 36 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 26¼ 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 potash 29.7 parts, sulphur 17.2; charcoal 1.7; black sulphuret of antimony 5.7. According to M. M. Desnoilles and Castelha, 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 45 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 ½ 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 height. 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 thin skids, 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 12x30 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 slag 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 far.

(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 upon 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 Florence 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 odorless.

(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 tourmiquet. But instead of the horizontal tubes, there is a horizontal drum, containing curved vertical walls. From the Latin turbo, turbine, 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 height of the object is known, or the height of that object when the distance is known; the rule for calculation is: As 1 is to 100, so is height 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 smokestack 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 500 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 packages 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 44, and sulphur 56, in 100 parts.—B. S. S.—It is talc, and is composed of silica 62, magnesia 33, and water 5.—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. Kaas: 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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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.
30,800.—PHOTOGRAPHIC CAMERA.—S. Wing. Nov. 18.
31,001.—STRAW CUTTER.—W. Gale. Dec. 2.

EXTENSIONS GRANTED.

30,021.—ROCK DRILLING MACHINE.—L. M. Gilmore.
29,003.—STEAM ENGINE.—W. Wells.

DISCLAIMER.

26,013.—GIRTH BUCKLE.—L. C. Chase.

DESIGNS PATENTED.

7,715 to 7,771.—CARPETS.—R. H. Campbell, Lowell, Mass.
7,722.—COOKING STOVE.—J. V. B. Carter, Detroit, Mich.
7,723.—SPICE MILL.—W. Haslam, Philadelphia, Pa.
7,724 to 7,736.—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.—G. 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.

1,350.—CARPET WARP.—E. W. Holbrook & Co., Troy, N. Y.
1,351.—FLOWS, ETC.—Lawrence et al., Kalamazoo, Mich.

1,352.—FERTILIZERS.—W. W. Leman, Macon, Ga.
1,353.—WHISKY.—Shields & Co., Cincinnati, O.
1,354.—PAPER BAGS.—Chastfield et al., Cincinnati, O.
1,355 to 1,357.—CLOCKS.—F. Kroeber, Hoboken, N. J.
1,358.—WHISKY.—B. M. May, Cincinnati, O.
1,359.—AMMONIA MANURE.—J. J. Turner & Co., Baltimore, Md.
1,360 and 1,361.—MEDICINES.—A. Vogeler & Co., Baltimore, Md.
1,362.—PLASTER.—A. Vogeler & Co., Baltimore, Md.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
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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.—L. 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, Seaford, 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 cookie from wheat, called "The Balch State Cookie 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 Arresters." 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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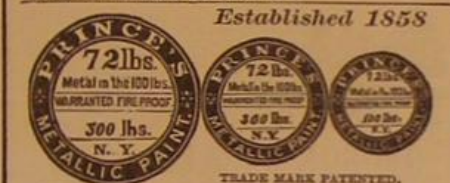
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Vol. XXXI.—No. 15.
[NEW SERIES.]

NEW YORK, OCTOBER 10, 1874.

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IMPROVED CURRENT WATER WHEEL.

The invention illustrated in the annexed engraving is an undershot wheel, which is mounted in a float or raft. The latter is inclosed in a basin made by cutting away the bank at right angles to the stream, the sides being protected by piles and planking, or by stone revetments. The length of this slip is the same as that of the float, so that, if desired, the latter, with the wheel, can be carried back therein, and thus be removed out of the current. The raft is made of proper dimensions to balance the weight of the wheel, and the slip is excavated to a sufficient depth to float the apparatus at low water.

Our engraving shows the wheel projecting into the current and into operation. Its motion is communicated through gearing, A, to a horizontal shaft, B, supported in the middle portion of the raft. On this shaft slides a loose pulley, C, on the left hand side of the hub of which is an annular recess and a clutch, to engage it when desired with the shaft, B. In hub recess enters the end of a shipper lever, D, the other extremity of which is secured to the bank. A hinge in the middle of this lever allows of its adjusting itself to the position of the raft as the latter rises and falls with the varying level of the water.

It will be evident from the illustration that when the float is drawn into the slip for a certain distance, the lever, D, remaining rigid, will push the parts of the clutch asunder, so that such motion as the wheel may maintain will not be communicated to the loose pulley, nor through the latter, by the belt shown, to the point at which the power is to be utilized. On the other hand, however, when the raft is moved out so that the wheel enters the current, then the lever will draw the clutch into action and the power will be again transmitted; consequently the starting or stopping of the mechanism is readily governed by the means employed for moving the float, and this consists simply in a shaft, E, supported in suitable standards on each side of the slip, around which are wound chains leading to the opposite extremities of the raft. When this shaft is rotated, by the wheel shown in the hands of the figure to the left, the raft is necessarily drawn in; and when turned the other way, the opposite movement of the latter takes place. A pawl dropping into a recess in the shaft, E, holds the wheel in proper position when run out. Rollers, F, are attached to the longitudinal timbers of the raft to take against the planking of the basin, and thus to lessen the friction between the same and the raft, in moving the latter when the current forces it into close contact.

In streams which become swollen and choked with drift wood during the heavy rains and spring freshets, the device above described will prove of especial value, since the possibility of withdrawing the wheel entirely out of the current affords an excellent means of protecting it from injury or destruction.

Patented through the Scientific American Patent Agency, September 15, 1874. For further information address the inventor, Mr. Michael McCarty, Pueblo, Colorado.

Manufacture of Oatmeal.

The manufacture of oatmeal is beginning to attract the attention of many of the milling fraternity, both on account of the increasing demand for this wholesome article of food and the large profit in its manufacture. In Canada oatmeal is a common article of diet, but in the United States, though in considerable demand, comparatively little is known of its manufacture. Although the manufacture in this country is quite limited, the method is simple and inexpensive. But

little information can be derived from those who are running oatmeal mills, simply because they desire to monopolize the trade to as great an extent as possible. After the outside hull and the stratum of down or fuzz covering the kernel are removed, the clean grain is ground into meal; and being deprived of its tough outer covering, care must be taken lest it be reduced to powder. The first and most expensive apparatus required is the kiln for drying or expelling the moisture from the grain until the kernel is hard and the hull stiff and rigid. The ordinary kiln is built of brick or stone, and so arranged as to distribute the heat equally under and around the drying floor. This floor consists of sheet iron or cast iron plates thickly perforated with funnel-shaped holes, the wide end downward, thus allowing the heat and smoke to pass up, and preventing the oats and dust from passing

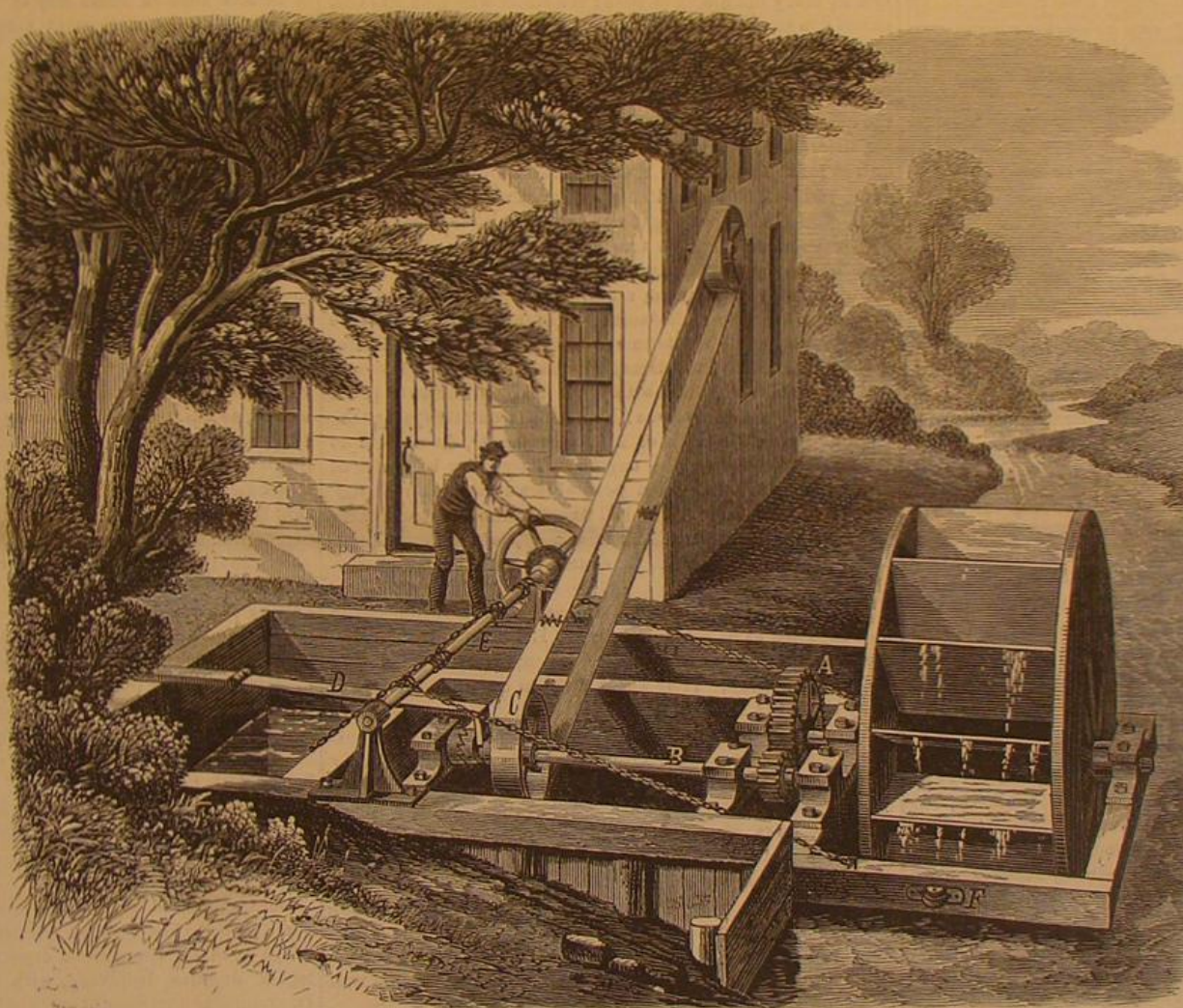
about a kernel's length apart. The duster and fan for removing the hulls and dust are simple and easily constructed. The grinding is sometimes done on the hulling stones, but it is generally advisable to use much smaller stones, furrowed, and having a smoother and much less grinding surface. The apparatus for bolting and sifting is very simple in construction, being a series of inclined sieves placed one above the other. These sieves are usually made of tin or zinc, into which are punched round holes of suitable size and sufficiently far apart to allow the hulls to slide over. The meal passes through these sieves while the bran passes over it at the lower end of each.—*American Miller.*

Composition for Picture Frames.

1. To make composition ornaments for picture frames:

Boil 7 lbs. of the best glue in 7 half pints of water, melt 3 lbs. of white resin in 3 pints of raw linseed oil; when the ingredients are well boiled, put them into a large vessel and simmer them for half an hour, stirring the mixture and taking care that it does not boil over. When this is done, pour the mixture into a large quantity of whiting, previously rolled and sifted very fine, mix it to the consistence of dough, and it is ready for use.

2. Dissolve 1 lb. of glue in 1 gallon of water; in another kettle boil together 2 lbs. of resin, 1 gill of Venice turpentine, and 1 pint of linseed oil; mix together in one kettle, and continue to boil and stir them together till the water has evaporated from the other ingredients; then add finely pulverized whiting till the mass is brought to the consistence of soft putty. This composition will be hard when cold; but being warmed, it may be molded to any shape by carved stamps or prints, and the molded figures will soon become dry and hard, and will retain their shape and form permanently. Frames of either material are well suited for gilding.



MCCARTY'S CURRENT WATER WHEEL.

or choking the holes. The roof is constructed like an inverted hopper, with a square opening at the top for ventilation, and surmounted by a cupola with latticed sides. The oats, which are spread upon the kiln floor, are constantly stirred, to dissipate the moisture and prevent the lower strata from being scorched until the batch is sufficiently dried. In this way, from one hundred and fifty to six hundred bushels per day are kiln-dried, according to the capacity of the kiln.

Another style of kiln is also in use. This consists of two or more perforated sheet iron cylinders placed in the furnace one above the other, and so inclined that the oats gradually move from the higher to the lower end. The oats, after passing through the upper cylinder, are deposited into the upper end of the second, and from the lower end of the second into the upper end of the third, and so on; the number of cylinders, their length and velocity, being governed by the capacity required. This is, undoubtedly, much superior to the old style kiln, as it has a regular feed and dries the oats much more evenly and thoroughly. After the oats become cool, they are ready for shelling.

The stones best adapted for shelling are a coarse free sandstone, usually imported from England. The bedstone is faced perfectly true, but the runner has a boss of about three sixteenths of an inch around the eye and running back to nothing at about two thirds of its diameter. The outer third is dressed to a true face corresponding to the bedstone. The faces are picked or roughened as for ordinary grinding, but have no furrows. The runner is set upon a stiff ryne, keyed to the spindle. The ryne has three or four arms which are let into open grooves cut into the stone. The faces of the stones are not allowed to run very close to each other, being

Phosphorus and Phosphates in Putrefaction.

It has been shown by Pasteur and others that the presence of calcium phosphate accelerates the decomposition of gelatin and other animal matters, and they consider it is because the salt furnishes the necessary elements for the development of the sporules suspended in the air. These sporules fix themselves upon moist surfaces, and by producing mucidines and microzymes accelerate decomposition of animal matters. Animal secretions, such as urine, which naturally contain a considerable quantity of calcium phosphate, do not putrefy more quickly by the addition of calcium phosphate, because they naturally contain enough of the salt to nourish the microzymes developed by means of the albuminous substances. Flesh which contains much calcium phosphate decomposes more rapidly than that which contains less, or in which the phosphoric acid is combined with an alkali. It is well known that the flesh of fishes alters more quickly than butcher's meat. According to Von Bibra, the ash of perch and carp yields 44.34 and 42.20 per cent of earthy phosphates, while the ash of beef and veal furnishes only 20.60 and 16.40 per cent; but, on the contrary, the latter are one third richer in alkaline phosphates than the former.

The muscular flesh of sea fish and mammalia contains the following percentages of phosphoric acid: Skate, 0.514; mackerel, 0.532; beef (fillet), 0.395; veal (ditto), 0.374; pork (ditto), 0.430. The animal ferment, like the vegetable ferment, has then an indispensable want of earthy phosphates, and especially of calcium phosphate, for its multiplication, and this want is so strong that the microzymes attack the most insoluble phosphates. Flesh begins first to putrefy in the part nearest to the bones.—*J. Lafort.*

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THE SCIENTIFIC TREATMENT OF CRIMINALS.

The *Tribune* is alarmed at the logical consequences of the mechanical theory of life, seeing in them not only the downfall of theological dogmas, but the subversion of our entire criminal jurisprudence. If we are to push to ultimate conclusions the theory that the acts of the lower animals are purely automatic, it argues, we shall be confronted immediately by the extension of that theory, demanded by the similar anatomy of man. This point yielded, we are brought face to face with the problem presented in the case of the wounded French soldier, who is scrupulously honest when the sound part of his brain is acting, but, when under the influence of its impaired portion, is an inveterate thief.

For example: "A prisoner, brought before a court of justice for assault, might admit that he struck the blow, but allege that the act was simply [the mechanical effect of] a piece of 'unconscious cerebration.' An insult from the man he struck called forth the blow in return, by reflex nervous action. His will bore no more part in the matter than would the winking of his eyelids if something suddenly approached his eyes. Certainly," concludes the *Tribune*, "no court would at present accept such a plea; but is it utterly at variance with scientific teachings?"

The *Tribune* apparently sees in this a fatal objection to the automatic theory. Perhaps it may be rather a fatal objection to the present constitution of the court—a proof that the current theory of criminal jurisprudence is altogether wrong.

Suppose the plea of the hypothetical prisoner to be admitted: say, further, let the prisoner assert that the assault was due to *conscious* cerebration—in other words, that he knew precisely what he was doing and why he did it. Let his plea be that, owing to the structure of his physical and mental machinery, the alleged insult was a sufficient cause—an irresistible cause, if you will—of the muscular action in which the assault culminated: in other human machines the effect might be different; but for him he could not do otherwise, and he ought not to be punished for what he could not help.

Suppose, we say, that such a plea is accepted as cogent. Would the foundation of justice be undermined, and the stability of the social order destroyed? The *Tribune* would undoubtedly reply with an emphatic affirmative. A thoroughgoing scientist might claim, on the contrary, that until such a plea can be accepted as valid, a rational judicial system is impossible; that, not until criminals are recognized as badly working, yet not wholly useless, machines, will it be possible to treat them with impartial and passionless justice, rendering justice at the same time to the well behaved.

Our present manner—we cannot call it method—of dealing with offenders against the commonwealth is an irregular inheritance of vengeance, intimidation, sentimentality, superstition, brutality, and party politics. Feeling for or against the criminal marks every stage of our treatment of him. We exorcise him and pray over him. We shut him up in an unwholesome cell and give him a Bible. We drag him to the gallows between two clergymen and dispatch him with a

passport to eternal bliss. From first to last, he is held responsible for the conditions of his birth and education, the structure of his body, and the constitution of his mind. He is born a thief and a liar, and is alone held to blame for it. His judgment is weak and his passions strong; his mind is uncultured and his tastes depraved by vicious surroundings in infancy and youth; yet we pursue his perverted course as vindictively as if he were free to choose the right at every stage of his career. We imagine that to punish him will satisfy the fetish called law and justice, will prevent others from doing the same things, and possibly, by some miracle, may make a different and better creature of him. That our criminal proceedings accomplish none of these things effectually is only too apparent; and they add to this failure the fault of being grievously burdensome to the well doing. For our part, we see no path out of this tangle of contradiction and injustice so clear as that opened up by the mechanical theory of human action.

From this point of view, the plea of our imaginary criminal would be respectfully heard. Then the judge might say: "The court is sorry that your organism is so viciously constructed, since it therefore becomes necessary for the community, in self-defense, to take it in charge. Have you ever learned a trade?"

The prisoner replies in the negative, and the judge continues: "That is to be regretted, since it makes it the harder for you to square your account with society. You will proceed to the public works, to perform such labor there as you may be found competent to do, under such restrictions as may be needful in your case. The man you struck has lost, in consequence, three days' time, for which we allow him so many dollars. The fee of the officer who took you into custody is so much. The cost of this court, so much. The expense of your keeping while under arrest has been deducted from your daily earnings. Your indebtedness to society is therefore so many dollars. This will be paid from the amount you may be able to earn at hard labor, after paying therefrom the cost of your keeping and what may be required for the support of those dependent upon you. This done, you will be set at liberty at such time as, by your conduct, you shall have demonstrated that your mental and physical machinery is in trustworthy working order. May your cure be speedy and effectual!"

But, it may be objected, all crimes are not of this simple character; the robber, the incendiary, or the murderer deserves punishment, while a lifetime of hard labor may be inadequate to make good the damage he has done.

Shall we therefore throw away all the possibilities of profit which his organism involves? Because a locomotive jumps the track and wrecks a train or kills a passenger, do we add to the loss by smashing the engine? There may be states of society in which the most profitable way to deal with disturbers of the peace is to kill them in the most summary manner; but in a working community, where every man's strength is needed, such a course is the reverse of economical.

The murderer is simply a bit of mechanism, not sufficiently well adjusted to be self-regulating. Left to itself, it works mischief; but, under proper supervision, it can do much that needs to be done. It is sheer folly to destroy it or lock it away to rust in idleness.

As for the deterring effect of the treatment of criminals upon those approaching criminality, we should certainly trust to the resistless, passionless logic of the scheme we have suggested, quite as much as to the uncertain and illogical disposition we now make of them. Impress the evil minded with the fact that it is easier and pleasanter to earn an honest living out of prison than in it: in other words, that crime does not pay, and will not pay them, and the great motive for wrong-doing will be gone. Make the criminal class self-supporting, and not only will a great burden be lifted from the shoulders of the virtuous, but crime will cease to be the refuge of the lazy.

For the reformation of criminals, there is demonstrably nothing more effectual than habits of industry, sobriety, and respect for the rights of others, which are not, but should be, the great lessons of the prison school. Further, when the prisoner is made to feel that his loss of freedom and privation of comfort are not intended as punishment, but as a social precaution, that he is regulated by others, simply because he has shown himself incompetent of self regulation, and that his return to liberty, full or partial, is conditioned solely on the payment of his obligations and the assurance of society that he is fit to be trusted with himself, the highest possible incentives will be offered for his genuine reformation, which, next to its own protection, is the chief object society should have in its exceptional treatment of him.

HUXLEY'S THEORY OF MAN.

There is nothing so easy as to forget. Just now half the world is discussing as a new theme the logical tendency of Professor Huxley's latest utterance, or speculating as to the grounds of his declining to accept the conclusion that man is nothing but a machine, after demonstrating that animals are simply conscious automata and admitting that the view thus taken of the relations between the physical and mental faculties of brutes applies in its fullness and entirety to man. Yet it is but a little while since Professor Huxley went over this matter from the beginning, developing his position with a thoroughness which ought not to be forgotten after the fierce discussion it aroused.

The inseparable connection of matter and life is a fact of every day experience. Whatever the spiritualists may claim, Science has no knowledge of bodiless living beings. The inseparable connection of life and a particular combination of

matter was demonstrated by Professor Huxley in the celebrated "Lay Sermon" on the physical basis of life (first delivered in Edinburgh one Sunday in November, 1869) by a line of argument substantially as follows:

The four elements never absent from living matter are carbon, hydrogen, oxygen, and nitrogen. Carbon and oxygen unite in certain proportions and under certain conditions to give rise to carbonic acid; hydrogen and oxygen produce water, and ammonia is the product of nitrogen and hydrogen. These several compounds, like the elements of which they are composed, are lifeless. But when they are brought together under certain conditions, they give rise to the still more complex body called protoplasm, which exhibits the phenomena of life, and which is found to be the formal basis of all life. From the elements to protoplasm there is a series of steps in molecular complication, a series showing no discernible break; and there is no good reason why the language which is applicable to any one term of the series may not be applied to any of the others.

We think fit to call different kinds of matter carbon, oxygen, hydrogen, and nitrogen, and to speak of the various powers and activities of these substances as the properties of the matter of which they are composed.

When an electric spark is passed through a mixture of hydrogen and oxygen in certain quantities, the elements disappear, and a quantity of water, equal in weight to the sum of their weights, is found in their place. There is not the slightest parity between the passive and active powers of water, and those of the hydrogen and oxygen which have given rise to it. Nevertheless, we call the phenomena exhibited by water the properties of water, and do not hesitate to believe that in some way or other they result from the properties of its component elements. We do not assume that something called "aqueosity" enters into and takes possession of the oxide of hydrogen as soon as it is formed, to guide the aqueous particles to their place in the facets of an ice crystal, or among the leaflets of the frosty imitations of vegetable foliage which we see on our window panes in cold weather.

Is the case changed in any way when carbonic acid, water, and ammonia disappear, and in their place an equivalent weight of the matter of life makes its appearance?

What justification is there for the assumption of the existence in the living matter of something which has no representative or correlation in the not living matter which gave rise to it? What better philosophical status has "vitality" than "aqueosity"?

Further, if the phenomena exhibited by water are its properties, so are those presented by protoplasm, living or dead, its properties. If the properties of water may be said to result from the matter and disposition of its component molecules, there is no intelligible ground for refusing to say that the properties of protoplasm result from the nature and disposition of its molecules.

But having shown in another connection that protoplasm is the common basis of life, Professor Huxley sees no logical halting place between the admission that the properties of protoplasm are the result of the nature of the matter of which it is composed, and the concession that the highest manifestations of life are equally the expression of molecular changes. "As surely as every future grows out of past and present, so will the physiology of the future gradually extend the realm of matter until it is coextensive with knowledge, with feeling, with action." With equal confidence he predicts that we shall, sooner or later, arrive at the mechanical equivalent of that most metaphysical of phenomena, consciousness, just as we have arrived at the mechanical equivalent of heat.

Does this land him in materialism? He avers not, and takes pains to say that he reprobates the fundamental doctrines of materialism as he does the most baseless of theological dogmas, believing, with Hume, that they, like the fundamental doctrines of spiritualism and most other "isms," lie outside the limits of philosophical inquiry. The materialistic aspect of these matters has had an immense and a most beneficial influence upon physiology and psychology. And he shows, in the discussion of the philosophy of Descartes, that he is prepared to go with the materialists to the extent of holding that the human body, like all living bodies, is a machine, all the operations of which will some time be explained on physical principles; but when they declare that man is nothing but a machine, they go farther than he thinks they have any right to. Most emphatically does he decline to follow them in the assertion that the Universe is nothing but matter, and force, and necessary laws. Here he sides with the idealists, considering "matter" and "force" to be, so far as we know, mere names for certain forms of consciousness. "If I say that impenetrability is a property of matter, all that I can really mean is that the consciousness I call extension, and the consciousness I call resistance, constantly accompany each other. Why and how they are thus related is a mystery. And if I say that thought is a property of matter, all that I can mean is that, actually or possibly, the consciousness of extension and that of resistance accompany all other sorts of consciousness. But as in the former case, why they are thus associated is an insoluble mystery."

In all this no account is taken of what by many is deemed the essential factor of humanity—the soul.

While Professor Huxley evidently frames his definition of man so as to leave room for the introduction of this hypothetical element, if any one feels so disposed, it is clear that he regards its existence and influence somewhat as questions of "lunar politics"—questions which neither he nor any one else has any means of determining, and in the discussion of which he has no time to waste. Seeing that matter and

spirit—which are but names for the imaginary substrata of groups of natural phenomena—lose themselves in each other in ultimate analysis, what is the use of wrangling over them while there is so much honest work to be done in the world?

"In itself," he says in the "Lay Sermon" first referred to, "it is a matter of little moment whether we express the phenomena of matter in terms of spirit, or the phenomena of spirit in terms of matter; matter may be regarded as a form of thought, thought may be regarded as a property of matter; each statement has a certain relative truth. But with a view to the progress of Science, the materialistic terminology is in every way to be preferred: for it connects thought with the other phenomena of the Universe, and suggests inquiry into the nature of those physical conditions and concomitants of thought which are more or less accessible to us, and a knowledge of which may in future help us to exercise the same kind of control over the world of thought as we already possess in respect of the material world; whereas the alternative, or spiritualistic, terminology is utterly barren, and leads to nothing but obscurity and confusion of ideas."

ALCOHOL, FOOD, AND FORCE.

We had supposed that Liebig's notion of the relation between food and force had been generally repudiated by scientific physiologists; but its appearance as a stumbling block in the recent discussion of the action of alcohol in the human system, by the Neurological Society, seems to show that it is not yet permanently set aside in all circles presumably scientific. Indeed it was never more emphatically enunciated than in the inaugural address of the newly elected president.

"We know," said Dr. Hammond, "that a certain amount of tissue is decomposed with every functional activity of the organ to which it belongs. Just as steam results from the combustion of fuel, so thought results from the combustion of gray nerve tissue, motion from the combustion of muscle, and the power to secrete bile from the substance of the liver. We know very well that, if fresh fuel be not supplied to the engine from time to time, steam ceases to be formed, and the machine set in motion by it no longer works. The like is true of the body; and were it not for the formative processes which are continually going on, whereby new material derived from the food is deposited to take the place of that which is consumed, death would very soon result. It must be distinctly understood, however, that ordinary food does not directly furnish any force inherent in the body, but that it must first be converted into flesh and brain and heart and liver, etc., from the destruction of which the force peculiar to each is evolved."

In restricting the theory to "ordinary food," Dr. Hammond evidently had in mind the extraordinary action of alcohol, which, according to his own showing, does furnish force to the body without first forming tissue, and—more perversely still—while it retards the process of tissue consumption by which alone, according to the theory, force can be evolved.

The experiments establishing this point are narrated at length in the address, as published in the *Psychological Journal*. A given amount of food plus a moderate dose of alcohol appears to enable one to do more work, without drawing upon the reserved forces of the body, than can be done on the food alone; or, when food and work remain constant, and so adjusted as to keep the body at a fixed weight, the addition of a small portion of alcohol to each meal is followed by a gain in weight. Similarly, if the weight of the body be increasing, the gain will be augmented, if losing, the loss will be diminished, when alcohol is taken, other conditions remaining unchanged.

This conflict between theory and observation is fairly faced. By the theory, alcohol, which does not form tissue, ought not to supply force to the system; by stopping the destruction of tissue, it ought to diminish the available force of the system. But the experiments show that, properly administered, it does increase the working force of food, both physical and intellectual. That the force thus developed under the use of alcohol is directly supplied by it, Dr. Hammond is certain. How it does it, he cannot see.

From first to last, indeed, the Society seems to have stumbled over Liebig's teachings; and curiously there was no one present sufficiently familiar with recent physiological research to challenge the theory and accept the facts as not inconsistent with known effects of food.

It is nearly thirty years since the death-in-life doctrine of force from tissue combustion was questioned by Dr. Mayer of Helldorf, then an obscure country physician, now honored the world over as one of the first to propound the greatest generalization of modern Science, the correlation and conservation of force. More recently, Fick and Wislicenus, Dr. Edward Smith, Mr. Heaton, Professor Houghton, and others have demonstrated its baselessness by elaborate investigations showing that the waste of tissue is not proportionate to work done; while, save in cases of starvation, it is altogether inadequate to account for the forces evolved. Under normal conditions the larger part of the force required to maintain the body's temperature, to keep up the processes of thought, digestion, respiration, and other vital functions, and to perform the various sorts of external work demanded of the muscles, is shown by these investigations to be derived directly from the blood, or more precisely, from the food which the blood carries to the several organs.

The wonder is, not that the contrary view should have been entertained so long, but that it should ever have been accepted. An engine working in the manner thus attributed to the human system—first using its fuel to build up its parts, then burning up its own substance to develop power

would have been pronounced absurd by the most superficial observer. The fact, that it was, within certain limits, self-repairing, would not have made its mode of developing force in the slightest degree more economical; though it might help to hide its foolishness, as it seems to have done in the supposed case of our bodies.

If, from this point of view, we were to develop Dr. Hammond's comparison of the body to a steam engine, we should have to regard the organs, by means of which intellectual and mechanical work is done, as parts of a complete mechanism, capable of developing and transmitting the forces evolved by the decomposition of the food conveyed by the blood, just as the steam engine develops and transmits the power arising from the combustion of fuel. The work done in either case is proportioned, not to the loss of substance experienced by the machinery employed, but to that available in the food in the one case, in the fuel in the other.

True, as Professor Houghton observes, the same blood, which, by its chemical changes, produces movement and thought, also repairs the necessary waste of muscles and brain by means of which movement and thought are possible; just as if the steam that works an engine were able, without the aid of the engineer, to repair the wear and tear of its friction and waste spontaneously. "But no greater mistake is possible in physiology than to suppose that the products in the changes of the blood, by means of which mechanical and intellectual work is done, are themselves the result of the waste of the organs, whether muscles or brain, on the exercise of which that work depends."

Having thus a clear conception of the function of food in the animal economy, it is easy to see that alcohol, though not a tissue-forming substance, may nevertheless, under proper conditions, add directly to the working force of the system. The fact that, when taken in moderate doses, it disappears in the system as completely as beef or bread, lends probability to the opinion that it is a force supplier. How far it is a useful and profitable adjunct of food is another matter.

BULLS ON THE TRACK.

Horace Greeley used to compare people, whose opposition to the normal progress of events was more zealous than discreet, to a plucky but shortsighted bull that tried one day to stop a railway train to Chappaqua. The result was disastrous—chiefly to the bull. Had the honest old gentleman lived to witness the revolt of the Wisconsin farmers against the social and material prosperity of their State, he would have found in their bovine attempts a striking and very pertinent occasion for recalling the comparison.

From a higher point of view, the action of the farmer class affords a perfect though costly illustration of the inability of human kind to profit by the fate of others, men as well as bulls. It furnishes also one more proof of the law of human development, that all societies proceed from barbarism upward along practically the same course, marked by the same characteristic stages, which may be more or less rapidly passed over, but which can never be altogether avoided.

One of the earliest steps which men take toward social improvement is that of combination. Unfortunately, however, first combinations among men are always for offensive ends, and are always destructive in their reaction. The first gang of prehistoric savages who ever put their shoulders in line for a common purpose doubtless had in view the wiping out of encroaching neighbors; a more enlightened self interest would have taught them that, in their severe struggle with the forces of Nature, not war, but friendly alliance, with all other men was the better policy. The same suicidal tendency crops out continually in the history of human progress. Nations spend ages—and their own manhood as well—in destructive wrangling, to discover at last that friendship and mutual helpfulness would have been infinitely better for both sides. And as with nations, so with the integral parts of nations. Each class must learn its wisdom by independent experience.

When the mechanic classes first reached the combining stage of development, they straightway declared war against capital, against machinery, against rival labor, against the inevitable, generally. Gradually, through bitter disappointment and loss and suffering, the more intelligent are learning that the wiser course is to form closer and more amicable alliances with all productive interests, especially with the men without whose money and organizing ability their own exertions would be prevented or rendered fruitless.

The farmers' turn has come now, and they seem bent on going through the same unsatisfactory mill. They have discovered that there is strength in union, for them as for others; but they—at least those of Wisconsin—have not learned that it is madness to use their strength in overturning the corner stone of their own prosperity. It may be hopeless to expect them to profit much by the dear-bought wisdom of the classes which have preceded them along the same line of intellectual and moral development; nevertheless it is safe to predict that it will not take them many years to learn that the "independent farmer" in these days does not stand alone in the world; that his interests are inextricably blended with the interests of others, even those of the obnoxious railway magnate; and that in the long run a general regard for the Golden Rule will not seriously conflict with the advancement of agriculture.

Descending from general principles to special facts, it might be instructive to the Wisconsin farmers to give an impartial thought to the relation which the railroads bear to their present condition, to consider seriously their indebtedness to these enterprises, and to speculate a little in regard to the retroactive effect on their own prosperity, likely to result

from the pressure they have brought to bear on the arteries of civilization.

The Providence which causes great rivers to flow by great towns for the advancement of commerce is seen not less clearly in the distribution of railways—particularly in the West. As a rule they have led the way, while population, and all that population brings, has followed after. Without them, except perhaps along the water courses, the country would have been to-day a wilderness. Contrast the rapid growth of Wisconsin with the slow development of States, in the days before the T-rail (with a dash) began to supersede the Indian trail; States which, like New York, were blessed with infinitely superior natural advantages, both from position on the coast and because of their facilities for internal communication by water. Or contrast those parts of Wisconsin which railways traverse with those which know them not; and it may be possible to estimate vaguely the influence which railways have had on the State's development.

In 1850—two years after Wisconsin became a State—the census takers found a population of 305,000, or 6 to the square mile. There were then three "railway men" in the State, and forty thousand farmers, with improved lands amounting to one million acres, and above the same number of acres unimproved, the average value of both together being less than ten dollars an acre. The aggregate wealth of the State in real and personal property was \$42,000,000, or less than \$140 a head. In 1870 the number of persons engaged in agricultural work in the State was 160,000, of whom 109,000 reported themselves as farmers and planters. The aggregate population exceeded 1,055,000, or 20 to the square mile. The value of the farms, now showing nearly six million acres of improved lands, had increased in amount from less than \$30,000,000 in 1850 to over \$300,000,000 in 1870. From less than ten dollars an acre, the average value of the farm land, improved and unimproved, had increased to more than twenty-five dollars an acre; while the aggregate wealth of the State had swelled to \$700,000,000 and over, or an average of \$665 to each individual. In the mean time the three railway men of 1850 had multiplied a thousand fold, and 1,525 miles of railways had been constructed.

We should like to see an honest Granger's estimate of how much of this enormous increase in wealth and population has been—we will not say produced, but—made possible by the railways which have been so oppressive (?) to farmers, while they have brought, in towns and cities, manufactories and markets, without all which the richest farmer in Wisconsin would, we fancy, find little encouragement in his work.

Have the millions invested in railways brought a corresponding reward to those who furnished them? In justice, they should; in reality, they have but little more than held their own. This result was not unexpected. In sparsely settled countries railroads are built, not for present but for future profit. If for years they pay their current expenses, they do well. It is only after the country has become thickly settled, and the connected points important, that they can hope for profits commensurate with those of other branches of industry. That the roads affected by the Potter law, namely, the Chicago and Northwestern, and the Chicago, Milwaukee, and St. Paul, have never yet been able to earn a fair income on the capital invested, is well known. At such a stage, to have their receipts arbitrarily cut down 25 per cent is, to say the least, not encouraging to such enterprises, or calculated to impress the stockholders with a high appreciation of bucolic wisdom and honesty.

By skillful management, and with a great reduction of working expenses, the companies may be able, with the help of through traffic, to sustain themselves and pay the interest on their bonds; but the outlook is not encouraging. Already a large amount of rolling stock has been withdrawn; the speed of trains will have to be reduced, and second class coaches substituted for first class. Whether the through traffic can be retained in connection with the new arrangements remains to be seen. It is more than likely that it will be largely diverted to lines running through other States.

If the farmers only were to suffer the reflex consequences of this sudden set-back of the progress of their State, there would be fewer to deplore it. But they will not; nor will they be the first to feel it. The mercantile, manufacturing, and lumbering interests may be prostrated before the farmers begin to discover the mischief they have wrought—assuming, of course, that the United States Court affirms the validity of the law, and it remains unrepelled; but the penalty will be none the less certain because delayed. The farmers have been chiefly benefited by the rapid development of the country; by arresting its development, they will ultimately be the heaviest losers.

New Postal System.

On January 1, a new law is to take effect, requiring the prepayment of postage by the publishers on all newspapers and magazines mailed to subscribers. The result will be to increase the postal revenue by insuring the payment of postage on all publications; and it is believed that the system will prove a convenience to subscribers.

Instead of the subscriber being required to pay any postage to the office where he receives his paper, it will be delivered to him free, and the publisher will include the postage in his subscription rates.

In an ordinary open fire grate, 75 per cent of the heat, resulting from the combustion of the fuel, goes up chimney and is wasted, only 25 per cent being radiated into the apartment.

FURNACE FOR THE LARGE HAMMER AT WOOLWICH ENGLAND.

We have already described the 35 ton steam hammer, recently erected at Woolwich, England, for use in the Royal Gun Factories; and we present herewith an engraving of a reverberatory furnace (one of two) of unprecedented size, to be used in heating the coils of which the ponderous ordnance is built up. The furnaces are built upon a block of concrete 4 feet thick, laid in an excavation dug out for it, and having large slabs of cast iron placed upon the top, so as to distribute the pressure evenly throughout the whole mass. Upon these slabs a series of cast iron standards is erected for the floor of the furnace to rest on, four rows of standards being beneath the hearth, where, of course, the greatest weight, that of the "heat," comes. The hearth has four strong cast iron girders around it, forming a square frame above the standards; and the bottom of the hearth consists of thick cast iron slabs. It is sunk about one foot, so as to admit of a deep bed of fettling being formed within it upon the iron slabs. Girders also run along the sides of the furnace floor for the wall plates and brick side linings to be built on. These girders rest upon the standards before alluded to. The end walls are built upon large cast iron cross beams, which are perforated transversely with holes and grooved longitudinally to prevent their twisting and buckling with the heat. The two side walls of the furnace, and one end wall—that over the fireplace—are constructed externally of light plates of cast iron, as shown in the engraving (for which we are indebted to *The Engineer*), with flanges at the edges to connect them, and ribbed on the outside for strength. They are cast with large apertures in the plates between the ribs. A large circular aperture is contrived on the side opposite the door, which is ordinarily filled with a wall of fire bricks, but could be opened in emergency to introduce a long heat, required to be welded in the center. The plates are generally connected at the flanges by means of keys, wedges being driven into slots cut in the keys on one side. Where there is no room for driving the wedges, such as at the sides and lintel of the doorway, where there is a double flange, bolts and nuts are

employed. Within the walls of plates the lining of fire brick is built, and it is bonded here and there into the apertures of the plates to keep it in position, as, except at the ends, it is very thin. The bricks are all headers. The brick ends of the furnace are, of course, arched over, and meet in the center to form the roof. The side walls are prevented from separating by stout wrought iron bars, square in section, running across at the top and floor from outside to outside, which are keyed in a similar way to the flanges of the plates, with wedges passing through slots in the bars on either flank of the plates.

The flue leading to the chimney stack is supported upon plates and perforated beams; thus every facility is afforded for the free passage of a current of air around, above, and beneath the entire furnace, so that the exterior of it may be kept as cool as possible. This is essential for the preservation of the furnace and to prevent radiation, the lightness of its construction enabling an intense heat to be generated inside while the exterior is not affected by the temperature; at the same time, expansion and contraction may take place with impunity. Internally the furnace consists of three parts, the fire chamber, the hearth, and the flue leading away to the chimney. The first two of these are separated from each other by a low wall of fire bricks to throw the fire upwards and over the top of the heat. The fireplace is of the ordinary character, the fire being built upon trapezoidal bars. It is fed through two apertures in the iron and brick end walls. The hearth, which has already been described, has a channel beneath, on one side, for the slag to run off as it is formed. This is collected in molds in a pit behind the furnace, and afterwards hoisted up by a small hand crane for removal. The flue and chimney stack present no new features. The door of the furnace and the means for lifting it are novel. It consists merely of a cast iron frame filled in with fire bricks, and is bound together with bands of wrought iron, as shown in the engraving. It weighs 8½ tons. In order to lift this heavy weight, a massive chain, passing over two pulleys suspended to a girder above, has a counter weight attached to it weighing 7½ tons, which sinks into a

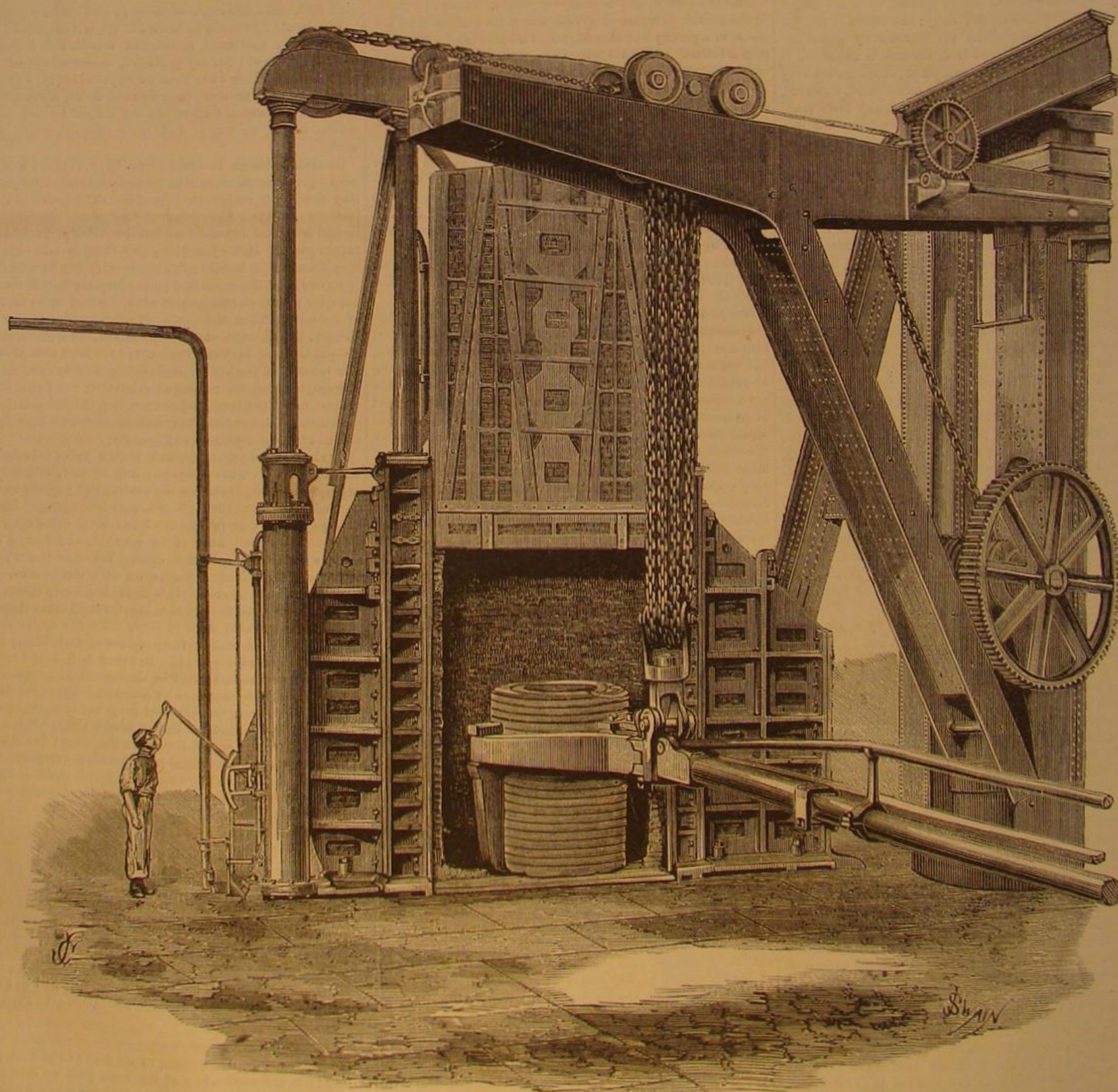
well in the ground as the door ascends. As, however, this counter weight would not of itself be sufficient, and in order to overcome friction between the chain and the counter weight, a long cylinder is contrived, to the piston rod of which the chain is attached. When it is required to raise the door, steam is admitted above the piston, which descends, the counter weight accelerating its movements. The door, in closing, is sufficiently heavy to raise the counter weight, and is given a slight excess of weight for this purpose over the latter.

