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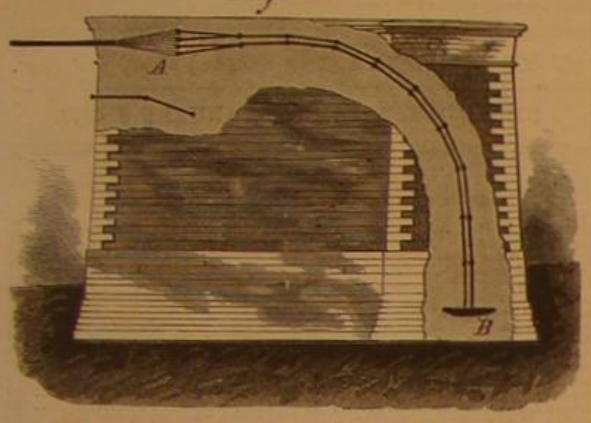
THE NEW YORK ANCHORAGE OF THE EAST RIVER BRIDGE.

Located in New York city, and on the block bounded by Cherry, Dover, Roosevelt, and Water streets, a huge pile of massive masonry, during the past summer, has been rapidly reared. Work upon the structure has been arrested for lack of money and by the setting in of winter, principally from the former cause; and until the opening of spring, it will remain in its present condition. Early summer will, however, find it finished, if New York city responds in furnishing the money for its share of the cost; and the day on which its final stone is laid will mark the completion of the last of the four great monuments which are destined to sustain the wire network of the suspension bridge which will join the metropolis and its sister city, Brooklyn.

Fig. 2

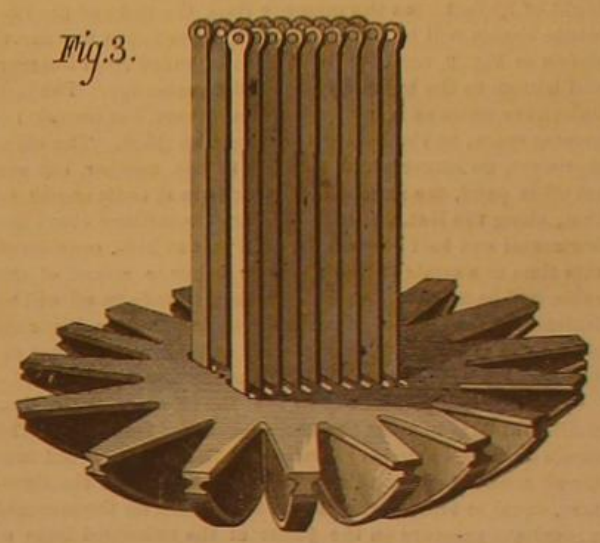


The building of the immense piers, which stand sentinels on the two banks of the East river, has been energetically pushed forward during the year just closed. The tower on the Brooklyn side is entirely finished, save the few cap stones, which cannot be added until after the cables are in place; the summit of the New York pier has reached a hight of two hundred and eight feet, leaving thirty feet yet to be erected. The anchorage across the East river, in Brooklyn, is practically finished. The New York anchorage is the great structure to which we refer in our initial paragraph, and which is represented in completed state in the largest of the engravings given herewith

The reader, even if not versed in engineering technicalities, will, without doubt, understand the object and uses of these colossal heaps of stone termed anchorages, from the name alone. Upon them falls the greatest pulling strain of the weight of the enormous wire structure and the traveling weight it is to sustain, since the piers, though withstanding of course a portion of the load, serve primarily to elevate the bridge to the proper hight above the river. Hence the object sought in the construction of the anchorages is extreme solidity and strength, sufficient in fact to enable them to undergo a stress six times greater than that to which, by any chance, they can possibly be subjected. The two structures, located necessarily at each extremity of the bridge, are practically alike, the difference being slight variations in dimensions to suit their respective sites. The New York anchorage is, however, situated in the heart of the business portion of the city, and without doubt will attract a greater share of public attention. For this and other reasons, the following article is devoted to its description.

On the 7th of May, 1875, the pulling down of the warehouses and old rookeries, which covered the ground on which the masonry now stands, began. So rapidly was the work prosecuted that three months later found an excavation, in some places twenty-one feet deep, finished, and 500,000 lineal feet of yellow pine timber foundation in place. This substratum of wood consisted of four layers, placed relatively crosswise, and interspersed with concrete, the whole measuring four feet in thickness. On this was laid the first course of stone, which covered an area 129 feet long by 116 feet 4 inches in width. The material used is a good quality of limestone, obtained from along the Hudson river, parts of New Jersey, and the vicinity of Lake Champlain. As soon as two courses had been set, preparations were made for placing the anchor plates. Of these there are four, each an enormous mass of cast iron weighing twenty-three tuns and made in spider shape, having sixteen radial arms, as shown in Fig. 3. The contract requirements as to the metal were that it should bear a strain of 500 lbs. to the square inch, on a test portion resting on bearings 4½ feet apart. Each plate was cast in a single piece, at Wilmington, Del. To transport such a heavy mass from the pier to the anchorage was a difficult operation, but it was accomplished by suspending the plate by strong bolts from beams of pine extending between two platform cars which traversed tracks laid in the streets. The usual jack screws supplied the lifting power.

Fig. 3.



From the longitudinal section, Fig. 2, the position of the plates, one of which is shown at B, will be understood. All are located in the rear of the anchorage, two meeting on the center longitudinal line, and one being disposed at each side. Each plate is embedded in concrete in the third course of stone, the second course being somewhat thinner immediately beneath, so as to form a species of socket. Through the apertures left in the center of the plates, the first set of bars for the chains is placed. Each chain consists of ten sets of links, and two chains lead from each plate. The corresponding links of each pair of chains contain together about nineteen bars. This will be better understood by reference to Fig.

THE NEW YORK ANCHORAGE OF THE EAST RIVER BRIDGE.

8, in which one row of vertical bars make the first link of one of the pair of chains, and the other row of similar vertical bars the other. Each bar at each end has a perforated circular head. The apertures in these heads, when the bars are in place, are in a straight line, so that pins may be put through said holes and also through the openings on the heads of the bars of the next link, when the latter are placed in suitable position, thus connecting the two links and forming a joint. Similarly pins are run through the apertures of the heads, which, in the lowest link, come below the anchor plates, and thus confine the chain to the latter. The heaviest pin used, as above mentioned, measures 7 inches in diameter, and the bars which constitute the links are 18½ feet in length, and vary in area of cross section from from 27 to 21 square inches, according to position The iron of which they are made has a breaking strength of 50,000 lbs. per square inch.

After the bars which form the first links were in place, the laying of the masonry was continued, and four courses of blocks of granite were built up above the plates, each stone weighing about ten tuns. Then the limestone work was resumed, and this, with appropriate granite trimmings, will be continued through the forty courses, and to a total hight of 89 feet. As the masonry rises, the links of the immense chains will be added, and the latter led in the curve shown in Fig. 2, until they will have extended from the rear and bottom to the top and front of the anchorage. The last links have twice as many bars as the others, but occupy no greater space, as the bars are only half as thick. The bars, moreover, no longer stand parallel to one another, but are set off in pairs, the members of which are at acute angles, so that, along the last pin, half the bars are inclined above the horizontal and half below. To each pair of bars, considered this time in a straight line above or below, a strand of the cable will be attached, so that nineteen strands in all will be fastened to the ends of two chains leading from each anchor plate: and as there are four plates, so there will be four cables, which will convey the strain to the masonry.

A glance at Fig. 2 will show that the effect of the cables, pulling at A, is to upset the anchorage on its front edge. The strain on each cable is estimated at 1,833 tuns, or 7,332 tuns for all four. Against this is the dead weight of the structure, equal to 44,000 tuns. There is, besides, on the masonry a resultant pressure on the joints of the imbedded links of 2,267 tuns; and to meet the pressure at each of these knuckles, a heavy plate of iron is interposed, backed with a large granite block. The strain on each anchor plate is 1,352 tuns.

The general aspect of the structure is excellently shown in the large engraving. It decreases in size toward the top, the area of the summit being 85 feet 3 inches in width by 117 feet in length, and the surface slopes to the rear at the rate of 3 feet in 100. Through the interior of the pile are two arched passages, in front 61½ feet high and 23 feet wide, in rear 22 feet 7½ inches high by 14 feet wide, the difference in size being due to the upward slope of the surface of the ground to the rear. At the present time the structure is 44½ feet above tide, or 35 feet above Water street.

As soon as the New York anchorage is finished, the large unobstructed area of its summit, as well as that of its companion structure in Brooklyn, will be occupied by the machinery for spinning the wire cables, which will be one of the most interesting mechanical features of the whole enterprise. The first cord will probably be thrown across the river sometime next June, and from that time forward the building of the wire portion of the bridge will, it is expected, be vigorously prosecuted.

A NEW USE FOR THE EAST RIVER BRIDGE.

It is a well known fact that, owing to the rapid increase in size and population of the city of New York, the water supply is insufficient to meet all demands. The daily consumption is on an average something over 100 000,000 gallons, a much larger quantity in proportion to the population than is the case with either Paris or London. There is no question but that at the source, the valley of the Croton, into which the watersheds of Putnam county and vicinity direct their streams, there is an abundance of water. The difficulty is found in the aqueduct, which is a brick tube 53 34 square feet in area of cross section, and which is called upon to supply pipes aggregating 57 feet. The friction of the fluid in the smaller tubes and the approximate cessation of drafts on the reservoirs between midnight and morning alone prevent absolute deficiency in the ten days' supply which the Croton Bureau is obliged to keep constantly on hand. The new aqueduct, of which, we understand, the preliminary surveys are begun, will without doubt cure the difficulty; but in the meanwhile a large part of the built-up portion of New York, including the exclusively business section, suffers severely from a lack of water for fire purposes.

How to provide for this want is just at present a mooted question; and among the various plans proposed is one by Mr. A. W. Craven, ex-chief engineer of the Croton Aqueduct, which consists in constructing large storage reservoirs in the lower part of the city and keeping them filled with sea water by powerful pumping engines. The principal objections urged against this project are its expense and the fact that the reservoirs themselves might not be wholly free from danger in case of an extensive conflagration in their vicinity. It seems to us, however, that both of these objections might in a measure be obviated by using as the tanks two enormous ones which are now built and lying empty, and of which no one, so far as we are aware, has hitherto suggested any means of utilization. We mean the hollow towers of the New York pier of the Brooklyn bridge. This immense structure contains within it two watertight cavities 120 feet in depth, or rather in hight above the ground, and 13 by 19 feet in cross section. An approximate calculation of the contents gives about half a million gallons to each; or in both together, over one million gallons of sea water might be stored. It is not assumed, of course, that the supply from these could or would be utilized for up-town districts, and there supply is not so much needed; but it would, in case of a conflagration, offer a valuable addition to the present deficient water facilities down-town, among the warehouses and shipping of the city. Similarly the interior of the Brooklyn pier would offer a reservoir for water for protecting the valuable storehouses and shipping in its vicinity. The hight of the head is fully 60 feet above the tallest buildings, excepting, of course, the very lofty structures recently built by the Western Union Telegraph Company and the *Tribune*, and a few other fireproof structures, and therefore the water could be led under a heavy pressure directly to any story.

ELECTRICITY AS AN EXECUTIONER.

The revolting scenes accompanying the execution of several criminals in this vicinity are well calculated to bring to public notice the disadvantages of hanging as a a mode of capital punishment.

The teachings of Science are heeded and sought for in the building of prisons, in the management and care of convicts, and in every modern correctional system; and yet in so simple and easy a process as the extinguishing of human life, they are utterly ignored.