A Case of Fragile Bones.

A correspondent, Mr. Z. P. M. King, says: "I noticed your account of a remarkable woman without bones. My wife once witnessed a case in Lodi, Wis., which bears some analogy to it. The bones of a child, 2½ or 3 years old, seemed to be of such tender nature as to be in danger of breaking every time it was moved. The limbs had been broken repeatedly in attempting to lift it, so it was carried on a pillow exclusively. The child had not outgrown the size of an infant 9 months of age. The bones seem to knit readily, but broke in another place as soon as the child was lifted."

The National Board of Fire Underwriters.

At a meeting of the Executive Committee of this body, held on September 23, it was resolved that, the authorities of Chicago having failed to comply with the suggestions put forth by the National Board of Fire Underwriters on the 24th of July last, "this committee now recommends that all companies belonging to the National Board discontinue the business of Fire Insurance in the city of Chicago, either by new policies or renewals, on and after October 1, 1874; and that the General Agent be instructed to communicate this decision at once to all National Board Companies for immediate action." The committee is advised that the board companies will carry out the above recommendation with great unanimity.



HEATING FURNACE FOR THE MONSTER HAMMER, WOOLWICH, ENGLAND.

AMERICAN RAILROAD STATIONS.

Since the civil war, progress in the United States has been rapid and vigorous in all directions, but in no department has this been more marked than in railroads. The main lines or arteries throughout the country are becoming every day more substantial; and their permanent way, stations, warehouses, shops, etc., are rapidly assuming the solid appearance that we see on English and Continental roads. No road stands higher in this respect than the Pennsylvania Railroad; in fact, it has always maintained a preëminent reputation in matters of this kind, with its iron bridges, its solid ballasted track, steel rails, and fine shops.

We publish an engraving herewith, taken from *Engineer-*

ing on this part of our subject. In the case of any casting, upon the metal changing from a liquid to a solid state, the crystals arrange themselves in lines perpendicular to the cooling surfaces; or these lines lie in the same direction in which the heat went out of the iron. If the heat leaves all surfaces of a casting, then each surface will have the lines in which the crystals assemble, and which lie near to it, perpendicular to itself.

We may then briefly state the law thus: The lines about which the crystals assemble are perpendicular to the surfaces of the casting.

Fig. 2 shows a view of the end of a casting. This shows the assemblage lines, though the individual crystals are too

angle, the lines which we have been considering are perpendicular to the surfaces forming this angle, A, and extend beyond the angle until they interlock, as before, and, together with the diagonal from the corner, B, form a weak line, the entire distance from A to B. Now, though there is much more metal between A and B than between A and C, yet the casting will always break through A B, rather than through A C, the break taking the longer course.

Castings may be made which will not show this peculiar appearance, and may not have it in any marked degree; but if such castings are exposed to heat, the crystals will change position and assemble in lines perpendicular to the surfaces through which the heat entered the casting. The greater



RAILROAD DEPOT AT BRYN MAWR, PA

ing, of a passenger station erected recently on this line, at Bryn Mawr, eight miles from Philadelphia, a portion of the country thronged with summer residences and country seats of wealthy Philadelphians. It is only a sample of a number of others on the road, and shows what this road is doing for the comfort of its patrons.

This station consists of a main passenger building and agent's dwelling combined, on the south side of the road, and a passenger shelter on the north side, an iron foot bridge connecting both sides, to prevent the necessity of passengers crossing on the tracks. The buildings are constructed of a handsome native gneiss rock, with dark pointing, and Connecticut brown stone dressings. The interior is finished up with hard woods, black walnut and ash, throughout, and presents a very handsome appearance. The main waiting room covers an area of 24 feet by 37 feet, and has an open timbered roof. The building is lighted by gas made on the premises. The engineers and architects were Messrs. Joseph M. Wilson and Henry Pettit.

THE WEAK POINTS IN IRON CASTINGS.

Iron poured into a mold, on changing from a liquid to a solid state, becomes a mass of crystals. These crystals are more or less irregular, but the form toward which they tend, and which they would assume if circumstances did not prevent, is that of a regular octahedron. This is an eight sided figure, and may be imagined to be formed out of two pyramids having their bases together. In Fig. 1 is a group of crystals from a pig of iron, among which you see one that has, by the aid of favorable circumstances, succeeded in gaining the natural form. In a perfect crystal of iron, all the lines joining the opposite angles are of equal lengths and at right angles to each other. These lines are called the axes of the crystal. The crystals assemble or group themselves in certain lines, in the direction in which the least pressure is exerted. When we define the direction of these lines as in the direction of least pressure, we deal with pressure due to the mass itself, and heat leaves a mass of iron according to the same law; and, therefore, the lines of assemblage will be in the direction in which heat leaves the body. This direction is always perpendicular to the cooling surface. We can now state the law upon which we shall base all of our reason-

small to be visible. In this figure you see the lines perpendicular to the bounding surfaces; but what I wish to call your attention to especially is the behavior of these lines at the corners of the castings. When two surfaces, as in this example, lie at an angle to each other, the systems of perpendiculars must meet in a plane diagonal to those surfaces. Some of the lines of each group run by into the lines of the opposite group, so that in the diagonal plane the lines interlock, breaking up the natural order, and making very poor connection. We shall find in every such case that the diagonal is the weakest part, and that the casting will bear less strain there than through a part where the lines lie parallel to each other. In the figure which we are considering, each corner has its weak line, meeting at the center of the casting.

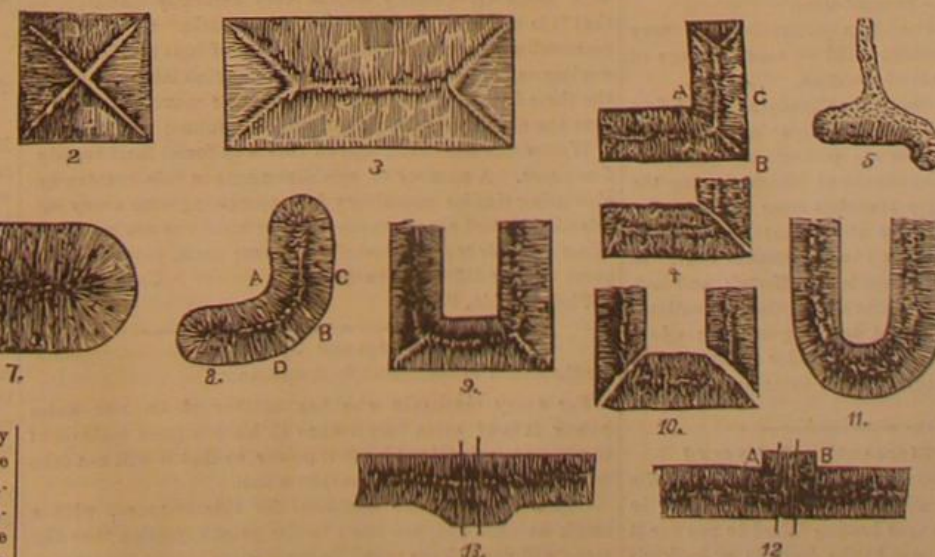
In Fig. 3 we have a drawing of a flat bar, and in it we see the same diagonal lines of weakness. The pairs of diagonals, joining the corners nearest to each other, are joined by a long line parallel to the two long surfaces. This line is also a line of weakness, as the lines in which the crystals assemble, in the systems belonging to each surface, begin at the surface, and as the casting cools elongate toward

the heat the more marked will be this peculiar structure, and the law, as before stated, applies equally in this case, all the crystals finally assembling in lines perpendicular to the bounding surfaces which were heated.

This can be illustrated in the following manner: Take two pieces of zinc which have been rolled into sheets, and heat one of them just below the melting point. To make what I am going to say illustrate the point in question, it must be remarked that rolling any metal into a sheet elongates each crystal in a direction perpendicular to the pressure exerted in rolling—that is, lengthwise of the sheet; and if metal is drawn into wire the crystals are lengthened in the same way. If you bend the piece of zinc that has not been heated, you will find that it is tough, and can be bent many times without breaking, the crystals running lengthwise. Take the other piece of zinc that has been exposed to heat. In it the crystals have turned round, and have formed themselves in lines perpendicular to the surface through which heat entered; and you will find that it breaks when it is bent. The peculiar crystalline structure to which we have referred is varied somewhat by the quality of the metal used, but it depends more directly upon the amount of heat either passing out of or into a casting, or upon the rapidity with which the operation is performed.

We see from the foregoing remarks that the strength of a casting is greatly impaired by the lines of weakness caused by angles, especially re-entrant angles.

Now, let us look for a means of remedy. Referring again to Fig. 2, and then to Fig. 6, or comparing Figs. 3 and 7, we see that by making the angles into curves, the lines in which the crystals form themselves are all nearly parallel to each other, and the



the center. When they meet in the middle they do not form continuous lines through from one surface to the other. Before leaving this class of surfaces, I wish to refer to Fig. 4, also a drawing of a casting. In this way we observe the same phenomena as before, at all of the angles except at the angle, A. Here the metal lying mostly outside of this

absence of abrupt changes of surface also avoids changes in crystalline arrangement, which will materially affect the strength of the casting. Compare Fig. 4 with Fig. 8, and you see that there is the same amount of metal through A B, in Fig. 8, as there is through A C, and yet the strength at the two places is nearly the same. And, of course, their

change of form produces a corresponding derangement of crystalline structure, but the defect, which in Fig. 4 was concentrated in the line A B, is in Fig. 8 spread out between the points C and D, so that no single point is much weaker than a similar point beyond C or D.

During the erection of one of the tubes of which the Britannia bridge is composed, a hydraulic press was used, the cylinder of which had a bottom formed as shown in Fig. 9. When pressure was applied the bottom went out, breaking where we would be led to expect it would, through from the inner to the outer angle, as we have shown in Fig. 10, though metal was in excess at that part. A new cylinder was cast, having a semi-spherical bottom, a section of which you see in Fig. 11; and although it was not as thick in the part where the first cylinder broke, yet it sustained a much greater strain without giving way.

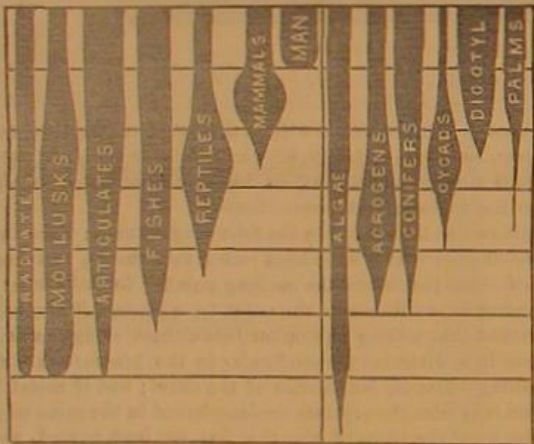
In making patterns for whatever kind of castings, the greatest care should be taken to avoid all angles, of whatever size or shape, for, as has been said already, every change of form brings its corresponding lines of weakness. If curves are necessary, the larger they are the better.

Many of the catastrophes which result from the falling of bridges, or of buildings, might be avoided if this matter had received proper consideration.

For example, it is required to cast a bar with a hole through it. To make up for the iron lost by the hole, the pattern maker adds a square piece to the top of the pattern, as is shown in Fig. 12. When strain is put upon the bar, it breaks through one of the angles at A or B, and it is found that the bar is weakened by the addition more than by the loss of iron which the hole occasioned. The bar shown in Fig. 13 would have been better.—W. Keep.

GEOLOGICAL RECORDS OF LIFE.

Our engraving illustrates the progress of life, as developed by an examination and study of the fossils contained in the various deposits and geological subdivisions of so much as is known of the earth's crust. The diagram is separated into two general divisions, one for animals, the other for plants. It is again divided into seven subdivisions, corresponding to the geological periods. Commencing with the lower or azoic period, we find the first appearance of life was vegetable—the *algæ* (sea weeds), a flowerless order of plants, propagated by spores instead of seeds, and vegetating in low, swampy places, or such as are entirely covered by water. This is the lowest form of life, and just what we might expect to find at the very beginning thereof.



GEOLOGICAL RECORDS OF LIFE.

As soon as we leave the azoic period, we come into the lowest order of animal life, which consists of radiates, mollusks, and articulates (crustaceans and worms). Each of these have continued in slightly varying quantities through all geological periods to the present time. The width of the shadings represents their increase or decrease through the several periods.

Fishes next commenced their existence, and have slowly increased in number up to the present time.

Next follow reptiles, and after them mammals, with very important variations in quantities until we reach the age of man, the last and crowning act of creation.

In the vegetable world, as we have already said, we first find the *algæ* or sea weeds—flowerless plants; next come the *acrogens*, a second class of flowerless plants, embracing the coal plants, the wonderful abundance of which, during the carboniferous age, is strikingly manifest from our diagram. The *conifers* also began to appear about this time, and, as will be seen, have steadily increased to the present time. In subsequent succession came the *cycads*, the *dicotyls*, and lastly, the *palms*—the most magnificent of vegetable creations.

The remains of all these animal and vegetable creations are found as fossils, and always in the order of superposition as here given. They present most interesting and instructive study.

What Constitutes a Mercantile Delivery?

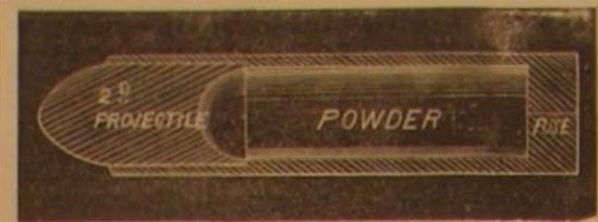
The Superior Court at Boston, Mass., has ruled on the question whether a wagon built to order and remaining in the maker's store room, the buyer having failed to pay for it and refused to allow its sale, was at the buyer's or maker's risk, it having been burned. The court decided that "the article having been specially selected for the defendant, set apart for him and marked with his name, and all with his knowledge, and nothing remaining to be done except that he should pay the agreed price, no further act was needed to vest the title in him, subject to plaintiff's lien for the price, and it remained in the plaintiff's (the maker's) possession at the defendant's (the buyer's) risk at the time of the fire."

Correspondence.

The Sczaroch an American Invention.

To the Editor of the Scientific American:

In your issue of August 1 you describe a recent Russian invention called the sczaroch. I herewith send you a drawing of a projectile which I invented last January, and which I showed to a number of influential men here. I made drawings (which I still possess), and it would be easy to prove the truth of what I say. The enclosed sketch needs no explanation after reading your article of August 1. But I have thought of a use for the projectile, not named in your article.



It cases where it would be of advantage to send a shell a long distance, this could be accomplished by making the outer projectile of rolled iron, so that the second explosion would not burst it. The inner shell would, I think, travel as far as the outer would have done, plus the additional distance given by the powder contained in the outer shell. Of course, great accuracy of aim could not be effected.

If I understand the sczaroch, my invention is substantially the same.

Minneapolis, Minn.

G. RIDGWAY SNYDER.

V-Threaded Taps.

To the Editor of the Scientific American:

Your surmise that "Max Adeler's" account of his pyrotechnic experiment with Pitman's chickens "emanated from this side of the water" is quite correct. But the *Danbury News* man is guiltless of any part in it. Max is a Philadelphian, and can point a moral with fun, and disclose the ludicrous side of human imperfections. He has had his turn, too, with the plumbers, and tells a story thereof, which, though quite different from that on page 176 of your current volume, is equally moving. This, with much beside to provoke quiet laughter, may be found in his "Out of the Hurly-Burly, or Life in an Odd Corner." From chickens, morals, etc., to taps is a somewhat violent change of base; but it is the very one I must make.

If my experience of nearly thirty years in a machine shop has taught me anything, it is that a tap (I speak only at this time of those having a V thread) should have clearance in all parts of its thread. The curve of any thread between two adjacent grooves should be an involute, not a circle. Simply filing away the tops of the threads is only a little better than nothing. After the thread is finished, grooves cut, and burrs carefully cleaned from the cutting edges, blue the tap over a clean fire and let it cool. Now take a good Stubbs' taper saw file, lay it nicely between the threads, and file the clearance. The color will show the work of the file, and should be left untouched for a small distance back from the cutting edge, say, in an inch tap, one thirty-second of an inch. A machine tap, never requiring to be turned backward, may be cleared entirely across the section, so that its cut will be like that of a reamer in principle, but with less clearance. A hand tap, which requires to be turned backward, should be filed straight across the section, leaving both the cutting and following ends of each thread up to the original diameter; and the grooves should be shaped something like those in the lower figure on page 187, current volume. This will most effectually prevent any trouble from the cuttings wedging in backing out. A fair mechanic will very readily acquire the knack of filing up taps as above with ease and rapidity. A little experience will also teach him how much clearance is best. Too much causes the tap to work with some irregularity unless very carefully handled, so that it is better to commence with but little. Of course, in establishments where the manufacture of taps is a business, devices can readily be attached to an engine lathe, by which the thread-cutting tool shall receive such movement as will give the clearance as required, without subsequent filing.

Whitworth has made taps in this way for at least twenty-five years. A number of establishments in this country are also using similar machinery for tap-cutting with every satisfaction. And a good many smaller concerns are regularly filing all their taps as described above; each, perhaps, with some trifling difference in detail.

Philadelphia, Pa.

Grindstone Spindles.

To the Editor of the Scientific American:

For every mechanic who has neither steam nor water power, it is of some importance to have a good method of turning his grindstone by foot power, so that it will not take more than one person to sharpen a tool.

Common grindstone spindles, for this purpose, with a crank at one end, are open to the great objection that the stone will never keep round, because every person is inclined, more or less, to follow the motion of his foot with his hand, which causes the pressure on the stone to be unequal. The harder pressure is always applied to the very same part of the stone, and will soon make it uneven, so that it is impossible to grind a tool true. To avoid this, put in place of the crank a small cog wheel to the spindle, say with twelve cogs; have another short spindle, with a crank and a cog wheel of thirteen cogs, to work into the former. The stone

will make about 0.07 of a revolution more than the crank, and the harder pressure of the tool on the stone will change to another place at every turn; and the stone will keep perfectly round if it is a good one. This is a very simple contrivance, but it will be new to many of your readers.

W. KAPP.

Small Printing Press Engine.

To the Editor of the Scientific American:

Some weeks since, I noticed an article in the *SCIENTIFIC AMERICAN*, requesting a statement of the performances of small engines. A few years ago, I built a small engine, which I set up in the *Herald* office in this place. The dimensions of the engine were as follows: cylinder 2 x 4 inches, steam ports $\frac{3}{8}$ x 1 inch, and exhaust $\frac{1}{2}$ x 1 inch. Outside lap of valve was $\frac{1}{8}$ of an inch; no inside lap. Throw of valve was $\frac{1}{2}$ inch. The engine also had a link, the slot of which was 2 inches long. The main rod was 8 inches from center to center. The pin in the crosshead was $\frac{1}{2}$ of an inch in diameter, and the bearing of the main rod on crank was $\frac{1}{2}$ of an inch in diameter. The entire length of the bed plate was 2 inches. The shell of the boiler was $\frac{1}{2}$ of an inch thick, and the heads, $\frac{3}{8}$. The boiler was 3 feet long by 1 foot in diameter, with nine $\frac{1}{2}$ inch flues. Half of the boiler and the flues made up the heating surface. The grate was 1 foot square. The flame went under the boiler, and returned through the flues to the stack. The pulley on the engine shaft was 6 inches in diameter, over which a belt ran to a 16 inch pulley on a fly wheel of 700 pounds. This wheel was belted to a line of $\frac{1}{4}$ inch shafting, from which a large Potter newspaper press was run. The pulleys were of equal diameter from the fly wheel to the press. With 75 pounds of steam, the engine, making 300 revolutions per minute, ran the Potter press, printing 1,000 sheets per hour, also a medium sized press printing 1,200 sheets per hour. A small armful of wood and four buckets full of water was sufficient to run off the edition of 1,200 copies in a little over an hour. The water was pumped cold from a tank by a half stroke pump directly into the boiler. The exhaust steam was turned into the stack. Has the performance of this engine been beaten by any similar small engine? The edition was formerly worked off by four men, turning the large wheel by cranks, in four hours.

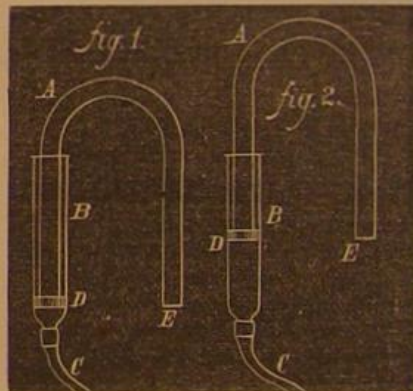
FRANK C. SMITH.

Delaware, O.

A Siphon for Drawing Liquids.

To the Editor of the Scientific American:

I wish to bring to the notice of your readers a siphon, which I believe to be new. I have been using it for two or



three months, and I find it very convenient for drawing acids and solutions. It is composed of the glass tubes, A and B, B being about twice the diameter of A, and drawn down small at one end, to which is attached a rubber tube, C. The tube, A, is packed at D. By immersing E in a liquid, taking the rubber tube, C, between the thumb and forefinger, and drawing it down as far as possible, it will create sufficient vacuum to cause the liquid to pass the bend and flow out, which it will continue to do until the rubber is released. J.W.S.

Magnetic Experiments.

To the Editor of the Scientific American:

On reading the account of the magnetic experiments of Mr. H. P. Henry, on page 100 of your current volume, it occurred to me that an interesting and instructive variation would be to substitute mercury for water. Let the magnet be cemented to the bottom of a glass vessel, to keep it from floating, and then drop iron filings on the surface of the mercury. It seems to me that the laws that govern the movements of the currents would be more correctly exhibited than in the usual experiments on glass and paper, where the friction must necessarily interfere with freedom of movement. The experiment could be still further varied by first sprinkling iron filings on the mercury, and then causing the magnet to approach from above, first with its plane parallel to the surface, then at right angles, etc.

Will you please request Mr. Henry or some one else who has the time and facilities to make the experiments suggested, and publish the results in your paper?

Albany, N. Y.

A. F. ONDERDONK.

A RECENT report on the Great Butler Oil District, covering the entire production of the country south and west of Pittsburgh, gives at present 596 producing wells and 81 wells now drilling. There are 1,076 engineers employed. The working capital invested is \$1,859,000. The daily production of oil in this district is 15,548 barrels, which indicates a large decrease within the past month.

PRACTICAL MECHANISM.

NUMBER X.

BY JOSHUA ROBE.

FITTING CYLINDERS.

To fit the cylinder cover joint, put marking on the joint face of the cover; put the cover into its place on the cylinder face; then, in order to discover how much the faces are out of true, strike the outside of the cover on one side of its diameter, and then the other, alternately, with the hands; and if the faces at any point are open, they will strike each other with a blow, the sound of which will clearly indicate to what extent they are out of true; if much, the cover may be removed and the high parts rough filed to the extent the judgment may indicate; if, however, when the cover is struck, the faces give no sound of striking, smooth filing will answer. When the faces mark nearly all over, the high spots may be eased with the scraper until the surfaces are sufficiently close that a light coating of marking will mark them all over, when they may be ground together as follows: Place on the cylinder face grain emery and oil, and then put the cover on. Fasten to the cover a lever, and then place sufficient weight upon the cover to leave it capable of being conveniently moved by means of the lever (which should project on both sides of the cover). The cover must not be revolved all in one direction, or the emery will cut grooves in the face, but must be moved back and forth while it is being revolved. When the grinding has proceeded until the cover moves smoothly upon the cylinder face, indicating that the emery has worn down and worked out (as it will do) from between the faces, the cover may be removed; and if the grinding appears equal and of one shade of color all over the faces, the emery may be wiped off them, and the cover replaced and revolved back and forth as before, which will cause the faces to polish each other, removing all traces of the emery, and showing plainly the slightest defect in the surfaces. If, however, the first grinding is not sufficient (as is generally the case), oil and emery must be again supplied, and the grinding continued as in the first instance. The cover of an 18 inch cylinder, even if it is much out, may be made of a steamtight fit by this process in about half an hour.

It is obvious that, in the case of a large cylinder cover, such as are used for marine purposes, the hand will not strike a sufficient blow to indicate how much the faces, before fitting, are out of true, and a block of wood and a hammer must be employed instead.

The next operation is to cut out the cylinder ports to their requisite dimensions.

In facing up the valve faces, the surface plate may, in like manner, be struck on its opposite corners, or a pressure may be placed on them by the hands to ascertain if the surface plate will rock, and to what extent. If it rocks at all, a rough file should be employed to file away the high parts of the face; if it does not rock, a smooth file should be employed to take out the tool marks, the filing being continued until a light coat of marking on the surface plate will mark the cylinder face all over, when the scraper may be applied to finish it. The slide valve itself may then be surfaced and scraped to the surface plate, and then placed upon the cylinder face, and the valve and cylinder face scraped together.

The joint of the steam chest may be made by filing the planed surfaces to a straight edge, and placing between the chest, and its seat, on the one hand, and the cover and the chest, on the other hand, a lining of very thin softened sheet copper, which plan is generally adopted on cylinders for locomotives.

In cases where a number of cylinders of similar sizes are made, the whole of the marking off, and much other work, may be saved by the employment of gages, etc.

For drilling the cylinder covers and the tapping holes in the cylinder, the following system is probably the most advantageous: The flanges of the cylinder covers are turned all of one diameter, and a ring is made, the inside diameter of which is, say, an inch smaller than the bore of the cylinder; and its outside diameter is, say, an inch larger than the diameter of the cover. On the outside of the ring is a projecting flange which fits on the cover, as in Fig. L, *a* being the cy-

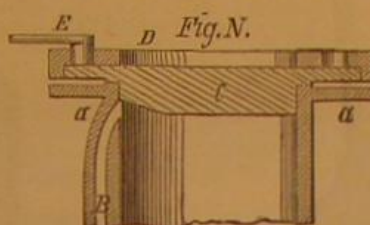


linder cover, and *b b* a section of the ring, which is provided with holes, the positions in the ring of which correspond with the required positions of the holes in the cover and cylinder; the diameter of these holes (in the ring, or template, as it is termed) is at least one quarter inch larger than the clearing holes in the cylinder are required to be. Into the holes of the template are fitted two bushes, one having in its center a hole of the size necessary for the tapping drill, the other a hole the size of the clearing drill; both these bushes are provided

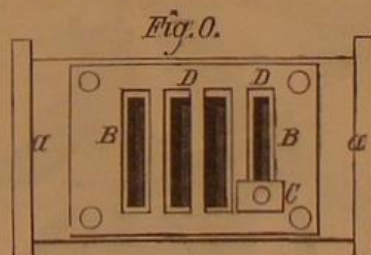


with a handle by which to lift them in and out of the template, as shown in Fig. M, and both are hardened to prevent the drill from cutting them, or the borings of the drill from gradually wearing their holes larger. The operation is to

place the cover on the cylinder and the template upon the cover, and to clamp them together, taking care that both cover and template are in their proper positions, the latter having a flat place or deep line across a segment of its circumference, which is placed in line with the part cut away on the inside of the cover to give free ingress to the steam, and the cover being placed in the cylinder, so that the part so cut away will be opposite to the port in the cylinder, by which means the holes in the covers will all stand in the same relative position to any definite part of the cylinder, as, say, to the top or bottom, or to the steam port, which is sometimes of great importance (so as to enable the wrench to be applied to some particular nut, and prevent the latter from coming into contact with a projecting part of the frame or other obstacle); the positions of the cylinder, cover, template, and bush, when placed as described, being such as shown in Fig. N, *a a a* being the cylinder, *b* the steam port,



e the cylinder cover, *D* the template, and *E* the bush placed in position. The bush, *E*, having a hole in it of the size of the clearance hole, is the one first used, the drill (the clearance size) is passed through the bush, which guides it while it drills through the cover, and the point cuts a countersink in the cylinder face. The clearing holes are drilled all round the cover, and the bush, having the tapping size hole in it, is then brought into requisition, the tapping drill being placed in the drilling machine, the bush serving as a guide to the drill, as shown in Fig. N, thus causing the holes in the cover and those in the cylinder to be quite true with each other. A similar template and bush is provided for drilling the holes in the steam chest face on the cylinder, and in the steam chest itself. While, however, the cylinder is in position to have the holes for the steam chest studs drilled, the cylinder ports may be cut as follows, which method was introduced in 1867, with marked success, by Mr. John Nichols, who was then manager of the Grant Locomotive Works, at Paterson, N. J.: The holes in the steam chest face of the cylinder being drilled and tapped, a false face or plate is bolted thereon, which plate is provided with false ports or slots, about three eighths of an inch wider and three fourths of an inch longer than the finished width and length of the steam ports in the cylinder (which excess in width and length is to allow for the thickness of the die). Into these false ports or slots is fitted a die, to slide (a good fit) from end to end of the slots. Through this die is a hole the diameter of which is that of the required finished width of the steam ports of the cylinder; the whole appliance, when in position to commence the operation of cutting out the cylinder ports, being as illustrated in Fig. O, *a a* being the cylinder, *B B* the false plate, *C* the sliding



die, and *D D* the slots or false ports into which the die, *C*, fits. Into the hole of the die, *C*, is fitted a reamer, with cutting edges on its end face and running about an inch up its sides, terminating in the plain round parallel body of the reamer, whose length is rather more than the depth of the die, *C*. The operation is to place the reamer in the drilling machine, taking care that it runs true, place the die in one end of the port, as shown in Fig. O, and then wind the reamer down through the die so that it will cut its way through the port of the cylinder at one end; the spindle driving the drill is then wound along. The reamer thus carries the die with it, the slot in the false face acting as a guide to the die.

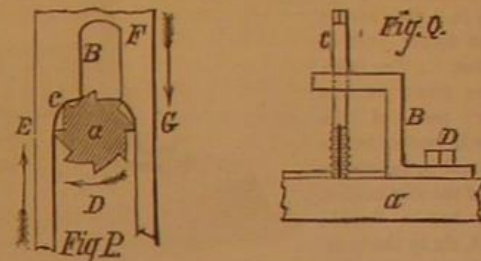
In the case of the exhaust port, only one side is cut out at a time. It is obvious that, in order to perform the above operation, the drilling machine must either have a sliding head or a sliding table, the sliding head being preferable.

The end of the slot at which the die must be placed when the reamer is wound down through the die and cylinder port, that is to say, the end of the port at which the operation of cutting it must be commenced, depends solely on which side of the port in the cylinder requires most metal to be cut off, since the reamer or cutter, as it may be more properly termed, must cut underneath the heaviest cut, so that the heaviest cut will be forcing the reamer back, as shown in Fig. P, *a* being a sectional view of the cutter, *B* the hole cast in the cylinder for the port, *C* the side of the port having the most cut taken off, *D* the direction in which the cutter, *a*, revolves, and the arrow, *E*, the direction in which the cutter, *a*, is travelling up to its cut. If the side, *F*, of the port were the one requiring the most to be cut off, the cutter, *a*, would require to commence at the end, *F*, and to then travel in the direction of the arrow, *G*. The reason for the necessity of observing these conditions, as to the depth of cut and direction of cutter travel, is that the pressure of the cut upon

the reamer is in a direction to force the reamer forward and into its cut on one side, and backward and away from its cut on the other side the side having the most cut existing the most pressure. If, therefore, the cutter is fed in such a direction that this pressure is the one tending to force the cutter forward, the cutter will spring forward a trifle, the teeth of the cutter taking, in consequence, a deep cut, and, springing more as the cut deepens, terminate in a pressure which breaks the teeth out of the cutter. If, however, the side exerting the most pressure upon the reamer is always made the one forcing the cutter back, as shown in Fig. P, by reason of the direction in which the cutter is traveled to its cut, the reamer, in springing away from the undue pressure, will also spring away from its cut, and will not, therefore, rip in or break, as in the former case.

In cutting out the exhaust port, only one side, in consequence of its extreme width, may be cut at one operation; hence there are two of the slots, *D*, Fig. O, provided in the false plate or template for the exhaust port. The cutter, *a*, must, in this case, perform its cut so that the pressure of the cut is in a direction to force the cutter backwards from its cut. The time required to cut out the ports of an ordinary locomotive cylinder, by the above appliance, is thirty minutes, the operation making them as true, parallel, and square as can possibly be desired.

In order to tap the holes in the cylinder heads and steam chest seat on the cylinder true, without requiring the workman to apply the square, a long tap and a guide is employed as shown in Fig. Q, *a* being a section of the cylinder end face, *B* the guide for the tap, *C* the tap itself, and *D* a bolt



for holding the guide to the cylinder face. If the end cylinder faces have a projecting ring on them (so as to leave a small surface to make the joint), the guide may be cut away on its bottom face to fit the projection, so that, if the guide is held against the projection, while the guide is bolted fast, the hole in the guide through which the tap passes will stand true (both ways) of itself, to the hole to be tapped in the cylinder. In the case, however, of there being no projection of the kind mentioned, as, for instance, when tapping the holes in the seat for the steam chest, the guide will require adjusting, sideways, by the eye. The distance, however, of the holes in the guide, being the same from center to center as the distance from center to center of the holes to be tapped, insures, without any setting, that the holes tapped are true with each other one way.

The saving of time and labor effected by means of the employment of this system and its appliances is much greater than might be supposed at first sight; it may, however, be appreciated when it is stated that, under it, three pairs of locomotive cylinders have been fitted up in seven and a half days, the work done to each pair being the holes, amounting to 200, drilled, and those for the cylinder covers, cylinder cocks, steam chests, steam pipes, and exhaust pipes, tapped; the steam and exhaust ports cut out, and the faces and those of the slide valves scraped up, the cylinder end and cover faces filed, scraped, and ground up steamtight, the steam chest seat faces filed up true to a straight edge, the seat for the steam and exhaust ports faced out with the cutter, all necessary bolts and studs put in, the cylinders bolted together, their bores being set true with each other, and the whole turned out so that the cylinders were complete and ready to bolt to the engine frames.

Rapid Transit in New York.

The American Society of Civil Engineers has appointed a committee, consisting of O. Chanute, M. N. Forney, Isaac C. Buckhout, Charles K. Graham, and Francis Collingwood, to investigate the necessary conditions of success, and to recommend plans as to the best means of rapid transit for passengers, and the best and cheapest methods of delivering, storing, and distributing goods and freight in and about the city of New York. Investigations of this kind by the committees of the Legislature, of the Common Council, and of private citizens have been annually made, in New York, during the past twenty years. There are any quantity of plans. The only thing lacking is the money to build with. If the present committee can solve that problem, they will render valuable service, and do something that the wealthiest capitalists of the city have not yet been able to accomplish.

Death of Judge Benjamin H. Curtis.

We regret to announce the death of this eminent jurist, which took place on September 16. Born in Watertown, N. Y., on November 4, 1809, he graduated at Harvard in 1830; and three years afterwards he commenced legal practice. From this date his career was one continued success, gaining him fame as a lawyer, an orator, and a logician. In 1851, he was appointed Judge of the Supreme Court of the United States, and here he delivered his celebrated decision in the Dred Scott case. He resigned his seat in 1857, and resumed his practice. He defended President Johnson before the Court of Impeachment.

Judge Curtis' learning and high personal character gave great value to his writings and his judicial decisions. His return to the bench was looked for when his death occurred.

IMPROVED PIPE AND BOLT THREADER, CUTTER, AND NUT TAPPING MACHINE.

The accompanying engravings illustrate an improved machine, intended to perform the work enumerated in the title of this article, the nature and advantages of which are specified in the following description:

A is the frame which supports the entire machine. In this frame slides a vise holder, B. The shape of the vise holder is a parallelogram, except at the top, which is slightly arched. It slides in ways formed on the inside of the vertical part of the frame. On the inside of the vertical part of the vise holder, B, are formed ways which guide the movement of the upper half of the vise, C. The lower half of the vise, D, is fastened in the lower part of the vise holder, B. In the arched top of the vise holder is formed a threaded hole for the upper part of the differential screw, E. A thread is also formed in the upper part of the frame, A. The end of the differential screw plays freely in a step socket in the upper part of the vise, C. The pitch of the screw in the upper part of the frame is twelve to the inch, and in the upper part of the vise holder, B, it has a double thread, six to the inch. The turning of the screw, therefore, causes the lower part of the vise holder, B, to rise, while the upper part of the vise, C, descends, or vice versa. The purpose of this movement is not only to gripe the pipe or bar to be threaded or cut off with great firmness, but also to make the apparatus self-centering. To the front side of the wheel, F, is attached the casting, G, which forms ways upon which the die carriage, H, travels. By this means the dies are carried forward constantly parallel to themselves and the work, thus obviating friction from any deviation from the parallel motion, and preventing stripping of the thread—a difficulty heretofore encountered in many pipe cutting machines. The die carriage is forced forward at the commencement of the operation by means of the left hand lever screw, I, the purpose of which is to make the dies engage the work at the beginning. As soon as the thread is started, the carriage, H, traverses of itself, at a rate corresponding to the pitch of the screw cut, in the same way as a chaser follows the thread in cutting a screw in a hand lathe. The carriage, H, the casting, G, and the wheel, F, are all caused to rotate by means of bevel gearing actuated by means of the balanced lever handle, J, which is shown broken away in the engraving, to avoid unnecessary space. K, Fig. 2, represents the cutting device, by which pipes or bars are cut off. This consists of a pivoted tool holder, which is fed by the ratchet headed screw, M, which turns in the threaded hole formed in a lug.

Motion is imparted to the screw, M, by coming in contact with the pawl, N, at every revolution of the wheel, except when the pawl is turned up out of the way in cutting threads. In this way, an automatic intermittent feed is obtained, which is considered of great advantage, as, in machines with automatic continuous feed, the contact of the tool with a high spot in the iron often results in splitting the pipe, owing to the increasing depth of cut consequent upon the nature of the feed and upon the suddenly increased depth of the cut caused by the lump. The reason for this is that, with the continuous automatic feed, the tool is constantly entering deeper and deeper into the material, while with the intermittent automatic feed it can be so set as to cut only to such a depth as ensures safety to the tool and to the material itself, according to the nature of the work to be performed. In the performance of most kinds of work, a deeper cut can be taken, and the cutting can be performed faster than with machines having automatic continuous feed. By sliding the handle, J, in or out, so that a pin on the shaft engages with the inner or outer pinion of machine, the speed of machine is increased or lessened as desired.

Fig. 2 represents the machine in the operation of cutting off a piece of pipe. The machine can also be used for tapping nuts, the tap being held in the vise and the nut in the carriage, H, or vice versa.

Fig. 3 shows a centering device, which is put in place of the screw, I, for centering bars after they have been cut off, and to prepare them for turning in the lathe. Either square or round iron may be thus cut off and centered, the screw, I, being removed, and the centering device in Fig. 3 being substituted.

It will be seen that the capacity of this machine is unusual. It cuts and threads pipes and bolts, taps nuts, and cuts off and centers bars to fit them for the lathe. It is extremely compact, weighing only one hundred and eighty pounds, and can be run either by hand or power. A power attachment is

supplied with a backward and forward fast and slow motion, so that the machine can be driven by power by merely throwing the belt over the main shaft, without putting up a counter shaft. The machine is therefore portable, and its convenience is greatly enhanced. It can be used in any part of the shop where it is most convenient. All the parts are interchangeable, and may be replaced when damaged by any accident.

Patents for this machine have recently been obtained. Further particulars may be obtained by address.

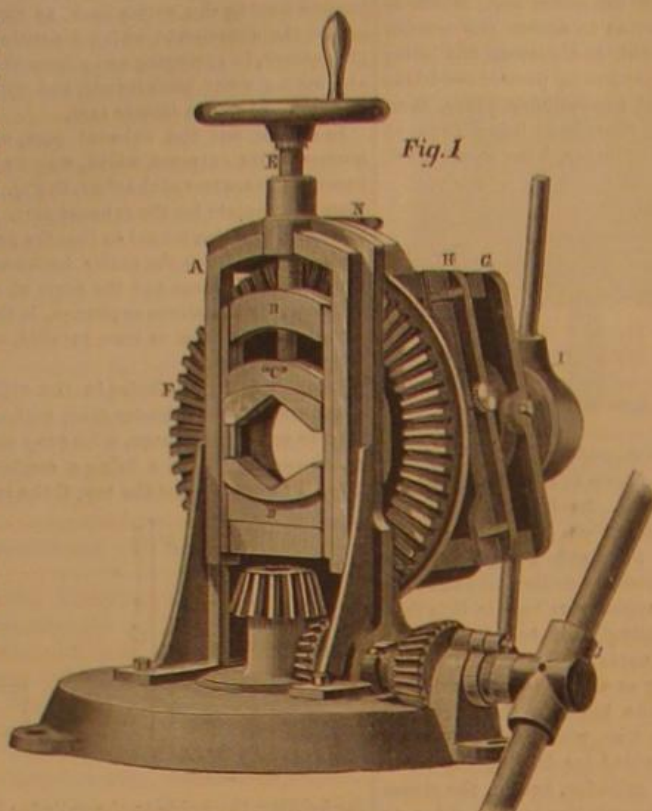


Fig. 1

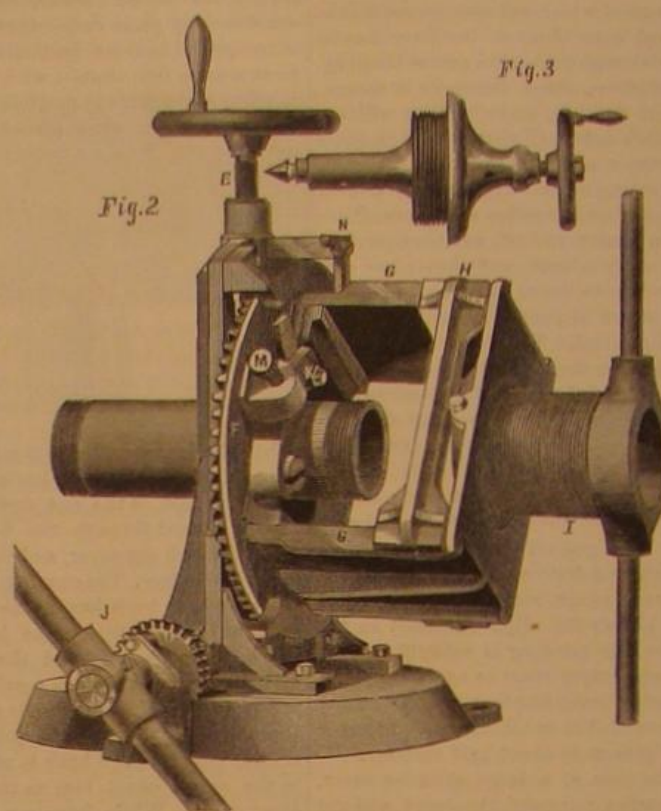


Fig. 2

Fig. 3

PIPE AND BOLT THREADER, CUTTER ETC.

ing Mr. C. T. Litchfield, General Manager of the Empire Manufacturing Company, 18 William street, New York city.

JONES' HEEL TRIMMING MACHINE.

In the invention represented in our illustration are combined a variety of novel and ingenious devices which, together, form an improved machine for trimming shoe heels.

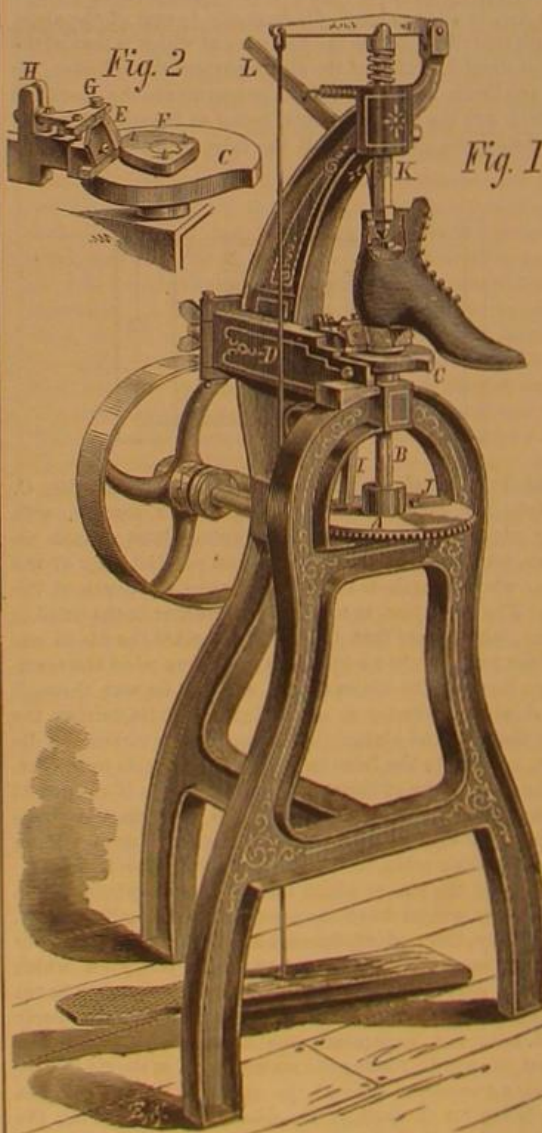


Fig. 2

Fig. 1

attached a hook rod, which enters a groove under the cam plate. This portion of the device is necessarily hidden by other parts in the engraving. The object, however, is to cause the knife to move forward quickly to cut the elongated sides of the heel, and slowly while cutting the short curve of the rear portion of the same. At I is shown the lower extremity of a drop or clutch, which is hinged to the frame at or near its middle, so that its upper end enters a socket on the under side of the knife arm. At a certain point of the revolution of the gear wheel, A, a stud, J, thereon comes in contact with the drop and carries the same partially around, thereby relieving the strain on the hook pin when it enters the short curve of the slot of the cam plate, at the same time serving as a brake.

The rear leg of the frame projects upward and curves forward, so that its upper extremity is directly over the vertical shaft, B. Through this upper end passes a shaft, K, which connects with a spring lever above. The latter is operated by the treadle shown, and the device serves to hold the shoe down upon the guide. Near the lower end of the shaft, K, is a joint worked by the lever, L, the object of which is to trip the shoe, when it becomes necessary to give one part of the heel more bevel than another. The knife, besides, has a spring upon its inner side which will allow of its conforming to all ordinary styles of heels without requiring the employment of the tripping lever.

The mode of adjusting the shoe to be operated upon is already shown in Fig. 1. The pulley is operated over about 2½ revolutions to trim the shoe, and the speed required is some fifty revolutions per minute.

Patented through the Scientific American Patent Agency, July 1, 1873. For further particulars relative to sale of rights, etc., address the inventor, Mr. E. U. Jones, Woodhaven, Queen's county, N. Y.

A sample machine may be seen at the office of Messrs. William Butterfield & Co., 6 Murray street, New York city, or at the Bay State Shoe Works, King's County Penitentiary, L. I.

REMARKABLE FALL OF A RESERVOIR.—A reservoir to supply Conshohocken, Pa., was built last fall at a cost of \$72,000, and is an excellent piece of workmanship. Its supply was pumped from the Schuylkill river, and throughout the past year the town of Conshohocken has been plentifully supplied with water, to the gratification of the citizens. Recently the reservoir was discovered to be empty, and the keeper, in making his morning inspection, discovered that a portion of the embankment had dropped straight downward for 25 feet, and resolved itself into an enormous hole, the sides of which are precipitous rock.

THE VICISSITUDES OF MINING.—It is bad enough for miners to be deluged with cold water; but to be drenched with the hot article is rather trying. This is what recently happened to the Gould & Curry people in California. A large body of hot water was struck in the 1,465 foot level of the Consolidated Virginia mine. From this level a drift extends into the Gould & Curry, with a downward slope, and the water runs into the latter mine. The Gould & Curry pump is a foot in diameter, and it requires its utmost capacity to control the water.

NEW YACHT FOR THE KHEDEVE OF EGYPT.

Mr. John Fowler, C. E., recently instructed Mr. J. S. White, of Cowes, England, to build a yacht for the personal service of the Khedive of Egypt. The instructions were to provide a launch which should be a good sea boat, stiff in the water, and of a mean speed of at least 10 miles per hour on a continuous run at sea. These conditions have been admirably fulfilled in the launch under notice. Her sea-going qualities were thoroughly tested during her run from Cowes to London in the face of a strong easterly gale, and her speed in fair weather was easily maintained at one mile per hour above the contract rate for any desired length of time.

The Phylloxera.

We recently published the terms of the reward of \$60,000, offered by the French Government, for a remedy for this extraordinary vine pest. At a recent *séance* of the Paris Academy, no fewer than eleven communications were received relating to the destruction of the phylloxera. A letter from a vineyard proprietor proposed sowing tobacco seed among the vines: he had found this an effectual remedy, in the case of artichokes, for destroying an aphid which attacked the roots. Hemp and *datura stramonium* were proposed as preferable to tobacco, on account of fiscal restrictions on the latter. One suggestion was to destroy the insect by electri-

Phosphorescence of Putridified Animal Matters.

Phosphorus exists in animal flesh in the state of alkaline or earthy phosphates, and also as one of the elements in protagon. The phosphorescence and alliaceous odor, sometimes observed during the putrefaction of flesh, are due to the formation and subsequent decomposition of sulphur phosphide. This substance, formed from the sulphur of the fibrin and the phosphorus of the protagon, is spontaneously inflammable in presence of oxygen, producing hydrogen sulphide and phosphorus or phosphoric acid.

Muscular flesh, to which $\frac{1}{1000}$ part of its weight of calcium phosphate was added, and which was kept at the ordi-



STEAM YACHT FOR THE KHEDEVE OF EGYPT

The following are a few of the leading dimensions:

Length, 50 feet; breadth, 10 feet; draft forward, 2 feet 10 inches; draft aft, 3 feet 6 inches; displacement, 11 tons; screw (four bladed), diameter, 3 feet 6 inches, pitch, 3 feet 3 inches to 4 feet 6 inches; cylinders, diameter, 7½ inches, stroke, 6 inches; grate surface, 5.5 square feet; heating, 215 square feet.

At the speed of 11.03 miles (9.58 knots) per hour, the number of revolutions was 268, and the boiler pressure 76 lbs. per square inch. With a mean effective pressure in the cylinders equal to 75 per cent of that in the boiler, the power developed would be 43.4 indicated horse-power, an exceedingly good result for so small a boat.

The launch is built entirely of teak and mahogany, diagonally, coppered and copper fastened, and the interior fittings are most luxuriously carried out in white satin and gold. Even the awning is profusely ornamented with gold braid; indeed, the instructions generally were to make the boat in every detail as perfect as possible, and that no legitimate expense need be spared to attain that end.

The engines were constructed for Mr. White by Messrs. G. E. Belliss & Co., of Birmingham, and they behaved admirably during the stormy run from Cowes to London, when their failure but for a quarter of an hour would, at times, have inevitably entailed the total destruction of Mr. White's very perfect launch and of the lives of those navigating her.—*Engineering*.

A Tripod Boat.

A novel boat velocipede was lately tried on the Allegheny river at Pittsburgh. The machine consisted of three floats, each three feet long by 15 inches diameter, two of the floats placed side by side, a short distance apart; the other a steering float placed in front, like the front wheel of a velocipede, and made movable. A seat on slender rods rising from the two central floats supported the operator. Between the two floats were a pair of 8 inch paddle wheels worked by cranks from the driver's seat, where the front steering float was also operated. This novel machine, when set in motion, carried its inventor safely across the river at the speed of a slow walk. The paddles are evidently too small. A contrivance of similar character was suggested some time ago, we believe by W. J. Allen, of Grand Rapids, Mich.

At the last advices, Coggia's comet was brilliantly visible in Australia.

trical discharges. A committee of the Linnæan Society of Bordeaux have pronounced, as the result of their researches, that the phylloxera is not the cause of the disease, but an effect of an organic malady attributable to five causes, which they specify (exhaustion of soil, inclement seasons, bad choice of stocks, and bad treatment, etc.). They state that while phylloxera is an effect, it may aid in deteriorating the vine.

A correspondent of the SCIENTIFIC AMERICAN declares that the liberal use of cow dung manure is a sure cure for the phylloxera on vines. He wants the editors to bring it to the attention of the French authorities, and offers to give them one half of the reward, namely, \$30,000, when the whole sum is paid over. We accordingly take pleasure in making the remedy known to the Paris Academy and the

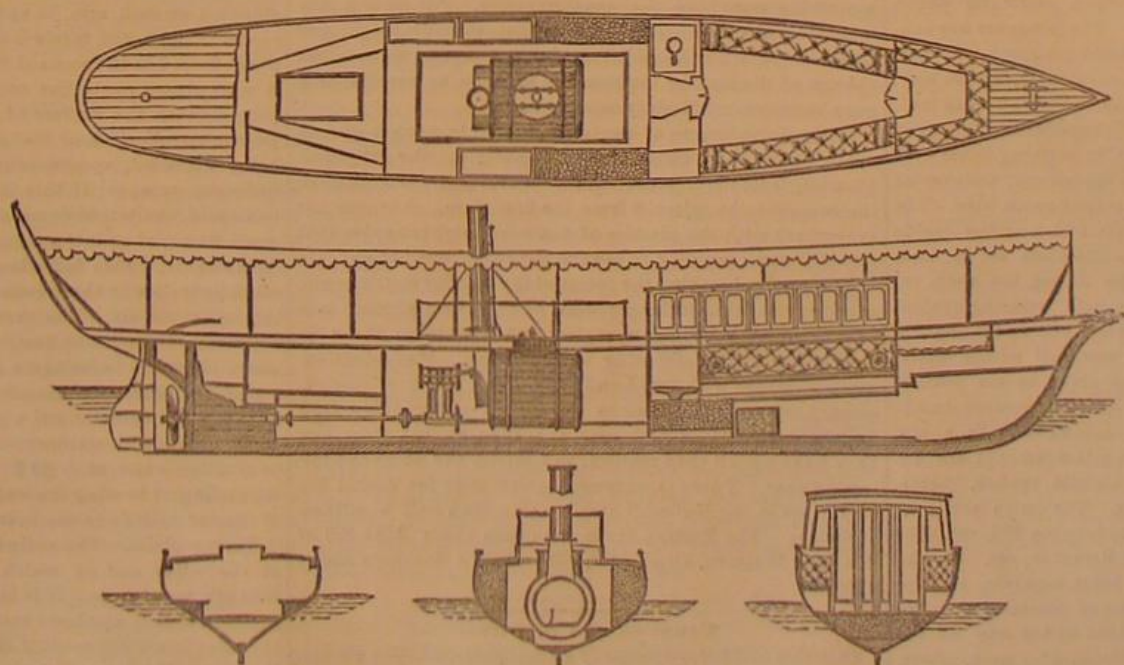
nary temperature, had a very fetid odor by the third day, while a sample not treated with calcium phosphate did not become putrid until the sixth day. As all ordinary waters contain calcium and magnesium salts, it is desirable that they should not be used in the cleansing of ulcers, etc., for, by the combination of these salts with the alkaline phosphates of the flesh, active agents of decomposition are produced.—*J. Lafort*.

Otto of Roses.

The *Moniteur Industriel Belge*, in an interesting article on this costly perfume, says that the manufacture is largely carried on in the valley of Kesanlik, Roumelia, the annual production of the rose farms of which amount to 4,400 pounds of the otto per year. As it requires about 130,000 roses, weighing some 57 pounds, to make an ounce of the oil, some idea of the extent of the plantations may be formed from the above given total.

The flowers are gathered in the middle of May, and the harvest continues for three weeks. The blossoms collected each day are at once worked, in order that none of the odor may be lost. The process consists in distilling them in water and then causing the water alone to undergo distillation, when the oil is skimmed from the surface. The labor is principally done by women and children, at wages of about ten cents per day.

The otto is always adulterated, before transmission to market, with one third or one fifth its quantity of geranium oil.



PLAN AND SECTION OF THE KHEDEVE'S STEAM YACHT.

French Government. Our correspondent avers that the effect of the liberal use of cow dung manure is to give new life and stimulus to the vine, and thus put a prompt end to the phylloxera and other bad conditions. The researches of the Linnæan Society of Bordeaux appear to confirm the theory of the SCIENTIFIC AMERICAN's correspondent; and should the remedy proposed be adopted in France as effective, we request the French authorities to remit the amount of the reward to this office, without any formalities.

LUMINOUS APPARITIONS OR FALSE LIGHTS.—These are not due, as was long supposed, to the products of animal or vegetable decomposition, but are caused by insects which possess organs that become luminous at the time of their sexual congress. It is now well known that the phosphorescence of the sea is due to the presence of immense numbers of microscopic animals.—*Journal of the Chemical Society*.

A TERRIBLE disaster occurred in Fall River, Mass., on the 19th of September, in the burning of a cotton cloth manufactory known as Granite Mill No. 1. The building was a large granite structure, some 368 feet in length, and five and a half stories in height, containing the usual spinning and other machinery. About 350 operatives were employed, a large proportion of whom consisted of girls and children. Twenty were killed and thirty wounded. The mill was badly provided in respect to fire-extinguishing apparatus and means of escape.

A CORRESPONDENT, Mr. L. P. Alden, of Quincy, Mich., states that the striped potato bug was for many years common in Southern Illinois, and that its vesicatory powers were well known.

(OLD AND NEW.)
DENTISTRY IN THE UNITED STATES.

NUMBER 4.

INSTRUMENTS USED BY DENTISTS.

These are classed by the profession into extracting, plugging, excavating, and scaling instruments. It is impossible to give an accurate statement of the number of different forms used of all these; but the dental catalogues of the present day will show over ninety different patterns of forceps alone—an instrument used only for extracting teeth. There are, besides, five different forms of turnkeys, and eighteen different forms of screws, punches, and elevators. All these hundred and thirteen instruments are used solely for extracting teeth and stumps, or roots, of teeth. As a fully furnished mouth contains thirty-two teeth, arithmetic will show that there are just 8½ kinds of these instruments to each tooth. This proportion, however, becomes quite insignificant when compared to the number of plugging instruments. Of these, according to the catalogues and to my own knowledge, there are over four hundred varieties in respect to size and to shape of point, all used to consolidate the material with which the cavities in the teeth are filled. The patterns of excavators, burrs, and drills, used to clean out these cavities before filling, will number over three hundred and twenty-five; and one hundred and eighty different patterns and sizes are used of chisels, gouges, and scalars, used to remove tartar from the surface of the teeth, or for cutting down the walls of cavities before using the excavators. This grand total of one thousand one hundred and eighteen differently shaped instruments sums up the class of standard patterns regularly sold by the dealer to the operator. As though this were not variety enough, it is made still greater by putting all these instruments, except the forceps, in handles of different kinds and sizes. The finer ones are of pearl, agate, and cameo; the second class of ivory, ebony, buffalo horn, walrus tooth, and bleached bones; and the cheapest, of steel file-cut, steel octagon, taper steel, and plain steel finish. This makes twelve styles of handles. Of each there are several sizes; those most commonly used being quarter inch, half inch, five eighths, and seven eighths. These forty-eight different sizes and styles, of course, make the total number, in a complete assortment of plugging instruments, fifty-three thousand, six hundred and sixty-four, which the dealer must keep on hand, at only one of each. As, however, he must have in stock several gross of some of them, that total gives a very inadequate idea of the capital invested in the stock of a first class dealer.

To give the names of these different instruments would require, at least, twenty octavo pages closely printed. The specification would begin somewhat thus:

First, extracting instruments, divided into forceps, turnkeys, and stump instruments. The forceps are subdivided into lower central, lower lateral, lower canine, right lower bicuspid, left lower bicuspid, right lower molar, left lower molar, right lower wisdom, left lower wisdom; then the same over again, substituting upper for lower; also various shapes of alveolar forceps, splitting forceps, screw forceps, cow horn forceps (named from a peculiarity in their shape), bayonet forceps, separating forceps, fragment forceps, wedge-cutting forceps, and so on. (N. B.—These are the names of a part only.) The turnkeys have each a particular name, and so have the stump instruments. The pluggers are subdivided into hand, mallet, and automatic pluggers, and each of these heads is subdivided. The burnishers, by the way, are always classified with the pluggers. As the names indicate, the hand pluggers are used to condense the filling by manual pressure; the mallet pluggers, by striking them with a small mallet, some dentists using a leaden one, because its blow is "soft," while the majority prefer lignum vitae. The automatic plugger has a hollow handle and a spring inside with a small catch: the head has a solid piece set in; and, when the point is pressed against the filling, the shaft recedes into the handle a fraction of an inch, pressing against the spring, which, slipping off the catch, allows the handle head to come suddenly down upon the butt of the shaft, which thus receives a blow like that given by the mallet. Other automatic instruments have an arrangement inside for striking with a drop weight, somewhat as in a pile driver. The names of the excavating instruments are too numerous to give; there are hoes, hatchets, spades, rights, lefts, etc., hooks, wedges, and spears. The burrs are cone, cocked hat, flat head, bevel edge, round, spoon bill, etc. The drills are square, twisted, bevel point, Scranton, etc. In like manner, the scalars and chisels have their separate descriptive names. Then there are a number of miscellaneous instruments, which could not be classified under any of the above heads: nerve and abscess instruments; gold, silver, rubber, and glass syringes; saliva pumps; napkin, check, and tongue holders; lip protectors, and a variety of others, all used solely in repairing the natural teeth.

The manufactures of dental materials, knowing what instruments are most generally used, have contrived various neat patterns of cases for holding them, and will furnish a case with the most useful operating instruments, complete, at prices varying from seventy-five dollars to twelve hundred and fifty dollars. More expensive ones can be had if required. The dentists of the Eastern division of the States prefer using what are termed the loose instruments, for they believe more in fact than fancy; and they find it economical, if the point of an instrument break, to be able to fit another at once into the same handle. An Eastern dentist will probably be satisfied with an operating kit costing fifty dollars—this means of instruments, only for repairing the natural teeth—while the dentist of the Western division will not be contented unless he has a two hundred and fifty

dollar case of instruments to start with. This he keeps to show to his patients, the majority of whom will judge of his professional ability by the amount and quality of his outfit. He is shrewd enough, however, both to use this as a plaster to draw custom, and to use "loose instruments" to operate with. More sad is the case of the beginner in the Southern division. He must not only have his fine outfit for show, but must use it to cover up some of the blunders of his inexperience. The quality and style of an operator's instruments are no criterion of his ability; for I have known dentists, who, with a chamol skin roll-up case, with seven pairs of forceps, one turnkey, four stump instruments, and a gum lancet, were ready to extract any tooth that was ready to be extracted, and to do it neatly, quickly, and successfully. During the civil war, the United States Government furnished its military surgeons with this kind of outfit; and no complaint was made about it, although cause enough might have been found. There was not a sufficient variety of tools; and, as they were made of that inferior steel called German steel, they had to be heavy or clumsy in order to bear the strain put on them. Nor would the price paid by the government allow of their being polished as highly as is required both for the looks and for the preservation of instruments.

Over two hundred dozen of these cases were made by one manufacturer in New York city; and those which were rejected by the inspectors were purchased by private practitioners at fair prices, which shows what materials some dentists will use. The richest outfits of dental instruments, as a general rule, are sold for foreign service. I call to mind two dental cases, one costing \$1,800, the other \$1,500. The former was made expressly for an employee of the Chilean Government. He was not engaged in a dental capacity, but as an engineer, having, with several others, to make a map of that country. Notwithstanding the high position he held, he could not forego the pleasure he derived from his original profession of dentistry, which he had practised in the Eastern states before going South. The case ordered and accepted by him has never been excelled; the extracting instruments being all octagon-shaped and plated, the others having, some agate handles, others pearl set with garnets and rubies, all with coin gold ferrules. The case was rosewood with silver corners, and plate inlaid. It was on exhibition at the manufacturers', in New York, several days before shipment, and was seen by hundreds. The other was for a young man who borrowed enough to pay for a handsome outfit, and went to Havana, Cuba, where it assisted him not only in paying for itself, but in accumulating a fortune. The most parsimonious outfit ever purchased, in proportion to the wealth of the purchaser, so far as I know, was bought for two hundred and fifty dollars by the far famed Don Esteban de Santa Cruz de Oviedo, of diamond wedding notoriety. He owned an extensive plantation in Cuba, and preferred operating on the teeth of his slaves himself, to giving it out to any of the many itinerant practitioners who perambulate that country. There are at present only three large firms who manufacture dental instruments exclusively; though there are many small shops in which instruments of all kinds are made on a small scale. One of these large firms made and sold during one year twenty-five thousand pairs of forceps (one instrument is called a pair); that is, about eighty a day for each working day in the year. This was something more than the usual quantity. But sixty a day is considered a medium business in that establishment; and this number, with the additional labor necessary to turn out enough of the smaller instruments to make up assortments, gave employment to sixty workmen.

In the manufacture of dental instruments, each workman must thoroughly understand his part; for the slightest blunder, from the "forger" to the "burnisher," will cause an instrument to be rejected from the first class. Any one not conversant with the practice of dentistry might suppose that a dentist once supplied is always supplied; but not so. He is continually breaking the points of the smaller instruments, cracking the joints of larger ones, having them altered into new patterns, getting new styles, and discarding the old; and is thus daily purchasing and changing. Many dentists who commence with two hundred dollars' worth of instruments keep on purchasing to the extent of three hundred dollars during their first year, and even at that they find they have not all they require, and repeat the same the following year. There is expended every year for dental instruments in the United States not less than half a million of dollars. The Eastern division invests about \$160,000 of this; the Western, about \$140,000; and the Southern about \$200,000.

Usual Causes of Fires.

Churches and lecture rooms of all descriptions.—Hot air, hot water and steam pipes, and furnaces and stoves. Sticking candles against coffins in vaults. Christmas and other decorations around or too near gas fittings, fires, or lights. Sparks falling upon birds' nests in spires and belfries.

Carriers and workers in leather.—Lime slaked by rain. Sparks from foul flues and furnaces passing through opening and projecting eaves of drying rooms. Friction of machinery in bark mills. Timber, coals, shavings of wood, and leather too near flues. Drying stoves and furnaces. Spontaneous ignition. Smoking in bark and other rooms.

Drapers, tailors, makers up and vendors of male and female attire.—Working late, being tired and falling asleep, or becoming careless too near fires and lights. Unprotected and swinging gas brackets. Crinolines coming in contact with fire in open fireplaces. Light, pendent goods being blown, by the opening and shutting of doors or by concussions or drafts, into unprotected lights. Goods hung on lines increase the risk in various ways, such as conveying the flame from

one end of a room to the other, and, when the line breaks down, making three separate fires, one at each end and one in the middle at the same time, thus originating three distinct fires for each line. Cuttings left carelessly about. Using lights while intoxicated, especially by tailors' work-people. Ironing stoves, hot plates, smoothing irons, etc., too near and sometimes on timber and goods. Smoking tobacco, and matches for lighting it.

Engineering works, and workers in metal of all descriptions.—Sparks from striking hot metal. Hot metal castings, etc., left too near timber. Heat from furnaces, forges, and smiths' hearths and flues. Friction of machinery. Japanners' stoves overheated or defective. Accidents with melted or hot metal. Explosions of blast furnaces. Spontaneous ignition of oily waste, molders, lamp, and other blacks; sawdust or sweepings and oil; spontaneous heating of iron turnings, etc., when mixed with water and oil.

Farming stock, stables, hay, grain, or flour stores of all descriptions.—Stacking hay while green. Sparks from passing locomotives, etc. Sparks from steam thrashing machines. Sticking candles against walls and timber in barns and stables. Vagrants smoking in stables. Vagrants being refused alms. Fire arms used near farming stock, such as haystacks, etc.

Makers of gunpowder, fireworks, lucifer matches, and explosive compounds.—Overheating of drying stoves, and explosive mixtures. Dropping lucifers. Unprotected lights. Smoking. Leaving phosphorus uncovered with water. Friction and percussion from nails in boots. Sparks passing through broken windows. The sun's rays being concentrated through bull's eyes, knots, etc., in glass. Defective casks containing gunpowder or other explosive materials. Spontaneous ignition of red fire and such like compositions. Carelessness in the supervision of young children employed. Shavings and chips too near fires and lights.

Gas works.—Hot coke near timber, etc. Seeking for an escape with unprotected lights. Timber too near furnaces, retorts, etc. Lime slaked by rain. Defective fittings and appliances. Spontaneous ignition of coals.

Hat manufactures.—Boiling shellac. Hot irons left on timber and other inflammable things. Defective drying and other stoves. Smoking tobacco.

New Lecture Experiments.

Oxydizing Power of Charcoal.—Freshly prepared leucaniline dissolves in alcohol, and forms a perfectly colorless liquid, which may be kept for a long time without change. If this solution is boiled for a few moments with a small quantity of animal charcoal, it becomes of a deep carmine red, due to the action of the oxygen condensed in the pores of the charcoal.

Oxidation, shown by Change of Color in Compounds on Contact with Air.—If a tolerably concentrated alcoholic solution of naphthalene red is boiled for a few minutes with zinc dust, a colorless solution is obtained; and if the flask is corked while full of the vapor of the alcohol, the liquid remains colorless, and the zinc settles to the bottom. If the flask is then shaken so as to wet the sides, and the cork withdrawn, the inner walls are instantly colored deep red. It is only necessary to boil again, in order to repeat the experiment.

Liquid Phosphoretted Hydrogen.—A thick walled U tube, about one seventh of an inch in diameter, and provided with a stopcock on each arm, is surrounded by a freezing mixture (—10° to 20°), and receives the phosphoretted hydrogen prepared from 7 to 10 drams of freshly made calcium phosphide. A wide glass tube in the cork of the generating flask, dipping beneath the surface of the water (at about 60°), serves for the introduction of the phosphide. While the liquid is being collected, spontaneously inflammable phosphoretted hydrogen escapes; if this is displaced by a stream of carbonic acid, the bright flame is replaced by a scarcely luminous green flame, of so low a temperature that a taper cannot be lighted at it. This flame is caused by the liquid phosphoretted hydrogen in the stream of carbonic acid coming in contact with the air. The carbonic acid may be replaced by a stream of some combustible gas, for example, hydrogen, and a luminous flame again obtained.

Point of Maximum Density of Water.—The apparatus consists of a tall cylinder and a pear-shaped glass float, which is so weighted (with mercury or otherwise) that when immersed in distilled water, at + 39.2° Fahr., it neither sinks nor floats. On cooling or heating the water in the cylinder, the float rises to the top or falls to the bottom.

Sodium Press.—The sodium is placed in a metal cylinder, at the lower end of which is a fine opening, and forced through by a screw. If it be received in mercury instead of rock oil, a pure amalgam may be readily formed.

Leidenfrost's Experiment Reversed, to Explain the Action of the Alkali Metals on Water.—When potassium is thrown in water, the hydrate formed by the reaction swims about on the water for a few seconds, in the form of a red hot globule, and then disappears with a sudden explosion. The manner in which this effect is produced may be illustrated by the following experiment: An ellipsoid of pure silver (weighing about 150 grains) is provided with an ear to which a stout copper wire is fastened. If it be heated to redness and dipped into water in a large beaker, it remains passive for five or six seconds, and then a violent explosion suddenly takes place, scattering the water, and usually shattering the beaker.—A. W. Hofmann.—Deut. Chem. Ges. Ber.—Journal of the Chemical Society.

THE yield of precious metal from the Pacific slope during the last quarter century is found from an aggregation of the various yearly returns to be in value \$1,534,380,000. The product for 1873 was 14 per cent greater than for 1872, amounting in value to \$77,440,000.

THE FAIR OF THE AMERICAN INSTITUTE.

As compared with its predecessors of the past three years, the present Fair is undeniably far in advance, not only in the number, variety, and intrinsic beauty and merit of the articles exhibited, but in the unwonted vigor which has characterized its management. With some trifling exceptions, the display is now complete, and that this can be said in the presence of the fact that an unusually large amount of heavy and bulky goods have been entered is no small credit to the gentlemen whose exertions have brought about so excellent a result in so short a period of time.

It is the verdict of almost every visitor that the general appearance of the hall has been greatly improved. The various articles have been grouped with an eye to artistic effect as well as to convenience, a task all the more easy owing to the entry of so many objects of elegant and tasteful design. As we before intimated, the display of red, white, and blue drygoods on the roof mars the general effect; but this aside, there is plenty upon the floor to gratify the most fastidious taste. Few art lovers can pass the cases of the Gorham Manufacturing and the Meriden Britannia Companies without a long look at the exquisite designs in silver and gold therein exhibited. There are some miniature models of yachts, and one tea set in gold and frosted silver which will well repay more than a passing glance, for the work upon them is admirable. As another very beautiful specimen of somewhat similar labor may be mentioned a copper lectern in the form of an eagle, to be found in the exhibit of Messrs. J. and R. Lamb, church furniture manufacturers and decorators. The modeling of the bird is very fine, and the way in which it is mounted to serve its purpose is quite artistic. In fact, it seems to us that the fine art department of the present Fair is scattered throughout every division, and exists everywhere but in the special quarter set aside under that name. The photographic display is little more than a repetition of that of last year, and there are some pictures present which have done similar duty for several years. Kirtz has some excellent photographs, as usual; Prang, one chromo among others which is especially good, and worth mounting a long staircase to look at: it is a child holding a bunch of flowers. And there are some fair specimens of photo printing, and work by the sand blast process, which has been described so often.

THE HORTICULTURAL DISPLAY

is exceptionally good. There are a number of admirable specimens of fine fruit, so large and luscious that one is forced to regret that their fate is to decay on their plates, and not to gratify somebody's palate. Several prominent florists in this city have sent some exquisite baskets of cut flowers, one of which, made of oat straw in the form of a bird house, stuffed humming birds perched here and there answering for the living inmates, is remarkably beautiful—and doubtless costly in proportion. The exhibition of growing plants is worth examination, as many rare and beautiful varieties are included. There is one specimen in which the very large leaf is half green and half pure white, and others look as if some one had shaken a brush full of white paint about their verdure. We do not remember to have seen any scientific explanation of this peculiar appearance, and it might be a subject for study as to why the chlorophyll or coloring matter of the leaves should thus be absent or inoperative in certain spots. From the main hall we proceed to note the novelties in the Machinery Department. A curious machine is that for

MAKING CORRUGATED ELBOWS

in stove pipes. The sheet of iron, bent in tubular form, is slipped over a mandrel of suitable size. In the extremity of the latter are two clamps, each made in two pieces, hinged opposite to each other. The inner clamp, when brought over the pipe and its halves forced together by a lever on one of them, makes a slight, narrow swelling around the surface of the pipe. The other and outer clamp has a square inner edge, which forms a crease or plait on top of the iron and outside the elevation formed by the first mentioned clamp. Both clamps are securely fastened, and a powerful lever in the rear is worked, which bends the outer edge of the pipe upward. The clamps are then loosened, and the return motion of the lever operates mechanism to carry the pipe a certain distance forward. The operation is then repeated until the pipe is bent to the proper angle. The machine is made by the Corrugated Elbow Company, of this city. It is operated entirely by hand, doing its work with great rapidity and accuracy.

A MACHINE FOR CUTTING OUT CLOTHES,

the invention of Mr. Albin Warth, is a remarkably ingenious apparatus, which bids fair to prove a great blessing to the tailoring trade. There are two forms of the machine, one of which is movable and is carried against the cloth, while the other is stationary and has feed wheels drawing the fabric to it. In the movable device, a long rod is fastened along the edge of the table, serving as a way for a traveling carriage. A belt passes over two pulleys at one end of the rod, and its light over a single horizontal pulley at the other, and to this power is applied. On the carriage is a pulley, against which the two parts of the belts, passing it on each side, are forced by means of binder wheels, the degree of pressure applied to the latter regulating the amount of power transmitted from the belt to the pulley. Just above the latter, and on the same shaft, is a smaller belt pulley, and above this again is pivoted a long arm, which extends out over the cutting table. Another belt for the smaller pulley passes along the arm, thence to other pulleys, which it rotates, so communicating motion to an eccentric, which gives a knife in a suitable support a fast vertical reciprocating motion. Below the knife is a flat metal disk, with beveled edges,

which is passed under the cloth. The part which holds the knife has a handle, by which the operator can guide it, the arm being pivoted on the carriage, and the latter having a free motion along its way, affording a kind of universal movement over the plane of the table. There is a presser foot that holds the cloth, and devices for instantly shifting the driving belt in the movable part to a loose pulley, and so stopping the operation. The machine cuts through half an inch of solid cloth with the utmost ease. No pinning of the material is necessary, and the inventor informs us that, in many of the largest clothing manufacturing houses in the city, forty men are readily enabled to do the work of one hundred. In the smaller or stationary machine, there is mechanism under the table to give the knife working through the same a reciprocating motion, and also to operate feed wheels, which draw the cloth against the edge. This cuts through $1\frac{1}{2}$ inches of solid cloth, and we are told that with it four men can easily fold, sketch, and cut 800 pairs of pants, or 500 coats, in a working day. There are very many ingenious and interesting details about these machines, which will well repay examination.

Considerable interest is being excited by the performances of the new lubricant,

METALINE,

a substance which we described and illustrated some months since, and which has proved successful as a substitute for oil in a variety of machinery. The material is a peculiar alloy which is inserted in cavities made in the interior of the journal boxes, and its effect is to form a thin film over the opposing metal surfaces, and to prevent either heating or cutting. At the Fair is exhibited a counter shaft, speeded to 750 revolutions, in which the bearings are cut down to the diameter of the shaft, one inch. This communicates motion to a short emery grinder spindle, speeded to 3,500 revolutions, and the latter to a cotton spindle, which runs at 14,000 revolutions. There is not the slightest cutting visible under these very high speeds, and the amount of heat developed is barely discernible by the touch. The Fall River mill, which was burned through friction generated by an uncoiled mule head, would doubtless be standing to-day had such a substance as this metaline been employed.

Next week we hope to have room for a longer report of the Fair.

MEDICAL NOTES.

Kousso for Tape Worm.

A correspondent of the *Druggists' Circular*, F. R. P., of Augusta, Me., narrates a case where he effected the removal of a tapeworm after the patient had taken male fern, turpentine, and a number of other remedies, prescribed by different physicians, without avail. First, a dose of castor oil was given at night; it operated early in the morning. Then one ounce of pulverized kousso was put in half a pint of warm water and allowed to stand a short time. The patient drank what he could of it in twenty or thirty minutes. He retained about one half the quantity used, his stomach rejecting more. In three or four hours he took another dose of castor oil, meanwhile having an operation from the kousso, but no tapeworm put in an appearance. But in an hour and a half the last dose of oil operated, and with it came twenty feet of the tapeworm in one unbroken piece, the head remaining, the end coming first being half an inch wide, and the last portion about one sixteenth of an inch wide, evidently being very near the head. Some two weeks after, the same treatment was repeated, only the kousso was given in capsules instead of water. This time eight inches more of the troublesome tenant were dislodged, one end running down to the size of a knitting needle, and the joints almost square. Several physicians say the head must have passed. The patient feels much relieved in mind and body, and has already begun to grow fat. The prescriber finds the books vague, and desires some one to give him a plain description of the head of the *tania solium*.

Styrax in Itch.

At the Stuttgart hospital, they treat scabies with the following ointment: Styrax, one ounce, olive oil and common spirits, each one drachm; mix. If an old case, the patient is first washed thoroughly with soft soap, nine to twelve times in three days, and then anointed with the above, one to three times a day. In recent cases the soft soap is not required. In 1,659 cases thus treated, every one was cured, although no precautions were taken to destroy the insects on clothing, and not one relapse occurred.

Surgical Treatment of the Eye.

Mr. C. S. Jeaffreson, surgeon of the Eye Infirmary, Newcastle-on-Tyne, makes very important remarks on the treatment of the eye when injured or diseased. He says: "There is one rule in ophthalmic surgery which will help us to deal with a large class of these cases, and it is this: An eye which has been damaged by accident or disease, and which is no longer useful for visual purposes, is a dangerous organ and should be removed. I do not wish to assert that this rule should always be rigidly carried out as regards eyes which have been destroyed by idiopathic disease, although I think, in those cases, a rigid conformity to it would rarely carry us astray. In traumatic cases, I firmly believe that it can never be safely departed from, and should be carried out as soon as we have convinced ourselves that the visual power is gone, or will be so low as to be practically useless. Scarcely a day passes in my public or private practice without my seeing a case of sympathetic ophthalmia, which might have been averted had this rule been thoroughly understood by the bulk of practitioners; and every year a large number of persons are consigned to a life of darkness and misery from a want of appreciating the importance of it.

Patients have a great horror of enucleation, and require usually a great deal of pressing to submit to it; and for this reason the surgeon must be firm and unflinching, and must indicate the necessity for action in the most forcible language. What should guide our treatment in doubtful cases? In my judgment, the following circumstances: 1. If there are the slightest signs of sympathetic ophthalmia in its fellow, the injured eye should be immediately excised. 2. If vision is absolutely lost beyond hope of recovery, the eye should be sacrificed. 3. If the wound is in the ciliary region, and there is no prospect of really useful vision, the eye should be excised. 4. If the wound is not in a dangerous region, and the impaired vision seems to be in a great measure due to effused blood, I should not advise immediate operative interference. When once we have made up our minds that enucleation is necessary, is it advisable to wait till acute inflammatory symptoms have in a measure subsided? For my part, I think not. I have frequently performed enucleation during the most inflamed stages, and I never have seen any bad results follow. I believe that by following this rule, we may frequently curtail a great deal of pain and anxiety, which would have been incurred by waiting.

When foreign bodies are lodged in the anterior chamber, lens, or iris, they are generally clearly visible, and may usually be removed without much difficulty while the structures are still transparent. When they are lodged in the lens, no time should be lost, for sometimes it happens that a body which remained *in situ* while the lens was firm disappears behind the iris when the lenticular matter becomes diffused; and if extraction be attempted at this period, especial care must be employed, as the lenticular matter not unfrequently flows out, leaving the foreign body hidden by or entangled in the folds of the iris. Occasionally a foreign body which has been lodged in the eye will escape spontaneously.

SIR JOHN RENNIE, the distinguished civil engineer, died on the 3d of September, in England, at the ripe age of eighty years. He constructed the new London Bridge, completed Plymouth Breakwater, designed and built Sheerness Dockyard, Ramegate Harbor, parts of the Cardiff Docks, and other important works.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT FRUIT JAR.—THE CONSOLIDATED FRUIT JAR COMPANY vs. JAMES T. WEIGHT.

WOODRUFF, Circuit Judge: The bill is filed herein to restrain the alleged infringement of a patent granted May 10, 1870, to John L. Mason for "an improvement in fruit jars," and, by assignment, now held by the complainant. The application of Mason for the patent was made on the 15th of January, 1868. In the specification, the invention is said to relate to a new and improved construction of jars and other vessels designed for the preservation of fruit and other substances which are seriously affected by exposure to air, whereby India rubber packing rings or gaskets can be employed in making tight joints without exposing the rubber to the contents of the jars, and whereby flat horizontal shoulders, formed outside of the jars, are adapted to afford bases, upon which to receive said rubber packing rings, upon the exterior of the jars above the continuous glass screw; and whereby flanged caps or covers can be used, the flanges of which are adapted to fit over annular ribs or flanges surrounding the mouths of the jars; and whereby flexible flanged screw rings, made of thin metal, are adapted to confine the caps or covers down firmly in place over the mouths of the jars and upon the said rubber packing rings, placed upon the said shoulders formed outside of the jars.

After a more minute description and reference to the drawings annexed to his specification, the patentee states that he claims: The combination, first, of the shoulder *b*, to receive a gasket outside and a little below the top of the jar; second, of the cover *c* with the rim *d* extending down outside of the top to press upon the gasket; and third, of the screw ring or screw cap *e*, with its screw threads operating upon those of the jar below the gasket shoulder, all substantially as above set forth and described.

It is to be noticed that the patentee does not claim either of the elements or parts of this combination; nor does the patent purport to secure to him the exclusive right to use either, nor does it secure to him the special form of either, but only the combination of the three.

The patent, therefore, in no wise hindered the use by any one of a cover having a rim or flange extending down outside of the top of the jar to press upon a gasket, nor of a shoulder upon the outside of the jar, a little below the top, to receive such gasket, nor of both of these combined, provided the purpose was not produced by a screw ring whose threads operated upon threads in the glass jar below the gasket, and so of any other jar not combining the three parts. The patent is strictly a combination patent, in which the parts are not claimed to be new.