The most certain and painless death known to Science is caused by the lightning stroke, or by, what amounts to the same thing, the electric shock. When a powerful discharge of electricity is received in the body, existence simply stops, and the reason is obvious. Helmholtz has proved that, for any vibration which results in sensation to reach the brain through the nerves, one tenth of a second of time is required. Furthermore, time is also needed for the molecules of the brain to arrange themselves through the effect of that vibration, through the motions and positions necessary to the completion of consciousness, and for this an additional period of one tenth of a second is expended. Consequently, if, for example, we prick our finger with a pin, it takes two tenths of a second for us to feel and recognize the hurt. It can easily be conceived, therefore, that if an injury is inflicted which instantly unfits the nerves to transmit the motion which results in sensation, or if the animating power is suddenly suspended by an injury to the brain before the latter completes consciousness, then death inevitably follows with no intervention of sensibility whatever.

Now a rifle bullet, which traverses the brain in the one thousandth of a second, manifestly must cause this instant stoppage of existence, and proof of this is found in the placid faces of the dead, and in the fact that there is nothing more common than to find men lying dead on battle fields, shot through the brain, but with every member stiffened in the exact position it was in when the bullet did its work. But a rifle ball is slow beside the electric shock. Persistence of vision impresses a lightning flash on the retina for one sixth of a second, but its actual duration is barely one one-hundred thousandth of a second.

The effect of the shock on the system is excellently described by Professor Tyndall, who, while lecturing before a large audience, inadvertently touched the wire leading from 15 charged Leyden jars, and received the whole discharge through his body. Luckily the shock was not powerful enough to be fatal; but as the lecturer regained his senses, he experienced the astonishing sensation of all his members being separate and gradually fastening themselves together. He says, however, that "life was blotted out for a sensible interval," and he dwells with much stress upon the opinion that "there cannot be a doubt that, to a person struck by lightning, the passage from life to death occurs without consciousness being in the least degree implicated. It is an abrupt stoppage of sensation, unaccompanied by a pang." So much for the death which, by suitable alteration of the law, we would have substituted for slow strangulation. The next point is its practical accomplishment.

Instead of building a gallows and providing rope, the sheriff, advised by a competent electrician, would procure a powerful Ruhmkorff coil and a heavy battery. These instruments would rarely need replacing, and would last indefinitely for other executions. The battery and coil should be of sufficient strength to deliver an eighteen inch spark. In case of their being more than one person to be executed, all of the condemned would be conducted with all due ceremony to the place of execution, the left hand of one man handcuffed to the right hand of his neighbor, and the conducting wire fastened to bracelets on the disengaged wrists of both criminals, if only two are to be hanged, or to the wrists of the outer men, if more than that number are to suffer. The culprits being seated so as to be seen by the legal witnesses, the sheriff presses a button. The current is instantly established from the coil, passes through the bodies of the men, and all is over. With a competent electrician, who might be a member of the police force, and specially charged with the duty, there would be no possibility of mistakes. The same ignominy which attaches to the gallows would be transferred to this mode of destruction, while the peculiar death by lightning, which, among the ignorant of all nations and ages, has been the subject of profound superstition, would without doubt, through its very incomprehensibility and mystery, imbue the uneducated masses with a deeper horror.

J. F. H. says: "I have six volumes of the SCIENTIFIC AMERICAN, in which I can find nearly everything that is known as to engines and machinery."

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NEW YORK, SATURDAY, JANUARY 8, 1876.

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 2.

For the Week ending January 8, 1876.

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IS INSURANCE A BENEFIT?

It is difficult to conceive of a more horrible tragedy than that perpetrated by the author of the recent dynamite explosion on the wharf of the steamer Mosel at Bremerhaven; but the scores of people there killed and wounded would form but a small proportion of the total number of victims had the fearful design been carried out as it was planned. The object was to gain a heavy insurance which had been effected by the projector of the scheme on the vessel; the means, a powerful explosive in connection with mechanism, the study and invention of which shows the deliberate nature of the crime. There was a train of clockwork which could be set to run noiselessly for ten days; then a lever weighing thirty pounds would crash into a box of dynamite. The fearful explosion which prematurely happened on the wharf would have taken place in the hold of the vessel in mid-ocean, and not a soul on board would have survived to tell the tale. The man, Thompson, who conceived this diabolical crime, has cheated justice by committing suicide, but it is said that he has denounced his accomplices, and for these the rigid German law will show little mercy.

Amid the universal execration which this atrocity has called forth, little attention has been given to the incentive, perhaps for the reason that it is one for which crimes have over and over again been committed. Sooner or later, we think, however, it must become a question of serious consideration whether the present system of insurance, against loss or casualty in any form, does not, as a temptation to the depraved as well as a cause of negligence by all, outweigh its advantages to the community in general.

Mr. Plimsoll's recent keen denunciation, in Parliament, of some British shipowners, for their inhuman cruelty in sending men to sea in old and unseaworthy vessels, covered this among other points. Ship after ship has left English docks, loaded almost to the water's edge, and built of green or rotten timber, which, when the vessel worked in a rough sea, must have opened at every seam. Ship after ship has never been heard from after leaving port. The owners cared nothing, for they risked nothing: if the vessel made the voyage in safety, they pocketed their profits from her cargo; if she sank, they pocketed their profits all the same from the insurance companies. Morally, if not legally, it cannot be contended that these merchants are not as criminal as the wretch who has just killed himself. More criminal, we think, for they, for the most part, are wealthy and educated gentlemen, the other an ignorant vagabond. They, in other matters at least, possess refined moral sensibilities; he was apparently destitute of any such quality; and yet the incentive to crime in both cases was identical, and the object, the insurance money, brings all to a common level.

A few weeks ago the Deutschland, a steamer of the same line as that on which the explosion took place, was totally wrecked on an English sand bank. As usual there was a lack of life-saving apparatus, and scores of people were drowned. We say as usual, because the same has been the case with the Ville du Havre, the Atlantic, and the Metis, and in other marine casualties of late years. Why are not efficient means of safety provided, when the same, in almost endless variety, are in existence? It is no injustice to impute to the companies, who thus fail in their plain duty, the influence of the insurance money again. Why should they, they may ask, protect their ships, why encourage inventors to devise or test new appliances for that purpose, when the loss of the vessel does not carry with it any loss to the company's treasury? By similar reasoning, of what use are protections against fire to a building which the owner knows he has insured just a little above value, no matter if it is a crowded tenement? Of what use are safeguards on steam generators? And why not employ patched and leaky boiler sheets so long as the boat or building is insured?

No one knows better than do the insurance companies of the repeated arsons, and attempts at arson, that are committed in order to realize the insurance money on buildings. The records of almost any criminal court will show a startling prevalence of these crimes, which even the life imprisonment penalty, affixed thereto by the laws of some of the States, does not seem materially to check. On being notified of a loss, the policy of an insurance company is not to seek proof that it was the result of fraud, but apparently to assume that fact as true, and to throw the *onus* of proving to the contrary on the loser. This is a natural enough course, and the legitimate consequence of the frequency with which the companies have been victimized; but it goes to strengthen what we have said above. Again, we have a fire marshal in this city, charged with the express duty of tracing the origin of every fire, and armed with all the powers of the law to help him. His official existence is simply an official recognition of the prevalence of incendiarism; and the records of his office likewise will show that that crime, which in malignity is by the law deemed next to wilful murder, is rarely committed save with the object of realizing insurance. Its very prevalence compels people to insure, for a fire is not always confined to the single building in which it originates; and in burning his own structure, the criminal equally endangers that of his neighbor, and the latter must protect himself against such peril.

Argue the question as we may, the insurance system is defective, begetting either carelessness or crime. The struggle for wealth is too close and too bitter to expect mankind to guard against what seems to be, and what is, to his selfish self, an already guarded contingency, when an expenditure of money is involved thereby. If it may be predicated of the best of us that, Nero like, we will fiddle when our property goes to destruction through our carelessness, knowing that we lose as little as did the heathen Emperor, then it may equally be assumed that those not possessing our moral restraints will as coolly set designedly in motion the same course of events.

To advocate the abolition of all insurance would be, we are well aware, to strike at great interests; but it does not seem impossible that in the main the community would thereby be the gainers. "An ounce of prevention," says the old saw, "is worth a pound of cure." Query: Would not the extreme care that we should take of our property, and indeed of all our interests (involving, as many do, the well being of other people) more than compensate for the loss of the very often doubtfully gained "pound of cure" for misfortunes thereto, which the insurance system offers?

MR. EDISON'S ELECTRIC DISCOVERY.

On the evening of Thursday, December 16, Mr. Edison brought his discovery, of what he supposes to be a new force, before the Polytechnic Club of the American Institute. Dr. Beard gave a very lucid account of the phenomena, observed by himself as well as by Mr. Edison; and he pointed out in what particulars the new spark is similar to some forms of electricity and in what it appears to differ from the various known forms of that force. Like a true scientist, he pointed out that only such phenomena as every competent experimenter is able to verify at any time are worth consideration; and he spoke of the sources of illusion and delusion which misled Reichenbach, and afterwards others who asserted that they had verified his alleged discovery of the so-called odic force.

Some writers who gave the first reports of Mr. Edison's discoveries to the daily papers, with more enthusiasm than discernment or knowledge, said that, in their opinions, there was identity between Mr. Edison's discovery with the so-called results of Reichenbach's experiments. But the difference is that in the first case we have a reality, and the experiments have results which any one can see and verify; while in the other case we have alleged results which nobody can see but the mediums, so that all belief in the reality of Reichenbach's phenomena rests exclusively on outside testimony.

Dr. Beard also pointed out a feature to which we referred in an article in our issue of December 25, namely, the dissimilarity of the experiments of Reiss, with what he calls weak sparks, and Mr. Edison's discovery. They differ in origin as well as nature. Reiss' experiments were made with static electricity, while Mr. Edison obtains his results from the contact breakers of electromagnets. Dr. Reiss' weak sparks have polarity, while those of Mr. Edison show none, and in that respect the latter differ from all other known forms of electricity: at least neither Dr. Beard nor Mr. Edison have been able to discover any trace of polarity, but, as this is only a negative proof, and we do not know what future investigations may reveal, it is as yet premature to give a decided opinion.

After considering Dr. Beard's elaborate and masterly exposition of the phenomena thus far observed, and seeing the experiments which Mr. Edison kindly exhibited before the members of the Polytechnic Club, with his apparatus of three vibratory sounders, charged by six chromic acid battery cells, we see no reason to change the opinions we have already expressed: That, after all, the phenomena may be due to a peculiar form of induction. They prove that the inductive power of a coil, when charged or discharged by a sufficiently strong voltaic battery, extends all around to a distance of one or more inches, and can not only induce currents in other coils, but also in straight wires or, better, in metallic bars, kept within the range of this influence, which influence may be called an inducing atmosphere surrounding the coils. Dr. Beard also appears inclined to the view that the phenomena are due to electricity; while Mr. Edison differs from him on this point, and is strongly inclined to consider the phenomena to be due to a new force, as distinct from electricity as light or heat is. Mr. Edison would rather prefer to consider it as a new form of heat or light than of electricity, and gives, as his principal reason for this view, the absence of polarity, which absence exclusively belongs to heat and light, while electricity without polarity is (to use one of Herbert Spencer's expressions) unthinkable. We fully agree with him in this respect; and according to Mr. Edison's invitation, we will assist him in a new course of experiments, laying the results before our readers at an early opportunity.

MECHANICAL DRAWING.