Held as follows: A patent for a fruit jar claimed in combination an outside shoulder below the top for holding the gasket, a cap with a rim pressing on the gasket, and a screw ring engaging with threads below the shoulder for holding the cover down; and it is claimed a gasket which was pressed down upon a similar shoulder by means of a clamp as well as a similar screw ring for holding a gasket on the top of the jar. Doubtless whether there was the exercise of anything more than sound judgment in substituting the screw ring for the clamp in one case, or the gasket on the shoulder for the one on the top in the other.

Where a patentee disclaims so many elements of his invention as to leave no room for the exercise of invention in forming the combination which he claims, it is of no avail for him to show that he was really the first inventor of all or any of the parts thereof.

A patent is void if more than two years before the application for it was filed the patentee had sold the patented articles for the double purpose of realizing the proceeds and of seeing if they would sell, and others had had them in actual use.

An invention held to have been abandoned to the public when the author, after having reduced it to perfection and actual practice, took no further measures with it for nine years and suffered the molds to be lost, and meanwhile others, independently of him, reduced it to practice and introduced it extensively into market.

It is not necessary that the latter should obtain a patent; it is enough if they have reduced the invention to practice, and it has gone into use. The first inventor does not lose his right in such a case in consequence of the mere lapse of time, but because the circumstances indicate an intention of abandonment, and because the rights of others have intervened. Bill dismissed with costs.

(J. J. Todd and J. H. B. Luttrell, for complainants. W. C. Witter and George Gifford for defendants.)

Inventions Patented in England by American

(Compiled from the Commissioners of Patents' Journal.)

From August 27 to September 9, 1874, inclusive.

BOILER FURNACE.—W. L. Fowleson, San Francisco, Cal.
BOOT MAKING MACHINE.—E. P. Richardson, Lawrence, Mass.
BRAKE.—J. Y. Smith, Pittsburgh, Pa.
BREACH-LOADING FIRE ARMS.—B. H. Hotchkiss, Paris, France.
CAULKING TOOL.—J. W. Cushman et al., Philadelphia, Pa.
CUTTING BUTTER, ETC.—S. Richards, Philadelphia, Pa.
EQUALIZING PRESSURE.—W. Miller, Boston, Mass.
FILLING BOTTLES, ETC.—P. McC. Sherwood, New York city.
LEATHER CRIMPING MACHINE.—G. Platts et al., Newark, N. J.
MAKING PAPER PULP.—H. B. Meach, New York city.
PAPER CUTTING MACHINE.—V. E. Mangor, New York city.
PIANO-FORTE.—M. W. Hanchett, Syracuse, N. Y.
PILE FABRIC LOOM.—J. Cochran, Jr., Malden, Mass.
RAILWAY CAR, ETC.—Revd. J. C. Nobles, Elmira, N. Y.
ROTARY ENGINE.—R. D. Mills, Los Angeles, Cal.
SOLDERING APPARATUS.—J. Sears, Chicago, Ill.
STEAM PACKING.—P. W. Richards, Boston, Mass., et al.
STOPPING BOTTLES, ETC.—N. Thompson (of Brooklyn, N. Y.), London & SUSPENDING CHANDELIERS.—Bradley et al., New York city.
TRAVELING BERTHS, ETC.—T. P. Ford, Greenpoint, N. Y.
TRIMMING BOOT SOLES.—H. E. Townsend, Boston, Mass.
UMBRELLA RUNNER.—J. J. Higgins, M. D., New York city.

Recent American and Foreign Patents.

Improved Sprinkling Nozzle.

Biddle H. Moffett, Swanton, N. Y.—This invention consists of a nozzle with spout, cut off under suitable inclination, to be closed by a tightly fitting packing at the end of a spring lever, which is partially opened or closed by the hand to throw out the required quantity of water.

Improved Imitation Embroidery.

Henri François Timothée Mégard, Paris, France, assignor of one half his right to Edward Vernon, same place.—A strip of any suitable fabric, such as tape, is first impregnated with a strong gum, in order to impart the necessary stiffness. It is then cut on one or both edges, according to any desired pattern, by means of machinery already patented by this inventor. The strip is then passed through another machine, also patented by M. Mégard, whereby it is covered with threads, which are wound by a rotating thread-carrying arm as it is drawn through the machine; or the strip may be covered by a machine, described in another patent of the inventor, in which rotating arms wind threads around the strip at the same time that shuttles carrying other threads form with the first named a kind of woven edge to the strip. In either case, the surfaces of the strip are so covered with threads as to resemble satin stitch when sewed to any fabric.

Improved Card Worker.

Willard C. Smith, Norway, N. Y.—To a shaft are attached wheels, to the rims of which are attached perforated sheet metal plates which form the curved wall of the cylinder. In the opposite sides of the latter are formed openings, which are closed by doors formed by attaching sheets of perforated sheet metal to suitable frames to stiffen them. By suitable construction the cylinder is revolved slowly, while a fan wheel is rotated rapidly so as to force a strong stream of air through the said cylinder. To wheels are secured longitudinal bars with cross pins to break up the card as the cylinder revolves. The wheel trough fits upon the lower side of the cylinder, and is so arranged as to be raised and lowered by turning the shaft. The upper edge of the end of the trough is notched directly above the spout, so that, should the trough overflow, the whey, as it runs over, may flow into the spout, and thence into the receiving vessel.

Improved Corn Planter.

Francis Bolduc, St. Anne, Ill., assignor to Joseph Dalpay, same place.—The axle carries a bevel gear wheel with it in its revolution, and thus gives motion to gear wheels, pins on which strike alternately the rear ends of the forks of a lever at each revolution, thus oscillating the same. The lever is pivoted to the frame, and its forward end is attached to the center of the slide bar, the ends of which enter the seed hoppers and connect with the dropping disks, operating them to drop the corn. The size of the dropping openings, and consequently the number of kernels dropped at a time, may be regulated at will. By the downward movement of a bar, the driver can determine the exact space passed over by the machine while the dropping device is out of gear. This enables him to throw the dropping device out of and into gear at such times as will cause the hills to be planted in perfect check row.

Improved Hot Air Furnace.

David Boyd, New York city.—The products of combustion pass up through a dome space into a flue. The upper compartment is occupied by a concentric flue which communicates with the flue first mentioned at the center of the compartment, and also at the periphery or outside. A pivoted damper is located in the latter, between the inner and outer portion of a flue, to cause the products of combustion to take either a circuitous and return course or a direct one, thus, in large measure, controlling the degree of heat radiated by the heater, and also the rapidity of combustion.

Improved Game Board.

John Butt, Brooklyn, N. Y.—This is a toy ten pin alley, in which the ball may be projected, by a spring plunger hung upon a pivot against pins placed upon a table, knocking down more or less of them according to the skill exercised in aiming.

Improved Spike Extractor.

Michael Biglin, Pleasant Valley, Pa.—The spike hook is of hollow shape with a recess in the bottom part, the sides of the latter being tapered off toward the recess, so as to be placed under the projecting parts of the spike head and close around the shank. A curved hook-shaped rail plate fits over the top part of the rail, and forms the fulcrum, by which the lever turns when raising the spike. The straight upward motion of the hook draws the spike completely out of the cross tie without breaking or injuring it, so that it may readily be used again.

Improvement in Treating Cotton Seed Oil for Paint.

Henry Goldmann, New York city.—This is a process of converting cotton seed oil into a drying oil by adding aqua regia, bisulphuret of carbon, sulphate of baryta, and by heating and agitating the liquid compound.

Improved Water Wheel.

Jeremiah J. Dodson, Greensborough, N. C.—This consists of a wheel made with buckets whose width increases from the central conical entrance part toward their middle sections, and diminishes toward the issuing ports at the circumference. The water enters through diametrical chutes at the top, and an enlarged water space of the cap piece, to the conical center and the buckets. A considerable pressure of the water in the buckets is thereby produced, and the wheel rotated with increased utilization of the power of the water head.

Improved Dust Catcher for Thrashing Machines.

Rudolph Z. Bader, Papillion, Neb.—This invention consists of side tubes or channels, which pass at both sides of the thrasher to the fan openings and are tightly attached thereto. A laterally connecting tube passes in front of the cylinder, and is connected with a detachable center piece having perforations at the bottom and side facing the cylinder, for the purpose of drawing in the dust produced by the feeding operation and the cylinder, and conducting the same, by the suction of the fans through the side tube, to the rear part of the thrasher.

Improved Door Securer.

Augustus Bobetey, Newark, N. J.—A face plate is applied by an inner flange and the spring to the hasp, the door being open at the time. The door is then closed and a sliding bolt carried forward over the lock as far as a rear shoulder or projection of the same admits. This shoulder passes along the outside of the hasp to or nearly up to the rim of the same, and throws the bolt with wedge-like pressure on the lock, forming a strong, safety device to the same, by resisting any attempt to open the door from the outside.

Improved Car Coupling.

William M. Underhill, Oconto, Wis.—Each drawhead has a hook above and a printed link below. Before coupling, the links are thrown back; and when the cars come together the concussion is sufficient to cause the links to swing forward and catch over the hooks. Spring pushers also arranged in the drawheads then force the cars apart, tightening the coupling.

Improved Automatic Gate.

Jefferson Ellis, Detroit, Mich.—By suitable construction, when the platforms and cross bar, which form the base of the gate, are forced downward by the weight of a horse, carriage, or other object passing upon them, the downward movement of track bars will turn gear wheels, and thus raise or open the gate, which gate will be held raised until the platforms are released from the depressing weight, when the elasticity of the springs underneath will raise the cross bar and platforms to their former position, closing the gate.

Improved Compound for Cough Syrup.

Jesse G. Coumb, Millville, N. J.—This consists of tincture of lobelia, tincture of myrrh, tincture of capsicum, tincture of blood root, alcohol, oil of anise, and wintergreen, mixed with molasses.

Improved Washing Machine.

Giles F. Leckenier, Stockport, N. Y.—This washing machine is formed of a large fluted or corrugated roller, and a series of small rollers with a suitable arrangement of springs to exert the requisite pressure on the clothes as they pass between the rollers. Extension leaves are supported in horizontal or inclined position during the time the washing machine is in use, for conducting the clothes over the feed roller and leaf to the main and friction rollers without injuring and squeezing the fingers.

Improved Draft Equalizer.

Henry H. Stevens, Riley, Ill.—To the rear side of the draft bar is bolted an iron bar, in which are formed holes to receive the draft, one of which is in the center line of the lever, and the others at different distances upon each side of said line, so that, by changing the point of draft attachment, an advantage of leverage may be given to one of the three horses or one pair of the four horses. To the under side of the end parts of the lever are pivoted two pairs of pulleys, and to the upper side of the middle part is pivoted a third pair of pulleys, upon the opposite sides of, and equally distant from, the center of the lever. There are three tugs, one of which is passed around each pair of pulleys, and to their ends are attached the traces. To the right hand ends of the right hand and center tugs are attached the traces of the first horse. The traces of the second horse are attached to the left hand ends of the said right hand and center tugs. The traces of the third horse are attached to the ends of the left hand tug; or the hitch may be reversed by commencing with the left hand horse. By this construction, by changing the point of draft attachment, the third horse may be made to draw more or less than one third of the load, while the two other horses will draw equally.

Improved Lathe.

John H. Stinson, Newark, N. J.—In order to apply spool blanks automatically to the lathe, and thus save the labor of feeding them by hand, a pair of spring fingers are employed, connected to a collar, so as to slide out and back on said arm, and open and close. The collar has a spring to pull it back, and an arm for forcing it out by running over a cam on a disk. When the spring pulls the fingers back, it opens them; and when they are pushed out by the cam, they close on the blank and hold it. The spool blanks are delivered to the fingers from the vertical conductor, into which they descend from an inclined conductor, one being let fall into it each time the fingers come to their position under it. The arm, on which the carrying fingers are mounted, is mounted on a rock shaft, which is turned by a tappet, to swing the carrier down between the lathe centers to present the blank to them; but just before the carrier is thus swung down, it is pushed outward along the arm by the cam, so as to extend it to reach the spool blank to the axis of the lathe, and also to allow the fingers to escape from the spool blank by sliding back on the arm after the blank is secured. The arm escapes from the cam the moment the spool blank is secured by the tail center and swings back to the place for receiving the blanks.

Improved Car Brake.

Charles Mathews, Fredericksburg, Ohio.—This invention consists in connecting the main or central brake lever of the series to the bottom of the car by a flexible medium, to adapt it to cooperate with the other parts of the brake mechanism, with minimum strain and friction. By the turning of the brake rod at either end of the car, the brakes or rubbers are simultaneously applied to the wheels by means of the symmetrical lever connections of the main lever and brake bars.

Improved Oil Rock Preserver.

Henry A. Snow, St. Petersburg, Pa., assignor to himself and Wesley Chambers, same place.—This is an oil rock preserving tube, incasing the pump, whereby the water column below the influence of the suction will maintain the oil, or oil and water, as high as the top of the oil rock, or thereabout, to protect it from paraffin deposit. There is also a water packing, in combination with the oil rock preserving case, to prevent the flow of the oil to the pump under or through the lower portion of the case.

Improved Combined Hand and Standard Mirror.

Abel M. Kestey, New York city.—This invention consists in the handle of a hand mirror, made in three or more parts, hinged, all or part, at their upper ends, to adapt them to be opened out to serve as a stand for the mirror. The upper ends of the two rear parts of the handle are hinged to each other by a hinge, so that their lower ends may be spread apart.

Improved Churn.

Thomas H. Herndon, Verona, Miss.—A pail or can with closed top is simply made fast in each one of the hollow heads of a box, which is then rotated by clockwork mechanism, arranged in a suitable frame, until the butter comes.

Improved Spring Back Rest for Vehicle Seat.

John L. Gessler, Clinton, Iowa.—This invention relates to novel means whereby the jar, shock, or jolt to the back of an individual, resulting from the sudden starts of horses in a vehicle, or from unevenness in the roads, may be completely taken up and neutralized. The invention consists in providing the seat of a vehicle with a pivoted back and spring arms.

Improved Test Valve.

Edwin A. Wood, Utica, N. Y.—The nature of this invention consists in giving to the valve opening a definite area, as, for instance, a square inch, and loading the valve so that it will be equal in pounds to the pressure at which the steam or pressure gauge is to be tested, with the parts so arranged that, when the slightest pressure greater than such weight operates on the valve, it will instantly rise; and if the gauge to be tested is attached to the same pump, the index on the gauge will, at the instant the gauge rises, show whether the gauge is correct or not.

Improved Machine for Graining Pails.

Lyman Jennings, Winchendon, Mass.—This invention consists of tapered printing and taking rolls, and a roller block for holding the pails, etc., combined and arranged to apply two or more colors to a pail or tub. The type rollers have type portions and vacant spaces, and they are so geared by a wheel, which also turns the block supporting the pail, that the type of one roller prints in the spaces left by the spaces of the other roller. As the ink rollers have inks of different colors, the patterns are thus applied to the pails in alternate order, when two printing rollers are used. By the same plan, three or more printing rollers may be employed.

Improved Neck Yoke.

Michel Krebs, Assumption, Ill.—This is an improved neck yoke, by which the wearing out of the breast straps, both on the flat side and the edges, is prevented, while it allows the breast straps to work freely, and obviates the jerking of the horse's neck and the injury frequently caused by it. The invention consists of a bracket attachment to the ends of the neck yoke, which supports a loose roller, and side washers for the ready adjustment of the breast strap.

Improved Wash Boiler.

Joseph H. Jenkins and Elijah W. Jenkins, Liberty, Mo.—To the side edges of the cover of a square metal-lined wooden box, near its rear edge, are provided short rods, the lower ends of which are pivoted to the sides of the box. The pivoted rods thus serve as hinges to the cover, and also enable it to be slipped forward after being turned back, so that its rear edge may project over the boiler, to conduct the water draining from the clothes back into said boiler. The movement of the pivoted rods is limited by two stop pins. The cover, when turned back, is supported by an arm or bracket, detachably secured to the box.

Improved Ball and Instep Stretcher for Boots, etc.

Frank A. Fay and Rudolph Spahn, Brooklyn, N. Y.—Two side pieces, arranged between a bottom piece and the instep piece, and pivoted at the heel, are provided with a tapered screw plug, a little in advance of the pivot for forcing them apart at the ball for stretching it. A divided nut is formed, half in each piece, for the plug, and the plug is provided with a stem and a handle for turning it. The instep stretcher is pivoted to the bottom piece at the toe, and it is connected behind the instep by a yoke to the nut of a hollow screw resting on the stand, which is supported on the bottom piece. This hollow screw surrounds the rod and allows it to extend down in the same axis to the plug, and it has a handle for turning it. This forms a stretcher both for the ball and instep of a shoe.

Improved Hedge Trimmer.

Andrew J. Heavner, Pittsfield, Ill.—The rear end of the frame, being suspended, may be raised and lowered, as desired; and by operating a lever the forward part of the suspended frame may be raised and lowered as required, and, when adjusted, will be held securely in place. A sickle bar, which is made in two parts, meets at the angle of the cutter bar and works in bearings in the rearwardly projecting ends of some of the fingers, or in bars attached to the cutter bar. Each part of the sickle bar is vibrated by a zigzag wheel, which works in notches formed in the said sickle bar. The zigzag wheels are attached to shafts, which work in bearings in the rearwardly projecting ends of some of the fingers.

Improved Running Gear.

Celestin Jackman, Georgia City, Mo.—This invention consists of a connection of a bolster, by a concave wheel, with a convex follower and a pivoted brace attached to the front axle and the pole. The king bolt forms the connection of axle and bolster, and may, in smaller wagons, be entirely dispensed with; while, in heavier wagons, the same forms, in connection with the sliding wheel and follower, perfect security of the king bolt coupling.

Improved Bung Hole Lock.

Carl Faubel and Friedrich Knorr, New York city.—This invention consists of a lock plate attached to the bung hole, which is provided with a hinged hermetically sealing bung hole cover, to be locked by a suitable bolt, and retained in open position in a recess of the base plate by a band spring catching thereon. The device dispenses with the use of bungs and the injury to the barrel by driving them in.

Improved Locomotive.

Thomas Benton Smith, Nashville, Tenn.—The object of this invention is to prevent the drive wheels of a locomotive from slipping upon the rails by using the weight of the train being drawn to give a downward pressure upon the said wheels, causing them to hug the rails, thus increasing the traction power of the locomotive. Pivoted bars extend along the sides of the locomotive, and connect with longitudinal bars passing under the tender and fastened to the first car. At the joints of the first mentioned bars are connected vertical rods which communicate with the piston of a steam cylinder situated above the locomotive. With this construction, when the engineer admits steam into the cylinder, the piston is forced upward, drawing the bars upward into an angular position. The weight of the train then tends to draw the bars downward into a horizontal position, which throws the weight of the train upon the drive wheels of the locomotive, causing them to hug the rails.

Improved Roller Skate.

John Fenton, Indianapolis, Ind.—The wheels revolve in forked bracket pieces attached by loose rivet connections to hinged plates. Bed plates are provided on each side with wedge-shaped ears which extend down on each side of the skate. Rubber springs allow the foot piece to rock from side to side, while the wedge-shaped ears keep the brackets and wheels in position. On the weight being thrown upon either side, the skater is enabled to turn and change his course at will, and perform all the movements and evolutions on a smooth floor that he could on ice with the ordinary ice skates.

Improved Metal Planing Machine.

Joseph L. Hewes, Newark, N. J.—A case is attached to the bed with a cap screwing on the front face, to enclose the worm gears to protect them from dust and to hold oil. There is a fast pulley and a loose one for the belt which gives a forward motion to the bed, and the same for the belt for giving the back motion. The shifters are alike in form, but reversed in position, and have a loop at one end, to receive the belt, and a notch at the other, which latter interlocks with angular projections on a slide, while the side faces of the slide act upon the sides of the levers at points opposite to the notches. In the slide are spaces which allow it always to move so as, by one projection, to shift one belt from a fast pulley before the face of the slide begins to shift the other belt from the loose pulley.

Improved Grain Separator.

John T. Hicklin, Olympia, Wash. Ter.—There is a horizontally shaking shoe in which fingers are mounted for separating the straw, chaff, etc. Said fingers are pivoted at the upper end, and rests near the front end upon a bar, so as to be allowed to rise and fall. A bar attached to the under side of the fingers carries a couple of cams on its under side, which, in passing forward and backward over rollers on fixed bearings supported on the case, give to the fingers a quick up-and-down motion in addition to its horizontal motion with the shoe, which increases its efficiency in separating the light matters from the grain.

Improved Curtain Fixture.

Charles E. Howard, Philadelphia, Pa.—This device is used in connection with curtains secured to rings which slide on wires. A cord passes through a pulley on the window case, thence up through a pulley secured at one end, and above the curtain wire, thence along the same around a second pulley at the opposite end, back and over the same route to the first pulley, where the ends may be secured together. One end of one curtain is attached by a clamping ring to one part of the cord, and the similar portion of the other curtain by like means to the other, so that, by pulling one or the other lower end of the cord, the curtain may be brought together or opened.

Improved Milk Receptacle.

George C. Greenleaf, Molra, N. Y.—This invention relates to a means of cooling and preserving the sweetness of milk; and consists in a milk pan fastened to a frame with a second frame or tray divided into compartments by partitions. Said pan rests upon these partitions, and into the central compartment formed thereby is introduced cold water, which, after cooling the central portions of the milk, circulates, through holes in the partitions, around the edges of the pan, and is finally discharged through an outlet.

Improved Molding Flask for Cement and Clay Pipes.

Joseph F. Andrews, Nashua, N. H.—The core is constructed of two parts, which are connected horizontally by a tapering socket joint, the lower or bottom part of the core having a large flange, which is secured to the bed plate of the mold, so as to support the same in an upright position. The cement for forming the pipes is filled in from the top, the end section being then placed on the top end and pressed on the material after the mold is completely filled. After the pipe is sufficiently dry the upper core section is drawn out by suitable hoisting mechanism, the lower core being drawn out in the opposite direction by hoisting end section, pipe, and flask, which produces, by the draft of the core sections from the center, a smooth core, of equal diameter along the full length of the mold. The top and bottom sections remain on the pipe until the ends are perfectly dry, when the outer flask and end sections are removed.

Improved Machine for Facing Tiles.

George Barney, Edward P. Parsons, and Rufus L. Barney, Swanton, Vt.—The rubbing disk is cast in sections with a recess in the center, and the sections are locked together by dovetail notches and projections to prevent them from throwing off by centrifugal force. A vertically adjustable center piece is fixed on the shaft by a collar and a set screw, over the central recess, for shifting down as the disk wears down and to be kept level with it. A friction wheel on the upper part of the shaft turns another shaft by a wheel to revolve the tiles upon the disk, the tiles being confined in holders connected to the lower end of the shaft by bars. The shaft is supported in bearings in the arms of another shaft, on which it and the holders are swung from a platform or table, after receiving the tiles on the disk, and back again for applying the stones to the disk and removing them. The last mentioned shaft is stopped in a bearing in the short arm of a foot lever, so as to be lifted a little, to take the weight of the tiles off from the table and disk, so that they will swing free in turning forward and backward.

Improved Car Coupling.

Leonard Fleckenstein, Creswell, assignor to himself and Martin Miller, Highville, Pa.—This invention consists of two spring bars with arrow heads, which interlock firmly with similar heads of the connecting coupling. The spring bars are pivoted to a standard at the bottom of the car and supported in a surrounding guide piece with vertical spring rod, having operating treadle and adjusting mechanism for uncoupling, raising, and lowering the coupling arrow heads. When the arrow heads are adjusted and centered correctly, they will couple automatically on the approach of the cars, and may be instantly and readily uncoupled by the action of the foot on the treadle, or, in case of accident, by a change of their relative position.

Improved Automatic Fan.

Paul Magnus, New York city.—This consists of two fans attached like wings to a vertical spindle, which is rotated by suitable mechanism in a pedestal case. The apparatus moves without noise and is a convenient portable device for cooling the person.

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An article, with engraving of the above Motor, appeared in the *Scientific American* of August 1st. Owing to the absence from town of the person to whom letters for further particulars were addressed, many communications were not received. Any desired information can be received by addressing C. T. CRAWFORD, Box 253, Post Office, Baltimore, Maryland.

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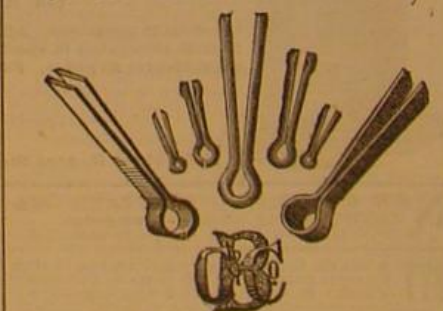
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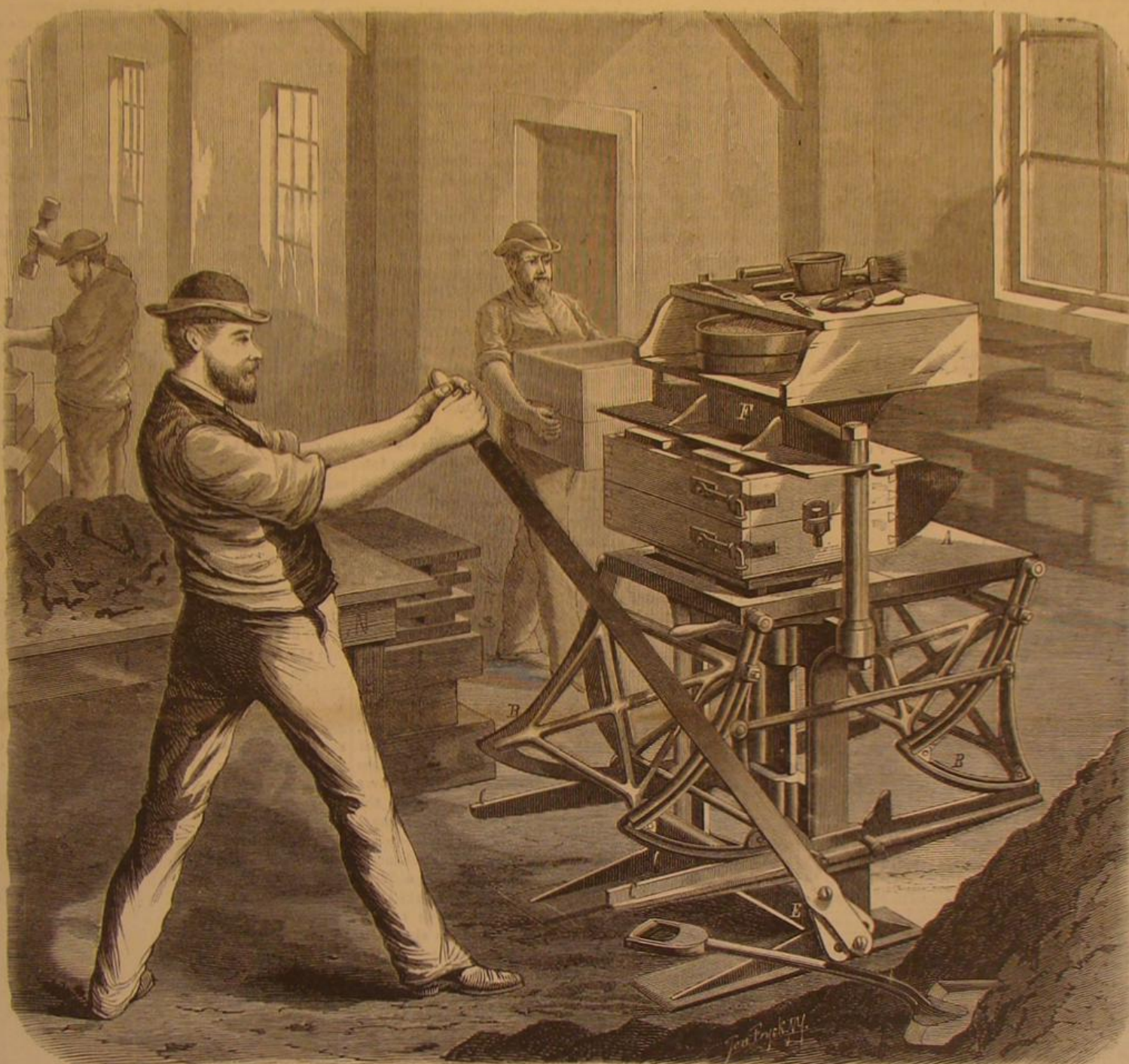
SCIENTIFIC AMERICAN

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Vol. XXXI.—No. 16.
[NEW SERIES.]

NEW YORK, OCTOBER 17, 1874.

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With Postage, \$3.20]



EAMES' AND BROADMEADOW'S MACHINE FOR MOLDING METAL CASTINGS.

MACHINE FOR MOLDING METAL CASTINGS.

The ramming of molds is an operation which not only requires care, but judgment. Care in the venting, in placing the bottom board, in the quality of the sand, is alike essential, and to this is added the exercise of a judgment which is only attained by long and watchful experience, in ramming hard at one point or soft at another, according to the nature and style of the work to be produced, or in packing the sand with the absolute uniformity, at all points, which becomes necessary in many forms of casting. Ramming, therefore, is almost an art to which a man must educate himself, and certainly not one in which a few days' or a few weeks' practice will render a previously unskilled workman proficient.

It is unnecessary here to enter into any discussion regarding the obvious utility of mechanical devices which fulfill the double purpose, of on one hand superseding the fallibility of hand labor by the certain accuracy of the machine, and on the other of saving the time which otherwise would be expended in acquiring the knowledge necessary to perform the work.

We have recently returned from a visit to New Britain, Conn.,—one of those thriving manufacturing towns of New England which have sprung from the dimensions of small villages almost within memory of the present generation—where, at the factory of its manufacturers, we devoted some hours to the examination of a machine which excited in our minds an interest which will doubtless be shared in by every metal worker.

The apparatus, of which we append an excellent engraving, is one for ramming molds, and in construction is extremely simple. There is a carriage composed of a table,

A, which is supported on segmental wheels, B, the latter resting on ways, C, attached to the main standard. The segments, B, are suitably connected and travel upon the same arc, so that upon them the table can be moved toward or from the workman at will. In the table is an aperture through which works the rod supporting the platen, D. The upper end of the rod enters a socket in the bottom of the platen, while its lower extremity receives a projection on the vibrating cross piece, E. To the right hand end of this cross piece is secured the lever, shown in the hand of the operator, by bearing down on which, as will be evident from the connection of parts, the platen can be raised. By this means, whatever may be placed between the platen and fixed head plate, F, can be compressed as desired. An adjusting screw is arranged in the platen connecting rod, by which the length of the same and consequent throw of the lever before pressure begins can be regulated, and there is also a simple latch by which the table is locked in proper position. The operation of molding consists in first swinging the table outwards by pushing up the lever and so locking it. Then the match and pattern is laid upon the platen, and above the former, the lower half of the snap flask. Sand is first sifted upon the pattern and subsequently shoveled in until the receptacle is evenly filled. The back board is then laid on top, the latch lifted, the table swung in, and the lever pulled down. The back board is thus brought up against the head plate, forcing down the loose sand beneath it. The table is again carried outward; on the pressure being relaxed, the match is removed, the flask reversed, and the cope adjusted, sand is placed in as before, another board laid above, and the whole brought again under compression. This is the position of the machine as shown in

the engraving. Again the table is swung forward, and on removing the upper board two shallow cavities, made by projections therein, are found in the sand. A hollow metal punch is forced down into these, forming the pouring holes, which, with the subsequent preparing of the mold, are finished in the usual way. The use of sprues by this means is done away with.

This sums up the construction of the machine and its working, and it now remains to point out what it will do. Standing in the molding room, watch in hand, we noted the time taken by a first class molder to complete ten molds by the old process of ramming, and then to finish the same number by the aid of the apparatus. The snap flasks were 11 by 13 inches in size, and the castings $4\frac{1}{2}$ inch iron rim locks. By hand, the ten molds were completed and deposited on the floor in 39 minutes; by the machine, the same work was done in 18 minutes. The hand made molds also were fully one third heavier than those made by the apparatus.

A reference to the foreman's books also furnished us with other interesting points. A fair day's work in ramming the molds in the old way for lock castings averaged 163 pounds of metal, against 250 pounds from same patterns by the machine. Common butt hinges showed 397 pounds by machine against 260 by hand. The average saving in labor, on all kinds of work, is fully 33 $\frac{1}{3}$ per cent. Perhaps more striking evidence will be found in the fact that an entirely unskilled workman, on the second day of his attempting the task, completed 110 molds of about the size above noted, and another man on the fourth day made 140 molds. In the casting of small work in brass, such as keys, etc., we were told that 1,752 pieces are made in a day through the machine, against 1,008 pieces through hand labor, the reason given being the possi-

bility of putting a larger number of pieces in a flask, of making more molds, and of getting out much better work.

We may add that the specimens of castings exhibited to us, as coming directly from molds thus prepared, appeared fully as sharp and clear as those from the best hand-rammed molds. Nor does the intricacy of the pattern seem to cause any difficulty, as we were shown molds for very irregular blind hinges, and completed castings for bank locks, the latter weighing some 80 pounds each, and of considerable intricacy of form. We also remarked that, through the evenness of the ramming, the waste through imperfect casting of large numbers of keys, hooks, and similar small goods was very small, almost every object coming from the sand true in shape.

Our readers can draw their own conclusions from these simple facts, so that we forbear further comment. We examined the score or more machines which the manufacturers, Messrs. P. & F. Corbin, of New Britain, Conn., had in use in their factory, noting in every instance the ease and rapidity with which they were handled by the workmen. The amount of pressure to be applied to the lever seems to be the only point requiring practice to judge; but that this knowledge is readily acquired, is proved by the work of the unskilled hands above detailed.

The patent granted to Albert Eames and John P. Broadmeadow, of Bridgeport, Conn., under which the device is manufactured, was extended November 25, 1873, and many essential improvements are covered by another patent dated August 4, 1874. Further particulars may be obtained by addressing the manufacturers as above, who are the sole licensees for the sale of the machines.

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 17, 1874.

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OUR FEVER NESTS AND THEIR REMEDY.

Though blessed by nature with a situation unrivaled for sanitary advantages, New York has a death rate such as few cities in Christendom can equal. The appalling mortality of the past summer, especially among children, has given rise to a great amount of sorrow and indignation on the part of the daily press, and not a little severe criticism of the action of the medical and police authorities, the common theory being that the enforcement of proper sanitary regulations would have prevented the larger part of the needless loss of life. That much might have been done to improve the health of the city by more rigid sanitary measures, there is

no doubt; but it is useless to expect a Board of Health, however efficient, to achieve impossibilities. The great source of disease and death in the city is the tenement house system, whereby families are massed by the hundred in huge barracks, destitute of light, ventilation, the means of keeping clean—of every appliance, in short, for healthful living; and until wholesome dwellings can be substituted for these dens of disease, New York must endure the shame of being one of the most unhealthy cities in the world. No other city, in its densest portions, crowds half as many inhabitants to the acre as can be seen in some of our lower and eastern wards, and nowhere are the dwellings so poorly fitted for a numerous occupancy. And not only are these huge hives, with narrow halls and lightless sleeping rooms, crowded from the roof to the pavement with poverty-stricken families, but underground, in damp, unwholesome basements, multitudes find miserable shelter. Says the Children's Physician to one of the largest dispensaries: "An experienced dispensary physician can detect a patient who comes from a basement simply by the sense of smell!" Is it any wonder that the deaths of children in such a house number five or six a week? Or that a week of excessive heat may swell the weekly death list of children under five years of age by four or five hundred? About two thousand of these candidates for early death are born in our tenement houses every month.

With high culture, scientific management, and abundant means, it may be possible for many families to dwell together in health and safety under one roof; but where ignorance, poverty, and filthy habits prevail, the massing of families is little short of pestilential. Only by the dispersion of the tenement house population can the now over crowded wards of the city be made tolerable, and the death rate reduced to reasonable limits; and we see no way by which such a desirable result can be effected humanely, save by providing means for carrying the poorer working people to and from country homes more rapidly and cheaply than is possible with surface roads.

To some extent it may be necessary to do for this class of the community what Mr. Stewart is doing for the more fortunate in his Garden City (a description of which was given in the SCIENTIFIC AMERICAN about a month ago), and that is to build country cottages for them.

The success that has attended the operations of the Artisans', Laborers', and General Dwellings Company, in providing cheap suburban homes for the working men of the larger English cities, is proof that such enterprises may be profitable as well as philanthropic.

In connection with the recent inauguration of one of their villages, the London Times gives a detailed account of the history of this company and of the work it is doing. The new village, called Shaftesbury Park, will illustrate its mode of proceeding. The site embraces forty acres. The foundation stone was laid in August, 1872; and it is expected that, by the opening of the coming winter, 749 of the intended 1,200 dwellings will be ready for occupation. The houses are engaged long in advance of their completion, while over 1,200 applications, for houses still to be built, are on the books. The dwellings are of four distinct classes: Class 1 contains eight rooms—a front parlor with bay windows, a bathroom for meals, a kitchen with dresser and kitchener, a small larder, a scullery fitted with copper and sink, a closet, ash pit, and coal cellar; while on the floor above are three bed rooms and a bath room. Class 2 are seven roomed houses, without the bath room. Class 3 have six rooms, and class 4 have five rooms, of which two are bed rooms. Gas and water are laid to every house. Ventilators are supplied to each room; and the drainage (except surface water) is carried back from the closet and sink in the rear, so that no drain passes under any house. The foundations are of concrete, and the roofs are of slate. The paths have been laid with asphalt, and shade trees have been set out. There is also a temporary lecture hall, now used as a school room. School houses will soon be built, and baths and wash houses are projected. A site is left for a coöperative store, and two acres and a half have set apart for park and playground.

The houses have been built, to a great extent, on the coöperative system, the work being let out, under foremen in each branch, to the bricklayers, carpenters, painters, plasterers, slaters, and plumbers employed, and it is reported, as a matter of special satisfaction, that, under the piecework plan which has been adopted throughout, union and non-union workmen have worked harmoniously together, and there has been no cause for the intervention of the appointed arbitrators. Many of the workmen are shareholders in the company, and not a few of them live in the houses they have helped to build. The result of this arrangement has been unusual care in the finishing of their work. The houses built by the company, the directors say, are better than those usually erected, yet they can be sold at equally low prices, in consequence of the materials saved by the workmen, who are shareholders. It is further claimed that these interested workmen earned, by piecework, forty per cent more than their ordinary wages.

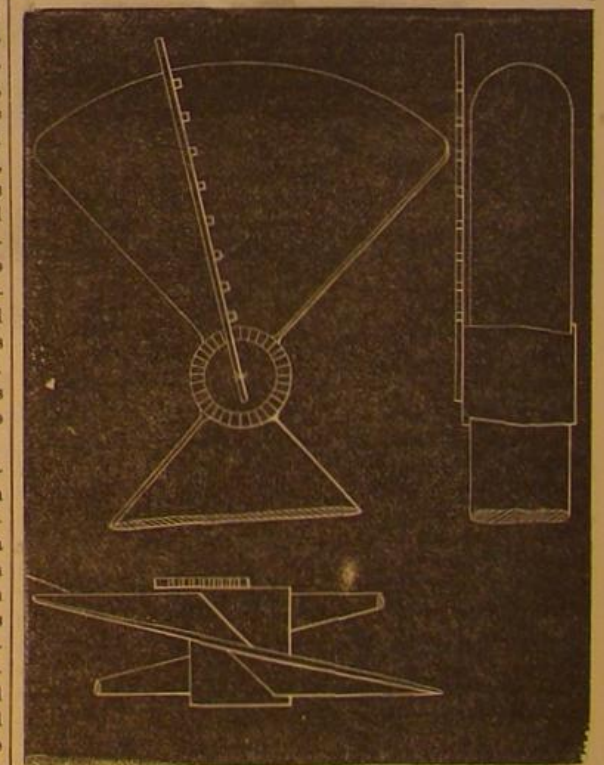
The growth of the company in popular favor is shown by the annual amount of stock taken. At the close of the first year, 1867, the share capital in hand was only \$2,500; at the close of the next year it was \$9,000. In 1869 it rose to \$15,000. In 1870 it was \$30,000. In 1871 it increased to \$92,500. In 1872 it rose to \$260,000, and at the end of 1873 it was \$560,980. The last annual dividend was six per cent, and previously they had divided seven and a half per cent.

Were our means for cheap and speedy transit equal to those of London, villages like this might be multiplied indefinitely along the Highlands, in Westchester, and on Long Island. The advantage, not only to those who would thus

be enabled to take their families into wholesome air, but to thousands who would of necessity remain within the city limits, would be incalculable.

MEASUREMENT OF A SCREW PROPELLER.

A correspondent asks for a rule for measuring the pitch of a screw propeller. The process, though simple, requires considerable explanation to make it understood, and as the subject will doubtless be interesting to many of our readers, we devote some little space to its consideration. The surface of a screw propeller is the same as would be generated by a line revolving around a cylinder, through the axis of which it passes, and at the same time advancing along the axis. In this way the under or back surfaces of the blades may be supposed to be formed, and then the proper thickness is put on, so as to make the front or entering surfaces. All measurements of a blade should of course be made on the back surface. It will be evident, from the explanation of the manner in which the surface of a blade is formed, that by varying the shape of the generating line, or the rate of its motion along the axis, very different forms of blades can be produced. The pitch of a screw is the distance the generating line moves in the direction of the axis, while it is making one revolution around the cylinder. It is evident from this that the pitch of the screw may be constant throughout, or it may vary from forward to after part of the blade, or from hub to periphery, according to the rate of motion of the generating line in an axial direction, and its angle of inclination to the axis. Hence in measuring a screw propeller, it will be necessary to determine the pitch at a number of points, for the purpose of ascertaining whether it is variable or constant. Every point in the generating line describes a curve which is called a helix. If measurements are taken along one of these helices, they will show whether the pitch varies from forward to after part of the blade, and measurements on corresponding points of different helices will indicate whether or not the pitch is constant from hub to periphery. As a general thing, the hub of a screw propeller is faced off at the ends, and the blades do not overhang a plane passing through this face. If necessary, however, a faced surface can be fitted to the hub, and made thick enough for its plane to clear the blades. Provide a straight edge a little longer than the radius of the propeller, and secure cleats for it, every foot of its length for large wheels, and from nine to six inches apart for small wheels. These cleats are intended to serve as guides for a rule, so that measurements can be made with accuracy at right angles to the straight edge. Secure to the end of the hub a piece of paper on which the center of the hub is marked, and the circumference is divided into any number of equal parts. Then place the straight edge on the end of the hub, bringing a mark near its end to the center of the hub, and making its direction coincide with a division of the circumference. Measure the perpendicular distance from the straight edge to the surface of the blade, at each of the cleats; then move the straight edge to coincide with the next division of the circumference, and again take measurements. The arrangement is represented in the accompanying engraving, the circumference of the hub being



divided into thirty-two equal parts. Suppose that, in the position represented, the measurements from the straight edge to the blade, taken at each cleat, are each six inches. Then move the straight edge to the next position, and suppose that the measurements are each fourteen inches. This shows that the generatrix, in one thirty-second of a revolution, has advanced eight inches in an axial direction, consequently the pitch is thirty-two times as much, or twenty-one feet and four inches. If measurements taken at successive divisions of the circumference give a successive increase of eight inches for each division, it shows that the propeller is a true screw, with a pitch of twenty-one feet and four inches. Of course, if the pitch varies, it will be shown by the variation in the difference of the measurements taken at successive divisions of the circumference. It will be observed that the measurements made at one cleat in different positions of the straight edge give determination for the pitch at different

points of the same helix, and therefore show whether the pitch varies from forward to after part of the blade. The measurements taken at different cleats, in successive positions of the straight edge, show the pitch at corresponding points of different helices, and indicate whether the pitch varies from hub to periphery. The method here described is one of the simplest and most accurate that can be given for determining the pitch of a screw propeller. The other measurements, the diameter of the screw, length of blade, dimensions of hub, and fraction of pitch employed, are so simple as to need no explanation.

CRIME EPIDEMICS.

The discussion of Professor Huxley's views, developing the idea of "conscious mechanism" as explaining the various forms of human action, coupled with that of Dr. Hammond's theory of "moral impulse," the kinship of which to the former hypothesis—indeed, the fact that it is but a corollary of the same—we have already pointed out, leads to some curious speculation relative to what extent the conscious machinery of one person may be set in motion, so to speak, by the activity of that of another individual. In other words, we are led to regard not merely the direct influence which one being exerts over another, through sentiments of respect, through intimidation, or through a score of other easily suggested conditions, but that indirect influence which is termed "force of example," that power which impels one man to do as another does, although the compelling cause of, (to illustrate) gain, revenge, or desire to benefit may be totally absent—irrational imitation, if we may use the term.

Abundant instances of this are to be found in the actions of the lower animals—sheep blindly following the bell wether, parrots imitating speech, monkeys repeating motions, and mocking birds sounds, and the inclination of the horse to race, will readily suggest themselves as cases in point. More striking still is the development of the peculiarity in children, shown not only in their learning to talk, but in their every action, even their plays being but endless imitation; and thus we are led up to the faculty in the man, which may impel him, with equal facility, to the commission of every crime in the decalogue, or to the re-writing of somebody else's poetry, after the fashion of the multiple only original authors of "Betsey and I are out," and "Beautiful Snow."

The serious aspect of the phenomena to which we allude, however, is one which those who make a science of the prevention of crime must eventually take into earnest and thoughtful consideration. It certainly is a fact that crime propagates itself by infection as surely as does disease. "There is a large class of minds," says Dr. Charles Elam, in "A Physician's Problems," on which great crimes exert a kind of fascination; and those who have never trained themselves to exercise the responsibilities of moral freedom are liable to become victims of the strongest delusions, and catch easily at the moral infection which is always lurking, and sometimes raging, in the atmosphere of the world." Nor need we seek long for illustration. The prevalence of the species of highway robbery known as garotting, in New York some years since, may be recalled, and the crime found plenty of imitators throughout the country. Not many months ago, murder appeared to be rife, and hardly a daily journal could be glanced over without the eye encountering horrible details of the killing of some human being. It is a suggestive fact that the last census, compiled when the Ring in this city was in the full tide of its power, and when such a thing as honesty was rarely to be found in the persons of the ruling men, shows a ratio of crime in New York State far ahead of that in any other State of the Union. Many will recall how common defalcations in banks and other institutions of trust have been during the last year or so, these crimes being, in the majority of cases, committed by men for whose action it was difficult even to assign a motive. Attempted frauds upon insurance companies have also found repeated occurrence of late; cases of suicide have happened, again and again, under conditions strangely similar; and thus we might go on, multiplying example after example.

The cause of this state of the mind, which renders it not only receptive to outside influence, but forces it to act in accordance with the same, is difficult to apprehend. If we attempt to trace a theory in accordance with Huxley's views, we must believe that the particles of brain matter are disarranged slightly by the individual's first impressions of the crime. A second impression causes more disarrangements, influencing, besides, those faculties which impel us to recoil from such subjects—causing a dulling of the sensibilities, or a familiarizing of one with the ghastly details; a third results in a still greater and similar effect, until finally the mechanism between brain and muscle is set in motion, and the person commits the deed. The theory leads to morbid impulse again, and, besides, to another class of actions, exemplified in the deliberate planning of the details of a defalcation, which, from the very period of time necessary for their development, precludes the idea of sudden or impulsive performance. Whether the reader may choose to adopt so material a view as this, or may cling to the opinion that the mental and moral forces of the body are only taken from our self-control by some intrinsically perceptible foreign agent, such as intemperance or connection through evil counsel, and hence flatly deny the primary principle that body and mind may be so constituted as to negative the efforts of the unfortunate person to obey moral and civil law, matters little in the face of the fact that the crime epidemic exists, and social science must find a way to meet it.

We must look deeper, in short, for the causes of crime. If society makes murderers and thieves through its example, then should it punish them for its own misdeeds? Is the person who suggests the crime to be the avenger? Is a man amenable to punishment because his brain is beyond his control, under one theory, or because he has not the moral vigor to repel the crime disease, under the other? How is discrimination to be made, on the other hand, between him who wilfully and maliciously sins, and him who falls through cerebral weakness? If education is a safeguard—and it doubtless is, in great measure—against crime, then if society fails to compel its members to assume that protection, who should be punished for the neglect? These are perplexing questions, posed somewhat at random, it is true, but nevertheless the legitimate offspring of psychological fact, which leaves us without a doubt that prevention of crime is to be sought for rather than means for its cure. "It is very evident," says the last report of the New York Prison Association, now before us, "that society is wrong in its philosophy or practice, most likely in both. For if the theory be wrong, the practice is wrong. It is therefore clear that an intelligent application of remedies makes a knowledge of causes imperative. We have no well defined, accepted theories of the causes, degrees, and penalties for the violation of the civil code. Until we attain a true theory, our work must often blunder and often fail. How much is due to constitutional organization, and how much to the influence of society, we have failed to determine, because of our ignorance of causes."

THE COMMISSIONERSHIP OF PATENTS.

We learn that General M. D. Leggett, the present Commissioner of Patents, is about to resign the office, and that he is to be succeeded by the now assistant commissioner, the Hon. J. M. Thacher.

We much regret that the country is to lose the services of General Leggett, who has labored indefatigably, from the hour he took office, to improve the working of the department. For the most part, his labors have been crowned with success.

But some of his rulings and decisions have been variable and peculiar, especially on questions of patentable novelty. At times, he has pronounced the most broad and liberal opinions in respect to the rights of inventors to receive patents, but they have been followed by recantations or reversals of these opinions. For example, in the case of the applicant for a patent for a knitted tobacco pouch, package, or sack, that is to say, merely a section of a stocking leg, he held, on the appeal to him in person from the Board of Appeals, that the Board was in error in deciding adversely to the applicant, and ordered a patent to issue. He said: "That the sack, for the use contemplated, is a new and superior one is clear, and it is the object of the law to promote the production of new and improved articles, for the use of the public. Very little analogy appears between a stocking or purse and a sack for a tobacco package. The principles controlling the case were clearly stated by Justice Blatchford, in *Strong vs. Noble*—whip case. After this clear and excellent decision, the applicant, having omitted payment of the second government fee, was obliged to renew his application, when the examiner again rejected the case, giving a new reference, similar in character to those previously presented, which had been overruled by the Commissioner. But General Leggett, instead of maintaining the excellent decision first given, now went back on himself, and denied the patent."

In the case of Professor Hedrick, so long and favorably known as examiner-in-chief of chemical inventions, whose established policy was to grant patents where the case by any possibility admitted of the grant, Commissioner Leggett long maintained and approved that policy. But he has lately gone back on Professor Hedrick, removed him from his original position, and substituted an examiner whose policy in granting patents is diametrically opposed to the practice of Professor H. The new examiner has made some very stupid decisions, which, if continued, will be very likely to give so much dissatisfaction as to cause his removal. Both commissioners and examiners at the Patent Office should remember that the chief object of their employment is to grant patents, not to reject them. They should study out every possible way to encourage and assist the inventor, and allow claims upon every possible point of novelty, however small. This is the true and reliable policy, and the only one that can give permanent or general satisfaction. It is far better to err in favor of the inventor than against him.

Should Mr. Thacher become the Commissioner, as we are led to expect, he will have an opportunity of carrying into practice some of the advanced views by him enunciated in his address before the Vienna Patent Congress last year. He there expounded the necessity of the most liberal practice in the grant of patents, and went so far as to declare that they were to be considered as the simple recognitions of that right of property in the productions of the mind, which God Almighty had himself bestowed upon man. We hope that, during Mr. Thacher's official term, he will see to it that no narrowminded examiner is suffered to remain who takes it upon himself to deprive an inventor of his heaven-born rights, no matter how small the degree of the invention.

The foregoing comments upon one branch of Commissioner Leggett's administration are not made by us in any spirit of fault-finding, but simply for the benefit of his successor in office, whoever that person may be. It can be justly said of Commissioner Leggett's administration that, as a whole, it has been a splendid one. He has been an honest and faithful officer. He has inaugurated many noble reforms, and he

will leave the Patent Office in a better condition of efficiency and usefulness than it ever before reached. At another time, we shall take occasion to particularize some of the many excellent improvements that are due to his assiduous labors. We will now mention but two of them, namely, the production of the weekly *Official Gazette*, and the printing of the patents in popular form. The successful inauguration of this last named enterprise is an honor of which General Leggett may well be proud, and it will always redound to his credit. It is a benefit to the country, of incalculable value.

INFLUENCE OF THE PRICE OF COAL ON SHIP BUILDING.

Of late years, the competition between steamers and sailing vessels has threatened to end in a losing struggle for existence on the part of the latter. The sudden jump in the price of coal in Great Britain, however, seems to have turned the tide once more in their favor.

The change is specially shown in the ship yards of the Clyde. In 1868, the number of sailing vessels built at this center of the trade was 108, aggregating 79,346 tons, against 100 steamers of 87,000 tons. In 1869, the sailing vessels numbered 104, of 69,150 tons, while the steamers were 96, of 85,600 tons. The next year, 1870, marks the beginning of the decadence in the building of sailing vessels, the number launched falling to 63, with a tonnage of 38,870 tons, the number of steam vessels rising to 121, of 133,000 tons.

The year 1871 showed a still further decline in the building of sailing vessels, the total being 25, of 12,720 tons, against 170 steamers of 180,000 tons.

In 1872, the tonnage of new sailing vessels fell to one-fifteenth of that of the steamers, the ratio being 24, of 14,500 tons, to 161, of 215,000 tons.

Last year, the number of sailing vessels launched was about the same, but the ships were of a larger class, twelve being foreign trading vessels, and thirteen, small coasters; in all 25, aggregating 21,050 tons.

The price of coal went up toward the close of the year, and the effect on the character of the ships called for has been remarkable. The returns for the first six months of the current year (1874) show that of 93 vessels launched, 25, of 30,000 tons, were sailing vessels, and 68, of 99,500 tons, were steamers. In July, the launches were equal, 5 sailing vessels, of 6,800 tons, and 5 steamers, of 8,580 tons. Returns are also in hand for the first half of August, and show 6 sailing vessels, of 7,010 tons, against one small steamer, of 150 tons, for the coasting trade.

The sailing vessels for this year are thus four times greater in tonnage than for the corresponding period during the three preceding years, while the steam vessels show a decrease, during the same period, of 40,000 tons.

PECULIAR PEOPLE.

Consistency is a jewel. The orthodox journals of England have scarcely ceased to denounce the "prayer test" suggested by Dr. Thompson and introduced by Professor Tyndall, working themselves into a fever of pious horror at the bare suggestion of a doubt of the efficacy of prayer as a sanitary agent, when they join, with equal unanimity, in denouncing Baron Pigott for declining to condemn a man who sincerely trusted to prayer for the restoration of his sick child.

There is, in England, a religious sect calling themselves "the peculiar people," one of whose peculiarities is that, in a nation of Bible worshippers, they accept its teachings as their rule of life. Nothing can be plainer, for example, than the directions there given for the treatment of the sick—to call in the elders of the church and let them pray over him, anointing him with oil, "and the prayer of faith shall save the sick, and the Lord shall raise him up, and, if he have committed sins, they shall be forgiven him."

It is the practice of "the peculiar people" to follow these directions literally, much to the scandal of their pious neighbors, whose belief is tempered by a superior trust in the doctor.

A short time ago, the child of one Thomas Hines was taken sick. He was prayed over and anointed, and the Lord did not raise him up. At the coroner's inquest it was testified that the child was nursed with great tenderness and fed with the best of food; but no physician was called in, for which omission a verdict of culpable neglect was rendered, and the father was sent to the criminal court, to answer to the charge of manslaughter.

In view of the man's religious convictions and the fact that he had done everything for the good of the child according to his lights, the judge refused to let the case go to the jury. Against this decision the popular protest is loud and severe, the direct consequences being anticipated, if such literal applications of Scripture texts, by the ignorant and superstitious, are to be allowed.

It is instructive to turn over the files of the papers, now so indignant at the judge's ruling, and note the different tone of their utterances at the time when the efficacy of prayer was questioned. Then it was blasphemous to doubt the sure force of the believer's petition; now it is criminal to trust to it!

Has Dr. Thompson's proposition wrought its logical effect? Or are these would-be leaders of public opinion incompetent of feeling the forces of logic?

THE boiler of a thrashing machine lately exploded at St. Paul, Minn., killing three persons instantly, and injuring three others. One of the latter was blown 400 feet from the spot, and subsequently died.

MR. M. FLURSHIM requests us to state that the length of the boiler mentioned in his letter (published on page 120, Vol XXXI.) should be 3 or 4 feet, and not 4 feet, as printed.

THE AUTOMATIC COW MILKER.

A correspondent of ours, in making some researches in the Patent Office recently, stumbled across an old device among the forfeited applications, which appears to be an automatic cow milker. From sketches furnished us, we have prepared the annexed engravings, showing the invention as applied to the animal and, separately, in section.

About all that is necessary is to insert two tubes into the teats, through which the milk flows into a receptacle strapped under the udder. The vessel and the cow are to be permanent companions, for the present antique method of milking is no longer required. No longer will the horny palms of the aged agriculturist irritate the tender members of the patient brute, in vain endeavors to elicit milk which is not

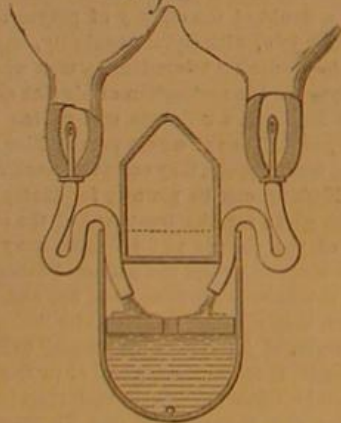
Fig. 1



there; no longer will his mellifluous accents be heard requesting her in winning tones to "come down," nor will the atmosphere of the barnyard vibrate with his wild imprecations when injured female dignity stirs up the well filled bucket with her hoof. When milking time arrives, a pail receives, from the opened faucet, the contents of the vessel, which is thus drawn off as easily as water from a cooler.

An irresponsible person, connected with this office, suggests that cows, provided with the device, might be driven by milkmen to their customers' doors, and the milk removed as wanted; and further that, by setting a dog after the animal, she might be induced to get up sufficient motion to churn the milk into butter. We have called the attention of the health authorities to the dangerous ignorance of our employee; for should he ever embark in the milk business, his erroneous views might lead him to supply the lacteal fluid in an unchalked and undiluted state to his customers, and so to produce widespread disease. Any inventor, however, who will find a way of combining a neat water reservoir and pump with this apparatus, will doubtless find his invention

Fig. 2



vastly appreciated by the average New York milkman. A little ingenuity, we think, could devise a kind of treadmill, to be worked by the cow, to operate a pump handle.

ENAMELED AND EMBOSSED PHOTOGRAPHS.

Take a piece of clear glass, free from bubbles or scratches, and clean it by immersing in a solution of concentrated potash over night. Wash thoroughly in clean water, and immerse for a few minutes in a mixture of nitric acid and water, one part of acid to three of water; let dry from the acid without washing. Now coat your plate with the following: Plain collodion one ounce, glycerin half a dram, and let dry. Then take sheet gelatin and soak it in cold water until it is soft; then put it in a cream pitcher or a wide-mouthed bottle, and cover with water. Dissolve the gelatin by heat, immerse your print in this warm gelatin, and lay it face downward on the collodionized plate, carefully



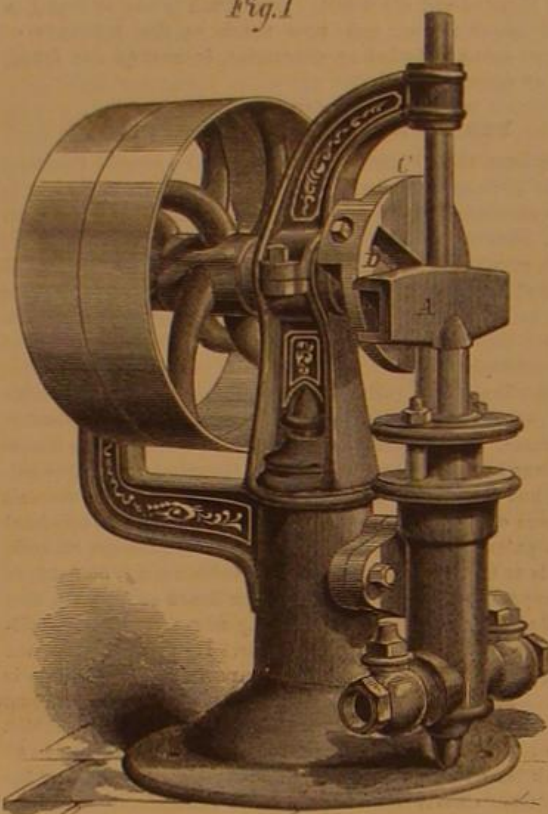
pressing out all air bubbles; now cement with gelatin a piece of thin Bristol board, previously dampened to make it pliable, to the back of your print. Let dry thoroughly, and loosen the edges with a knife blade, by running around the glass between the print and the glass, when the whole thing will leave the glass with a very superior polish; it is now ready for pressing in Ormsby's cameo press, the simplest, most practical, and cheapest cameo press ever invented. Any carpenter will make one for about three dollars. The press and process are free

for the use of the fraternity. This process is superior to any. Where rubber is used in the collodion, they will never crack in the pressing; and where the rubber gives less polish than collodion alone, the addition of glycerin gives an extra polish. I enclose you a photograph of my press. It is made of maple wood, three quarter inch thick. The raised center for molding is glued on. The top and bottom are hinged together.—E. D. Ormsby, in Philadelphia Photographer.

WORSWICK'S IMPROVED PUMP MECHANISM.

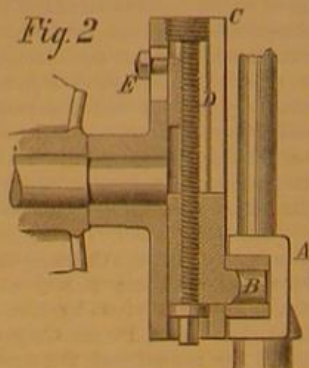
We illustrate herewith an ingenious device for converting motion, arranged in connection with a pump. It seems to do away with countershafting and other connections, thus materially decreasing the cost of the machinery, while it renders the latter easier to set up. It is adapted to almost any position, and is entirely free from any complication in its working parts. As applied to a pump, as will readily be perceived from the following description, it insures a nice adjustment of the stroke, so that a regular supply of water can always be obtained. This is an advantage of importance, as it is scarcely necessary for us to point out that an irregular feed is alike fatal to uniform pressure of steam and economy of fuel.

Fig. 1



The entire machine is shown in perspective in Fig. 1; the sectional view, Fig. 2, will aid to obtaining a clear comprehension of the essential features of the mechanism. The pump plunger has a slotted cross arm or yoke, A, in the slot of which works the wrist pin, B. This, as the head, C (fixed axially on the driving shaft), revolves, causes a reciprocating movement of the plunger. The wrist pin is attached to a slide which is adjusted in the diametrical slot, in head, C, by means of a screw, D, passing through it, so that the distance between the wrist pin and shaft or axis may be increased or diminished at pleasure and the throw of the plunger correspondingly regulated. A stop, E, is provided for the pin, B, which is adjustable by a nut screwed on a stem, projecting through a slot in the wrist pin plate. The position of this stop piece indicates the adjustment of the pin, B, for running the pump. The pin may, however, be adjusted out-

Fig. 2



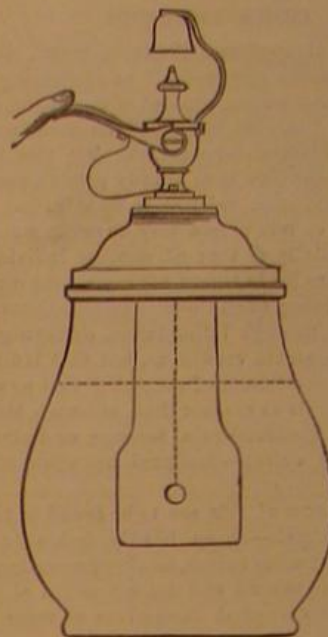
ward from the driving shaft to increase the throw of stroke of the plunger. When it is adjusted back in contact with the stop, the action goes on as before, so that the stop saves the time and labor which would be otherwise carelessly expended at every change of the adjustment of the wrist pin.

Patented through the Scientific American Patent Agency, June 9, 1874. For further particulars address the inventor, Mr. Thomas Worswick, Guelph, Ontario, Canada. Pumps thus fitted may be obtained of Messrs. W. L. Chase & Co., 95 and 97 Liberty street, New York city, or of the Armstrong Heater Manufacturing Company, Toledo, Ohio.

THE total number of complete patents issued in England, during the last year, was 2,906. In the United States, 12,864 patents were issued during the same period.

MULLER'S NON-EXPLOSIVE SELF-LIGHTER.

The annexed diagram represents an improved form of the Döbereiner or hydrogen lamp, a well known and useful apparatus in every chemical laboratory. The reservoir is filled with water acidulated with sulphuric acid, and a piece of zinc, inclosed in a bottomless tube, is lowered therein. The hydrogen thus generated rises through the tube, and, when the stopcock is pressed down, escapes from a small orifice above, and comes in contact with a fragment of spongy platinum held in the small bell shown. The platinum is thus caused to become highly heated and to ignite the gas jet. The improvements which this device offers over the ordinary lamp



consist in the vertical channel through which the hydrogen passes. When, as is usually the case, the gas is forced to turn into a horizontal outlet, the small particles of sulphuric acid, which are carried up, accumulate in the passage, corroding the metal and preventing a free escape of the gas. By having the whole channel in a vertical position, the acid will readily flow back to its reservoir.

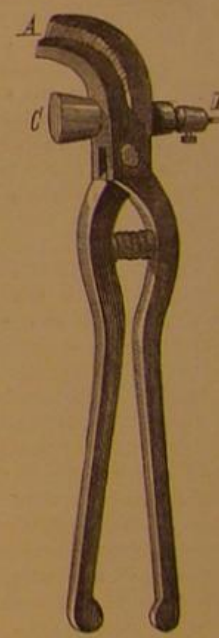
By securing the spongy platinum within a suspended bell it is covered and protected from injury. A working model of this invention can be seen at the office of the American School Apparatus Company, No. 21 John street, N. Y. For further particulars address the owner of the patent, Mr. Joseph Hertford, P. O. Box 998, New York city.

SHOEMAKERS' COMBINATION TOOL.

By means of the ingenious contrivance represented in our illustration, the shoemaker is enabled to draw the upper of his work into place, pierce a hole for the peg, and drive the latter home, all without once laying down the tool. This is accomplished as follows: The upper is grasped between the curved jaws of the pinchers, A, and pulled into position. The instrument is then reversed while being raised, and, by a blow, as if with a hammer, the awl portion, B, is driven into the leather. A peg, taken from the mouth, is inserted in the hole, and the tool once more reversed. Lastly, a stroke from the hammer, C, forces the peg into place.

In this way the lasting of the shoe may be finished with considerable rapidity, and consequent economy of time and labor.

The device was recently patented through the Scientific American Patent Agency, by Mr. Joseph F. Ober, of Mount Desert, Maine.



Surgical Freezing.

The successful employment of an anæsthetic which prevents pain without destroying consciousness is a matter of interest and importance to medical people everywhere. Dr. B. W. Richardson, in the London *Lancet*, describes two operations of this kind, by him performed, for removal of cancerous tumors of the breast, both patients being ladies. A spray of common ether was directed upon the tumor until thoroughly chilled. The lighter fluid, a compound of ether with hydride of amyl, specific gravity 0.730, was then applied until the whole of the breast was frozen like a snowball. Instead of with a scalpel, the incisions and removal were effected by means of small, strong, sharp, and curved scissors. The use of this instrument is considered essential. The operations were successful, the healing speedy, without discharge or trouble of any kind.

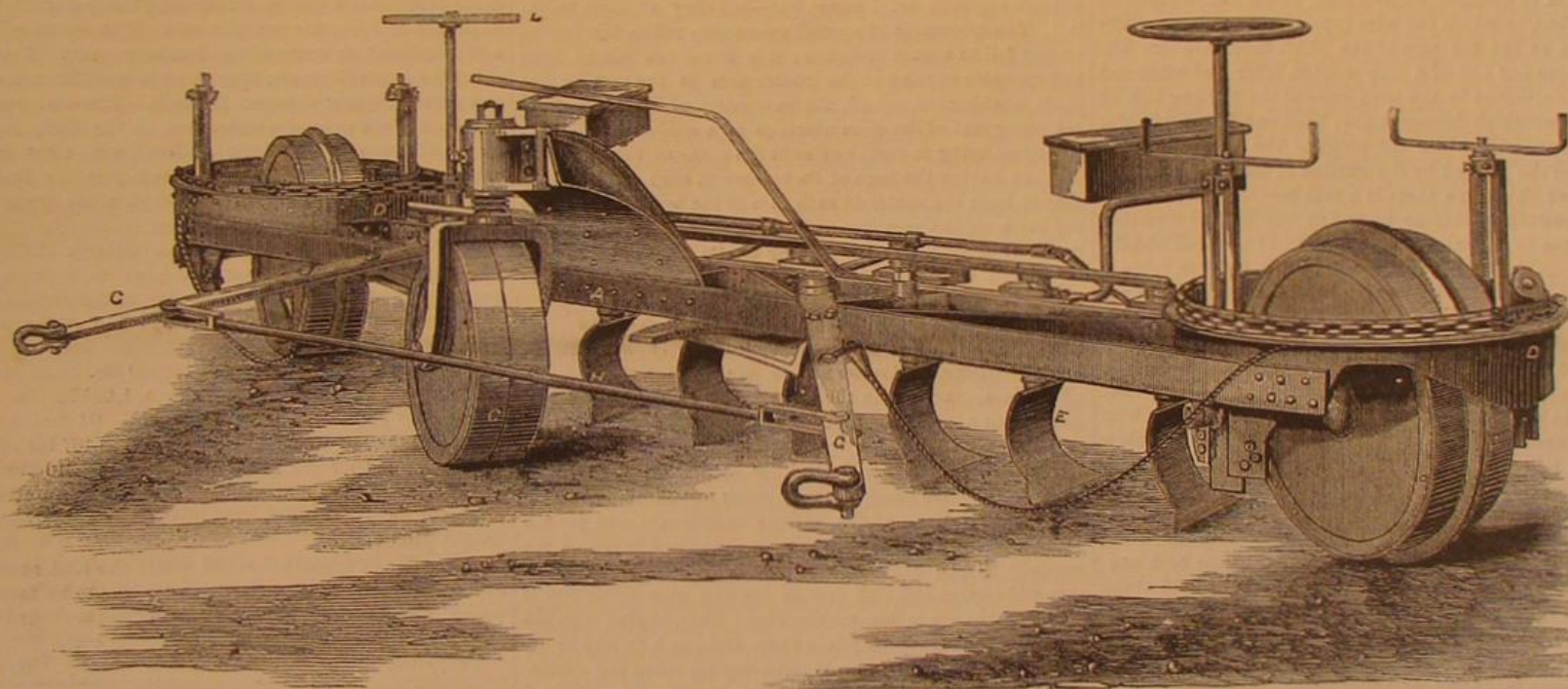
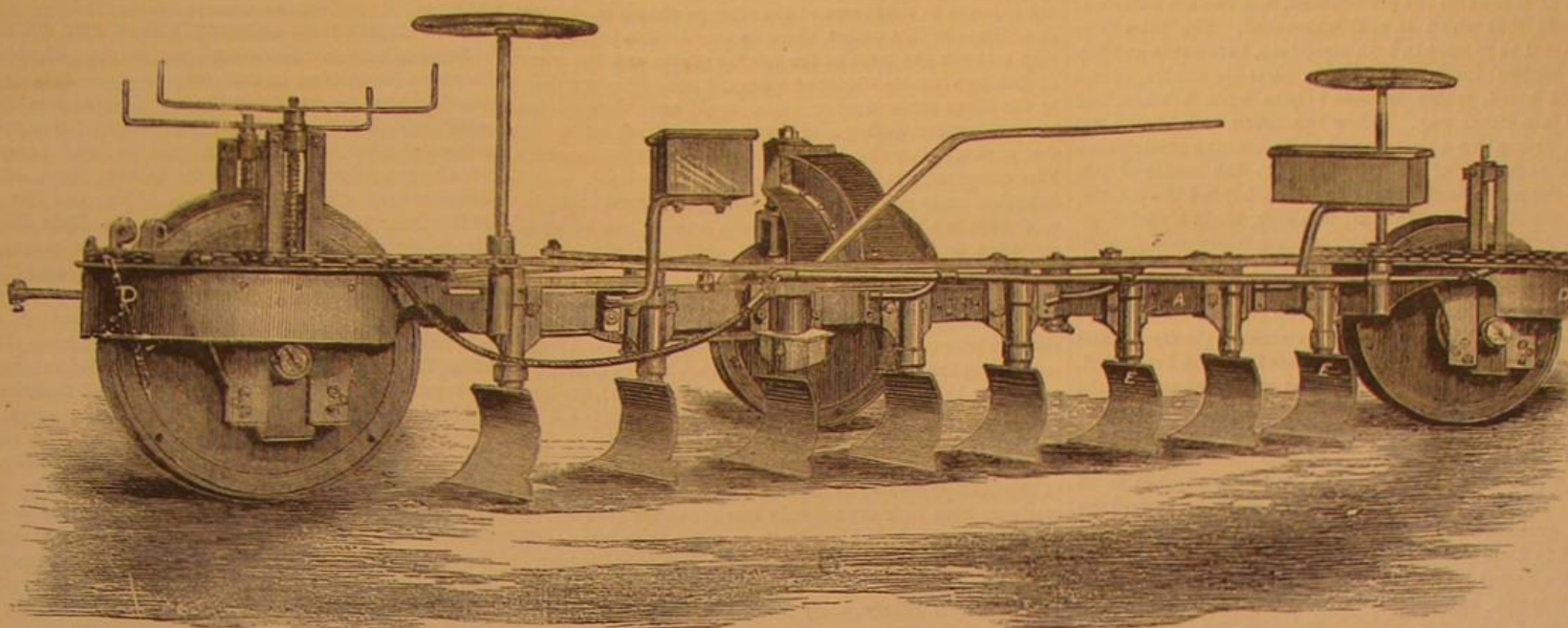
AN EIGHTEEN INCH RAILWAY.—The narrow gauge tramway, laid down along most of the avenues of the Royal Arsenal, Woolwich, has proved so completely successful that it has been decided to introduce the system at the new works at Chatham. The gauge is only 18 inches.

NEW STEAM PLOWS.

The steam plow problem has, for many years, occupied the attention of farmers and makers of agricultural implements in England; and the various designs which have achieved success have more or less embodied the original John Fowler plan of a gang plow drawn from end to end of the field by an engine operating a hauling drum and a rope. We give herewith (extracted from *The Engineer*) two views of an improved plow, designed by Messrs. Greig and Eyth, to meet a difficulty found in using the first Fowler plow, which was unsteady in action except in subsoil plowing. Messrs. Greig

themselves by a long rod, F, working short levers, so that the relative position among themselves is always the same, and that the turning round of one plow causes all the others to turn as well. There are, further, two horizontal pulling levers, G G, connected by a rod, H, to which the two rope ends are attached. One of them works a toothed segment, hidden by the framing in our engravings, above which a circular plain segment is fixed. The former gears into a corresponding segment, fixed to the nearest plow skife; the latter corresponds to a peculiarly shaped disk, also firmly attached to this skife. In turning the pulling levers either

ground completely over towards the same side, whether it goes backwards or forwards. While at work the main frame travels in a slanting position over the land, the front wheel running in the preceding furrow, the hind wheel on the unplowed ground, the plowman steering the furrow wheel at L or K. This position is readily maintained, as the pull passes through the center of the resistance of the plows. At the headland the levers are turned by the second engine beginning to work, and turn first the single plows at the same time as the two end wheels are turned square to the main frame. One end of the frame moves now along the head-



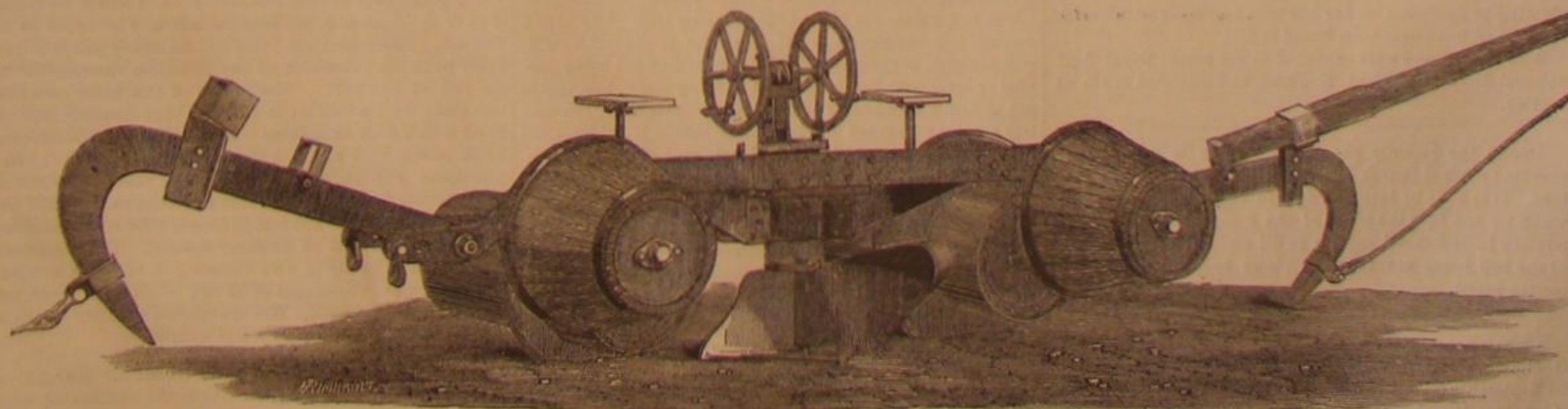
GREIG AND EYTH'S STEAM PLOW.

and Eyth's model is claimed to be especially useful when not deep cultivation but only competition with horse power is the object.

The longitudinal horizontal main frame, A, to which the plows are attached, stands on three wheels, of which the middle one, C, is a caster wheel, while the two end wheels revolve in turntables, D D. These turntables are so contrived that they lift or lower the main frame exactly by the depth of the furrow, according to the direction which is given to the wheel. The wrought iron plow skifes, E E, are fixed in sockets, in which they can turn, being connected among

backward or forward, the toothed segment not only turns the plows completely round, but the disk causes them also to be firmly locked, while the levers in their two extreme positions are still free to swing about through a considerable angle. These levers are also connected, by wire ropes and other suitable tackle, to the turning rings of the turntables, which, among themselves, are connected in a similar manner, so that the turning of the levers turns also the two end wheels into suitable positions. The plows themselves are of a peculiar shape, the share being shaped so as to cut with either end, while the short hollow moldboard, E, throws the

land, so that the slanting position of the whole is reversed, whereupon the implement proceeds on its back journey. These plows are intended to work to a depth varying from 3 inches to 5 inches only, but will turn over eight to twelve furrows, or a width of 8 feet to 12 feet, at a time. Nevertheless, in going from field to field, the implement will take no more space than a width of 4 feet to 5 feet. In turning round at the field ends, it is perfectly self-acting, giving no trouble whatever to the plowman, and producing very short headlands and clean straight ends, while, when at work, it rigidly keeps to the proper depth for which it is set.



THE SUTHERLAND STEAM PLOW.

Another entirely different form of plow, also constructed by John Fowler & Co., has lately been introduced on the Duke of Sutherland's vast reclamation works in his own country in the North of Scotland. A track of land was cleared (the roots of trees being dragged out by steam engines), plowed, and drained with stone and pipe drains. The plow (of which we give a view, copied from *Engineering*), which has been brought to its present state by successive improvements, may be described as an iron frame, about 10 feet long and 18 inches wide, supported upon six wheels or rollers, and bestridden by the plowman who guides it. Two of the rollers are underneath or within the frame, two are outside of it towards the plowed land, and two are outside of it towards that which is still untouched. The plow is so constructed as to work in both directions, backwards and forwards, without turning, and all its parts are double, except the mold board, which is made to turn upon a hinge, and thus to face either way. Below the center is a strong flat coulter, presenting a sharp point and a concave cutting edge towards each end of the frame, and to the center of this coulter the mold board is hinged. Just beyond the coulter, both fore and aft, there is a flat iron disk, about a yard in diameter, with a cutting edge, and turning freely on a horizontal axis transverse to the frame; and on either side of each disk there is a broad iron wheel or roller, 3 feet in diameter. On the side towards the land as yet unturned these rollers are 3 feet 6 inches broad, and are external to the frame; and on the side towards the furrow they are 18 inches broad, and, together with the disks, are contained within the sides of the frame. The disks rotate on the same axes as these internal rollers, but can be rendered more or less eccentric with regard to them; so that the depth of penetration of the disks can be regulated at will, and may vary from 4 inches to 15 inches. External to the frame on the other side, toward the plowed ground, are two broad wooden rollers, about 2 feet 6 inches in diameter. At each end of the frame its lateral pieces are united by a strong transverse iron bar, which also passes through, and serves as a pivot for, the end of an iron shaft about 6 feet long, which terminates in a large, boldly curved hook, having its point shod with steel. To the nose of this hook is attached an iron ring, and a rod to serve as a traction bar, to which the wire rope of the engine is made fast; while on the top part of the shaft there are two collars to receive one end of a long wooden lever, the other end of which is attached to the wire rope at the trailing end of the plow, and which depresses that hook and forces its point deeply into the soil, while the point of the leading hook is lifted out of the ground by the traction of the engine. Above the center of the frame there is a seat for the plowman, and a simple steering apparatus by which any desired direction may be given to the axes of the disk and of the iron wheels, so as to guide the course of the plow. The traction force is supplied by two steam engines, each of 16 horse power nominal, and working up to about 40. They are furnished with broad wheels, so as to be supported and to move easily on soft ground, and each carries the necessary length of wire rope on a horizontal drum situated beneath the boiler. They are found to work most advantageously when placed about 400 yards apart. Under ordinary circumstances, the plow completes its course of 400 yards in a quarter of an hour. When it reaches the hauling engine the lever is shifted to the other hook, a slight change is made in the steering wheel, and, in about a minute, the other engine takes up the work, and the plow is dragged back again. It traverses both sudden hollows and sharp ascents without losing its hold of the soil, which it penetrates to a depth of from 18 inches to 20 inches; and, although it rolls and flounders over the many hidden obstacles in its way, and gives an uneasy seat to its rider, it seems incapable of being upset. When any impediment is encountered, such as a huge stone or firmly bedded root, the disk acts the part of a wheel, and, no longer cutting its way, lifts the plow bodily over the obstacle, while the trailing hook, in most cases, gets its point underneath it, and tears the stone or root out of the ground.

When the leading disk rises over a stone or other impediment, the point of the trailing hook is buried more deeply than before, and thus very large roots, and masses of stone measuring a cubic foot and sometimes much more, are dragged out and left upon the surface by the action of the plow alone. If the hook does not obtain sufficient hold, the stone or root is somewhat cleared by hand, and a chain is cast around it. When the plow next passes, the chain is made fast to the rope, and in this manner very considerable boulders have been dragged out of the ground and carried away. Sometimes, however, a stone or root is too large, or too firmly fixed, to be so dislodged, and then recourse is had to blasting by dynamite, which has been employed with perfect safety, and has never been found to fail.

Both these plows were exhibited at the recent Royal Agricultural Show at Bedford, England, and attracted much attention.

Among the recently patented novelties is a method of mending cracked church bells, so as perfectly to restore their tone. It is done by introducing a furnace within the bell, to warm up and fuse the edges of the crack, at the same time pouring in new metal enough to fill out the crack, the sides of the bell being covered with plates to prevent escape of molten metal.

A BOAT RACE between E. Morris, of Pittsburgh, Pa., and G. Brown, of Halifax, N. S., took place at St. John's, N. B., on September 23. The course was five miles long, on the Kennebec river. Brown was the victor by only two lengths. Time, 37 minutes.

Correspondence.

A Practical Mechanic at the American Institute Fair.

To the Editor of the Scientific American:

In the machinery department, in which there is a much larger and finer display than usual, one is at once surprised at the din caused by the numerous practical operations being carried on, and especially so at the clang and jar caused by a large gear wheel on one of the air compressors, which wheel has two rows of teeth in the one casting, the teeth of one row being opposite to those of the other instead of the one opposite to the spaces of the other, as should be the case. In addition to this defect, there is considerable backlash or play between the teeth of the driving pinion and the wheel, producing a rumble and an occasional "pound" only equalled by the Blake stone crusher. One would have thought that inserted wooden teeth would have been employed rather than that such a clatter should be made by an exhibited machine. The compressor, it is true, is not doing any duty, and is doubtless more noisy than it would be under its load; but creditable as a piece of workmanship it never can be, under the most favorable circumstances, until that wheel is removed and a better one substituted.

The two engines driving the machinery are very creditable specimens of workmanship, although there are wide variations between the two in matters of detail. The Wright engine has the lugs of its eccentric straps open a quarter of an inch, so that they are not locked together by the bolts at all, and merely hang, as it were, on the eccentric; they are the only ones in the Fair possessing this defect. The connecting rod of this engine has solid boxes instead of straps, being in this respect similar to the side rods used on English locomotives; such rods are not only less expensive to make, but are easier to repair and less liable to suffer from wear. The joint faces of the brasses are, however, left open, instead of being fitted "brass and brass," as they should be; this defect exists in nearly every connecting rod exhibited, the Baxter and the Shapley engines being honorable exceptions. If one asks why such joints are left open, the reply is "well it don't ought to be, I know, but they all seem to do it." The movement of a small connecting rod on this engine cannot fail to attract attention; it is about ten inches long and connects one end of the rocker arm to the arm of the shaft working the cut-off, the movement of each end of the rod being part of the circumference of a circle, the plane of one circle being at right angles to the plane of the other, and said rod having the bore of its brasses at each end trumpet-shaped from the center to each face of the brass, so that the rod has a right-about-face and "slantindicular" movement, in all directions, merely hanging on its journals, since its faces will be free, and unconfined by flanges, collars, or other guides common to a respectable connecting rod.