The following is from the introductory chapter of "LESSONS IN MECHANICAL DRAWING," by Professor C. W. MacCord, given in SUPPLEMENT No. 1:

There is probably no other acquirement which so perfectly combines pleasure with profit as skill in drawing. Even regarding it as an accomplishment only—a source of pleasure and nothing else—this is of so refined a nature, and so elevating in its tendencies, that no better recreation can be suggested; and leisure time could hardly be put to a more commendable use than the cultivation and exercise of this art.

The ability to make drawings, of any kind or in any manner, is an unfailing source of delight and honest pride to its possessor; but a feature of greater importance and more widely extended interest is its great and varied usefulness: he who can draw correctly, even if roughly, wields a language clearer, more direct, and more nearly universal than any expressed by words. And it is useful to every one, without exception—of whatever age, of whatever position in the social scale, of whatever occupation; there is not a single individual of either sex who would not be, both directly and indirectly, the gainer by an acquaintance with this graphic tongue, which is here considered in its most comprehensive sense.

Naturally, mechanical drawing is of the most varied and extensive utility in pursuits of a mechanical nature; in these it becomes not merely an aid, but a necessity, to the greatest proficiency: not only to the professional draftsman in the office, who makes it his sole occupation, but to the molder in the foundery, the pattern maker at his bench, the blacksmith at the forge, and the fitter and finisher at vise or lathe. All these, in order to execute designs intelligently, must be at least able to read drawings, and would be, surely, none the worse workmen if able to make them also; so, too, of the carpenter, the stonemason, and the brick layer: while the boiler maker, in laying out his plates, the tinsmith, the coppersmith, or the worker in sheet iron, cannot call himself master of his craft unless he has some acquaintance with the art of mechanical drawing.

And yet there are thousands engaged in these very pursuits, journeymen and apprentices, conscious of this, but still making no effort to acquire the knowledge which would be so useful to them; and this in spite of the fact that they waste in frivolous amusements, if nothing worse, time enough, if properly used, to become quite skillful with the pencil and the pen. In some cases this may be due to sheer laziness, or dislike to study; to these we have nothing to say, except that they must not be astonished if they find themselves surpassed by their more energetic comrades. But to the great majority, we are sure, this does not apply; and to them we shall try to render some assistance. Leisure time at evening may be pleasantly and profitably employed in the practice of drawing and the study of its principles, by young and old alike; for this is one of the things which it is never too late to learn, and we are disposed to think that many would make this use of spare hours if they knew just how to set about it. Besides the lack of instructions suited to their circumstances, we believe that two other considerations deter a great number from making a beginning one is a false: impression that a fine and costly outfit of instruments is necessary at the outset; the other, a consciousness that mathematical principles are involved, which are beyond the limits of their education. Now, it is certainly possible to spend a great deal of money in the purchase of instruments—in fact, the professional draftsman who wishes to execute all kinds of work with facility has need of a variety; but the appliances absolutely essential to the execution of even the most elaborate mechanical drawings are in reality few and simple, and one who is not familiar with the subject would be astonished to see what can be done with very few and inexpensive things.

And no one should permit himself to be frightened off by the second consideration. We do not deny that a knowledge of geometry would be of use, great use; but we do say that any one sufficiently intelligent to be a good apprentice at any mechanical trade can, if he will but resolutely try, so school his eyes and his hands that he can produce drawings which will be both creditable and useful to him. A child learns music, not by waiting until he understands the principles of acoustics and of harmony, but by the practice and continued repetition of exercises which train his fingers, and he is master of the mechanical difficulties before he knows what acoustics means. And so any one may begin mechanical drawing, as he began writing, in a mechanical way: "I dot my *i* because I was taught so, sir; which is the very reason why I make *o* round." By the exercise of a little faith he may at least follow the lead of another; and, once interested in his own progress, it will be strange if, by the exercise of a little common sense, he does not gradually gain an insight into the principles which underlie the practice.

Now, great progress may be made in the study of principles and methods, and much valuable practice had, without any instruments at all, by any one who has something to mark on, something to mark with, and the will to put this and that together. But free hand sketching, though of itself a valuable acquisition, and one by no means to be neglected by any draftsman, is not what is usually understood by mechanical drawing, in which, not relying on the unaided eye and hand, the measurements are made by scale, and the lines by rule and compass. Consequently, in order that the hints which we have to give in regard to such drawing may be of the greatest use to the greatest number, we shall begin with a description of the simplest, yet perhaps the most useful, of the instruments which the draftsman uses.

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Our many friends will be gratified to know that the issue of our SUPPLEMENT, on the 1st instant, was attended with the most gratifying success. We printed a very large first edition, but it was exhausted almost before the last sheets were folded. We were obliged to print a second edition immediately, which is now going through the press.

For the present we are electrotyping all the pages of the SUPPLEMENT, and can therefore meet any demand for the numbers, however large.

We will take this occasion to repeat the invitation given last week to Engineers, which extends as well to those engaged in other branches of Science and the Arts, namely: that the publication of the SUPPLEMENT supplies us with a greatly increased amount of space, devoted to the information and benefit of our readers. We shall be pleased to receive copies of working drawings and specifications of new mechanical or engineering works of specially interesting or notable character, which, when possible, we shall engrave and publish in the SUPPLEMENT; also papers and drawings upon other scientific subjects. Papers so sent to us will be preserved, and returned to the authors when desired, due credit being given on publication.

The "LESSONS IN MECHANICAL DRAWING," begun in No 1 of the SUPPLEMENT, will be continued from time to time, and will afford, to all who desire to acquire this important art the most varied exercises and the most careful instructions.

THE KNOWLES STEAM PUMPS.

During the closing days of the Industrial Exposition recently held in Pittsburgh, Pa., a very interesting competitive trial was made of the various steam pumps exhibited. The tests were of a purely practical nature, no facilities being afforded for scientific determinations; but the results are, nevertheless, valuable to engineers, as showing quite clearly the relative efficiency of the machines under conditions of actual use. The details of one of the last competitions, between the victor in the previous contests and the other dumps below named as entered, sum up, in general terms, the result reached. The Knowles pump had already proved its superiority as a fire pump, and had also come off best as against the Blake, Niagara, and Hutchinson machines, in the latter trial being tested at slow running, at working against a pressure of 60 lbs., at regular working speed (piston speed 160 feet per minute) against the same pressure and also being subjected to critical comparative examination by well known experts as regards advantages of construction, facility of repairs, and similar points. The decisive contest below mentioned was the result of a claim for the premium by the exhibitors of a machine constructed on the pulsometer principle, on the alleged ground that the latter was a direct-acting steam pump and would throw more water with the same amount of fuel than any other apparatus. The conditions of the trial were to throw a stream through a three quarter inch nozzle, to a given hight, and hold it at the same point for three quarters of an hour. The start was to be made with two gages of water and 100 lbs. of steam pressure. The Knowles pump was selected by the judges as the competitor under this challenge, but subsequently exhibitors of other pumps were allowed to enter their machines in the same trial. We are informed by Messrs. Bailey, Farrell & Co., of Pittsburgh, who exhibited the Knowles pump, that the results were as follows: The pulsometer consumed 103 lbs. of coal, and failed at times during the test to keep the stream up to the required hight. The Knowles pump consumed 52¼ lbs. of coal, and kept the stream above the given point during the entire test. The other pumps also maintained the streams, but used greater quantities of coal than the Knowles, as follows: The Cooper (fly wheel) pump, 63 lbs.; the Niagara, 72 lbs.; the Blake, 62 lbs.; and the Hutchinson, 60¼ lbs.: the Knowles, therefore, winning the contest.

We have obtained from Mr. Knowles the following information relative to some of the best and newest forms of pump, engravings of which are given herewith. Fig. 1 represents the No. 3 pump complete, with boiler. This machine is adapted to general purposes, especially for supplying buildings and railway tanks with water. It is of very simple construction, and includes an improvement in swing-ing bolts, and a removable hand attachment, as represented in Fig. 2. The last mentioned device is useful for filling boilers when steam is down, washing decks, and for similar purposes. It is easily removed and applied.

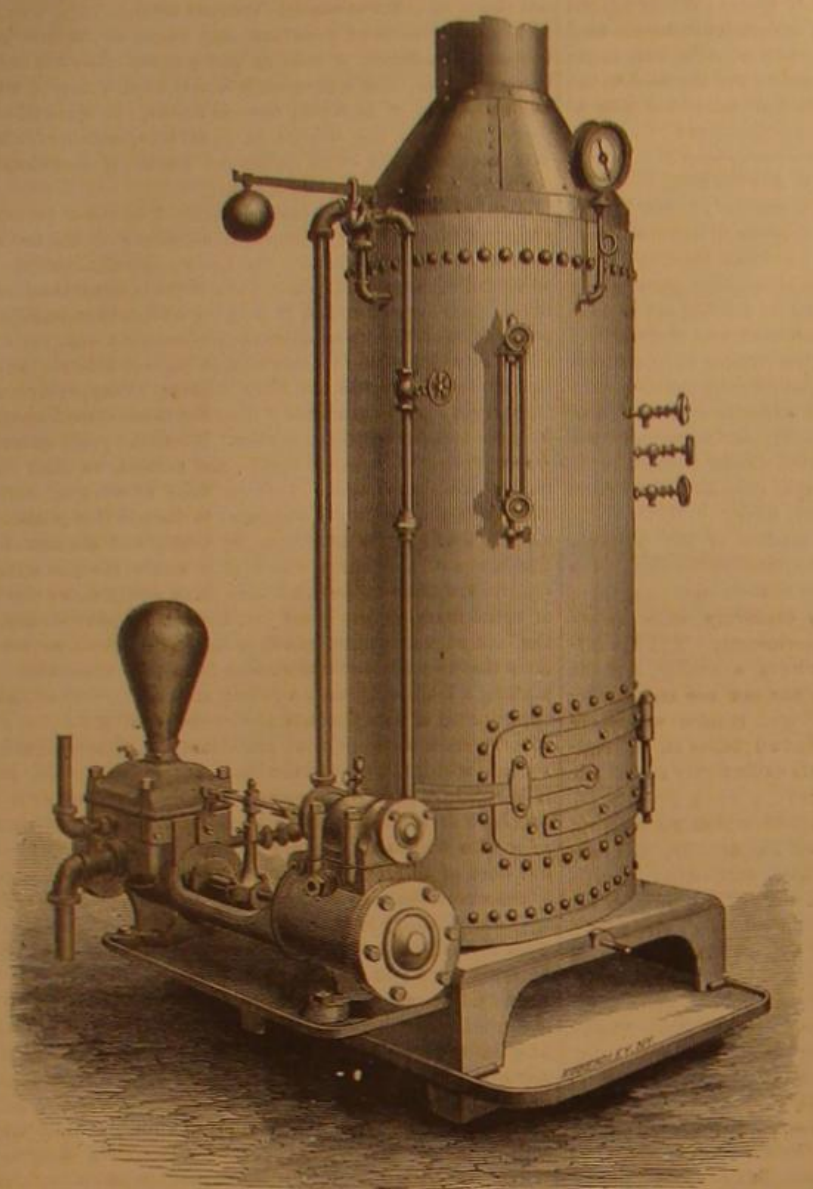


Fig. 1.—STEAM PUMP WITH BOILER.

Fig. 3 represents the pump arranged as an independent stationary steam fire engine. The capacity is only limited by the size of the machine, and it is claimed that steam can be raised and a stream of water thrown upon adjacent buildings in less than seven minutes from the time of lighting the fire under the boiler. In Fig. 4 a form of the pump especially adapted to fire purposes, and known as No. D D is shown.