The Hampson and Whitehill engine is an elaborate piece of machinery, but one cannot look upon it without the thought arising: "Are we not, in our rage for variable cut-off engines, traveling in the direction of complicated movements, and a multiplicity of parts with very small wearing surfaces, which, though very perfect in their movements while the engine is new, will, after becoming in a comparatively short time worn, cause so much lost motion as to destroy the relations of the various movements one to the other, and thus seriously impair the action and value of the whole?" The quality of engineer co-existent with the common slide valve and link motion era will soon be extinct if such engines are to become the rule. This engine also has its connecting rod brass joints open, and has a thump in its movement (as has also the Wright engine) when the connecting rod passes each dead center, the thump when the rod passes the dead center nearest the cylinder being in each engine the greatest, just as it might be expected to be if imperfect adjustment of the connecting rod brasses is partly the cause. Both engines work expansively to a high degree, and will give, no doubt, very economical results. A Bement axle lathe, exhibited by Geo. Place & Co., is a very superior tool. It is so geared that one pound on the cone is about 40 lbs. on the lathe centers, and it has a 3½ inch driving belt. That part of the bed on which the slide rest travels is raised so that the turnings do not fall upon the slides. The wearing surfaces are broad; the lock nut for the tailstock spindle acts upon the extreme end of the spindle guide close to the dead center, and clamps the spindle all around, avoiding the spring usual in such spindles; in fact the whole lathe evidences that its designer has provided a tool fit for a piece work turner (who generally puts a tool to its utmost capacity). On the tool post, however, is a taper washer, by means of which to regulate the height of the turning tool. With such a washer, it is impossible to put this lathe to the full duty it will perform, because, the face of the washer not being parallel or level with the face of the holding screw, the tool is not so firmly clamped as a heavy duty will require. The centers are not yet turned up, indicating that it is not intended to put any work on the lathe, which is an omission to be regretted.

ESOR.

Leaf and Flower Impressions.

To the Editor of the Scientific American:

In less than five minutes after reading the article in the *SCIENTIFIC AMERICAN* of September 12, I culled, inked, and printed the four impressions herewith sent.

Take a small quantity of printer's ink, thinly put it on glass, or on the lid of a blacking box, as I did, evenly distributed. The end of the index finger will serve as the printer's ball, to cover one side of the leaf uniformly; then lay it to the exact place where you wish the print to be; lay

over it a piece of thin, soft paper large enough to cover it; then, without moving the leaf, press all parts of it with the end of the thumb firmly, and you will have a perfect impression, that no engraver can excel; and by adjusting the leaves at the proper points, accurate prints can be taken, and, aided with the brush or pen, the stem and whole plant can be shown. I have excellent specimens of impressions of barks of trees, made by slicing the bark; and with a little care, the stems can also be taken, as well as flowers. I have many such; and when colored with the aniline colors, they are like colored engravings.

JACOB STAUFFER.

Lancaster, Pa.

(For the Scientific American.)

COAL BURNING LOCOMOTIVES IN THE SOUTH.

Burning coal in the locomotives on the railroads in the Southern States is an improvement of recent date. The plan was first tried by the Nashville and Chattanooga Railroad, which has specially good facilities for use of that fuel, there being a number of mines directly on its line. Later it was tried by the Atlantic and Western Railroad (from Atlanta to Chattanooga) with marked success. This road has no coal on its line, but gets its supply from the Dade Company's Mines, thirty miles up the Nashville and Chattanooga road. The company have adapted twenty locomotives for the purpose of using coal, and intend changing them all. As soon as an engine is brought into the shop for any important repairs, it is changed to a coal burner. They consume at this time about 50 tons of coal per day; it is supplied to them at 9 cents per bushel, and 25 bushels are counted to make a ton. Aside from the time and labor saved, the actual economy is about \$5 per day to the locomotive. The coal they use is as good a steam coal as any in the United States.

Stimulated by the operations of others and the absolute need to make better time with their trains, the Eastern Tennessee, Virginia, and Georgia Railroad has also tried the coal burners, and the report to the company at its late meeting says: During the month of July, the coal burners ran 17,600 miles and consumed 6,600 bushels of coal, which cost \$660, making cost per mile of 3¢ cents. Wood burners running the same number of miles burned 569 cords of wood at a cost in tenders of \$2.50 per cord, making \$1,423.75 or 8½ cents per mile run. The saving will make a fair dividend on many of the Southern roads. The cost of changing to coal burners, they show to be \$190 each engine, and they have now changed fourteen. The coal issued by this road is not so good a steam coal as the Dade coal used by the Western and Atlantic Railroad, and costs them 10 cents per bushel; while the latter road gets the Dade coal at 9 cents. The mines are little over 20 miles from Knoxville, and the coal should be cheaper.

The East Tennessee, Virginia, and Georgia Railroad has just finished its business year; and, as an instance of its good management and the prosperity of this section of the South, has declared a six per cent dividend from actual earnings. The summary of shipments from this point shows that, during the past 12 months, 468,469 lbs. bacon and lard, 1,122,174 lbs. flour, 4,809,883 lbs. corn, 1,603,781 lbs. wheat, and 327,348 lbs. hay were transported. Of coal and coke 59,142,000 lbs., of manufactured iron 1,608,187 lbs., of nails and spikes 723,077 lbs., and of marble 312,216 lbs., were shipped. From the shipments of articles, manufactured or produced in and around this place, the road received as freight \$103,471.70.

The region of country through which the road runs is one of the finest grass, grain, and fruit sections to be found anywhere; and ample manufacturing facilities are found in the abundance of good water power and cheap coal.

Knoxville, Tenn.

H. E. C.

New Jersey Minerals.

Several thousand specimens have been quarried from the serpentine and trap ridges in New Jersey, under the direction of Professor Leeds of the Stevens Institute. They consist of nemalites, occurring in translucent masses made up of long, silky fibers; marmolites of beautiful colors and polished surfaces; exquisitely tufted aggregates of crystals of hydromagnesite; globular masses of delicately tinted prehnite; clusters of sparkling datholite crystals; star-like aggregations of pectolite, apophyllite, molybdenite, natrolite, and other species too numerous to mention. They have been collected both with a view of developing the mineral treasures of the district in which the Institute is located, and to obtain, by exchange with the cabinets of other colleges, a much enlarged cabinet for the Institute itself.

New and Powerful Iron-Clad.

The Brazilian iron-clad Independence, of which we recently gave an engraving, has been successfully launched on the Thames. The vessel has sustained no injury and will probably be in the possession of the Brazilian Government by the end of the year. She is one of the most powerful iron-clads in the world; is of 5,300 tons burden; will be fitted with Penn's expanding trunk engines of 1,200 indicated horse power, working up to about 8,000 horse power; has a prominent gun metal stem, forming a ram; will draw 24 feet 6 inches forward and 25 feet aft, when fully armed and in sea-going trim; is 300 feet in length between perpendiculars, and has 63 feet of extreme breadth. Her armament, which is to be partly in two turrets and partly in bow and stern batteries, will consist of 35 ton Whitworth guns, and she will be bark-rigged. She is expected to make fifteen or sixteen knots an hour with a single screw.

EFFECT OF SOAP WATER ON INCANDESCENT METALS.—A red hot copper ball, plunged beneath the surface of water containing soap, remains quiet, being surrounded with a thick envelope of vapor.—*Moniteur Scientifique*.

[OLD AND NEW.]

DENTISTRY IN THE UNITED STATES.

NUMBER 5.

THE DENTAL LABORATORY.

Though the operating department of the dentist's establishment makes a brilliant display, with its multitudinous and variously shaped instruments, the laboratory has, perhaps, equal mechanical merits. Its tools are almost as varied as those for operating, equally useful, but not quite as numerous. They make up in size what they lack in numbers. In the laboratory, the dentist uses his lathe, furnace, vulcanizer, forge, rolling mill, steam blowpipe, and gas generator and reservoir, with all their appurtenances, also such small tools as files, scrapers, saws, chisels, plate benders, cutters, punches, hammers, shears, and so on; a few hundred more articles complete the list; and of each of these there are various patterns, sizes, and styles. A first class practitioner usually has in his laboratory, besides these mechanical tools, a miniature chemist's shop, as in his practice he frequently has to use chloroform, ether, acids, tinctures, solutions, elixirs, tonics, chlorides, sulphates, a hundred different chemical preparations, not including the perfumery which he uses for flavoring tooth powder, soaps, and mouth washes. The mechanical department varies in quality and value like the others. A well appointed laboratory costs about six hundred dollars; but there are many dentists whose complete outfit, operative and mechanical, did not cost, originally, two hundred dollars. In the laboratory, the work of making the sets, of false teeth is done. As the mechanical tools are continually getting dull and wearing down in sharpening, and the materials are being used up, the workman has to keep replenishing his stock; and when there is a great deal of mechanical work going on, the outlay is considerable: lathe burrs breaking, furnace muffles cracking, vulcanizers exploding, flasks bursting under too much pressure, retorts breaking, and other such accidents continually occurring. I was once seated in the laboratory of a dentist in the West. He had two "cases" in his vulcanizer, undergoing the process. He had examined the thermometer to note the degree of heat, and turned toward me to make a remark about the amount of pressure which the boiler was sustaining: he had not finished his remark, when we heard a noise like the report of a six pounder loaded to the muzzle without ramming; and the room was instantly filled with steam. When, in a few moments, it settled, it appeared that the boiler had burst. The top had been blown off, and was buried in the ceiling. Had the accident occurred thirty seconds sooner, the practitioner would have been killed. I have witnessed other accidents equally dangerous, though it does not seem as if the business was a hazardous one. In the mechanical department, a moderate practice requires an outlay of three hundred dollars per annum, after having a good start. The receipts of one firm for sales of laboratory tools and material were \$62,650; about three fifths of the goods being used in the Western division, one quarter in the Eastern, and the remaining three twentieths in the Southern.

DENTAL OFFICE FURNITURE.

The principal piece of furniture in the operating room is the dental chair, on the left of which generally stands the spittoon, with the dental operating case forward, to the right. This is what I term the "Torturing Trinity." These few pieces are about all that come under the head of furniture. Of each of these there are various patterns and makes; the chairs costing from thirty-five to two hundred dollars each, spittoons from fifteen to one hundred dollars each; and the case, as is previously stated, almost any price the dentist wants to pay. There are other pieces of furniture, such as the extension bracket table, footstools, and the stands used exclusively by dentists; but they are of minor importance. Nevertheless, all these separate pieces of furniture have to be kept in repair, which adds to the expenses of the office. The chair is so constructed that the seat rises, the back falls, and the head rest can be raised and moved to the right or left. As all these movements are independent of each other, it is easy to see that a considerable mass of machinery is contained among the upholstery, in order to do all this manœuvring. When this machinery gets out of order, the whole has to be taken to pieces before it can be adjusted. The spittoon meets with the greatest amount of mishaps. A patient will drop the tumbler into the glass bowl; at least two dollars is required to replace it. Another, in a fit of agonized abstraction, catches hold of the spittoon top, instead of the chair arm, and pulls it off its balance. The marble top smashes on the floor; the pieces, along with the remnants of the glass bowl and tumbler, are thrown into the dirt barrel; and the operator smiles, says "of no consequence," and puts down ten dollars to expense account. The operating case, being out of the patient's reach, is tolerably safe. But the color in the velvet of the chair will fade. Sometimes the veneer peels; the polish grows dull; the looking glass in the top gets cracked by the wood work warping; all these mishaps have to be remedied, and on such fine workmanship it is expensive. In one city in the Western division, eight dentists kept one dental cabinet maker constantly at work in repairing their furniture. The best furniture is used in the Western division; the next best, in the Southern; and the Eastern uses the poorest. The greater proportionate number of pieces is, however, used in the Eastern division, as there are more permanent dentists in proportion to population.

The uninitiated may imagine these statements exaggerated. Not only is every item mentioned to be found in actual use by dentists, but the enumeration is confined to articles that are commonly used.

The number of dentists in the United States exceeds five thousand; and allowing their gross receipts to be only one thousand dollars a year each, which is a low estimate, the grand total amount of money paid out by the people each year for tooth in and tooth out purposes (to pillage a recent pun) will not fall short of five million dollars.

ARSENIC IN AGRICULTURAL AND TECHNICAL PRODUCTS.

BY PROFESSOR AUGUST VOGEL.

It is an interesting fact that mineral substances which are poisonous to animals do not always exert a poisonous action on vegetation. Litharge and red oxide of mercury are known to be active poisons for animals, while seeds moistened and planted in either of these poisons germinate as soon as if planted in a fertile soil. This shows that vegetable organisms are not very sensitive to poisons. On the other hand, it is almost impossible to sprout seed in magnesia, a substance which is administered internally in large quantities as a medicine. The injurious influence exerted upon the germination of seed and the growth of the plant, by this apparently innocent substance, was made known in England through an unintentional experiment made on a large scale some years ago: A farmer there had a whole field sown with white earth which he supposed to be calcareous marl. The seed came up very sparingly in this field, and a chemical analysis of the fertilizer showed that it contained a large quantity of magnesia.

There are some poisons which exert the same powerful influence on vegetable and animal life. To these belong the salts of copper and, above all, arsenic with its numerous compounds. A strong, healthy plant can soon be killed by wetting it with a diluted solution of a salt of copper or of arsenious acid. The poisonous action of arsenic on vegetation is all the more striking because it is a substance very widely disseminated throughout the inorganic world; it has been found in many iron ores previously considered free, and in mineral springs, in bones, and even in garden soil. It confirms the statement of a talented chemist, that the analytical chemist of to-day can find everything everywhere if he earnestly hunts for it. Moreover, in the famous Lafarge poison case the celebrated toxicologist, Orfila, not without reason, pledged himself to prove the presence of arsenic in the chairs of the judge and jury at the Palace of Justice.

Without earnestly hunting for it, but rather by accident, we not long since found arsenic in the Munich street gas, which is now generally employed instead of alcohol lamps in chemical laboratories. The occurrence of arsenic in coal gas is not surprising, for it is known that coal always contains considerable quantities of sulphur, which is generally accompanied by traces of arsenic. In a shale, found at Linz on the Rhine, which is largely employed in the manufacture of photogen and paraffin, some not inconsiderable quantities of this poisonous substance were found. When distilled in large quantities, the collecting pipe, where it joins the distillation retort, often contains a brilliant crystalline crust, which is only partially soluble in water, and consists, for the greater part, of arsenious acid along with sulphuretted arsenic and arsenic. In drawing out the contents of the retort, the peculiar garlic odor of arsenic is perceptible. The workmen who charge the retorts frequently complain of colic, and also suffer from inflammation of the skin or ulcers at the root of the nose and in the joints. The inhalation of arsenious vapors must be supposed to be the cause of it. These arsenious vapors, of course, proceed from the decomposition of arsenical pyrites, which always accompany sulphur pyrites, either distributed in a fine state of division throughout the mass of the shale or present in single perfect crystals.

Since arsenic, as we have said, always accompanies sulphur, all the oil of vitriol made from it must contain arsenic; and through the oil of vitriol, the arsenic finds its way into a great many agricultural and technical products, in the manufacture of which this acid is employed. The acid phosphate of lime, known as superphosphate or prepared bone dust, and now so frequently employed as a fertilizer, is manufactured by the aid of crude sulphuric acid. The arsenic in the acid all goes into those artificial fertilizers. The ordinary analytical tests will prove the presence of arsenic in prepared bone dust.

The question naturally presents itself, whether the plants which grow upon soil manured with such substances will not take up the arsenic. Davy undertook to answer this question. For this purpose he set some cabbage plants, in a mixture of one part of bone dust containing arsenic and four parts of garden soil. At the end of four weeks he tested the grown plants for arsenic. The perceptible quantity of arsenic found in the plants proved, what was easy to foresee, that the arsenic of the fertilizer actually goes into the plant.

A no less important question is, whether such plants are able to exert an injurious effect upon the animal economy. With regard to this, Davy made the observation that sheep, fed upon Swedish turnips which were raised with prepared bone dust and hence contained arsenic, would not eat enough of them to fatten. It must not be overlooked that this is but a single observation. It still remains to be proved whether the arsenic contained in the plant is in such a form as to be dangerous to animals and men, and also whether the quantity is sufficient to be injurious. In a judicial-medical point of view these observations are very important, since it follows that the finding of a trace of arsenic in the viscera does not permit us to conclude with certainty that the person has been poisoned.

The traces of arsenic found in street gas and in artificial fertilizers are so small that, according to my opinion at least, it is scarcely possible to suppose that a case of direct or indi-

rect poisoning could arise from it. It is, however, to be regretted that the undeniable fact of these fertilizers containing traces of arsenic will injure the confidence in artificial fertilizers which had begun to be so important to the agriculturist.

To set at ease the anxious minds of our farmers, it should here be remarked that a certain quantity of arsenic agrees very well with the animal economy. The expression "poison" is in general only a relative one, for under certain circumstances everything is a poison; and on the other hand, a substance which will kill when taken in large quantities may be employed as a medicine in moderate doses. The most common examples show that the administration of a medicine which is not usually considered a poison, under some circumstances, will become such, if given to a sick person. A teaspoonful of alcohol is evidently a poison in cases of inflammation; and, on the contrary, prussic acid or belladonna, in such quantities as a physician would give it to a person having dropsy, is not poisonous, while the same quantity administered to a healthy person would produce dangerous symptoms. The quantity of opium which a Turkish opium eater consumes is no poison for him, as his body is not in a normal condition. Moreover, Nature can accustom itself to poisons; we know that the workmen in arsenic mines, inhaling an arsenious atmosphere, frequently enjoy the best of health and reach a good old age. Horses fed upon two grains of arsenic, or more, per day, thrive and grow fat on it.

New Process for Estimating the Alcoholic Value of Wines.

M. Duclaux states that, when alcohol is added to water, the density and superficial tension of the liquid are diminished, and consequently the number of drops yielded by a given volume from a determined orifice is augmented. The dimensions of the orifice being constant, the number of drops corresponding to each alcoholic mixture is constant also, and the variations between one mixture and another are great enough for a very sensitive alcoholometric process to be founded upon them, in the limits within which the ordinary alcoholometer does not move freely, and is uncertain in its indications.

The instrument proposed is a simple pipette of 0.3 cubic inch volume. It is filled with the alcohol under examination, and the drops are counted. The alcoholic value is then determined from tables which have been calculated for various temperatures. The alcoholic value of wines may be thus estimated with considerable accuracy without previous distillation. In these liquids the density varies very little, and is always near that of water; and as their superficial tension depends solely upon the alcohol which they contain, it is but necessary to count the drops which they yield, and refer to the tables for the result.

If to alcohol or water slight traces of a substance with a high organic equivalent, and consequently a feeble superficial tension, be added, such as acetic ether, butylic or amyllic alcohol, etc., the number of drops yielded by the alcohol or water rises very sensibly. A measurable effect can be produced with $\frac{1}{1000}$ th part of acetic ether. This process is thus available for detecting and approximately estimating certain substances when present in such small proportions as would not be indicated by any other method. By the aid of this instrument, it may be seen that the distillate from wines contains more or less of other matters besides ordinary alcohol, probably alcohols of a higher series.

M. Salleron has proved that the weight of a drop of a mixture of alcohol and water is the smaller the more alcohol it contains; and as the following table shows, the difference becomes larger if the quantity of alcohol be small:

Percentage of alcohol.	0	1	2	3	4	5	10	15	20
Weight of 20 drops....	1 gram	0.910	0.835	0.765	0.707	0.640	0.630	0.617	

This shows that a drop counter may be used for determining the quantity of alcohol in wines, and in the administration of Paris such an instrument is used in order to determine whether a wine entering Paris contains more or less than 15 per cent of alcohol.—*Comptes Rendus*.

Doing Much.

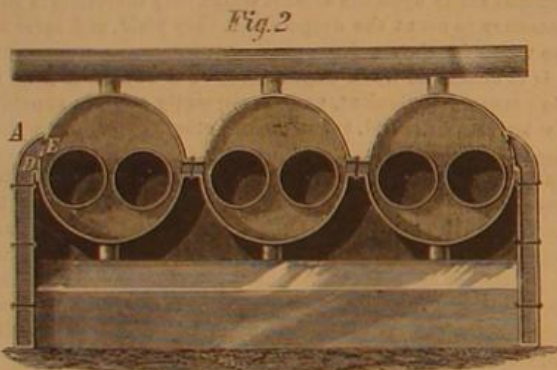
Dr. Hall, in the September issue of his *Journal of Health*—a most excellent family magazine, by the way—truthfully says that many persons seem to be always in a hurry, and yet never accomplish much; others never to be hurried, and yet do a very great deal. If you have fifty letters to answer, don't waste time in looking over to find which one should be noticed first; answer the one you first lay your hands on and then go through the whole pile. Some begin a thing and leave it partially completed, and hurry off to something else. A better plan is to complete whatever you undertake before you leave it, and be thorough in everything; it is the going back from one thing to another that wastes valuable time. Deliberate workers are those who accomplish the most work in a given time, and are less tired at the end of the day than many who have not accomplished half as much; the hurried worker has often to do his work twice over, and even then it is seldom done in the best manner, either as to neatness or durability. It is the deliberate and measured expenditure of strength which invigorates the constitution and builds up the health; multitudes of firemen have found an early death, while the plow boy lives healthily and lives long, going down to his grave beyond three score and ten.

INDIAN TEA EXPORTS.—The Bengal Chamber of Commerce remark, in their last report, that the growth of the tea industry of India has been almost unexampled in the history of its trade. The value of tea exported from Calcutta has increased from \$1,150,000 in 1863-64 to \$8,510,000 in 1873-74. The economic effects of the industry have not yet, however, been fully examined.

IMPROVED STEAM BOILER.

For marine use, and in localities where economy of weight as well as of space is of importance, the steam boiler represented in our illustrations will doubtless be found especially suitable. It can be put up without mason work, thus saving the cost of frequent repairing with fire brick, besides the handling and removing of much ponderous material in making other alterations or renewals; while, for the same reason, it is necessarily much lighter than the ordinary double flue generator. An equally important feature is the novel arrangement of a water jacket to form the sides of the fire box, back of the bridge wall and of the boiler, with which the mud drum is connected. In this arrangement the feed water is pumped into the jacket and not directly into the boiler so that, before it enters the main portion of the latter, it becomes heated to the boiling temperature, depositing its sediment in the inclined portion of the jacket, whence the impurities find their way readily to the mud drum. The feed water is thus rendered comparatively pure, scale prevented, and the generation of steam facilitated, while it is further claimed that a saving of fuel is effected of from 20 to 45 per cent, according to the size of the boiler.

Fig. 1 represents a battery of three boilers; Fig. 2 is a transverse sectional view of the same; Fig. 3 shows the single boiler in perspective, and Fig. 4 is a longitudinal section. The peculiar feature of the construction is the water jacket, A, which forms the water legs, and then extends back to the other end of the boiler and across the extremity, as shown at B, Fig. 4. The plates of this jacket are connected by stays, C, and the inner plate is riveted to the boiler shell, at D, Fig. 2. The outer plate extends nearly to the top of the shell, and also connects with the frame by a steamtight joint. A series of holes, E, Figs. 2 and 4, establish communication between the jacket and steam space. The mud drum, F, Figs. 1, 3, and 4, is connected



at the top with the shell, and its ends are riveted to the inner plate of the jacket. This is shown more clearly in Fig. 1. The bridge wall is also a water back, connecting with the water space of the boiler by the tube, G, Fig. 4. It will be observed, in Figs. 2 and 4, that the jacket extends down on each side from the inclined bridge wall to the end of the boiler, thus making the side of the fire flue to be steam generating surface, while the bottom of the jacket slopes both from front and rear toward the mud drum, so as to facilitate the deposit of sediment in the latter. In the battery, shown in Fig. 1, two mud drums are used, and the jacket bottom is made to incline toward both. It will be observed that the boiler is almost entirely enveloped in its water jacket, the stays and indeed all parts of which are easily accessible for repairs. The lower side of the fire flue is, besides, provided with a suitable covering, which may be readily removed for the like purpose, so that there is no portion of the generator that cannot be conveniently reached.

Patented through the Scientific American Patent Agency, April 7, 1874. For further particulars relative to sale of patent, etc., address the inventor, Mr. Nicolas D. Harvey, 55 Prytania street, New Orleans, La.

Safety Device for Railway Cars.

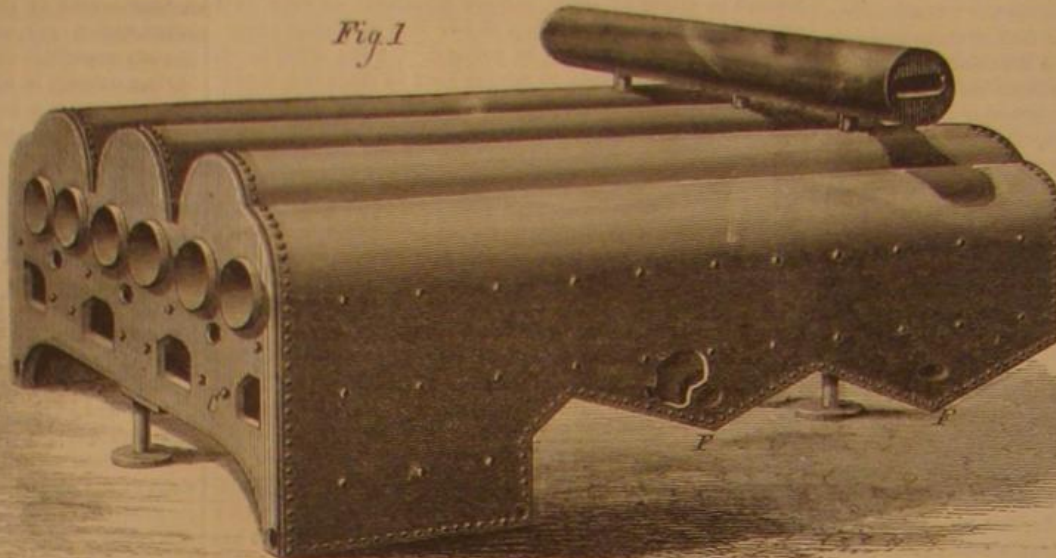
A practical trial was lately made on the Eastern Railway, Mass., of the safety shoe patented March 8, 1872, by Emery and Deyden. The invention consists of a longitudinal plate of iron, placed under the car track, and suspended an inch or so above the rails. The car wheels pass through openings made in the plate. The latter has side flanges which project down below each side of the rail; and if the wheels leave the rail in either direction, the flanges catch on the rail and the car slides on the shoe, bringing the car quickly to rest. The utility of the invention appears to be fully demonstrated by practice, and its employment very greatly reduces the liability of damage by derailment of cars. The following were among the trial tests.

The first test was to open a switch, or set it wrong, as a misplaced switch would be, so that a train must inevitably

run off the track. The engine then got up a speed of about twelve miles an hour; the car was detached before reaching the switch. The wheels ran off as soon as the switch was reached, but the shoe immediately caught the rails and the car slid along about three rods, and stopped. By means of a switch rope, the car was then got on the track by again leaving the switch open, the wheels striking the rails, the distance from the edge of the shoe to the center of the wheel being exactly that of the distance between two rails when a switch is opened.

The second test was at a greater rate of speed and was equally successful, the car sliding on the track by means of the shoes only a short distance further than before. The

Fig. 1



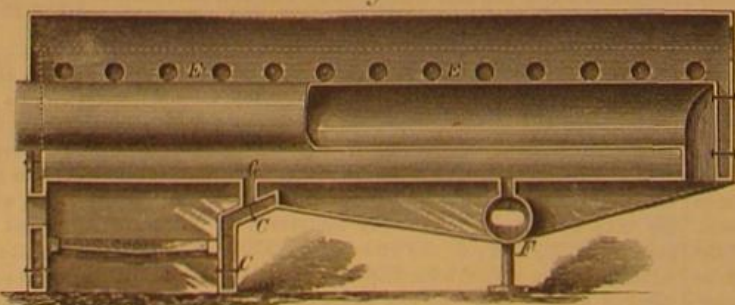
HARVEY'S IMPROVED STEAM BOILER.

third time the engine went back a long distance from the switch and put on a speed of from thirty to forty miles an hour, and the car came at a fearful rate. The result was exactly the same, the shoes holding the car on the track and sliding a distance of about 300 feet before it stopped. The next test was to take out one rail entirely from the track. The car was then sent along the track at a speed of nearly twenty miles an hour. As soon as the open space left by taking up the rail was reached, the wheels were thrown from the opposite rail, but the shoe on that side caught and held the car on that rail until the open space was crossed, when the shoe on the other side also caught and the car stopped within three rods. The shoe can be applied to any trucks with but slight change, and at an expense for a passenger car of about \$115, and of a freight car about \$90. In addition to its being a preventive to trains running off the track, it acts as a brake, stopping a train as quickly as a Westinghouse brake or any steam brake.

Old Boots.

If any body imagines, because an American boot has, as an irreverent humorist expresses it, become "more holy than righteous," because the sole and the upper show an irresistible desire to part company, and because the heel is all on one side and the leather rusty and red, that such things are proofs that its term of usefulness to the human race is ended, then somebody is seriously mistaken. Let it be considered that a medium sized pair of boots packed closely together measure about 36 cubic inches, and that every person in this country casts aside at least one pair per year. The result would

Fig. 4



be a small mountain of shoe leather, 95 feet in every direction, an amount amply sufficient to arouse a very curious interest as to what becomes of it all.

A large percentage of the old boots undergo a second "wearing out" before their treatment as waste. The rag picker who may fish them out of the ash barrel, or the shoemaker on whose floor we may leave them when we purchase a new pair, will sell them to a second hand dealer for some trifling pittance. This last individual, if the uppers be not hopelessly gone, will carefully cut away the ragged edges, and remodel them for entrance into new shoes of smaller size; the legs he will remove from the feet, oil them, and attach them to a new sole and vamp, so that it would puzzle a philosopher to discover the remains of our former well worn coverings in the two pair of spruce-looking and apparently brand new boots and shoes, in the composition of which they play the largest part.

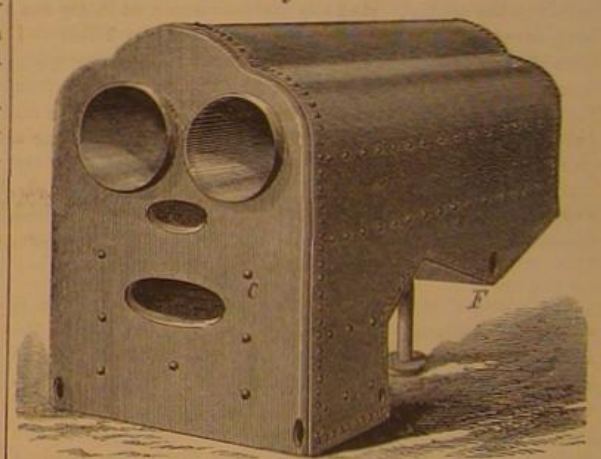
When these wear out, the old leather is too decrepit to be again rejuvenated in the ordinary way, so that finally it, together with the dilapidated soles and demoralized heels, is

handed over to chemical treatment, which works marvels; for from the old scraps new leather, ready to enter once more the hands of the shoemaker, is evolved. This is "pascake leather," however, unfit for anything save insoling medium shoes. It is employed, however, by conscienceless Israelites in Chatham street, with unblushing audacity, for making outer soles, and its durability will probably withstand a half mile walk or thereabouts. "Dose vash'n' shoes made to walk in," an aggrieved Hebrew is reported to have remarked to an irate customer, who threatened dire vengeance because the soles of his new purchase wore out before he had got around the block, "dose vas gavalry boots!" This delectable material is made by cutting the leather into small bits, mixing it with cement, and then squeezing the whole into a compact mass. A similar article is produced from Manila rope, which is said to answer better for insole purposes.

There are quite a number of patented processes for the utilization of waste leather, which convert it into leather board, valuable for a variety of employments. One way consists in grinding the material to a meal-like powder, mixing it with gums and cements, and applying steam. The compound is then kneaded and rolled into sheets. Another plan is to mix old leather, hemp fiber, and sheepskin cuttings, and boil with soda ash. Sulphuric acid and coloring matter are subsequently added, and the substance, molded into sheets, forms a good quality of leather board.

Oerting's process makes a good waterproof article, which is useful for making buckets and similar objects. It consists in dissolving rubber in benzine, to which a quantity of ammonia is afterward added. The leather in the form of pulp is next

Fig. 3



put in, and the whole worked into a plastic dough. Slaughterhouse cuttings are worked up into glue, raw hide whips, and small fancy articles in immense variety.

We had almost forgotten one valuable employment of old boots—the manufacture of jelly. The reader may stare, but Science smiles superior and asserts very emphatically that a toothsome delicacy can be made from a dilapidated foot covering. Some time ago, Dr. Vander Weyde, of this city, regaled some friends not merely with boot jelly, but with shirt coffee, and the repast was pronounced by all partakers excellent. The doctor tells us that he made the jelly by first cleaning the boot, and subsequently boiling it with soda, under a pressure of about two atmospheres. The tannic acid in the leather, combined with salt, made tannate of soda, and the gelatin rose to the top, whence it was removed and dried. From this last, with suitable flavoring material, the jelly was readily concocted. The shirt coffee, which we incidentally mentioned above, was sweetened with cuff and collar sugar, both coffee and sugar being produced in the same way. The linen (after, of course, washing) was treated with nitric acid, which, acting on the lignite contained in the fiber, produced glucose, or grape sugar. This, roasted, made an excellent imitation coffee, which an addition of unroasted glucose readily sweetened.

By way of conclusion, let us "nail" a paragraph which still crops out occasionally among "scientific items" in country journals, and has reference to the synthesis of leather in tea, affirming that the addition of milk to the infusion of the herb acts upon the tannin therein, to form the leather.

The only difficulty about this statement is that milk does not contain a particle of gelatin, and hence cannot possibly form leather with tannin; so the neat calculation of the number of pairs of shoes which every human being drinks yearly is like the owners of the subject of this article—without substantial foundation.

THE GUERNSEY BREED OF CATTLE.

From time immemorial the island of Guernsey has been famous for its breed of cattle, and a very just reputation it is, for there are few localities in Europe, and certainly none in Great Britain, where a more jealous care has been observed to prevent the mixture of foreign element. Of course, the isolated position of the island has greatly aided the inhabitants in their endeavors; in fact, we doubt if any but a locality so situated could, for so long a period, have preserved a breed so intact. The cattle are larger and more valued than even those of Alderney, the name of which is so familiar throughout the world. They are exquisitely delicate in form; colors varying from light red to fawn and dun, with a few black, each generally with white intermixed. The head is

CAN WE MAKE DIAMONDS?

Mr. W. Symons makes ferric ether by mingling a solution of zinc chloride in alcohol and ether with *liquor ferri perchlor. fort.* (B. P.). In this ferric ether, oils, bisulphide of carbon, and other non-conducting liquids may be brought under the influence of weak galvanic currents for many days. In many experiments, bisulphide of carbon was decomposed, resulting in a substance resembling spermaceti. The question is asked whether pure carbon might not be crystallized out by some similar process.

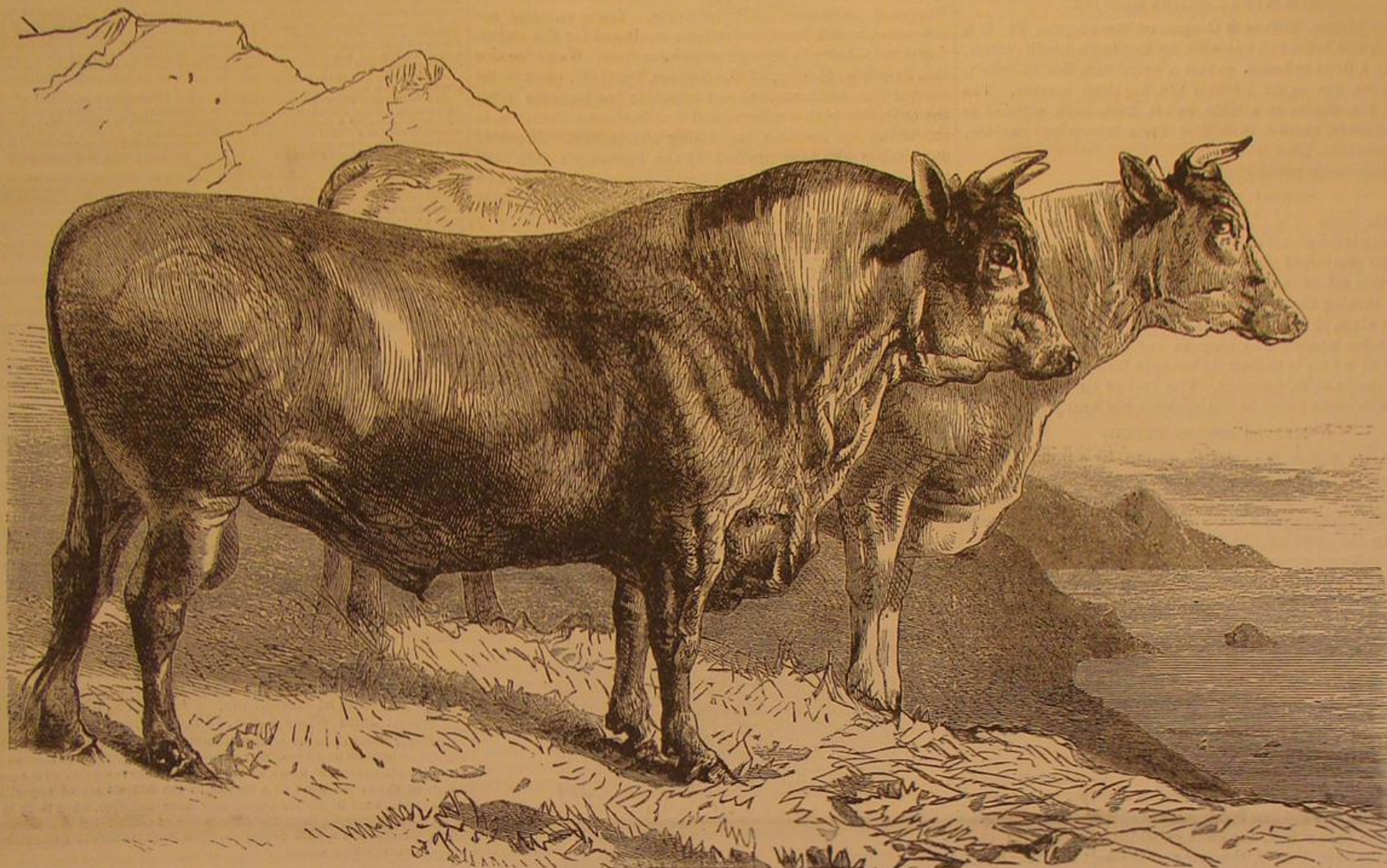
MOLECULAR CHANGES OF MAGNETIZATION.

Professor Barrett finds that, just before an iron wire passes to a red heat, a momentary contraction occurs, and subsequently the expansion proceeds regularly. A momentary

what can be perceived by one sense at one instant, while the higher orders can comprise in one act of thought a series of successions in time. The highest animal can comprise in one act of thought an entire class of co-existents or successions, so far as to combine with a particular fact the common element of co-existence or succession belonging to the class.

NEW THEORIES OF VOLCANOES AND EARTHQUAKES.

Dr. Vaughan endeavors to show that the terrestrial crust, if reposing on lava of a declining temperature, would receive accessions of buoyant solid material, chiefly on such points as extend deep into the fiery menstruum, and that the consequent growth of internal mountains would be interrupted only by the occasional movements of this light mat-



GUERNSEY CATTLE.

long and handsome, eye large and prominent, horns gracefully formed. For flesh giving qualities they are profitable, and for dairy stock they are truly excellent, yielding, on the average (if properly fed and cared for), one pound of the finest butter per day throughout the year. The size is a fair average, and doubtless the breed would be much larger were it not for the peculiar treatment they have ever been subjected to. The farms of the island being limited in size, it is found necessary to tether the cattle, whereby they lose much of that exercise and freedom which would tend to larger growth. They are also, by this means, too frequently exposed to excessive heat or cold, being without the possibility of choosing their necessary shelter. Notwithstanding these drawbacks, it is really remarkable how well the animals have always thriven. So great is the demand for this breed that, on an average, seven hundred cows and helpers, with about a dozen bulls, are annually exported.

We give herewith portraits of two fine specimens of this breed, from the pencil of Mr. Harrison Weir, a renowned painter of animal life, for which engraving we are indebted to *The Field*.

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

We continue below our brief abstracts of the papers read before this body at its recent meeting at Belfast, Ireland.

DEEP SEA CURRENTS.

Under this heading, Dr. Carpenter refutes the common idea that the Gulf Stream exercises an effect upon the climate of the British Isles. That current, he thinks, has nothing to do with the warmth of the winters. The bottom of the Atlantic is covered to a vast depth with icy cold water, caused by the melting of the polar snows. This cold water has a tendency to surge up on certain portions of the North American coast. A slow warm current travels up the western shores of Europe and Africa.

DAYS A MONTH LONG.

Professor Purser believes that the moon, in revolving around the earth and drawing the tides behind her, cause the latter to act as a brake on the revolution of the globe, and he considers that it may be mathematically shown that this action is slowly but surely checking the earth's speed of rotation, so that the days and nights are gradually lengthening. In a thousand million years or so, they may become each a month long.

elongation happens if the wire is first raised to a white and then cooled to a dull red heat. If in the dark, at this moment the wire becomes invisible and ceases to glow, although the sources of heat continue unchanged; it glows again with a bright red heat. The same phenomenon takes place in nitrogen and carbonic acid. The greater the tension of the wire, the more marked is the elongation and contraction, and a very audible click, such as would be emitted by an iron bar when magnetized, is emitted by the wire.

UNDERGROUND TEMPERATURES.

This subject is treated in a report by Professor Everett, in which it is pointed out that the average result thus far is that the temperature increases at the rate of 1° Fah. in every 50 or 60 feet in depth. A very valuable set of observations has been received from a mine, 1,900 feet deep, in Prague, Bohemia. The depths and corresponding temperatures are as follows:

Feet.	Deg. Fah.	Feet.	Deg. Fah.
68	47.9	1,290	58.3
299	48.8	1,414	59.4
621	50.7	1,652	61.2
939	57.8	1,900	61.4

INDIAN AND CHINESE TEA.

Of these two productions, Professor Hodges considers that analysis shows the former to be the superior. He also finds that with Indian tea fully 68 per cent of the mineral matter and 58 per cent of the nitrogen is removed in the infusion.

SPECTRA WITH THE OXYHYDROGEN FLAME.

Mr. P. Braham obtains good results by using a vertical oxyhydrogen jet and introducing the salt of a metal rolled up in thin paper. The length of time that the spectra lasts depends upon the length of paper used.

UTILIZATION OF SEWAGE.

The chief point of interest in Professor Corfield's report is that, during the year ending March last, at a sewage farm, 37.7 per cent of the nitrogen brought to the farm in the sewage was recovered in the crop, the amounts during previous years having been 26.0 and 41.76 per cent. The differences were chiefly due to the fact that very different quantities of the crops were left standing at the end of each year.

POWER OF THOUGHT IN VERTEBRATES.

Dr. James Byrne considers that the difference between the mental action of the lower order of vertebrate animals and that of the higher orders consists essentially in the fact that the lower orders can comprise in one act of thought only

ter to positions much higher than those at which they were first deposited. To the collision of such masses against the weaker parts of the earth's crust, earthquakes are ascribed. Volcanoes are explained by quantities of silicious rock rising and eroding channels. The same spots of the earth's crust, being thus exposed to repeated inroads of intensely heated matter, would be reduced in thickness by the frequent fusion, and would present a weaker barrier to subterranean violence.

THE SCIENCE OF EDUCATION.