The protection of large edifices, and especially factories

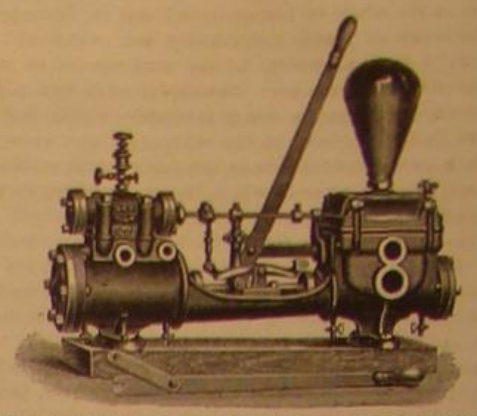


Fig. 2.—STEAM PUMP WITH HAND ATTACHMENT.

by steam pumping apparatus has been found by actual experience to be one of the best measures of safety. Where

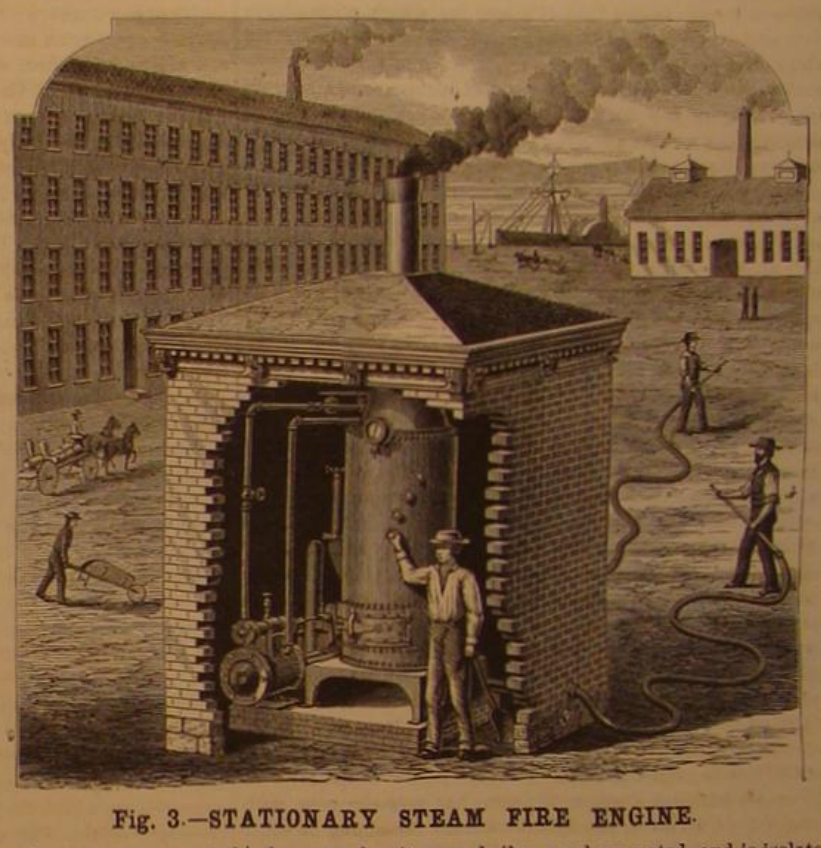


Fig. 3.—STATIONARY STEAM FIRE ENGINE.

the pump has its own boiler, as above noted, and is isolated from the main structure, it is out of the reach of danger, and is always ready for immediate operation. Pipes may be laid from it, underground, to various parts of the works; or a single powerful machine, connecting with hydrants, reservoirs, ponds, or running streams, and capable of throwing from one to fourteen streams to distances of two hundred feet, might be employed to protect an entire village or town. The manufacturer informs us that the pump under examination will be guaranteed to project the above number of streams to the distance named, from hydrants or other sources situated a mile away.

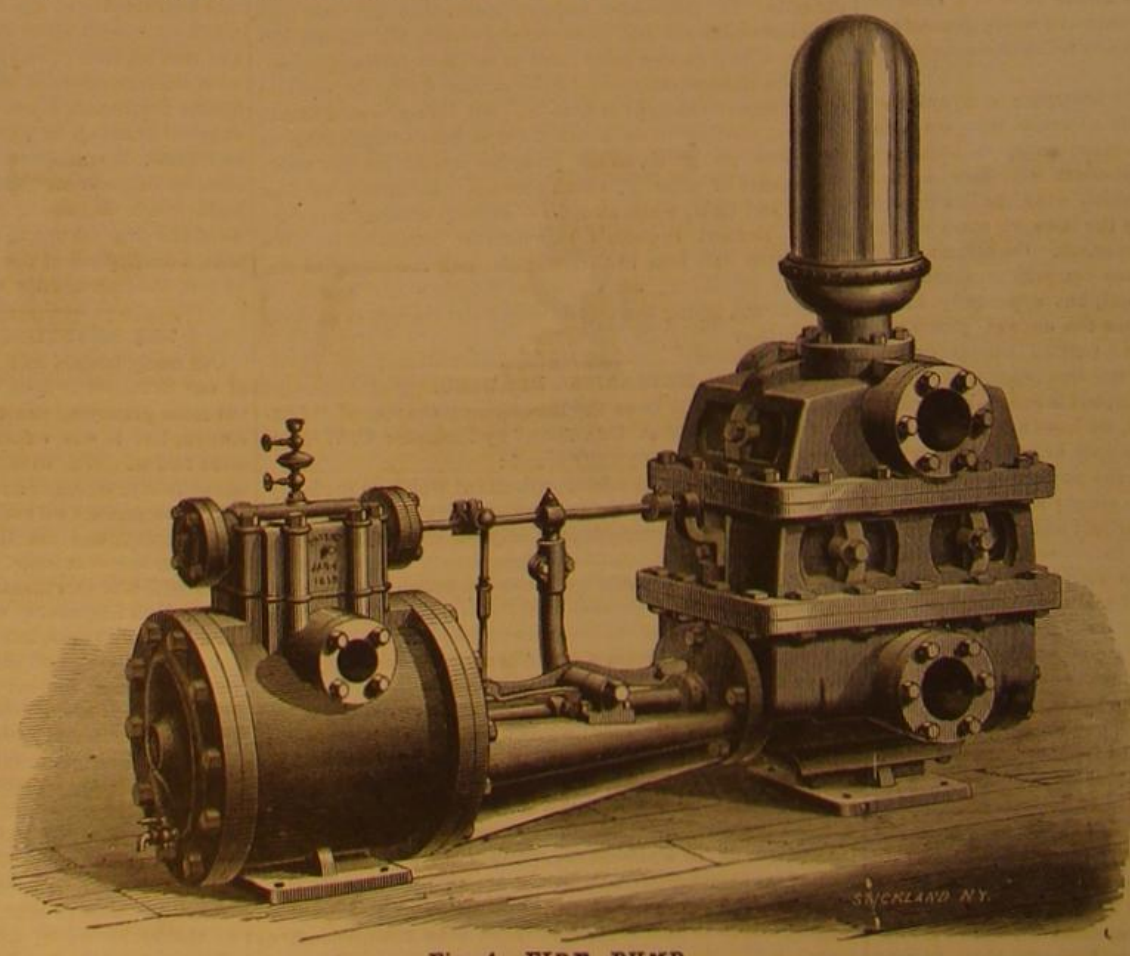


Fig. 4.—FIRE PUMP.

The Knowles pump finds one of its most important applications in mines, and two different forms, used for deep mining, are represented in Figs. 5 and 6. Fig. 5 is a double-acting plunger pump, arranged with hand holes for affording immediate and easy access to the valves. The valve plates are entirely separate from any other part of the pump, and all the stuffing boxes are on the outside. The water passages are large, and the general construction heavy and strong Fig. 6 is also a double-acting plunger pump with accessible parts. Its principal feature is the absence of joints in the water end, and the novel arrangement of valves by which not only the valve but also the valve seat is instant'y removable by simply unscrewing the cap nut. These pumps are now working on lifts equal to 1,600 feet vertical column, without causing shocks or pounds of any description.

The first pump made by Mr L. J. Knowles was produced in 1855, and patented at that time through the Scientific American Patent Agency; and two years later the manufacture

was regularly begun. The manufactory of these celebrated pumps is located in Warren, Mass., and was established in 1862, since which time it has been gradually enlarged until it now covers two acres of ground. The principal warerooms are at 92 and 94 Liberty street, in this city, and at 14 and 16 Federal street, Boston, with branch houses in Chicago and San Francisco. Upwards of five hundred different patterns of pumps are now made, ranging from the smallest sizes to pumping engines weighing from ten to forty tuns each, and possessing a capacity, as demonstrated by actual tests, of supplying several millions of gallons of water daily, and of forcing the same to hights of hundreds of feet.

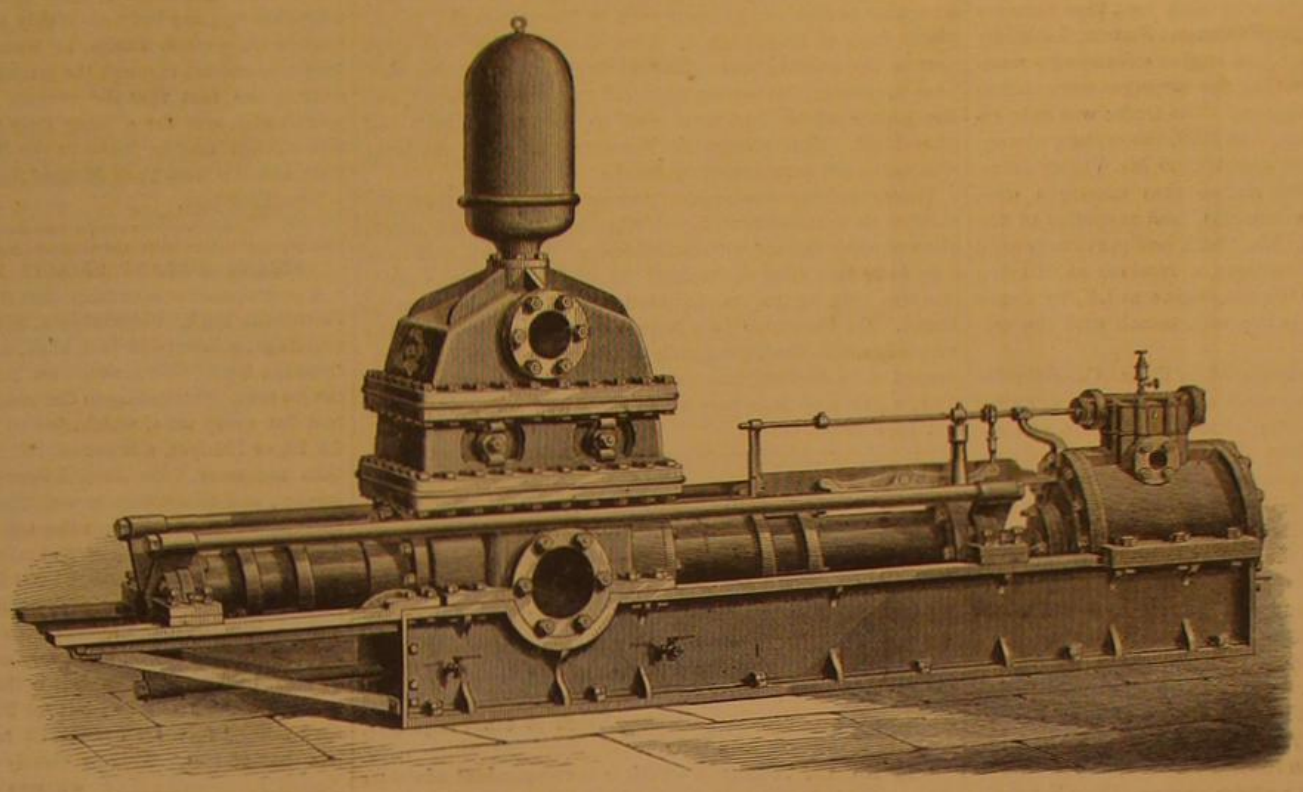


Fig. 5.—HORIZONTAL MINING PUMP.

The New Force.

The new force claimed to have been discovered by T. A. Edison may be demonstrated in the following manner:

Upon an insulated table place an ordinary Morse key and an electro magnet, the coils of which are so wound that no magnetism is produced in its cores by the passage of an electric current. Use for an armature a piece of the metal cadmium, to one of which fasten a flat spring. The other end of the spring attach rigidly to a standard fixed on the table. Adjust the armature a short distance away from the core of the magnet. The standard is to be connected by wire to one end of a glass rod or tube, say two feet long. The other end of the tube connects by wire with a graphite point (a lead pencil will answer). Another graphite point is connected by wire to a gas pipe or other suitable mass of metal, not in contact with the apparatus; and the two points, in position similar to the arrangement for producing the electric light, may be placed in a box from which light is excluded, but with a hole in the top for observation. Place 10 or 15 Bunsen cells in circuit with the key and the coils in the usual manner. Now, if the key be closed, a spark of considerable brilliancy will be evolved from the graphite points, but possessing no continuity. If, however (the battery circuit remaining closed), any part of the connection between the gas pipe and the cadmium is broken, and contacts be made either slowly or rapidly between the disconnected points, the spark re-appears at each contact. It is here that the phenomena are surprising, and apparently unexplainable. The graphite is not in the battery circuit, nor in any other. Moreover it is separated from the rest of the apparatus by the glass tube. This alone would seem to prove that the force is not electrical, at least as the term is generally understood; and when supplemented by the fact that the most delicate galvanometer and the chemicals most sensitive to the electric current fail to note its presence, this conclusion must be accepted. Many experiments have been made with a view of obtaining some definite knowledge, but nothing has been developed beyond the facts above stated, and in addition that, like electricity, the new force passes through or over some substances better than it does over others, and also that, as the resistance of one of its best known conductors is increased by length, the spark decreases in brilliancy.

The occurrence of this spark has frequently been observed by electricians while conducting experiments, but heretofore no attempt has been made to discover the cause or effect. Any theory upon the subject is, of course, at present only speculative, but it is not improbable that the phenomena are in some degree the physical manifestation of that mysterious magnetic power which is not obstructed by material obstacles, and is weakened only by separation. This view is supported by the analogy existing between two demonstrated facts. First: When the new force is conducted through the human body from points attached to both sides of the neck, the spark is of a certain strength. When the connection is through the trunk, from hand to hand, the strength is greatly diminished.

Second: Substances which act as dielectrics offer no obstruction to the passage of magnetic power. The action of a magnet upon a needle is the same when separated by a thickness of glass or porcelain, as when separated only by a distance of air equal to the thickness of the dielectric, and is diminished only by wider separation.—*Journal of the Telegraph.*

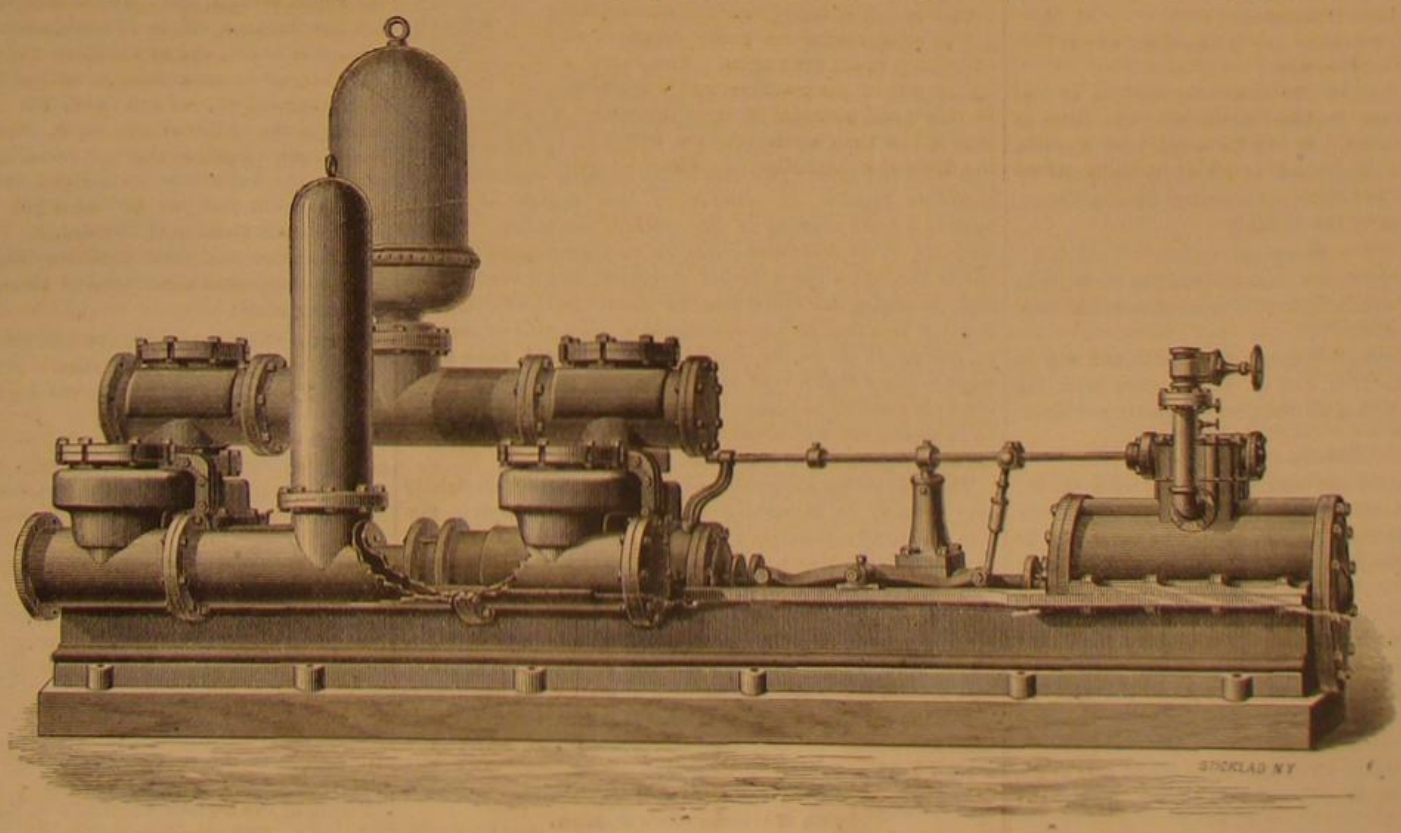


Fig. 6—HORIZONTAL MINING PUMP.

Remarkable Bird.

The London *Daily News* publishes an interesting letter from Mr. Smithurst, the engineer of the steamer which made the voyage up the newly discovered Baxter River, New Guinea. The river seems to be a magnificent one, and could evidently, says *Nature*, be made navigable to a considerable distance inland. The exploring party found the banks to consist mainly of mangrove swamps, though, near the end of the journey, high clay banks with *eucalyptus globulus* were found. Scarcely any natives were seen, though there were frequent signs of their being about. Mr. Smithurst refers to a very remarkable bird, which, so far as we know, has not hitherto been described. The natives state that it can fly away with a dugong, a kangaroo, or a large turtle. Mr. Smithurst states he saw and shot at a specimen of this wonderful animal, and that "the noise caused by the flapping of wings resembled the sound of a locomotive pulling a long train very slowly." He states that "it appeared to be about sixteen or eighteen feet across the wings as it flew, the body dark brown, the breast white, neck long, and beak long and straight." In the stiff clay of the river bank, Mr. Smithurst states that he saw the footprints of some large animal, which he "took to be a buffalo or wild ox," but he saw no other traces of the animal. These statements are very wonderful, and before giving credence to them we had better await the publication of the official account of the voyage.

Pneumatic Telegraphy.

Pneumatic telegraphy has become quite an institution of the age. Scarcely a capital in Europe has failed to avail itself of its facilities to complete its telegraphic system. When stations lie together, close and thick, it is manifestly advantageous to connect them by mechanical means, so as to save, by the transport of the actual telegrams themselves, the multiplication of wires, apparatus, and clerks; and especially so when this can be done with a rapidity equal to that of telegraphy itself. Messages cannot be manipulated or written out at a greater rapidity than forty words per minute; so that, if it is possible to transport a telegram itself from one place to another in a minute, not only is speed of transmission obtained, but all sources of error are eliminated. In fact, the average initial delay occupied by messages on the shortest lines is about five minutes, so that tubes which can convey the messages bodily within this limit are economical and beneficial. The essential element of telegraphy is speed of transmission, and it is evident that, when currents of air can produce greater dispatch than currents of electricity, pneumatic tubes are preferable to wires. But apart from the question of speed of transmission, tubes are essentially economical in the employment of staff, for their use reduces the number of clerks required to a minimum. But of course there is a limit to their useful employment, and a point is reached when, from telegraphic and economical grounds, wires surpass tubes in efficiency and durability. The limit of length is about two miles, for at this distance telegrams exceed the five minutes interval allowed for their average transmission. Of course, where rapidity is of no consequence, this distance can be much exceeded; but, fortunately for the British public, the one criterion which its telegraphists have always endeavored to attain, especially since the transfer of its telegraphs to the State, has been swiftness of transmission, and it is to swiftness more than to any reduction in price that the marvelous increase of business is due. In five years telegrams in England have increased from six millions to twenty millions.

The first germ of pneumatic telegraphy was sown in the year 1810, when Mr. George Medhurst (who, because he lived in Denmark street, Soho, has always been called a Danish engineer) proposed and patented "a new method of conveying letters and goods with great certainty and rapidity by air." His proposal is so clear and interesting that it deserves extracting:

"If a light and hollow vessel is so formed as to fill the area of a tube, and to move freely through it, carrying papers not exceeding three ounces in weight, it will be driven through the tube with the velocity of 150 feet in a second by the pressure of nine ounces per square inch.

"And therefore a tube of uniform dimensions, being laid upon or under ground, from one place to another, without any sudden curvature, will form the means of conveying packets of letters with the velocity of 100 miles per hour, by forcing the air through the tube with a pressure of three ounces per square inch for every ounce weight in motion.

"And if there are two tubes of the same dimensions lead

ing from one place to another, packets of letters may be conveyed each way, at the same time, without a possibility of their clashing against each other; and many packets may be conveyed the same way, in the same tube, which can never approach each other, but will all proceed with an uniform motion and equal rapidity to their destination, where, the tube entering an airtight room, the packets will be deposited, and may be delivered or forwarded to the next stage through their proper tubes, commencing in the same room, and their progress can never be impeded by the seasons or the elements."

This proposal did not take practical form until 1854, when Mr. Latimer Clark laid down a 1½ inch lead pipe between the Electric Telegraph Company's Central Station, Lothbury (LY), and the Stock Exchange. An engine exhausted a receiver at LY, and carriers containing the messages were sucked through from the Stock Exchange. The traffic was only required to flow in one direction. In 1858, the system was extended to Mincing lane, and about 1860 Mr. Varley introduced the use of compressed air, so that messages were drawn in one direction by a vacuum, and propelled in the other direction by a plenum. Mr. Clark had previously used a vacuum to work in both directions, a receiver at Mincing lane having been exhausted by the engine at LY, by means of a special pipe laid down in the same trench with the carrier tube.