This was a paper replete with sound common sense, and received with marked attention, since it came from Mrs. Grey. It concludes with a plea for more experienced teachers, and an appeal for system in the art of imparting instruction. What is wanted is that teachers, like practical navigators, shall be furnished with the principles of a science they have not had to discover for themselves, and with charts to guide their general course, leaving to their individual acumen the adaptations required by special circumstances.

The meeting of the Association closed with a brief valedictory from Professor Tyndall, after which Sir John Hawkshaw was chosen President for 1875, and the place of meeting for that year fixed at Bristol.

A MODEL CITY.—A curious piece of mechanism has been produced by an Amsterdam jeweler, called the "Great Mechanical City," and is twenty feet long by fifteen feet wide. There are houses, castles, churches, and stores in it, just as they appear in almost any European city. People walk and ride about. Horses and wagons and railway cars pass through the streets. Boats pass up and down the river, while some are loading and others unloading at the docks. Mills are in motion. A fountain plays in the public park, and a band of music fills the air with melody. There are also forts with soldiers parading about them, blacksmith shops with artisans at work in them, and pleasure gardens with people dancing in them.

M. GIFFARD, of injector fame, has invented a method of fitting railway carriages which eliminates oscillation. The carriage is suspended by powerful springs at each end; and at the trials recently made in the presence of some members of the French Association for the Advancement of Science, the carriage was found to be so steady that reading and writing could be easily carried on. It will shortly be exhibited to the English public.

THE FAIR OF THE AMERICAN INSTITUTE.

Among the novel and curious inventions exhibited at the Fair is a

HAIR HEADING MACHINE,

the object of which is to straighten out the tangled combings of ladies' hair, arranging the roots all one way. The hair is placed on a rubber pad under a vibrating dull blade which has a kind of drawing motion. The edge of the blade engages against the scales or nap of the hair and forces such as it catches in one direction or the other, to meet endless canvas belts. Upright pins on the latter encounter the hair as it is pushed from under the blade, and, catching it, carry it along, thus straightening it with the roots outward.

One of the neatest little machines exhibited is a

MINIATURE KNITTING MACHINE

made by Messrs. Tiffany & Cooper, of Bennington, Vt. It is clamped to a table and operated by turning a crank which, rotating a little cylinder, causes a spiral cam slot therein to give to the five or six needles the required motion. The cost of the device is a trifle, and it knits such articles as watch guards, curtain cord, and dress trimmings rapidly, and produces a good article.

Another small invention of merit is a

SELF LIGHTING GAS BURNER.

In this there is a little chamber beside the burner in which is placed a roll of paper, along which are dots of a harmless compound which will take fire by percussion. The end of this roll is carried up near the orifice of the burner; and by turning the cock, the uppermost match is lighted by a slight blow, thus igniting the gas. The device works well and remains operative as long as any of the roll of paper, the end of which is constantly brought into position by very simple mechanism, remains. The cost of the apparatus is said not to exceed that of the matches ordinarily employed.

MEYERS' ROTARY ENGINE

of 50 horse power is exhibited, driven by compressed air. The working portions of this machine are remarkable for simplicity and fewness of parts as well as strength. There are in fact but three moving parts. The ring revolves on its own center in the cylinder, the piston arm is attached directly to the shaft and passes through the ring in a movable bearing; and it terminates in two flukes resting against the inner periphery of cylinder, or one fluke if the engine be single-acting. There are no eccentrics, no springs, and no cams in the engine, and the wearing pieces are all heavy and substantial. The ring is merely a secondary part, as the power goes directly through the piston to the shaft. The machine at the Fair runs readily with an air pressure of $\frac{1}{2}$ pound. This engine will soon be illustrated in this paper.

MCCHESNEY'S SCROLL SAW

is a novelty in this form of machine. The frame is made something of an elliptical or flattened C shape. At points corresponding to the ends and middle of the C are pulleys over which pass a belt, the ends of which connect with the ends of the saw, that is, the saw and the belt together form a triangle. To the middle wheel, mechanism is attached which gives it a to-and-fro turning motion so that a reciprocating movement is thus imparted to the saw. The facility with which the latter can be stopped, and the ease with which it can be removed or tightened, render the machine a useful improvement.

Of the

NEW METAL WORKING TOOLS,

there is such a great variety that we can do no more than point out the especial novelties in those which strike us as of merit, leaving to the reader, should he visit the Fair, to make more elaborate examination for himself.

There is a bolt cutter from Messrs. Sellers & Co., in which the oil is pumped directly through the spindle. A drill grinder by the same firm has a neat device for clamping the tool, and an arrangement resembling an index wheel by which the lathe may be turned exactly over one half a revolution.

In the large collection of Messrs. George Place & Co. is a 12 inch slotting machine, which has a new cam motion and in which, instead of the ordinary wheel on top, a rod is provided connecting with a bevel gear at that point. The rod has a handle which is convenient to the workman in front of the machine. In a car wheel borer, we notice a friction arrangement for the feed, the mere turning of a hand wheel throwing the latter on or off at once. There is also a conical bearing for the table, which will doubtless give a truer wear. In a 15 inch shaper, the novelty is a quick return motion, a cam being used, instead of an eccentric, which gives return and drops immediately. An adjustable table which can be placed at any angle is the feature of a new radial drill. It is pivoted to the bed by lugs, and a turn of the pivot bolt with a wrench holds it in proper position. It turns on a circular rack in which suitable gearing operates to give desired elevation. A large table is provided at another side of the tool, to which the drill is easily swung around in doing heavy work.

There is also a three-spindle bolt cutter which opens and closes its dies automatically. The bolts are merely started in and left to themselves; when they are cut to the required depth, they strike previously adjusted mechanism which throws open the dies. This machine has also a new arrangement for the oil, so that the latter is always drawn from the top and hence is pure, not requiring frequent changing. A six-spindle nut tapping machine has its taps so held that they are self-centering, this being effected by a very short squared portion and the holding mechanism acting upon a recess cut near the upper extremity. In using the machine

it is only necessary to keep feeding nuts under the taps until the latter are full. Then, by pulling down collars, the tools are instantly released and the nuts may be readily dropped off. A new axle lathe has two changes of feed, and the clutch instead of being at the tail of the lathe, is between the two gears. The handle is so arranged as to be always convenient to the workman wherever about the tool he may be, and there is a friction attachment acting on an expansion box, which, enclosing the tail spindle, allows the latter to be readily and quickly set. We reserve mention of other machine tools for a subsequent article.

Among the entries which merit passing mention is a very fine display of

WOODWORKING IMPLEMENTS

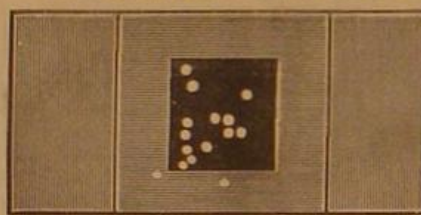
by D. R. Barton, of Rochester, N. Y., and a case of bolts from Hoopes & Townsend, of Philadelphia. These exhibits are alike conspicuous for their intrinsic merit and for the exceptional taste shown in arranging them for show. We notice also that President Morton, of the Stevens Institute, contributes several fine mathematical and scientific instruments from the collection of that college, and that Professor Thurston is exhibiting his machine for testing the metals. Those of our readers who have profited by the Professor's very able articles on testing, strains, and similar topics, which we have lately published, will doubtless inspect with much interest this machine, now for the first time publicly displayed.

THE INTERNATIONAL RIFLE CONTEST.

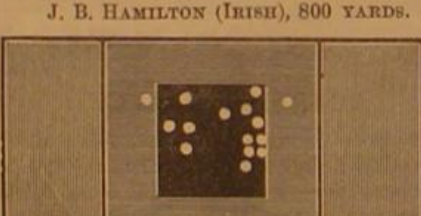
The trial of skill between six riflemen of America and six from Ireland, ended in a victory for America, the shooting on both sides being marvelous for accuracy. Two hundred and seventy shots (fifteen for each man at 800, 900, and 1,000 yards respectively) were fired on each side; and 4 points being given for each bullseye, the possible total was 1,080 to each competing team. The Irish party marked 931, and the Americans, previous to the last man's last shot, exactly tied them. Colonel Bodine was firing, and on him depended the result. He scored a center, 3 points, making a total of 934. We believe this total has never been exceeded. But the equality of the two scores was even more remarkable than this, as the Irish side lost 4 points by one marksman firing at the wrong target, on which he made a bullseye.

We give herewith diagrams of the four most remarkable scores:

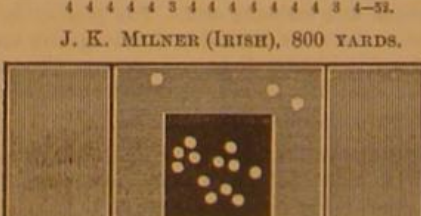
H. FULTON (AMERICAN), 800 YARDS.



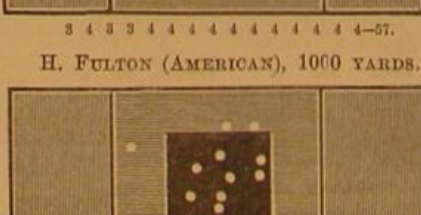
J. B. HAMILTON (IRISH), 800 YARDS.



J. K. MILNER (IRISH), 800 YARDS.



H. FULTON (AMERICAN), 1000 YARDS.



DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT AIR-CARBURETING APPARATUS.—THE GILBERT & BARKER MANUFACTURING COMPANY vs. OAKS TIRRELL.

WOODRUFF, Circuit Judge: The bill herein is filed to restrain the infringement of a patent granted to J. F. Barker and G. N. Gilbert, on the 3d August, 1869, for an improved apparatus for carbureting air. By means of this apparatus, it is claimed that gas is produced from petroleum, and similar volatile oils employed for carbureting atmospheric air, thus rendering it combustible, light-producing, and suitable for lighting houses, manufactories, etc. Neither the process nor the chief parts of the apparatus are claimed to be new. The claim in the patent which the defendant is charged with infringing is in these words: "The arrangement of the carbureter with a meter wheel, said meter wheel being driven by a descending weight or other equivalent mechanical power, applied to force the air through the carbureter to the burners, said carbureter being placed within a vault by itself, separate from the building to be lighted, the whole arranged and connected with pipes substantially as herein (that is, in the specification) described and set forth."

require, whenever for adjusting the motive power or machinery thereof it is desired to do so.

Such apartment being thus wholly separated by walls or intermediate earth, or both, no gas from the carbureter pervades it, and no danger of explosion arises.

Three questions are hereupon raised. Was this new arrangement patentable? Was it new, and were the patentees the first inventors? Does the defendant infringe? 1. Upon the first question, it is insisted that the patentees merely changed the location of the carbureter, and that the mere change in the location of an old device is not patentable.

In *Marsh et al. vs. the Lodge Stevenson Manufacturing Company*, in the Northern District, at the June term, 1873 (3 *Patent Office Gazette*, 399), I had occasion to say that "mere change of location is not invention." But it was also held that "where change of location involves the employment of new devices to adapt an apparatus for use in the new position, and a beneficial result is produced, then this location, in its connection with such new devices—that is, the means by which the result is produced—is not the result itself—is patentable. And where such change of location brings into existence a new combination of devices, operating by reason of such new combination to produce a new and useful result, such new combination is patentable."

The most important inventions ever made consist in subordinating natural elements or controlling natural laws to the production of useful results.

I cannot doubt that the invention of the patentees was patentable, as truly so as it is abundantly proved to be greatly useful and valuable.

The question of fact: Was this arrangement new, and were the patentees the first inventors? must be answered in affirmative.

Does the defendant infringe? It was but feebly, if at all, insisted that if the arrangement of devices by the patentees was entitled to be called invention and was patentable, as above explained, the defendant did not employ its distinguishing features or characteristics. The details in the construction of his carbureter were not precisely like that used by the complainant, but those specific features were not claimed. The substantial operation of his carbureter and the mode of impregnating the atmospheric air are alike in both.

The difference between the apparatus of the defendant and that of the patentees, chiefly relied upon, is that, whereas the latter make the cavity below the ground a vault having surrounding walls, the defendant, having inserted his carbureter in the cavity, surrounds it with earth in direct contact therewith, and carries up to the surface a pipe through which to replenish the carbureter with oil, instead of having a removable opening to the vault below, employed by the patentees.

The substance of the invention the defendant uses. The means of its effective operation are the same. The even, moderate temperature of the earth, the underground passage of the gas and the effect thereof are alike used in both. The difference in the construction of the carbureter, used by the patentees, as described in the drawings, may make a more permanent opening about its sides desirable, but I cannot regard these details as of the substance of the invention. The apparatus of the defendant does substantially operate by the same means, in the same way, and to produce the same result.

The complaint must have a decree for an injunction and account in the usual form.

(Stanley, Brown & Clarke, for complainant.

Westmore & Jenner, for defendant.)

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN GARDEN. Edited by James Hogg. Published monthly. \$3 a year. Brooklyn, N. Y.: Beach, Son & Co., 76 Fulton street.

The October number is the second of a new series, which renders the present a favorable time to subscribe. The number before us contains a great variety of information on horticulture, hints on gardening, fruit raising, and kindred subjects, accompanied with a descriptive catalogue of Dutch bulbs, lilies, etc., appropriate to the season. Among these are many new varieties, with practical hints in their culture and management. In form and character of information, the *American Garden* is similar to the *English Garden*, and is designed to occupy the same field in this country that its namesake does in England. The information is adapted to our soil and climate, which renders it of special value to all lovers of flower culture. It contains the names and description of all new varieties of plants and bulbs, and occupies a place in floral literature opened by the advancement of American taste.

ELEMENTS OF DESCRIPTIVE GEOMETRY. By S. Edward Warren, C. E., Professor of Descriptive Geometry in the Massachusetts Institute of Technology, and Author of a Series of Works on Geometry and Stereotomy. Part I., on Surfaces of Revolution. Large 8vo., 253 pp. New York: John Wiley & Son, 15 Astor Place.

Professor Warren's books are recognized throughout the country as the highest authorities on all branches of practical geometry. His method of classifying the problems by which the whole science is elucidated is excellent, and shows the hand of a master in the difficult art of imparting instruction. Such books are needed now more than ever, when there is a worldwide awakening as to the importance of technical instruction as a branch of common school education. The book is admirably illustrated with numerous folding plates.

POLITICS AND MYSTERIES OF LIFE INSURANCE. By Elizur Wright, late Insurance Commissioner of Massachusetts. Price \$1.50. New York: Lee, Shepard, and Lillingham.

The author of this excellent treatise has added to his great reputation as an authority on this important subject. It is stated that more than 500,000 persons, chiefly heads of families, have insured their lives in the United States, depositing their money periodically in the hands of corporations who are alleged to be nearly irresponsible, while their constitutions and regulations are so complicated that persons wishing to discontinue their insurances or to surrender their policies are nearly always victimized.

THE MOTHER'S HYGIENIC HAND BOOK, for the Normal Development and Training of Women and Children, and the Treatment of their Diseases by Hygienic Agencies. By R. T. Trall, M.D., author of "The Hydropathic Encyclopedia," etc. Price \$1. New York: S. R. Wells, 389 Broadway.

Dr. Trall is well known as the author of various excellent works on hygiene. His views on diet, regimen, and dress are sound and generally acceptable.

ON THE STRENGTH, ELASTICITY, DUCTILITY, & RESILIENCE OF MATERIALS OF MACHINE CONSTRUCTION, a Paper read before the American Society of Civil Engineers. By Professor R. H. Thurston, Stevens Institute of Technology, Hoboken, N. J. New York: D. Van Nostrand, 23 Murray street.

A reproduction of several articles, of the highest interest and value which have already appeared in our columns.

THE WESTERN PHOTOGRAPHIC NEWS, a Monthly Magazine of Photographic Art. Vol. I., Nos. 1, 2, 3. Chicago, Ill. Charles W. Stevens, 158 State street.

This periodical contains much news, domestic and foreign, as to the photographer's art, and so many valuable recipes and practical directions.

CINCINNATI INDUSTRIAL EXPOSITION CATALOGUE (German Edition). M. & R. Bargheim, Cincinnati.

EIGHTH ANNUAL REPORT OF THE MASTER CAR BUILDERS' ASSOCIATION. New York: S. W. Green, 16 Jacob street.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From September 8 to September 17, 1874, inclusive.

ANGLE BRICKS.—J. E. Billings, Boston, Mass.
BUTTON HOLE SEWING MACHINE.—H. E. Townsend, Boston, Mass.
CAR WHEEL.—E. B. Mealyard, Geneva Lake, Miss.
CLEANING GRAIN, ETC.—G. E. Throop, Syracuse, N. Y.
DESIGNS ON FABRICS.—W. Engstedt (of Chicago, Ill.) London, Eng.
DRIVING SEWING MACHINES.—J. Proctor, Boston, Mass.
GOVERNOR.—C. C. Jenkins, Philadelphia, Pa., et al.
IRONING HATS.—R. E. Brand, Plainfield, N. J.
LEATHER ROUNDING MACHINE.—H. F. Osborne, Newark, N. J.
MACHINE GUN.—W. B. Farwell, New York city.
MATERIAL FOR WELDING IRON, ETC.—H. Schlerloh, Jersey City, N. J.
PORTABLE GAS APPARATUS.—W. F. Browne, New York city.
PRINTING TELEGRAPH.—G. W. Howe, Stevenson, Ala.
PROPULSION OF VESSELS.—P. S. Devlan, New York city.
RAISING COAL, ETC.—J. L. Bates, New York city.
SEWING MACHINE.—H. P. Garland San Francisco, Cal.
SEWING MACHINE.—W. S. Gulderson (of New York city), London, England.
SURFACING METALS.—L. Bollman, Vienna, Austria.
WASHING MACHINE.—W. Scott et al., Culcago, Ill.

Recent American and Foreign Patents.

Improved Lathe Dog.

J. Henry Stimpson, St. Louis, Mo.—This invention relates to that class of lathe dogs in which are combined two serrated and slotted plates, each carrying a jaw, and clamped together and to the face plate of a lathe by a bolt. It consists in the application to the plates of serrations of such construction as to cause the jaws at all times, when force is applied, to be forced toward each other, and an improved construction and relative arrangement of the parts by which all torsional or twisting strain is obviated, by directing the force applied to close the jaws in planes that pass through and on both sides of the point of resistance.

Improved Drill Joint.

John H. Bauser, Parker's City, Pa.—By this device, the connection of the drill joint is strengthened without increasing the size of the coupling or joint, and also the breaking of the joint and consequent expense in removing the shaft is to some degree prevented. The adjacent ends of both parts are sufficiently enlarged for greater strength of the joint, and one part is provided with a threaded screw pin and a screw extension of smaller diameter. The socket of the adjoining part is recessed, threaded, and fitted for screws, securing, by means of the shoulders, a strong and intimate joint of parts.

Improved Smoke Stack and Spark Arrestor.

J. Wellington Nesmith, Golden, Col. Ter.—This is a smoke stack and spark arrester for coal-burning locomotives, which will not only prevent the escape of sparks, but economize fuel. There is an inverted pot over the top of the flue, coned in any substantial manner. Attached thereto is a series of concentric flanges, forming (together) an open pyramid, surmounted by a cap, and the smoke stack has a diamond-shaped head. The entire products of combustion, as well as the exhaust steam, are discharged into the inverted pot, and from that downward; the sparks falling, and the smoke, steam, and gases rising.

Improved Car Coupling.

Harrison E. Smith, Portland, Oregon.—This car coupling consists of a drawhead with weighted horizontal jaws swinging on small pivot pins, and connected to the drawhead by a vertical fastening pin. The jaws are recessed for the enlarged conical head of the coupling link, and lock over the same by the action of a diametrical cam on shoulders of the rear parts of the jaws. The cam is keyed to a lateral shaft, turned into horizontal position for uncoupling by mechanism applied to the top or side of the car, and held in position for uncoupling by the hook end of a weighted pivoted lever, which catches over a lug of the cam shaft, releasing the lug by the concussion of the drawhead, and producing the instant coupling of the pins to the link head.

Improved Wagon Body.

Benjamin Rankin, Jeffersonville, O.—This is a strong and durable wagon body, which may be readily taken apart for unloading, or for the purpose of storage, while it is easily put up by any person, and forms a secure and rigid connection of the sides, ends, and bottom parts. The detachable sides and end gates are firmly bound to the lateral bottom pieces by hinged hook bars of the same, swung in upward direction, and by stationary hook bars of the sides, in connection with a longitudinal side chain applied by screw bolts and cranks. For the purpose of discharging any load at once, without the use of a scoop, the cranks are released from the screw bolts, and the chains detached from the hook bars. The end gates are then taken off, and the sides raised out of their socket.

Improved Molding Machine.

William F. Wolf, Hollidaysburg, Pa.—This invention relates to an improvement in the means of connection between the treadle and the flanged balance wheel that is fixed horizontally on the bit stock or mandrel to which the molding cutter is attached. On the lower part of the mandrel is a gripping clutch, which is carried forward or backward by a flanged pulley for turning the mandrel continuously in one direction by gripping the flange of the balance wheel when it goes forward, and letting it go when it moves backward. This gripping action is effected by the form of the clutch, which is a tube with radial arms, and has two exterior projections, one wedge-shaped or triangular, for engaging the notched inner side of the flange when the clutch moves in one direction, but not when moving oppositely, and the other projection, which is round or smooth, serving to hold the clutch in position to cause the engagement referred to.

Improved Printing Roll.

Franklin E. James, New York city.—This invention relates to fastening the figures of paper-printing rolls upon them, the rolls being made of lead or other soft metal. It consists of cutting or engraving the outlines of the figures upon the surface of the roll, and driving the brass pieces used to project said outlines above the surface sharply into the cuts. Said pieces are previously drawn down to a feather edge, to be caused to burr out on one or both the sides by being driven to the bottom of the cuts, so as to be forced into the walls of the cuts to secure them in the rolls without the expense of soldering, screwing, or pinning them.

Improved Lamp Bracket.

Charles E. King, Central Falls, R. I.—The main arm swings in any direction of the circle, and may be fastened by the base clamp to any object and under any inclination, while adjustable upper arms and basket regulate the light and produce the horizontal position of the lamp. The flexibility of the bracket admits of its unlimited and useful application for the various purposes, and its easy detaching and storing away when not needed.

Improved Flood Fence.

David T. Deffenbaugh, Lilly Chapel, O.—This invention is an improvement in the class of flood gates whose lower fastenings are disengaged or loosened as the water rises, thus allowing the gates to swing out with the current. As the water rises, it raises the gate so as to unlatch latches which allow the gate to swing down with the current. Should, however, the panel not rise with the water, the pressure of the water against the upper part of said panel will cause said upper part to swing forward, which will draw the latches out of the catches, when the panel will swing down with the current.

Improved Faucet.

Lemen J. Birgler, Cincinnati, Ohio.—This is a faucet with vent attachment, for drawing off liquids from the barrel without the aid of a vent in the bung or other part of the barrel. The vent works automatically in connection with the opening and closing of the faucet. The faucet has a guide tube and sliding vent tube, and is provided at the inner end with a flexible rubber tube and floating valve, and with a second valve at the outer end, through which air is drawn into the barrel when the faucet is opened.

Improved Rein Holder.

John Boyse, Dodd City, Tex.—This rein-holding device consists of a pivoted, vertically swinging cam or locking jaw and a frame constructed suitably for attachment to the dash board of a carriage. The two jaws are curved on corresponding or parallel lines, so that they bite the reins at every point between their opposing faces. The horizontal arrangement of the movable jaw economizes space, and conduces to strength.

Improved Fare Box.

William S. Clapp, Carmel, N. Y.—This invention consists of a double spout, composed of a tapering entrance spout, with a central wire running at some distance below the slit. A supplementary tapering spout increases the former, and the whole is formed of a blank of sheet metal made of one oblong piece with triangular side extensions and lateral slit, to be bent into shape and soldered at the connecting edges, and then applied to a fare, letter, or other box.

Improved Die for Making Nuts.

James Hervey Stierburgh, Reading, Pa.—The piece of metal is placed, in order to be compressed into shape, in a centrally perforated female die. A centrally perforated male die is made to fit the cavity, their perforations registering, so that the hollow punch may pass freely through both. The nut has an angled projection on the bottom, so as to lock to the washer which will be used with it. In order to accomplish this, the male die is made with an angular lateral cavity, corresponding to the form of the projection.

Improved Compound Railroad Rail.

Isaac Thomas, Jackson, Mich.—This compound rail is formed of two parts or sections, which are connected together by keys. A beveled surface gives the head of the rail a good bearing, while the key holds the foot piece securely to its foundation. The key passes through holes punched in the parts of the web at suitable distances from each other, and stands at an angle of about forty-five degrees with the base, with its main bearings on the outside of the web, and on the top of the foot piece.

Improved Hydraulic Jack.

Edward Biddle, Carlin, Nev.—This is a convenient implement by which cross heads may be forced out of piston rods, bolts out of engine frames and cylinders, and similar work be done where only a small space is available for the application of the tool. The invention consists of a hydraulic jack, constructed of a piston or ram, with packed end sliding in a tube, being forced forward by the action of the liquid, which is compressed by a tightly packed piston fed forward by means of its screw bolt and a ratchet wrench in a tube, under right angles to the ram tube and connected therewith.

Improved Hemp Brake.

Thomas J. Dean and Montgomery W. Forward, Lawrence, Kan.—A carrier runs from under a stationary beater under the revolving beaters, and thus continually presents the flax hanging over the stationary beater to the revolving beaters, so that they have a more efficient action in the way of stripping the broken stalk from the fiber. The standards for the crushing rollers and the revolving beater are pivoted to the bed frame, and they are connected together by adjustable bars and braced, so that the revolving beaters and the stationary beaters can be adjusted relatively to each other, as required.

Improved Iron Bridge.

Andrew Burneson, Mansfield, O.—Two angle plates, of the same size, are fastened together at the edges by riveting them to angle bars, either with or without a flat plate between them. They are arranged in the bridge, with the corners of the chord thus formed lying in a horizontal plane, resting the end against the vertical plate of the shoe, and on the bottom plate. The suspending rods are attached by a yoke, embracing the lower side, and bolted to another yoke on the top, and are thus connected without bolting through the chords, except at the flanges. A top chord is composed of two angle plates, secured together by angle bars and a flat plate. The suspension rods are secured to the flange of the chord by a yoke and yoke-shaped bolts. The braces are secured to the chord by angle ends and yoked bolts.

Improved Screen for Coal, Ores, etc.

Peter Hayden, New York city, and William B. Hayden, Columbus, Ohio.—This invention relates to a screen which is formed of parallel bars, rests on and is revolved by a series of rollers having stationary bearings in a suitable frame. The bars are secured to the rims by stud pins on each side, which enter notches in the side of some of the rims, while the bars enter inside radial longitudinal notches in the rims, and are held in place by a ring bolted on against the bars at one end. The rims are connected together by long rods with tubes on them, extending longitudinally between to keep them the requisite distance apart. This is a simple and economical mode of constructing the screen frame in sections, so that it can be lengthened or shortened by putting on or taking off sections. Part or all of the longitudinal screen bars are constructed with beveled inner edges, and so arranged that they will arrest thin pieces of slate as the screen rotates.

Improved Middlings Purifier.

George W. Dellinger, Ripon, Wis.—This consists of a series of horizontal circular sieves, one above another, on a hollow shaft, with a hopper or funnel below each sieve. A discharge gutter is placed at the periphery, and a fan blower is connected with lower end of the hollow shaft. All parts are so contrived that the air blows up through the sieves from below, and, together with the centrifugal action of the sieves, which have an oscillating motion, causes the light matters to pass off over the edges of the sieves to the gutter, while the heavier matters passing through the sieves are conducted by the hopper to the center of the next sieve below, in a manner calculated to be very efficient in separating the impure matters from those suitable for regrinding.

Improved Trunk.

Thomas J. Massie, Arlington, Va.—This invention relates to mounting or suspending a cylindrical trunk on trunnions so as to revolve within a shell, and to providing the inner trunk with hinged loops for supporting it when removed from the shell or trunk case.

Improved Throttle Valve.

Ethan A. Gates, Burlington, Kan., assignor of one half his right to Sanford R. Leonard.—The packing is an elastic ring cut longitudinally, and confined between the shoulder of the valve and below the nut at the top, and is made to snugly fit the valve cylinder. This packing ring is expanded by means of a wedge. A chamber in the shell, around the cylinder, is provided with three ports on the sides of the valve. When the valve is on it, seat these ports are closed, and when the valve is raised the steam passes through the ports into the chamber, and is discharged into the steam pipe attached to the shell. An oil tube passes down through the shell, and delivers oil to lubricate the valve. This valve is balanced by the pressure of steam upon its sides, so that it works up and down with out undue friction, and always works steam tight.

Improved Water Wheel.

Frederick W. Tuerk, Jr., Berlin, Can.—This is an improved water wheel which may be run with a very low head of water, which shall be free from back pressure and waste, and will thus utilize almost the entire force of the water. The invention consists in curved and pivoted buckets, having shaped recesses in its rim. Wedge-shaped recesses are also formed in the rim of the wheel beneath the upper part of the buckets. There are curved slots in the partition plate and two sets of openings. With this construction, when the water is admitted through the chute, it flows through the one set of openings, being guided by a ring flange, and enters the wedge-shaped recesses. It thus forces the buckets outward, so that the water that enters through the other set of openings may strike against the buckets and drive the wheel forward. As each bucket enters an enlargement of the case, the water flows past them and strikes against the rear sides of the flanges or chutes, and is thrown back against the forward side of the buckets, closing them before they can strike against the said flanges or chutes.

Improved Ventilator Register.

Henry A. Gouge, New York city.—This ventilator register allows the air to enter the ventilating flue in a body, instead of being broken up into small streams, so that it may enter the flue in a compact current. A plate is supported on posts in front of the register, and its distance therefrom may be adjusted as desired. Inside the register is a valve hinged at its lower side and supported by a cord and weight so that it will stay in any position in which it is placed.

Improved Car Step.

José Medina, Cordova, Spain, at present residing in New York city. Office 62 Water street.—Each step is so arranged that by moving a hand lever the conductor can raise it or turn it on hinges so as to cap over the edge of the platform. On the entrance or exit of the passenger, the step is lowered, and the weight of the person, acting on suitable levers, moves spring pawls and through them a ratchet wheel governing a dial above the car door, which registers the fact. In addition to their office of operating the registering apparatus, the steps prevent passengers getting on or off the cars at will, whereby many accidents are avoided. They are also a check on the conductor, since a failure to raise the steps while the car is in motion would be considered equivalent to an attempt to defraud the railroad company.

Improvement in Mounting and Winding Guns.

James L. Avery, Madison Court House, Fla., assignor to Walter E. Avery, same place.—This invention is a spring gun for setting to be discharged by game or by burglars; and it comprises a stand for holding the gun, with a holder and bumper for attaching the gun to the stand. There is a breech piece of a peculiar construction, wherein the lock is mounted, adapted for attaching to the gun and a sliding trigger for causing the gun to fire the gun by its efforts to get the bait. The lock is provided with means for causing it to pull hard or easily.

Improved Vehicle Spring.

Robert Walker, Harrisville, O.—This is an improvement on the carriage spring for which letters patent were granted to same inventor December 9, 1873. The ends of an elliptic spring are connected by yokes around which open oval springs are passed. The latter are kept in place by projections on the yokes, and to one end of each is attached a block for the other end to strike against. There are also curved springs, the centers of which are attached to the centers of the upper and lower parts of the elliptic spring, and the ends of which rest upon the arms of the oval springs. These are slotted to receive bolts, by which they are kept in place laterally, while being allowed to slide longitudinally when the spring is put under pressure.

Improved Furniture Caster.

Cevreda B. Sheldon, New York city.—This invention relates to the construction of the socket for fitting in the furniture leg to receive the spindle of the caster wheel. It consists of the lower part of the socket, particularly the flange or collar which fits against the furniture leg, and having the chamber or channel for the anti-friction balls formed of a disk of sheet metal stamped in the shape required. The upper portion is formed of a plate of metal bent up in a tube and connected to the disk. This socket is to be used instead of the ordinary cast metal sockets, when deeper ones are required than can well be made in one piece of sheet metal by stamping or pressing the flange and the socket in one.

Improved Chair.

William W. Crawford, Delaware, O.—This is constructed in a strong and neat manner, and made more comfortable by giving greater play to the feet. The arms are supported, back of the front legs, by separate supporting pieces connecting the side rounds or stretchers and seat.

Improved Horseshoe.

Luther W. Griswold, Marshalltown, Iowa.—The object of this invention is to so construct horseshoes that they can be readily put on and taken off the horse's hoof without nailing or resorting to the blacksmith; and it consists of a shoe made in two parts, which are fastened together by means of dovetails at the heel and a screw at the toe. By turning down the screw the shoe is securely fastened, and may be tightened at any time by putting a cloth or rubber cushion beneath the foot. By loosening the screw the shoe is readily removed.

Improved Gun Sight.

Samuel W. Johnson, Newton, Mass.—A hollow cavity is made with a file in the bottom in the front face of the sight, surrounding the sight opening, or above or below, or on two opposite sides of it. The end of a match or other phosphorescent compound is revolved in the cavity, with sufficient pressure to scrape off enough of the phosphorus to partially illuminate the sight, so that it can be seen in the dark.

Improved Windmill.

Jacob L. Rust, Millersburg, Ill., assignor to himself and Oliver A. Bridgford, same place.—This invention is provided with a regulating device which begins to operate when the wind strikes the face of the wheel and side vane with such force that the action of the weight on the same is overcome, throwing thereby the wheel back toward the main vane. The greater the power of the wind, the smaller becomes the angle between the wheel and the main vane, till the same assumes at last a position parallel to the wheel. The wheel turns thereby more and more the outer edge of its wings toward the wind, so that its effect on the wheel is not increased, but the speed of the wheel kept up at a regular rate. When the wind diminishes, the weight carries the main vane gradually back in its old position, regulating thus the speed of the wheel in a simple and effective manner.

Improved Car Coupling.

Philip Oswald, Smithsburg, Md.—This invention relates to certain improvements in car couplings, and is a new and improved arrangement that is adapted to the construction of any of the ordinary cars, is simple in design, substantial in its construction, and possesses, in consequence of the same, great durability. It consists of a drawbar having upon its front end an abutment which acts as a buffer and an inclined hook over which a link passes when the coupling is effected, and upon its rear end a downwardly extending lug. Said abutment has behind it a cushion of rubber held between the same and the bumping sill of the car, and the said lug of the drawbar presses against a rubber cushion in front of it, the same being disposed inside a clevis-shaped piece fast in the rear of the bumping sill and securely bolted to the framework of the car upon the sides. Said drawbar has upon each side a flange, upon which rest longitudinal plates attached to the framework, by means of which the drawbar is fastened to the same.

Improved Scissors.

Horace S. Breeden, Barry, Ill.—A double shouldered catch is pivoted in a recess of one blade so that it may readily turn around in a small arc. On the other blade a projection is formed which rests on the shoulders of the catch, on one when the blades are closed and on the other when they are open. In order to hold the catch and projection locked, either when the blades are closed or open, a small spring is attached to the inside of the power arm of the lever blade, and caused to rest against the surface of the catch.

Improved Gate.

William Flynn, Scotland, Mo.—This gate is made in two parts which are connected together and move simultaneously, one to the right and the other to the left. These are provided with truck wheels, on which they move back and forth on the top of a foundation. By suitable devices, on applying power to either part of the gate, the parts will move to either open or close.

Improved Sun Dial.

George Mehr, Philadelphia, Pa.—This invention relates to a novel construction and notation of dial by which the correct time of day may be exhibited by the sun in a position inclined toward and convenient to the passer-by on the streets and thoroughfares of cities and towns, enabling all without difficulty or delay to perceive the solar time.

Improved Car Brake.

John E. Worthman, Mobile, Ala.—This invention has in view to connect all the brakes of a train with a mechanism on the tender or on the truck of any car. It consists in the mode of tripping the spring pawl which locks the brakes, so that the latter will be at once allowed to assume a position out of contact with the wheels. It also consists in a novel mode of automatically ungearing a drum-winding worm wheel or pinion with an endless worm or screw which rotates it, so that the brake lever will be locked at a given point and the brakes operated with a given pressure.

Improved Saw Swage.

Alonso G. House, Jacksonville, Fla.—Through the stock at the bottom of the recess are passed two transverse pins made of steel, one of which is perfectly round. The other pin has one flat side, and is so arranged that the same may be at such an angle with the inclined end of the recess as the inclination or taper of the tooth may require. The point of the saw tooth is placed between the pins, and blows with the hammer upon the stock will cause the pins to form small transverse grooves in the sides of the tooth. The swage is then adjusted to bring the point of the tooth between the inclined side of the flat ended pin and the inclined end of the recess, when one or more blows will bring the point of said tooth to the proper form, obliterating the grooves formed by the pins and finishing the point.

Improved Soda Water Bottle Stopper.

Horace A. Carley, New York city, assignor to himself and Samuel W. Saxton, same place.—This is an elliptical nozzle of a bottle for soda water with a seat at the inner end of the inside for a valve and a stopper of equivalent form, made of light material which will float on the liquid. A self-closing stopper is thus obtained that can readily be put in and taken out of the bottle to facilitate the cleaning.

Improved Means for Propelling Canal Boats.

John R. Parker, Toledo, Ill.—This consists of an elevated toothed guide bar hung over the canal, for carrying a sliding clutch and pawl. It is connected, by a lever rod, with a crank of the driving shaft of an engine placed in a boat, so that the forward part of the crank shaft rotation makes the sliding clutch, while, by the rear part of the crank shaft rotation, together with the action of the pawl, the boat is propelled in a forward direction.

Business and Personal.

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ANSWERS TO CORRESPONDENTS

P. E. McK. will find a recipe for cement for china on p. 346, vol. 24.—H. H. R. can dissolve rubber by the process described on p. 263, vol. 30.—H. E. M. and C. W. will find a recipe for blacking on p. 73, vol. 26.—W. B. M., C. D. A., and others who ask as to books on technical subjects should address the booksellers who advertise in our columns, for catalogues.—M. D. will find directions for tinning brass on p. 60, vol. 29.—W. J. can lacquer brass by following the directions on p. 409, vol. 30.—W. G. B. will find that the calculation of plaster is described on p. 399, vol. 29.—E. H. will find excellent directions for making sidewalks on p. 353, vol. 24.—J. L. B. and others are informed that the tonnage of the Great Eastern is 27,000 tons.—G. W. C.'s question as to firing a moving gun has often been discussed in our columns.—J. W. should consult a manufacturer of turbines.—E. H. S. can polish stones by following the directions on p. 138, vol. 30.—B. F. G. does not state what the trouble is with his engine, and should consult an engineer.—J. W. H. will find on reference that we have frequently given rules for the areas of steam ports, which have been determined by extensive practice.—W. B. will find a description of the process of enameling iron vessels on p. 149, vol. 28.—W. T. H. will find a recipe for ink on p. 106, vol. 27.—L. N. E. will find directions for making a cheap telescope on p. 7, vol. 30.—F. B., who asks as to backing a train up an incline, does not give his name and address.—A. D. will find a recipe for making root beer on p. 138, vol. 31.

(1) W. H. S. asks: Is there any material other than plaster of Paris that will receive the fine lines of shading in electrotypes and retain them, to cast metal in, or is there any way of preparing plaster of Paris so that it will be hard and smooth enough for that purpose? A. We do not think of anything that will answer your purpose as well as plaster of Paris, which is commonly used. Try solution of alum in place of water.

(2) F. W. asks: 1. How can I measure the pitch of a propeller wheel? A. See p. 240, of this issue. 2. What size of wheel is suitable for an engine 12x12, for a tug boat, and what size of boat would be best for such an engine? A. Wheel 4 or 4½ feet in diameter, with a 6 to 7 foot pitch. The boat should be about 20 feet long.

(3) H. C. W. says: I recently saw a luminous fountain, light being reflected through the water. How was it constructed, and does it need the electric light to produce the effect? A. The apparatus is what is known as a vertical lantern, and may be constructed as follows: Into a small metallic box, open at one side, is placed a mirror at an angle of exactly 45°. The mirror should exactly fit the case, slanting from the upper left hand side to the lower right hand side, and facing the open side of the box. Into the top of the box is fitted a plano-convex condensing lens. The lantern is placed in the fountain, and the light from outside is thrown upon the mirror, which reflects it up through the condenser and so illuminates the fountain. It is not necessary to use the electric light, as the lime light will fully answer the purpose; though the illumination will not be quite so brilliant, still it will be much more steady.

(4) J. B. G. asks: How can I make music by rubbing the fingers on the top edges of goblets? Will common glass do it? A. To produce the sounds you describe, select a large goblet, uniform in thickness and as thin as possible. Fill it, say, one third full of pure water. The glass and finger must be perfectly clean and free from grease. Dip the second finger in the water and immediately apply the under surface of the last joint to the upper edge of the glass, moving slowly around or to and fro with a somewhat firm pressure; to keep the finger and glass wet is essential to the success of the experiment. The vibrations produce a continuous monotonous sound, which may be varied by increasing or diminishing the quantity of water in the goblet.

(5) L. B. says: The entrance door of my dwelling is flanked by two cast iron columns 13 feet high and of 1 foot diameter; and finding that my two compasses and my galvanometer were inaccurate, I approached these columns with the compass and immediately the compass turned in such a way that it verified Oersted's law, showing the columns to be north at the base and south at the top. Then I found that the three hinges inside of the door were permanent magnets, and also that the large iron stove in the middle of the room (with the vertical pipes) was a magnet. Would it be possible to use the large magnets for experiments, and would they be strengthened by connecting them with a battery? A. The pillars, standing perpendicular to the earth, become polarized by its inductive influence. Their magnetism, however, is extremely feeble, in comparison with their dimensions. The cases cited are not an exception. We would not recommend the use of a battery in connection with the pillars, for the reason that such pillars (cast iron) when once magnetized could not be readily demagnetized, retaining for a time sufficient residual magnetism to endanger delicate pieces of mechanism (such as watches, etc.) by inductive influence.

I have made a magnet of nine plates of sheet iron 6 inches long and ½ inch broad, bent in the form of a horse shoe. The plates are covered with a thick wire. This magnet has only half the power of a solid magnet. How could I make it more powerful? A. By the passage of the current through the wires, every plate is converted into an individual magnet; and, as in this case, like poles are opposed to each other, the effect, if the plates were exact duplicates, would be nil, or nearly so.

(6) S. J. C. asks: What is your opinion in regard to bone dust and superphosphates for raising fruit, particularly berries, on sandy soil? I have muck and land plaster. Would it be advisable to compost the bone dust with either or both of these articles, or would superphosphate be better? A. If you use muck and land plaster, it would be better to use with them superphosphate instead of bone dust. The muck should be drawn out in the fall and allowed to stand in a heap one winter before using. The proportion of superphosphate used is optional, depending upon the soil, the time of year, etc. A good work to consult is "Agricultural Chemistry," by Johnson.

(7) J. B. T. says: A friend received an eagle that had been winged. The bird at time of reception answered fully the naturalist's description of the gray eagle. The next year, one white feather appeared where black and feathers suite. The white has continued to increase each year, and for several years the bird was an unmistakable American or bald eagle. The time of transformation occupied perhaps eight or nine years, during which I frequently called attention to the subject. Are naturalists not a little at sea in this matter? A. The gray eagle (*Haliaeetus albicollis*) is an inhabitant of Greenland, and (according to Baird) has never been found in any more southern locality on this continent. Your specimen is undoubtedly the bald eagle (*Haliaeetus leucocephalus*) which, when young, has its entire plumage (including head and tail) dark brown; which changes to white as to head, tail, and upper and under coverts.