In 1865 the system was introduced in Paris. Considerable modifications were made in its mode of working. Compressed air was used entirely, and the necessary pressure was obtained by admitting water from the mains into large air reservoirs. This tube served several stations, which were worked intermediately, like a line of railway, or a telegraph current, each station having its own store of power to propel or forward the carrier on to the next place. This mode of obtaining power was found wasteful and expensive, and it has been nearly entirely abandoned in favor of steam working at one end of the circuit.

About the same period (1865) a system was introduced in Berlin by Messrs. Siemens, who used two pipes, laid in the same trench, between the telegraph station and the Bourse, arranged in a circuit, through which a continuous current of air was always kept flowing in the same direction by a double-acting air pump, worked by a steam engine. This last mode of working was tried in London, but it has not proved successful, and it has been abandoned.

It will be seen how closely this system of Siemens' resembles that of Medhurst, and how curiously history works in a circle, for the vision of 1810 has become the stern fact of 1875. In all the places named the pneumatic telegraph has received considerable extension, and it has also been largely introduced in Vienna, where the Parisian system has been adopted.—*Telegraphic Journal.*

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for January, 1875.

Mercury.

Mercury should be looked for after the middle of the month in the southwest, farther north than the point at which the sun is seen to set. It will be in the best position on the 28th, and can be recognized by its white light and by its nearness to Saturn. At this time, Mercury, Saturn, Venus, and Mars can all be seen in the evening.

Venus.

On the 1st of January, Venus rises at 9h. 8m. A. M., and sets at 6h. 32m. P. M. On the 31st, Venus rises at 8h. 45m. A. M., and sets at 7h. 47m. P. M.

Venus will be well seen all through the month, and will be very near Saturn on the 16th, and in conjunction with the moon on the 28th, at which time the planets mentioned above can also be seen.

Mars.

On the 1st of January, Mars will rise at 10h. 55m. A. M., and set at 10h. 21m. P. M. On the 31st, Mars will rise at 10h. 13m. A. M., and set at 9h. 43m. P. M. The moon will be near Mars (apparently) on the 2d of January, and again on the 30th.

Jupiter.

Jupiter is still unfavorably situated for evening observers. On the 1st it rises about 4 in the morning, and sets at 1h. 39m. P. M. On the 31st it rises at 2h. 18m. A. M., and sets at 11h. 56m. A. M.

Saturn.

Saturn rises on the 1st at 9h. 56m. A. M., and sets at 8h. 5m. P. M. On the 31st, Saturn rises at 8h. 7m. A. M., and sets at 6h. 25m. P. M.

Venus and Saturn will have nearly the same apparent position on the 16th, but will be nearer the horizon, and therefore not so conspicuous as were Mars and Saturn in November.

Uranus.

Uranus is in good position, and can be seen with an ordinary telescope. It is among the small stars of *Leo*, rising on the 1st at 7h. 48m. P. M., and on the 31st at 5h. 41m. P. M. On the 31st it comes to the meridian at 12h. 40m. (20m. before one in the morning) and is then 9½° west of Regulus, and 3½° above that star.

Neptune.

Neptune rises at 0h. 35m. P. M. on the 1st, and sets at 1h. 47m. the next morning. On the 31st it rises at 10h. 38m. A. M., and sets at 11h. 50m. P. M. It cannot be seen without a powerful telescope.

Sun Spots.

The report is from November 17 to December 17 inclusive. From November 5 to November 18 no spots were seen. The photograph of November 18 showed two going off; but before the next picture, November 22, they had disappeared. In the photograph of November 23 there appeared a group of spots on the western limb, a group on the eastern limb, followed by a single one, and, near the center, two very small ones. Clouds prevented photographing on November 23. The pictures of November 24 and November 25 showed only a regular motion of the spots seen on November 22. In the photograph of November 27 there appeared but one large spot on the western limb: the two single ones first observed, near the center, November 22, could no longer be found, and the group which had been seen on the western limb had passed off. The picture of November 29 show the large spot going off, surrounded by faculæ.

Photographing was much interrupted by clouds from November 29 to December 12; but when openings in the clouds allowed observations with the telescope, the sun's disk was seen to be free from spots until December 12, when a small one was seen coming on, but after that date it could not be found. On December 14 a large spot was observed on the very edge. In the photograph of December 17, this spot appeared to be divided into two, and, near the center of the disk, a group of four very small spots was seen, which had not been found before.

Correspondence.

Electricity a Mode of Motion.

To the Editor of the Scientific American:

I take pleasure in briefly meeting the objections of Mr. R. B. West, of Guilford, Conn., to my theory that electricity is nothing more nor less than a motion of the atomic particles of matter. As Mr. West, in his communication, clearly sets forth what may prove a stumbling block to other inquirers, permit me to quote it in full:

"In No. 23, Volume XXXIII, a correspondent advances the theory, if I rightly understand, that electricity is nothing more than motion in the form of an impact or repulsion, communicated from atom to atom, and decreasing in force with the increase in distance from the starting point. This would seem very probable if electricity were capable of being communicated only by direct metallic contact; but on the contrary, it will pass, with comparatively little resistance, through a space made practically devoid of matter; and an inductive disturbance *is* produced when there could be no possible communication of force. Electricity may possibly be something like an allotropic form of motion, but the definition of an atomic impact alone can scarcely be used.'

Instead of entering upon a criticism of Mr. West's statement of facts, namely, that electricity will pass with comparatively little resistance through a (so-called) vacuum, I prefer, for the sake of the argument, to admit that he is correct.

The difficulty seems to consist in a lack of appreciation of matter itself. Mr. West seems to forget that it is impossible to render a space void of matter. What he conceives to be practically *nil*, as perfect a vacuum as can be formed, is really complete materiality, in which the atomic particles of what he conceives to be *nil* are in direct connection with the atomic particles of the metallic conductor, and therefore capable, in greater or less degree, of transmitting a force existing in the metallic conductor. I agree with Mr. West that there could be no transmission of electricity through a space devoid of matter; but it seems to me that, in raising his objection, he should have offered some proof of fact that he has discovered a space void of matter; or, failing to do so, he should have advanced some argument to show that a void is possible, and that, being possible, it is possible to transmit a force through it; otherwise, he is clearly not warranted in denying a material connection between one so-called conductor and another.

The concluding suggestion of Mr. West, that "electricity may possibly be something like an allotropic form of motion," I confess, puts me a long distance at sea. I am quite at a loss, for instance, to conceive of setting something in motion, and then, taking something away, having motion continue on its own account. I would like very much to witness a practical demonstration of that thing; or if that is impossible, to have somebody advance an argument showing that motion may exist independent of matter. It has always seemed to me a requisite of motion that something material shall move. W. E. SAWYER.

New York city.

The Rattlesnake's Poison.

To the Editor of the Scientific American:

My attention has been attracted by a statement made in your issue of December 4, 1875, page 353. After showing the fallacy of certain stories which have been widely circulated in print, and by word of mouth, which have gained credence, regarding the toxic effect of the spittle of man when administered to venomous reptiles, and relating the incident of the boot, which contained a serpent's fang and was credited with so fatal a record, you state that the inventor of this story did not know that the rattlesnake poison is only active when freshly injected from the poison bag.

The story, is of course, improbable; but the error of your statement is very clearly shown by the following experiments by Mitchell with the venom of that reptile. He says that "it is difficult to conceive of the singular energy of the venom of the rattlesnake without carefully conducted experimental research, or of the tenacity with which its powers are preserved in the presence of violent chemical reagents and extremes of heat and cold. The dried venom retained its potency after two years of climatic changes; nor was its action in any degree changed by strong sulphuric and hydrochloric acids, ammonia, chlorine water, soda, or potassa. Freezing or prolonged boiling in no way impaired its deadly qualities." He used the venom after five years' keeping, and found it uninjured.

Dr. Weir Mitchell's reports of his exhaustive researches with this virulent body are richly worth perusal, showing as he does the precise manner in which it is so swiftly and fatally transmitted through the serous tissues, and conclusively settling the fact that the serpent cannot inoculate itself, a point which was for a long time disputed. His reports on this subject may be found in the *Smithsonian Contributions*, 1860, and the New York *Medical Journal*, January, 1868.

New York city. HENRY S. WELCOME.

[For the Scientific American.]

SEEING DISTANT OBJECTS FROM ELEVATIONS.

A correspondent mentions that it is proposed to build, in Fairmount Park, Philadelphia, adjacent to the Centennial buildings, a tower 750 feet high, and asks if it is true that, from the top of this tower, New York city, 90 miles distant, can be seen. According to the rule that the horizon dips 8 feet for every mile, which, for 90 miles, would be a dip of 8×90, or 720 feet, a tower of 750 feet high would be taller than necessary. He does, however, doubt if this rule is correct, and this doubt is well founded. If the rule were correct, we could see from the top of Mount Washington, 6,400 feet, to a distance of 800 miles, and from the highest mountain plateau on earth, 24,000 feet high, to a distance of 3,000 miles, almost one eighth of the circumference of the globe. Inversely, the tops of such mountains could be seen from similar distances, and every one knows that this is by no means the case. The fact is that the dip is only about 8 inches for the first mile; but for 2 miles it is nearly 2 feet, for 3 miles 4 feet, for 7 miles 30 feet, and for 11 miles not less than 88 feet. This is clearly shown in the engraving,

wherein the circle represents a section of the earth through its center, O. PI is the horizon of the point, P, and R*r*, S*s*, and I*i* are hights from which the point, P, can be seen at different distances, P*r*, P*s*, and P*i*. Without going into any mathematical demonstration, it is clear that the hights R*r*, S*s*, and I*i* increase in a far greater ratio than the distances, P*r*, P*s*, and P*i*; but in order to find the relation between the respective hights and distances correctly, a simple trigonometrical calculation is required, without which the solution of the problem is impossible.

ORP, OSP, and OIP are rectangular triangles, in which the angles at R, S, and I are the complements of those at O. Let the distance, PS, be 70 miles, about 1°; then the angle, PSO, will be 89°; and as the sides, PO and SO, of the triangle, PSO, are to one another in ratio as the radius to the sine of the angle, PSO, we will have: SO : PO = *rad.* : *sin.* 89°. As PO is the radius of the earth, 20,691,914 feet, we will have: SO : 20,691,914 = 1 : 0·9998477, from which SO = 20,694,954. From this we subtract the earth's radius, O*s*, leaving 3,040 feet for S*s*, the hight required to see the point, P, at a distance of 70 miles.

In the same way, other distances may be calculated, and we have condensed some items of these calulations into the following table:

TABLE OF THE RELATION BETWEEN HIGHTS AND DISTANCES, SEEN ON THE EARTH'S SURFACE.

For	1′,	nearly	1	mile,	the hight is	8	inches.
"	2′,	"	2	"	"	2	feet.
"	3′,	"	3	"	"	4	"
"	6′,	"	7	"	"	30	"
"	10′,	"	11	"	"	88	"
"	20′,	"	23	"	"	338	"
"	30′,	"	35	"	"	760	"
"	35′,	"	41	"	"	1,036	"
"	50′,	"	58	"	"	2,116	"
"	60′,	"	70	"	"	3,040	"
"	80′,	"	93	"	"	5,430	"

These results are proved by experiment to be correct, as we shall find when traveling in mountainous districts and noting how far we can see. At the highest tops of the Highlands, on the Hudson river, near West Point, which do not reach 2,000 feet, we can, on a clear day, just get a glimpse of the highest buildings in New York city, using a telescope. The distance is only fifty miles; but at a hight of 1,600 feet, objects 50 miles off are invisible. In order to see to a distance of 90 miles, the hight necessary is about 5,000 feet; and if the Philadelphia tower is built to a hight of 760 feet, objects at a distance of 35 miles only, less than half way to New York, may be seen. If, however, two towers were built, one in New York and the other in Philadelphia, each 1,200 feet high, from each a circle of 45 miles radius would be visible, and the top of the one would be just perceptible from the top of the other, by means of a telescope, if the atmosphere were exceptionally clear. X.

To prevent water freezing in the gas meter add glycerin. The proper proportion is one pint of glycerin to a gallon of water.

PRACTICAL MECHANISM.

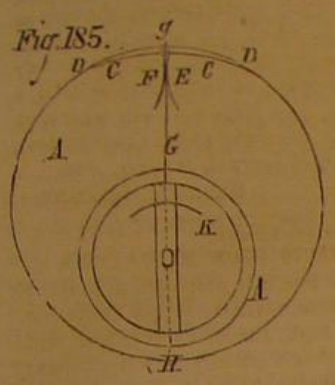
BY JOSHUA ROSE.

NUMBER XXXIX.

LINING OUT AN ECCENTRIC.

In measuring an eccentric to ascertain if it has sufficient stock to allow it to be cleaned up all over, it is not sufficient to measure the thickness of the outside diameter, and the size of the bore only, because those measurements do not take the amount of the throw into consideration, and we have therefore to proceed as follows:

Fig. 185.



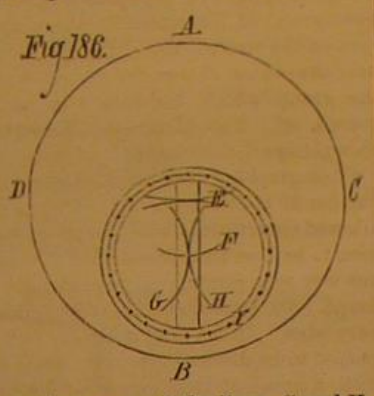
In Fig. 185, A A represent an eccentric, into the bore of which, on the hub side, we place the center piece, and mark upon it the center of the hole. We then take a pair of compasses, and set them so that, when one point is resting in the center of the hole, the other point will reach to within about a quarter of an inch of the extreme diameter of the eccentric, as shown above by the line, C C. We then, with a pair of compass callipers, find the center of the line, C C, by resting the calliper leg of the same against the periphery of the eccentric, at one of the points where the line, C C, meets it; and then with the compass leg of the compass callipers, we mark the line, E; and repeating the operation at the other end of the line, C C, we mark the line, F. We next take a straight edge; and placing it so that its edge is even with the center of the bore of the eccentric and with the center between the lines, E and F, we draw the line, G *g*, upon which we may make our measurements as follows: After setting a pair of compasses to the amount of throw required by the eccentric, we place one compass leg in the center of the bore, and with the other mark (on the line, G) the line, K, which will represent, at its intersection with G, the center of the finished diameter of the eccentric, providing we mark off the whole eccentric true with the hole. Then we take a rule, and measure from the center, K, to the ends, H *g*, of the line, G, which ends should be equidistant from K, if the amount to come off the surface of the casting in the hole is to equal that to come off the outside surface. It very frequently happens, however, that there will be more to come off the eccentric on one side of the diameter than on the other, especially when the eccentric is put together in two halves; because, in facing up the two halves, preparatory to putting them together, and to make them bed well one to the other, it does not always happen that the same amount of metal is taken off each face. Again, the quantity so taken off is not always that allowed on the pattern for the purpose; so that, in practice, an eccentric casting rarely marks off true with its rough outline.

Here, then, arises the consideration as to in what direction we shall throw the lines. Shall it be to bore the hole true, or to turn the outside diameter true, with the casting? The latter plan is always preferable; because, if in turning up the outside diameter the first cut does not true it up, the tool point will scrape over the sand, after leaving the cut and before it strikes it again, to such an extent as to rapidly destroy the cutting edge, necessitating not only frequent regrinding of the tool, but also that its cutting speed be very materially reduced. After having roughly ascertained, in the manner described (which process will take but a few minutes to perform), that there is surplus metal enough to clean up the eccentric, we may proceed to mark it out.

It is much easier to mark off an eccentric on its plain side than on the side on which the hub stands, because of the projection of the hub; and, furthermore, the marking for the hole and for the diameter can be performed at one operation, which is impracticable on the hub side. But if this plan is not adopted, it necessitates that, at the first chucking, either the hole only shall be bored, in which case there will be no face true with the hole, and hence no guide whereby to set the eccentric at the next chucking: or else, in turning off the outside face after the hole is bored, the marks for the second chucking will be effaced. The main consideration, however, is that there is only one way to chuck an eccentric to insure its being turned as true as possible; and the marking off must, therefore, be made to accommodate the chucking, the method and reasons for which are as follows: The eccentric must be chucked at the first chucking nearly true with the outside diameter, and with the plain face outwards, so that that face may be trued up. The next chucking must be that for boring the hole and for turning the hub and that face of the eccentric; and the third chucking will be done with the face of the hub bolted to the chuck plate by as many clamps as may be necessary to hold it, but none of them exerting any pressure save to clamp the face of the hub to the chuck, or rather to the face plate. By this method, the outside of the eccentric will be turned true with a face that has been turned at the same chucking at which the hole was bored; while the eccentric will stand sufficiently far from the chuck to permit of the strap being tried on when it is necessary. And, moreover, the skin of the metal will have been removed on three out of the four faces before either of the working parts (the bore and the outside diameter) is finished; and as a consequence, the work will remain true, and not warp in consequence of the removal of the skin. Furthermore, upon the truth of the last chucking only will the truth of the whole job depend; and if the face plate of the lathe is a trifle out of truth, the eccentric will only be out to an equal amount. It is not an uncommon practice (but a very reprehensible one) to face off the plain side of the eccentric, and to then bore the hole and turn the outside diameter, with the plain face clamped in both cases to the face plate. The fallacy of this method lies in the fact that, by such a procedure, the eccentric will be, when finished, out of true to twice the amount that the face plate is out of true.

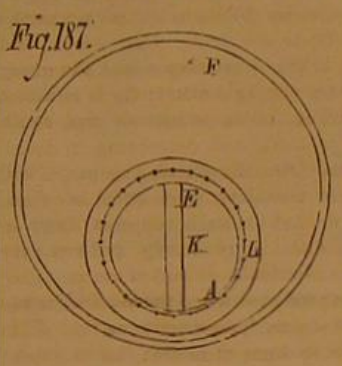
Taking all these considerations into account, we may mark off the lines for the hole and thickness of the hub, in the manner shown in Fig. 185, or we may adopt the plan shown in Fig. 186, which is perhaps the better of the two.

Fig. 186.



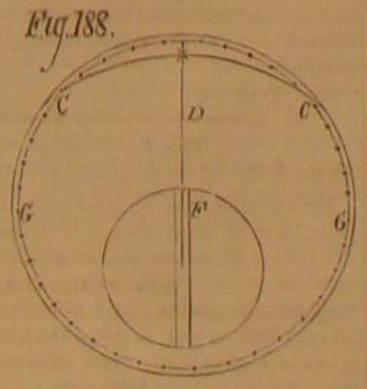
From the four points A, B, C, and D, w mark off, on the hub side of the eccentric, t center of its diam eter, E; we then, setting a pair of compasses to the amount of throw required for the eccentric, mark off from the center, E, the line, F; then, with a pair of compass callipers, placed in each case with one end against the bore of the casting, we mark the lines, G and H, the junction of the lines, F, G, and H, being the required center of the hole. We therefore strike from that center, around the face of the hub, the line, I, and mark it lightly with a center punch, as shown. If, however, it should be found that there is not sufficient metal to allow the hole to be cleaned up if marked off true with the circumference, we must throw the hole a little in the requisite direction, endeavoring (for the reasons already stated) to keep the diameter of the eccentric as nearly true for the throw as possible. For instance, in Fig. 187, if we suppose that is an insufficiency of metal in the hole, at A (E being the center of the diameter of the eccentric, and K the amount of the throw), we first set a pair of compasses to the required radius of the diameter; and from the center, E, strike the circle, F, which will show the amount of metal required to be taken off the circumference of the work, and therefore to what degree we are able to throw the hole to accommodate the scant spot, A. If there is more metal between the line, F, and the periphery than the spot, A, lacks, the eccentric will clean up, and we may mark off the hole, allowing it to just clean up, as shown by the circle, L. It is, however, best, on small eccentrics, to mark the circle, L, as large as the face on which it is marked will admit; because, the larger the circle, the less a slight want of truth in the chucking will affect the truth of the work. It will be observed that, in consequence of the centerpiece standing above the level of the face (to the amount of the hight of the hub), the circle, F, in Fig. 186, would be too small if marked with the compasses set to the correct radius; but since the duty of that circle is to merely indicate the amount of surplus metal on the outside diameter, it will be sufficiently correct on ordinary eccentrics, to mark it as directed, making a slight allowance of increase in setting the compasses to draw that circle. If, however, it should happen that the quantity of stock is so scant as to make it questionable whether the work will true up: then the center piece may be lowered in the hole to the level of the surface of the metal on which the circle, L, is marked, and the compasses may be set to the correct radius.

Fig. 187.



The hole being marked, no further marking should be performed until the eccentric has had both sides finished and the hole bored, when the diameter should be marked upon the plain side of the work, as shown in Fig. 188. After inserting the center piece, and marking off upon it the exact center of the hole, we mark the line, C C; and finding the center of its length, as already described, we strike the line, D; then we mark on the line, D, the amount of the throw, measuring from the center of the hole, and we thus obtain the center, F, from which we mark the circle, G G, which is only intended to be employed in setting the work, and need not, therefore, be made of any particular size. The marking will thus be completed, and it will be noted that the thickness of the eccentric and the hub, and the hight of the latter, have not been dealt with at all, the reason for the omission being that it is entirely unnecessary to regard them, since (providing of course that there is spare metal enough to clean them up) they may safely be left to the turner, who may accommodate the amount taken off the first side faced, according to the smoothness of the second cut, or a variety of other conditions which need not be here enumerated. If the eccentric has no hub, as is sometimes the case, it should be marked off as shown in Fig. 186.

Fig. 188.



After the turning is completed, the keyway or featherway may be marked off, as shown in Fig. 189. Placing the centerpiece on the hub side of the eccentric, so that the plain side may lie flat on the slotting machine table, and not require parallel strips or packing wherewith to chuck it, we mark off upon it the center of the hole in the eccentric; and from that center, we mark a circle whose diameter must be equal to the required width of the keyway to be cut. Then selecting the location of the keyway, we we describe there another circle of the same diameter. Placing a straight edge so that one of its edges is just even with one and the same side of each circle, we draw the line, A; and by repeating the operation on the other side of the circle, we shall have the sides of the keyway marked. To mark the depth, we make a fine centerpunch mark at the requisite distance from the bore of the eccentric, and then, using the square shown in Fig. 162, we place one of it sedges parallel with the outer edges of the two circles, and the other edge fair with the center of the centerpunch mark, and scribe a line along the latter edge and across the width of the keyway, the operation being shown in Fig. 190, A being the square. When, however, there are a number of keyways of the same width and depth to be marked, it is more expeditious to make the gage shown (together with its method of application) in Fig. 191, in which A represents the gage, being a piece of sheet iron about one sixteenth of an inch thick, the curved line being of the same curvature as the bore of the hole in the eccentric, and the projection, B, being of the required size of keyway. The ends, C D, are to be slightly bent (both in one direction), so that, while the projection, B, will lie on the face of the hub, the ends, C D (being depressed), will contact with the bore of the hole of the eccentric, and thus serve to keep the gage true with the bore. The gage should be carefully marked out and smoothly filed true to the lines. The small hole, shown near C, is to hang up the gage by when it is not in use.