(8) A. S. D. says: In theory a hundred horse power engine would raise 3,300,000 lbs. of water one foot in a minute of time. Will you be kind enough to inform me what is the best result accomplished in practice with piston engines and pumps, and whether a greater percentage is obtained by rotary engines or not? A. The best results obtained with direct acting steam pumps, at a test made at the American Institute Fair in 1867, was an efficiency of a little more than 52 per cent of the power applied. A test of centrifugal pumps at the same place, in 1872, gave, as the best result, an efficiency of 63½ per cent. The tests of the two kinds of pumps, however, were conducted in such a manner that they are not strictly comparable.

(9) J. H. B. asks: Is there any known preparation that will effectually remove freckles without injury to the skin? A. There are several varieties of freckles. Your best plan would be to consult a physician, who can determine what is the best method and the best lotions to use.

(10) W. J. D. says: On p. 138, vol. 31, I find it asserted by V. A. that a suppositious ball dropped down through a conjectural hole to the earth's center would "oscillate for ever from end to end of a diameter of the earth, provided that frictional or retarding media, such as air, etc., be excluded." A friend, with whom V. A. interchanged speculation, contended that "the ball, on arriving at the earth's center and losing its weight, also loses its momentum, and will come to rest without passing the earth's center." You "incline to V. A.'s opinion." If we suppose the earth to be a hollow sphere, and admit V. A.'s conjecture that the ball's momentum will carry it beyond the earth's center, the ball would be acted on by two forces, namely, its weight, or disposition to return to the earth's center, and its inertia, or tendency to keep on moving from it. Having passed the earth's center, a point might be reached where the two forces are equal, and the result then would be the rotation of the ball about its axis and its revolution around the earth's center; in other words, the law of the centrifugal and centripetal forces, which keeps the planets in their appointed orbits, would operate on the ball. We know that the tendency of the earth to fall toward the sun is counteracted by its rotation, which is the tendency to fly from the sun. Is it not analogous to suppose that the disposition of the ball to fly from the earth's center, checked by the inclination to return to it, would practically operate to produce rotation and revolution? A. The velocity acquired by the body in falling to the center of the earth, under the supposed conditions, would be just sufficient to carry it through to the other side, overcoming the attraction towards the center. When it reached the other side, it would come to rest, and then the attraction would cause it to return to the center. This is not an analogous case to that of the motions of the planets in their orbits.

(11) F. D. X. asks: In a cellar under a house there is a well about 16 feet deep, situated about 4 feet from the corner of the house. I want to conduct the water from the well to back part of house, to a pump. Pump is about 40 feet from well. How can it be done? A. Use a good house pump, with pipe suitable for its connections, and be careful to make all the joints of the suction pipe tight, and lay it with as few bends as possible.

(12) W. C. asks: Is the forward eccentric of a locomotive placed in an opposite position to that in which the back eccentric is placed? A. No. Is the cylinder of a Baxter engine placed within the smoke box or within the boiler? A. In the boiler. Can I enter a machine shop as a machinist after two or three years' study at Cornell University? A. Probably you would have to accept a subordinate position at first.

(13) C. H. M. asks: What composition is used in metallic cartridges, to make them take fire when struck? A. A mixture of equal parts by weight black sulphuret of antimony and chlorate of potassa is used for the purpose of discharging ordnance by means of a percussion tube placed in the touch hole of the gun. For this purpose also a mixture of amorphous phosphorus and chlorate of potassa is used. The needle gun cartridge contains a mixture of chlorate of potassa and black sulphuret of antimony, or a compound containing fulminate of mercury. The following is a good preparation: 16 parts of chlorate of potassa, 8 black sulphuret of antimony, 4 flowers of sulphur, 1 charcoal powder, are moistened with either gum or sugar water and about 3 drops nitric acid are added. In this country either the above or a mixture of chlorate of potassa and amorphous phosphorus are used.

(14) G. M. says: 1. In looking over the sizes of the Birmingham wire gage, I find that there is no common difference between the various numbers of that gage. How were these different sizes obtained originally? Were they just fixed on by haphazard, or is there a formula given, by which, if any one size be known, any or all the other sizes may be obtained? A. The gages appear to have been fixed at random, as you suggest, and the extensive use of the English gage in this country is no doubt due to its earlier introduction. 2. Would it not be better to have a wire gage with a common difference between the numbers, say the 100th part of an inch, or some such number that any ordinary mechanic could comprehend? With the gages now in use, there are few men who know exactly what any number on the gage corresponds to on the foot rule. A. There would be many advantages from the use of a regular system, such as you mention. One such plan is already adopted by many of the manufacturers in this country, who use vernier callipers, and measure their work by inches and decimals, frequently working to thousandths of an inch.

(15) N. L. asks: Which runs with the least power, a large or a small journal of equal length? Does the friction double if the size of the bearing is increased to twice the diameter? Two of us have a little dispute; one claims that if the size of the journal is increased, the friction is also increased; the other says this is not so, and quotes your article (extracted from the National Car Builder) on p. 258, vol. 30, being a test of car axles, one having ¾ inches bearing, the other bearing being 3½. The one with the largest bearing took the least power to propel. A. If the pressure on the two bearings is the same, and is not excessive in either case, and both are equally well lubricated and run at the same speed, the work of friction of the larger journal will be twice that of the other. In the experiment referred to, it is not improbable that, with the larger journal, the lubrication was so much more complete that the coefficient of friction was much less than in the case of the ¾ journal.

(16) A. B. W. asks: How can asthma be relieved or cured? A. Consult the best regular physician in your vicinity. There is nothing in the treatment of asthma that is not known to the entire profession.

(17) E. C. B. says: It was lately stated, in a daily paper, that a goblet, perfectly sound in appearance, full of water, was placed on a table about two feet under a gas burner, by a girl who came in to light the gas. With one hand still resting on the goblet, she turned the stopcock with the other, allowing the gas to escape for an instant. Then, touching the match, the gas flashed, and the goblet instantly flew to pieces. Can such an accident be possible? A. The tale bears evidence of being more wondrous than true.

(18) F. W. M. asks: In bringing water from a spring where the descent will be gradual for the entire distance, would anything be gained by starting from the spring and running a few rods with a larger pipe than would be used in the remainder of the distance? Would any more water come through a half inch pipe if the first few rods were ¾ inch pipe, than would come through if the entire course were only ¾ inch? A. There would be a slightly increased delivery by the adoption of the larger pipe; but it would probably be very slight.

(19) F. S. C. asks: Is water compressible at 35° Fahr.? A. Slightly.

Are there any jigsaws which move the board being sawn, automatically, to cut out the patterns? A. No.

Are there any engines with more than two cylinders? A. Yes.

Of what is tobacco composed? A. Some of its constituents are: Nicotine, nicotineine, resin, albumen, gluten, gum, nitrates, salts of potassium, woody fiber, water, and ashes.

What is the size of the largest engine in the world? A. Cylinder about 108 inches by 14 feet stroke.

(20) S. H. R. says: I have some old gold, taken off a cane head; and inside, the gold is covered with soft solder. What will take it off? A. Hold it over a hot gas or alcohol flame, sufficient to melt the soft solder but not to affect the gold. When the solder is about melted, give the head of the cane a quick jerk, when the solder will all drop out.

(21) T. O. Z. asks: Is the gas from a gasoline machine more unhealthy to burn than city or coal gas? A. It would be necessary to have the gases analyzed, and see which contained the greatest amount of combustible matter, before this question could be answered.

(22) F. E. says: In your patent law book it is stated: "When the air is exhausted from a pump tub (usually done by means of a piston), the pressure the atmosphere will cause the water to rise in the tube to a height of 30 feet." 1. Would another arrangement, something like a blacksmith's bellows, fixed on the top of the tube, withdraw the air out of the tube and consequently raise the water? If so, what should be the size of the bellows in proportion to the tube? A. Yes. Proportion of bellows to pipe should be about the same as that of a common pump. 2. What force (given in pounds) would be required to withdraw the air out of the tube in this way, in proportion to the weight of water thus raised? A. The work would be the same as that required to lift the weight of water in the pipe to the required height. 3. Does the water rise as quickly as the air is exhausted? A. Yes. 4. Would there be any difference in regard to the size of the pump tubes? A. It would take longer, with the same apparatus, to exhaust the larger of two tubes.

(23) B. says: I have a cloth awning which has been in use two years. This summer, small black spots began to appear on it and holes appeared in the center of each one, making the awning look as if a lot of scattering shot had been put through it. The spots seem to be caused by a rotting of the cloth, which breaks away easily. How can I stop it? A. If not too late to save it, try the plan of soaking it in strong brine.

(24) U. H. says: I want to make a collection of insects. How must I prepare them? Must the box I put them in be airtight? A. The necessary information required by you can be obtained by consulting "Packer's Guide to the Study of Insects," or J. G. Wood's "Insects at Home."

(25) E. H. M. says: Spirits, such as Holland gin and Scotch Irish whiskey, if allowed to remain in the original cask for 4 or 12 months, become tinged or colored from the wood, which deteriorates the market value, perfectly white being the desirable hue. What, if anything, will remove the objectionable color without deteriorating its value? A. The color is an amber tint obtained from the cask, which we were not before aware affected the value of the spirits. The astringent properties are also increased by the same means, but we know of no method to make the liquor colorless, except re-distillation.

(26) M. F. M. asks: Is there any instrument wherein the magnetic needle is replaced by other means, equally effective and not subject to local attraction? A. No.

(27) J. J. S. asks: Can I use a portable engine, of a small size, for heating a store room 30 feet square by steam, and also run the engine for half an hour per day? A. The boiler of a portable engine is not usually very efficient, except with the forced draft due to the blast. A boiler made especially for heating purposes would probably answer better. Subscriptions to the SCIENTIFIC AMERICAN are received every day in the year.

(28) I. T. H. asks: Will the United States government register foreign built iron or woodenships? Are there any lines of ships (trading to England) built in England, owned in America by Americans, and registered in America? A. No foreign built vessel can be registered in the United States. There are some steamship lines that are largely owned in this country, but the vessels sail under a foreign flag.

(29) J. asks: How can I build an ice house to hold eight tons of ice? A. Erect a building above ground 17 feet square on the exterior; make an interior compartment in the center of the same 5 feet square on the inside thereof; make both the interior and exterior walls 12 inches thick, by setting up 2 by 10 inch studs, about 2 feet apart in the interior walls and 3 feet apart in those of the exterior, and then cover the exterior and interior of each wall with one inch boards with tight joints, if tongued and grooved so much the better. The outside frame will require a foundation 3 feet deep in the ground; therefore excavate the interior and make the floor of the ice house say 2½ feet below the surface of the ground. Make the height on the interior 8 feet in the clear above said floor, and construct a strong level ceiling of boards secured to proper cross bearers. Then fill in the two frames with dry saw dust between the interior and exterior boarding, and lay similar filling upon the ceiling boards to a height of 12 inches. Pave the floor with cement concrete graded lowest at the center, and provide a good drain to carry off the water. Put a high pitched ordinary roof over the ceiling, and provide a tube from ceiling to exterior of roof for ventilation of interior of ice room. Make exterior and interior doors in these walls, lined with canvas and filled with sawdust. Fill the interior chamber with the ice, laid upon a few rails to keep it from the bottom, packing close in very cold weather, and throw water upon it occasionally to freeze it together. You will then have a cube of ice of 7 feet, which will contain something more than 8 tons, and which will have the protection of a 3 feet air chamber or passage all around it. This 3 feet chamber will be your cold closet, in which you can preserve your meats etc., in summer, care being taken to have the door to it opened as little as possible. This also answers E. S.

(30) J. A. H. asks: What will save clothing from moths better than gum camphor or cedar wood? A. There is nothing better.

What will remove (without injury to the skin) the small worms or black heads in a person's face? A. The treatment requires the employment of such means as are calculated to stimulate the skin gently, and excite it to the due performance of its proper functions. The parts affected should be saturated with soap and thoroughly washed; they should then be rubbed briskly with a rough towel, until the skin is felt to glow, and this should be repeated twice in the day. The immediate effect of this treatment may possibly be a red and patchy state of the skin, which will speedily pass away. It would be well also to extend the ablutions and frictions to the entire body, for the appearance of the disease in one part is indicative of a generally torpid action of the skin. Cold bathing and sea bathing are beneficial. In severe cases, bichloride of mercury in an emulsion of bitter almonds has been used.—Wilson "On Skin Diseases."

(31) A. L. D. asks: Is chronic nasal catarrh curable? A. Sometimes it is cured. Consult Niemeyer's "Practical Medicine," vol. 1, pp. 286-287.

(32) A. P. asks: How can I look at the sun with a common spy glass without hurting the eye? A. Place a disk of dark or smoked glass between two paper rings inside the eyepiece cap.

(33) C. A. S. asks: What kind of machine shop should I go into in order to become a master mechanic? Ought I to go to college first? A. Go to the one that does the greatest variety of work. Very few master mechanics, we imagine, have been through college.

(34) V. A. asks: Is the moon's orbit round the earth in the same plane as the orbit of the earth round the sun; and if not, what is its greatest divergence, expressed in degrees? A. The moon's orbit is inclined to the ecliptic 5° 9' 46". 2. I have heard it asserted that the moon shines with great brilliancy during the arctic winters, but fall to account for it otherwise than by a departure of at least twenty degrees in the lunar orbit from the plane of that of the earth. A. The moon's greatest distance is 238,263 miles, least 221,495, mean 228,855. The polar winter alternates with a fortnight of moonlight and a fortnight of darkness for six months.

(35) J. C. H. asks: What is the best non-conductor for filling the walls of a refrigerator? A. Air, probably.

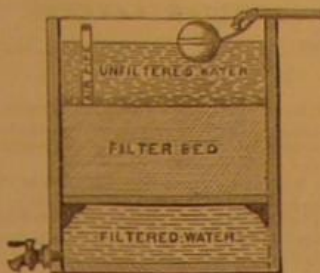
(36) E. L. M. asks: How is spermaceti purified? A. This substance occurs mixed with oil, filling large cavities in the head of the sperm whale. The oil is removed by pressure, and finally by washing in a dilute solution of potassa, and the spermaceti is obtained as a white solid, which fuses at 130° and crystallizes on cooling, in beautiful, broad, pearly plates.

(37) J. M. asks: What do actual and nominal horse power of a steam engine mean? A. Nominal horse power is calculated from assumed conditions, generally very different from the real conditions, upon which the actual horse power depends.

(38) A. B. C. asks: Is there a book that gives instructions on casting toys, figures, etc., in plaster of Paris? A. We do not know of any such work.

What is Parian marble? A. Parian marble is an unglazed statuary porcelain, similar to English porcelain, but more difficultly fusible, containing less flux and more silica. The color is a very slight yellow; the surface is waxy.

(39) G. T. O. says: I ask your opinion in regard to the construction of a water filter, and would like to know the best possible form. I want one that will hold about 5 gallons. What shall I put in it, and how shall I place it? A. The engraving represents a very good filtering apparatus, manufactured in England.



land; you can have one like this made of any desirable size. The best material for the box would be soapstone; the next best material, iron. Mott's cast iron tank plates come of a convenient size—15x18 inches and 9x12 inches—these may be galvanized or coated with slate paint. But Passaic water cannot be purified by filtering alone; the following (which we wrote in 1866 in answer to a correspondent in reference to the water supplied to Philadelphia) will also apply in this case: "If our correspondent is willing to take the trouble, he may obtain pure water by distilling, filtering, and aerating. Get a simple still to set on a cooking stove, and distill all the water intended for drinking, then filter it through freshly burned charcoal to remove the volatile odors that come over, and finally agitate it in the atmosphere so that it may reabsorb its supply of air to make it sparkling and palatable. A simpler process for obtaining pure water is to melt ice. This process is employed by some of the most eminent physicians in this city for their own families, to avoid the danger of lead poison from their water pipes."

(40) J. S. B. asks: Can nitric acid of a specific gravity of 1.34 be made, and would it be anything short of anhydrous nitric acid? Books of reference place the specific gravity, obtained by evaporating the acid to its greatest density, at 1.521. A. To our knowledge there is no nitric acid of so high a specific gravity used either in the arts or the laboratory.

(41) B. A. S. says: I wish to make a telescope of four joints. How long should each joint be, and what sized lens shall I put in, to see at the distance of 15 or 17 miles? What kind of material should it be made of? My object lens will be about 2½ inches. A. You will need a foot lathe with traversing mandrel in order to chase screw threads properly in thin brass tubes. See previous answers to correspondents for construction of eyepieces.

(42) A. D. C. B. says: 1. A friend of mine says that whisky can be made without being distilled? Is this so? A. Yes. 2. Is it more unwholesome than the other sorts? A. No. All are equally deleterious.

(43) D. McD. says: I send you a plan for the multiplication of the effects of two or more air-pumps, founded on the theory that if an air pump that will exhaust a receiver to 1-100 of the density of common air be placed under a receiver, already similarly exhausted, the smaller receiver will equal 1-10,000 the density of the common air. A. We do not see that any advantage is obtained by this multiplicity of pumps.

(44) S. says: A segmental brick arched bridge of 37 feet span by 8½ feet rise is about to be erected over a creek at Poughkeepsie, N. Y. It crosses the same at an angle of 52° 10', making the distance on the skew about 94 feet. Do you know of any brick or stone bridges placed at or near the above angle to be built in horizontal courses or as you would build a rectangular bridge? Is it possible to build one in horizontal courses at that angle with any certainty of the arch sustaining itself for an indefinite period? A. We do not know of any skew bridges built in horizontal courses, nor is it desirable to so build them, as such construction is unscientific and without guaranty of permanence. Edward Dobson, C. E., in his "Treatise on Masonry and Stone Cutting," published by Weale, has exemplified fully the nature of the twist required in such arches. A brick arch, when oblique, as you require, would be best built by laying the courses at right angles to the sides of the centering, depending upon the latter entirely for the shape of the soffit; the strains would then be properly received upon the abutments, and the bridge would be secure.

(45) J. P. & Co. ask: What cement will do to fill a corn burr? A. Try a mixture of dust from powdered French burr stone, alum, and water. Back up the stone with plaster of Paris. Your cheapest plan, however, may be to send the stone to a manufacturer to be repaired.

(46) A. R. asks: Will coal tar applied to fence posts before setting render them much more durable? A. Yes. It will render them insect and damp proof. It should be laid on hot.

(47) L. M. says: I have a hop vine which climbs around the pole from east to west; and near by are pole beans which turn from west to east. What is the cause of the difference? A. It is a principle of plant life for plants to wind themselves upon the first means of support, the manner of which is dependent upon no known law.

Is there anything that I can use to get coal marks off my face? A. We know of no preparation especially adapted for that purpose.

What do the terms "specific gravity" and "equivalent" mean? A. Look in Webster's "Dictionary."

(48) A. F. C. says: I have a 3 inch achromatic object glass of 48 inches focus, and am desirous of constructing a celestial eyepiece of as high a power as it will stand for use in a telescope. How must I arrange it? A. Rule for Huyghenian eyepiece of any power: Divide the focal length of object glass by the power required. Quotient doubled = focus of field lens. One third of focus of field lens = focus of eye lens. The two lenses are separated two thirds the focus of field lens. Both should be plano-convex, with curved side toward objective. Eye lens should be about half the diameter of field lens. A diaphragm is placed at the focus of the eye lens. Your previous enquiry was answered on August 1.

(49) H. B. C. asks: What food gives the most nutriment to the brain? A. No one material can be considered best; that sitting at one time may not be at another. That food is best for the brain which is best for the body, producing *mens sana in corpore sano*.

If heavy cannonading causes rainfall, what is the operation of it? A. It has been proved an absurdity. Is the expression "the cold is too great for snow" true or not? A. The expression is not true, some of the heaviest snowstorms in this latitude having taken place in the very coldest weather.

(50) W. G. L. says: We are building a press; the crank shaft is 4 inches in diameter, with crank in the middle of it of 4 inches throw. Our foreman says the key seat for the driving wheel or pinion on the shaft should be upon the same side of the shaft with the crank, as it would give advantage of leverage and less stress upon the key. I think it makes no difference. Who is right? A. It makes no difference where the key is. The key seat, however, is generally cut in such position as is most convenient to chuck the shaft to cut the key seat.

(51) J. J. S. asks: What book would you recommend for the use of a machinist, possessing an ordinary common school education? I wish to study the use of steam, especially applied to marine engines. A. Get Bourne's "Catechism" and "Recent Improvements of the Steam Engine," and Wilson's "Treatise on Boilers."

(52) G. B. Q. says: I append the principal dimensions of two pairs of compound surface condensing engines, which I will call No. 1 and No. 2. Engine No. 1 is rightly proportioned, and engine No. 2 is to be built in the same proportions, with a reduction of 3 inches in diameter of high pressure cylinder, and a reduction of 6 inches in low pressure cylinder, and of 4 inches in the stroke; but it is to carry higher steam. Should all the parts of No. 2 be reduced in proportion as the cylinders are reduced, and do you consider the surface condenser for No. 2 sufficient in proportion to No. 1, the steam being condensed on outside of tubes in condenser of No. 1, and on inside of tubes in condenser of No. 2? No. 1 has the advantage of sea water at a much lower temperature, while No. 2 has river water for condenser, the difference being about 8° higher in the river.

	Engine No. 1.	Engine No. 2.
Diam. of high pressure cylinder...	33 inches	30 inches
Diam. of low pressure cylinder...	66 "	60 "
Length of stroke...	36 "	32 "
Revolutions...	56	60½
Tubes in surface condenser...	3,200	1,500
Length of each tube in surface condenser...	5 ft. 6 in.	7 ft.
Diameter of tubes outside ½ inch, inside ¾ inch.		
Pressure of steam per square inch...	60 lbs.	50 lbs.
Steam cut-off at...	25 inches	25 inches
A. From simple examination, we should say that the proportions of No. 2 condenser are rather small, if No. 1 is just right. We think, however, that the proportions of No. 1 engine could be improved. Of course, if you think of building an engine of this size, you should entrust the design to a competent engineer.		

(53) W. S. asks: What will best cement glass, so as to stand blood heat? A. Try diamond cement.

(54) H. C. N. F. and F. G. H. call attention to an error in our answer No. 26, p. 202, current volume. The speed of the boat down stream should of course be 16 miles per hour.

(55) C. I. asks: Why is not the power of air utilized? Is it not preferable to steam, cheaper, and safer? A. Air engines of any considerable power, as at present constructed, are very bulky. Why is not electricity used as a motor? A. It is too expensive to compete with steam, on a large scale.

What has become of the one rail project for railroads? A. The inventor is, by last advice, trying to introduce this system in the South.

(56) A. F. L. W. asks: 1. How can I tell a high from a low pressure engine? A. As these terms are ordinarily used, a low pressure engine has a condenser, and a high pressure engine exhausts into the air. 2. How can I tell the horse power of any engine? A. It can only be ascertained with perfect accuracy by means of experiments. We have frequently given rules for its approximate determination.

(57) C. F. T. asks: How hot can water be heated? A. When the barometer indicates 30 inches, boiling point of water is 212° Fah. But as the pressure decreases, the boiling point of water is proportionately lower, and vice versa.

Which will freeze in the shortest time, hot or cold water, when both have been boiled? A. Cold water.

(58) W. L. asks: A friend and I had a dispute on the cause of the different seasons. He says that they are caused by an eccentric motion of the earth, and I claim that they are caused by the axis of the earth being inclined 23½° out of perpendicular. Who is right? A. You are right.

(59) E. B. W. asks: Into how many orders are the various curves divided, and upon what principle is the division made? Do the conic sections constitute a distinct order? What curves belong to each of the various orders? A. You will find this matter discussed in any good text book of analytical geometry. It would occupy too much space, and is too strictly mathematical to justify its consideration in these columns.

(60) R. O. B. asks: Who saved the Great Eastern during her first outward voyage? A. Mr. Hamilton E. Towle recovered a claim against the company for his exertions on the occasion of the disaster to the Great Eastern.

What is the best work on geometrical drawings? Is Rehm's book a good one? A. Professor Warren's and Minifie's books are good.

Can one of ordinary ability acquire sufficient knowledge of drawing in 6 months to be able to enter a drafting room? A. Yes, in an humble position at first.

Is there a rule by which a person can find the radius when the arc and chord are given? A. We know of none.

(61) A. R. asks: What machinery is needed to propel a boat by electro-magnetic action? A. There is no such machinery in the market. If you write to a maker of philosophical apparatus, or advertise, you may possibly be able to have a machine constructed.

(62) J. P. P. asks: Where can I get drawings of engines, low and high pressure and compound, with the details in full? A. N. P. Bergh's work on the marine engine, with appendix on compound engines, gives details of many English engines. Weissenborn's works give details of American engines, condensing and non-condensing, but not of compound engines.

(63) J. S. P. asks: What is the best mode or manner of improving the acoustics of public buildings, checking the echoes, etc.? Are wires the best remedy? If so, of what size, and how far apart should they be, in a room 20x50 feet, with a ceiling 19 feet overhead. There are 21 feet of rising seats and no pulpit; the speaker stands upon the floor. The sound of his voice echoes and reverberates to that extent that it is extremely difficult to understand a word he says. What is the scientific remedy? A. Try the wires on the vertical wall opposite the speaker; place them to run horizontally 6 inches out from the wall and 6 inches apart. If this does not sufficiently break the force of the echo, place a similar series in the two side walls extending from the back of the church where the speaker stands to the center of the depth of the building. Your ceiling is entirely too low for so large a room.

(64) W. C. says: I have a cistern in which the water smells so badly that it is impossible to wash with it or to use it in any way. My house is surrounded by water maple and horse chestnut trees. The cistern has lately been thoroughly cleaned, and has also had a bushel of charcoal put into it. A flat stone has usually covered the mouth of it, making it airtight to a certain extent; I have had the stone removed entirely, but still the water is unfit for use. Can you give me any remedy for the trouble? A. Are you sure that there is no drain that runs near it or leaks into it, or a defective cover or crown that admits of the drainage of surface water into it? Are your roofs clean and covered with the usual material? Is there an overflow pipe, and may not surface water enter by some break and obstruction in that? These points you ought to be sure of; because, if you have a clean, tight cistern properly ventilated, you ought to have good water.

(65) J. A. C. asks: In a steam hammer, what would be the diameter and stroke of cylinder, and the weight of hammer on end of piston rod, for ordinary ship work? Could I elevate the hammer by a spring pole, and use steam on top only? A. Cylinder 4 inches diameter and 12 inches stroke. Weight of hammer, 250 lbs. It would be best to raise the hammer by steam.

(66) C. W. McC.—Try a weak solution of ammonia.

(67) P. F. D. asks: How is the dull black, used for optical instruments, made? A. Dissolve a drachm bichloride of platinum in one ounce of water and add a grain nitrate of silver. Clean, polish, and warm the brass. Apply the solution with cotton wool rubbing until dry.

(68) G. W. C. says: I would like to ask H. L. M. how he could straighten a rifle barrel from the outside if the bore was not in the center? Rifle barrels are usually welded up from a flat bar with a small hole in the center, or as near the center as can be but never exactly in it. After a barrel is forged, bored, and polished, it is straightened from the inside (not outside) then a circle is struck on each end, and it is finished from those circles from end to end. Before a barrel is straightened the bore has many short crooks, some not over 3 inches long, and perhaps some less. Those crooks cannot be taken out with the wooden blocks and vise that H. L. M. tells I. G. N. to use. A rifle barrel, to shoot correctly, must be perfect for a foot at the muzzle, but it is not so important for the balance of the way. It is not absolutely necessary to have a shot gun barrel perfectly straight to make a good shooter. There is more difficulty to make a good shot gun than a good rifle. The best of gunsmiths cannot make a good shot gun every time, and they cannot tell what the trouble is.

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

A. K.—No mineral has been received under this name.—C. L.—Only one parasite was found in the box. By use of the microscope, it was found to resemble a common red scale bug, devoid of legs; but whether these were wanting naturally or were broken off, we cannot say. No description could be found to agree with it, and possibly it is unknown. The contents of the box were in a very poor condition when received. When Kansas and the adjacent States and Territories become as thickly settled as the Eastern States, there will be no more danger of locusts there than here.—W. A. S.—The plant or vine sent by you is the climbing wild hemp (*Mikania scandens*), very common in the middle portion of the Southern States. We know of no law or rule for the direction of the spiral of a climbing plant.

N. S. asks: How can I put solder up in small bars, the size of a knitting needle, without molds?—A. D. asks: How can I make soda water?—O. C. H. says: I have a lot of shingles, with sap that turns blue black, and green after a little exposure to the weather. How can I prevent this?—F. S. asks: How can I make black ink powder?

COMMUNICATIONS RECEIVED.

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

- On Aniline Black. By M. B. C. G.
- On the Texan Stinging Lizard. By T. L. W.
- On Type Setting Machines. By —
- On the Recent Rifle Match. By —
- On a Nut for Mr. Darwin. By J. B. H.
- On Cross Cut Saws. By A. H. I.

Also enquiries and answers from the following:

J. W.—F. L. Y.—W. S.—J. S. H.—R. L.—H. H.—C. B. A.—C. D. Q.

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 the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells the Leeds heater? Where is the cheapest and best shop to get small metallic articles manufactured? Who buys gold, silver, or copper coins? Who publishes books on tanning? Where can artesian well machinery be obtained? Where can I purchase a good horse power well drill? All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

September 15, 1874.

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

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Vehicle running gear, D. Gibbons	125,022
Vehicle wheel, W. C. Johnson	125,092
Vehicles, neck yoke for, L. Biddle	125,064
Vessels, plating for, J. McLaughlin	124,955
Watch regulator, F. Keeping	125,081
Watch, stem-winding, McNaughton et al.	125,097
Watches, lever escapement for, W. G. Schoof	125,044
Water wheel, turbine, J. E. Safford	125,012
Water wheels, preventing freezing, H. S. Atkins	125,041
Weather strip, W. D. Knox	125,094
Well, petroleum, E. M. Stevenson	125,119
Wheelbarrow, J. G. Harrison	125,084
Window screen frame clasp, J. W. D. and H. Kelley	124,963
Wire cables, machine for cleaning, R. Cotter	125,012
Wood-planing machine, A. Davis	124,947
Yoke, neck, W. A. Lloyd	125,033

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:

30,910.—PAPER FOLDER.—C. Chambers, Jr. Dec. 2.

30,953.—CUTTING BUTTON HOLES.—F. C. Leopold. Dec. 2.

30,923.—TOBACCO CUTTER.—W. H. Pease. Dec. 2.

30,981.—SPINNING FRAME CYLINDER.—R. P. Lewis. Dec. 2.

30,945.—VEGETABLE PARCHMENT.—X. Kachet. Dec. 2.

30,993.—WOOD PLANING MACHINE.—H. D. Stever. Dec. 2.

EXTENSION GRANTED

30,976.—WOOD SAW FRAME.—W. H. Livingston.

DISCLAIMER.

30,976.—WOOD SAW FRAME.—W. H. Livingston.

DESIGNS PATENTED.

7,735.—ORNAMENTING GLASS.—W. Beck, Pittsburgh, Pa.

7,756.—CAR WHEEL.—A. Miles, Copake Iron Works, N.Y.

7,757.—BURIAL CASE.—G. M. Biehart, Allegheny, Pa.

7,758.—TABLE GLASS.—L. Stoehr, Pittsburgh, Pa.

7,759.—SPOON HANDLES.—G. W. Hull, Wallingford, Conn.

7,760.—HARNES ROCKETTE.—F. Reynolds et al., Newark, N.J.

7,761.—GROCER'S CAN.—C. C. Warren, Toledo, O.

7,762.—OMNIBUS.—A. Wright, St. Louis, Mo.

TRADE MARKS REGISTERED.

1,978.—CATAREN REMEDY.—N. S. Coon, San Francisco, Cal.

1,979.—CANNED FRUIT.—G. M. Howell, Trenton, N.J.

1,980.—SUGAR.—Matthiessen & Wieders Refining Co., Jersey City, N. J.

1,981 & 1,982.—BREAST PUMPS.—O. H. Needham, N.Y. city.

1,983.—GLOVES.—Wibel et al., New York city.

1,984.—ARRATED BREVETAGE.—J. H. Champlin, Laconia, N.H.

1,985.—INSECT POWDER.—H. S. Danziger, New York city.

1,987.—TIMBER.—H. A. Frink, Baltimore, Md.

1,987.—CIGARS.—J. W. McCarthy, Independence, Iowa.

1,988.—BOOTS, ETC.—Phelps & Co., Cincinnati, O.

1,989.—STEAM INJECTOR.—Hoe Manf. Co., Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each caveat	\$10
On each Trade Mark	\$25
On filing each application for a Patent (17 years)	\$15
On issuing each original Patent	\$20
On appeal to Examiners-in-Chief	\$10
On appeal to Commissioner of Patents	\$20
On application for Reissue	\$30
On application for Extension of Patent	\$50
On granting the Extension	\$50
On filing a Disclaimer	\$10
On an application for Design (3 1/2 years)	\$10
On application for Design (7 years)	\$15
On application for Design (14 years)	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
SEPTEMBER 21 to 25, 1874.

3,820.—W. G. Enteklin, Philadelphia, Philadelphia county, Pa., U. S. Improvements in machine for burnishing photographs, called "Machine for Burnishing Photographs." Sept. 21, 1874.
3,821.—J. T. Waring, Tonkara, Westchester county, N. Y., U. S. Improvement in the treatment of felted, woven, and spun fabrics, called "Waring's Improved Treatment of Felted, Woven, and Spun Fabrics." Sept. 21, 1874.
3,822.—J. H. L. Wilson, Sherbrooke, P. Q. Improvements on crib attachments to bedsteads, called "Wilson's Crib Attachment for Bedsteads." Sept. 21, 1874.
3,823.—D. Dodge, Keeseville, Essex county, N. Y., U. S. Improvements on machine for cold-finish horse shoe and other nails, called "Dodge's Cold-Finish Horse Nail Machine." Sept. 21, 1874.
3,824.—W. A. Springer, Marlborough, Middlesex county, Mass., U. S. Improvements on trimming or cutting attachments for sewing machines, called "Springer's Trimming or Cutting Attachments for Sewing Machines." Sept. 21, 1874.
3,825.—W. H. Bowers, Franklin, Simpson county, Ky., U. S. Improvements on apparatus for propelling street cars by compressed air, called "Bowers' Apparatus for Propelling Street Cars." Sept. 21, 1874.
3,826.—J. L. Clark and J. Stanfield, 5 Westminster Chambers, Victoria street, Westminster, Eng. Improvements on floating docks and pontoons, called "Clark & Stanfield's Improved Floating Dock." Sept. 21, 1874.
3,827.—T. F. Ford, Brooklyn, Kings county, N. Y., U. S. Improvements on ships' berths, called "Ford's Self-Balanced Berth." Sept. 21, 1874.
3,828.—M. L. Barclay, township of Williamsburgh, Dundas county, Ont. Improvements on washing machines, called "Barclay's Washer." Sept. 21, 1874.
3,829.—J. R. Whittemore, Chicopee, Hampden county, Mass., U. S. Improvements on horse hay rake, called "Whittemore's Horse Hay Rake." Sept. 21, 1874.
3,830.—D. Rousseau and W. C. Smith, New York city, U. S. Improvement on electric signals and signal lamp locks, called "Rousseau's Improved Electric Railway Signal." Sept. 21, 1874.
3,831.—J. Lawrence, Palermo, Halton county, Ont. Improvement in reaping and mowing machines, called "Lawrence's Improved Shoe for Reapers and Mowers." Sept. 21, 1874.
3,832.—W. C. Stone, Almonte, Lanark county, Ont. Improvements on brush dusters, called "Stone's Duster." Sept. 21, 1874.
3,833.—E. F. Walker, Sherbrooke, P. Q. Improvements on gridirons, called "Walker's Dominion Double Gridiron." Sept. 21, 1874.
3,834.—O. W. Taft, New York city, U. S. Improvements on steels for sharpening knives, called "Taft's Steel for Sharpening Knives." Sept. 21, 1874.
3,835.—W. Foulis, Glasgow, Lanark county, Scotland. Improvements on machinery for charging retorts, called Foulis' "Retort Charging Apparatus." Sept. 21, 1874.
3,836.—G. S. Walker, Erie, Erie county, Pa., U. S. Improvements on washing machines, called "Walker's Washing Machine." Sept. 21, 1874.
3,837.—C. C. Gregory, Fredericton, New Brunswick, Improvements on exhaust regulators, called "Gregory's Exhaust Regulator." Sept. 21, 1874.
3,838.—J. N. Lander, Concord, N. H., U. S., assignee of T. M. Farrington, same place. Mechanism for raising and revolving the driving wheels of a locomotive steam engine, called "Farrington's Locomotive Eccentric and Valve Adjuster." Sept. 21, 1874.
3,839.—H. G. McMicken, Winnipeg, Mass., U. S. Improvements on a machine for breaking ice, called "McMicken's Improved Ice Pick." Sept. 21, 1874.
3,840.—C. H. Farley, Portland, Cumberland county, Me., U. S. Improvements on locomotive fire boxes, called "Farley's Locomotive Fire Box." Sept. 21, 1874.
3,841.—S. Hoyt, Magog, Stanstead county, P. Q., assignee of S. Rexford, same place. Improvements on stage-logs, called "Rexford's Improved Staging." Sept. 21, 1874.
3,842.—J. Inglis, Montreal, Montreal District, P. Q. Improvements on weighing scales, called "The Compensating Compound Beam Scale." Sept. 21, 1874.
3,843.—H. Pryor, Woodstock, Oxford county, Ont. Improvements in milk cans, called "Pryor's Improved Milk Can." Sept. 21, 1874.
3,844.—M. A. Goldstone, Toronto, Ont., assignee of T. Mepharm, same place. A compound or composition of matter for cleansing or purging boilers from the coating or scale which collects on the inside thereof, called "The Britannia Scale Purgative." Sept. 21, 1874.
3,845.—J. E. Lander, New Bedford, Bristol county, Mass., U. S. Improvement in flower pots, called "Improvements in Flower Pots." Sept. 21, 1874.
3,846.—C. C. Wolcott and W. W. Wood, Washington, D. C., U. S. Improvements on generating and applying motive power, called "Wolcott's Motive Power." Sept. 21, 1874.
3,847.—G. J. Baker, Oakville, Halton county, Ont. "Baker's Dominion Carriage Hub Iron." (Extension of No. 16.) Sept. 21, 1874.
3,848.—O. T. Shafer, London, Middlesex county, Ont. Improvements on land rollers, called "Shafer's Improved Land Roller." Sept. 21, 1874.
3,849.—G. Scott, Montreal, P. Q. Improvements on a clothes line pulley and fastener, called "Scott's Clothes Line Lock Pulley." Sept. 21, 1874.
3,850.—J. P. MacLean, Brooklyn, Kings county, N. Y., U. S. Improvements on clasps for uniting the fronts of corsets, corselets, or stays, called "MacLean's Improved Corset Clasp." Sept. 21, 1874.
3,851.—D. Lockhead, Hochelaga, Hochelaga county, P. Q. Improvements on mowing machines, reaping machines, and combined mowing and reaping machines, called "Lockhead's Combined Mowing and Reaping Machine." Sept. 21, 1874.
3,852.—T. Haynes, Kansas, Jackson county, Mo., U. S. Improvement on lubricators for railway car and other axles and journals of shafts, called "Thomas Haynes' Lubricating Oil Box." Sept. 21, 1874.

3,853.—J. L. Sprague, Hermann township, St. Lawrence county, N. Y., U. S. Improvements on chains, called "Sprague's Chains." Sept. 25, 1874.
3,854.—H. Wellington, New York city, U. S. Improvements in hydrocarbon burners, called "Wellington's Coronet Burner." Sept. 25, 1874.
3,855.—J. Currie, St. Thomas, Elgin county, Ont. Improvements on gang plows, called "Currie's Improved Wooden Frame Gang Plow." Sept. 25, 1874.
3,856.—H. Jetter, Milwaukee, Elgin county, Ont. "Carter's Improved Drilling Machine." (Extension of No. 9.) Sept. 25, 1874.
3,857.—E. Lavigne, Quebec, P. Q. "Une balance indépendante." (A swing. Extension of No. 21.) Sept. 25, 1874.
3,858.—A. Kenedy, East Zorra, Oxford county, Ont. "Kenedy's Flexible Roller." (Extension of No. 26.) Sept. 25, 1874.
3,859.—B. F. Ulmer, Savannah, Chatham county, Ga., U. S. Improvements on a medical compound, called "Dr. Ulmer's Liver Corrector or Vegetable Aperient." Sept. 25, 1874.
3,860.—I. Gordon, St. Catharines, Lincoln county, Ont. Improvements in a machine for grading and separating wheat, called "Gordon's Combined Wheat Grading and Separating Machine." Sept. 25, 1874.
3,861.—G. Smith, Clinton township, Lincoln county, Ont. Improvements on a machine for driving circular saws or cutting boxes, called "Smith's Adjustable Jack." Sept. 25, 1874.
3,862.—C. Shultz, Preston, Waterloo county, Ont. Improvements in wheels for carriages, called "Shultz's Improved Wheel." Sept. 25, 1874.
3,863.—G. H. Shephard, La Crosse, La Crosse county, Wis., U. S. Improvements in machine for bundling laths, called "Shephard's Lath Bundling Machine." Sept. 25, 1874.
3,864.—P. Huff, East Gwillimburg, York county, Ont. Improvements on a machine for restraining breechy cattle, called "Huff's Improved Poke." Sept. 25, 1874.
3,865.—J. Parker, Toronto, York county, Ont. Machine for heating and applying wax to thread, called "Parker's Improved Wax Thread Heater." Sept. 25, 1874.
3,866.—W. P. Tenny, Boston, Suffolk county, Mass. Improvements on disinfectant packages and receptacles for containing disinfecting powder and other powdered and granulated substances, called "Tenny's Disinfectant Package." Sept. 25, 1874.
3,867.—J. M. Gustin, Wilmington, Clinton county, O., U. S. Improvements on combined walking and sulky plows, called "Gustin's Combined Sulky and Walking Plow." Sept. 25, 1874.

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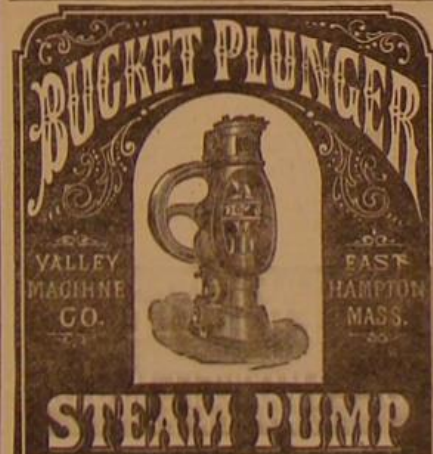
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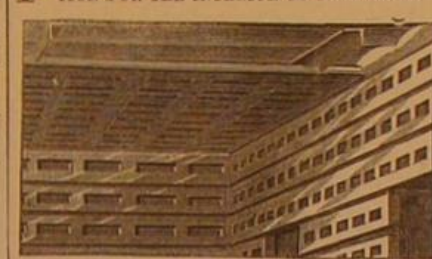
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