Fig. 189.

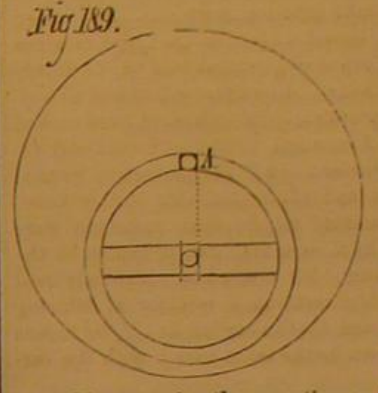


Fig. 190.

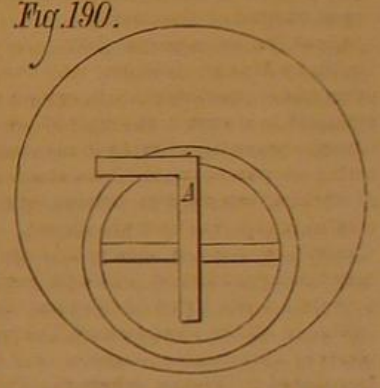
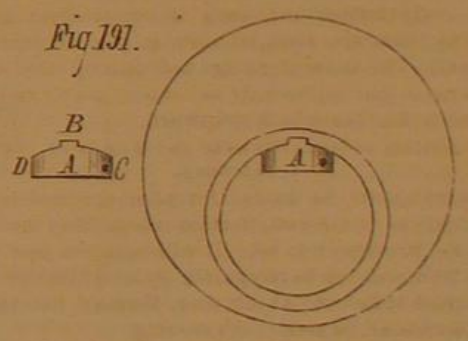


Fig. 191.



Quick Work in a Rail Mill.

Inter-Ocean says: "A few weeks since, the North Chicago Rolling Mill Company claimed the championship of the world in the manufacture of steel rails when they produced 1,010 rails in twenty hours. The Joliet mills laid themselves out lately with the following result: Between the hours of 5.50 p.m. on Monday, and 5.45 Tuesday morning, they turned out 603 rails. At 6.35 the day turn commenced, and at 5.45 p.m. had made 604 rails, thus accomplishing the wonderful run of 1,207 steel rails, weighing 53 lbs. per yard and 30 feet in length, in 17 hours and 25 minutes, and surpassing the work of the Chicago mills by 193 rails, with 2½ hours time to spare. The average time used for making each rail was 52 seconds, while the Chicago mills used 1 minute and 12 seconds. The Bessemer works of the Joliet Company also lead off with a run of 1,432 tuns, while the biggest run made by any other mill was 1,317 tuns, by the Chicago works last month. The boys claim that they haven't shown their best foot yet; and if anybody can equal this, they will go them a good deal better."

Wood for Docks.

A fact has occurred at Belfast, Victoria, which is well worth noting. In 1868 an auger was dropped in the bay there by one of the workmen employed on the jetty. Last Christmas, the tool was picked up on the beach near the mouth of the Moyne. The iron auger was encrusted with rust, sand, etc., and the iron partly destroyed, but the wooden handle (blackwood) was perfectly sound. In building jetti s this fact would prove that iron bolts are not as durable a treenails of blackwood.

IMPROVED RAILWAY RAIL JOINT.

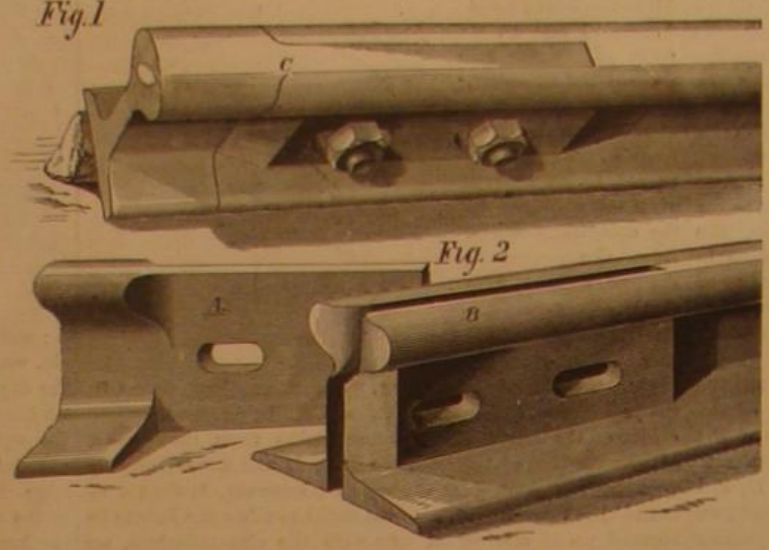
We illustrate herewith a new mode of forming the extremities of railway rails, so as to produce a joint which obviates the use of fishplates and offers the advantages of a practically continuous rail. The joint closed is shown in Fig. 1, and in Fig. 2 the parts are shown detached. The end of one rail, A, is made in the shape of a tenon to enter the mortice formed in the extremity of rail, B. The latter is made thicker at the parts through which the division is made, and also perforated with two slots, through which, and through similar slots in the tenon, the fastening bolts pass. In order to strengthen the rail, A, at the points where the tenon begins, the angles are curved, and fit against similar curved surfaces at the extremity of rail, B, as shown at C, in Fig. 1. The length of th slots is such as to afford abundant play for the rails to compensate for contraction and expansion, without disturbing the bolts.

By the use of this joint, it will be evident that the wheels of the vehicles never leave iron except when crossing switches, since, while passing over the joint, the tread of the wheel is on the tenon. This is made sufficiently strong to sustain any weight which may come upon it, even if no tie support it. The advantages of a continuous rail are found in the saving of wear to the rolling stock ordinarily due to jumping joints, as well as in the prevention of deterioration of the rails, which are rendered unserviceable through the battering down of their ends alone. It is claimed that the joint here illustrated is as strong as any other part of the rail, that rails made with it may be laid more easily and more rapidly than others connected only by fishplates, that it is as strong and as durable as the last mentioned mode of fastening while requiring two nuts less, and that it can be used wherever fishplates can be.

The rails, we are informed, are pressed or otherwise made into the necessary form by simple special machinery, at a low cost.

Patented through the Scientific American Patent Agency, November 9, 1875. For further information address the inventor, Mr. Geo. A. Mead, North Salem, N. Y.

Fig. 1



MEAD'S RAILWAY RAIL JOINT.

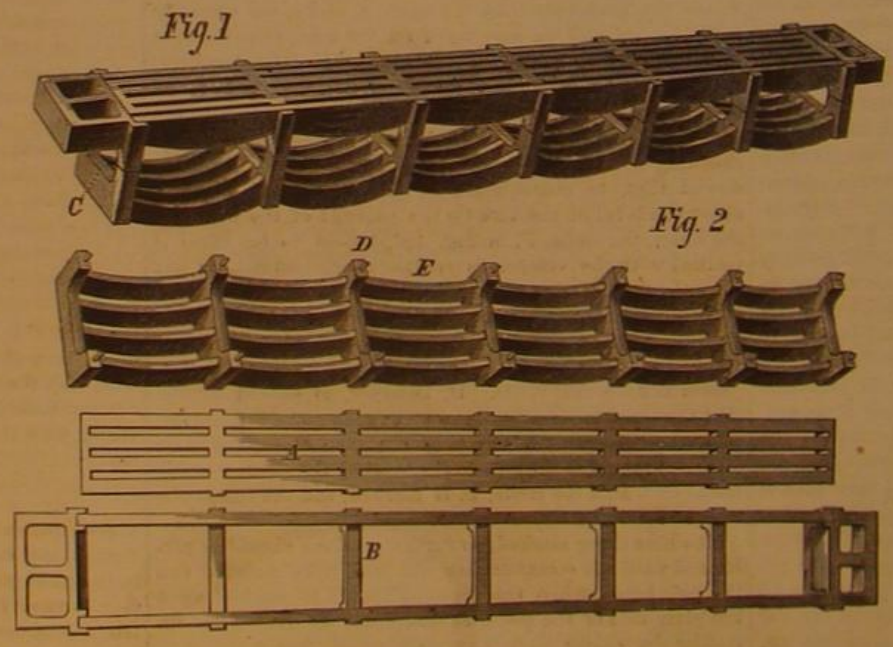
IMPROVED FURNACE GRATE BAR.

A new grate bar is illustrated in the annexed engraving, which, it is claimed, may be manufactured at a low cost and with a smaller quantity of metal than is usually employed, and is of sufficient strength to meet all requirements, and will not warp, crack, or twist by heat. If all the inventor claims for it is maintained in practice, it is certainly a valuable improvement. The engraving shows the patterns for the three portions which constitute the device, separated in Fig. 2, and the complete bar in Fig. 1.

A is a series of long parallel bars, which are arranged in groups of three or four or more, and which may be made slightly convex on their upper face to insure a greater circulation of the air when the coal is heaped upon them. These bars are firmly held in place by transverse supports, B, each of which is provided with an opening, C, to allow an air circulation from one to the other. The scalloped bars, D, are arranged below the fire surface and connect with the transverse supports, B. They are formed with knife edges at E, to prevent accumulation of ashes upon them. The projecting flanges at the ends rest upon the ordinary wall of the furnace and furnish a substantial support for the whole.

Patented August 31, 1875. For further particulars regarding sale of State and county rights, address the inventor, Mr. Edward M. Erdman, Lykens, Dauphin county, Pa.

Fig. 1



ERDMAN'S FURNACE GRATE BAR.

Simple and Compound Engines.

At the ordinary meeting of the Glasgow Association of Engineering and Shipbuilding Draftsmen, November, 1875, Mr. David Halley presiding, Mr. Robert Thomson read an interesting paper on "Simple and Compound High Pressure Condensing Engines." The object of the paper was to show that a simple high pressure condensing engine, using a high grade of expansion, was superior to the present more or less complicated compound engines. The subject, being one of paramount importance, naturally elicited an interesting and instructive discussion, in which many of the members took part, most of them failing to be convinced of the advantages that would take place by a return to the high grade expansion condensing engine, with a higher pressure of steam.

We would call the attention of the above association to the fact that several steamers are now plying between this city and New Orleans that are fitted with single high pressure engines, that they work with much satisfaction, and equal, if they do not surpass, in economy the best compound marine engines now in use.

Exporting the Soil.

A correspondent of the Winstead (Conn.) *Press*, writing in regard to a trip which he has recently taken to the West, says:

"Through Pennsylvania and in the valley of the Alleheny the stranger is struck with the appearance of good husbandry and general air of thrift on all sides. In the mountain region, he sees a country of different aspect and the evidences of other industries. This is the mineral region, the home of the coal, oil, and iron which bring so large an annual income into this State from abroad.

"Through Ohio, on the line of the Pittsburgh, Fort Wayne, and Chicago road, there is more level and uncultivated land than I expected to see. The same remark is applicable to a portion of northern Indiana. In Illinois, after leaving the flat prairies adjacent to Chicago, the Chicago, Burlington, and Quincy road runs through a seemingly continuous corn field. Corn at the right of us, corn at the left of us, corn in front of us, corn in the rear of us, in easy swells and apparently interminable reaches, cross the State till we strike the Mississippi at Quincy. There are fruit, other crops, and stock, of course; but corn is the great staple, and the query arises where so much finds a paying market; for it is also a leading crop in other States in the same latitude and south of Illinois.

"If the present price shall be maintained, the crops will be remunerative: but this ceaseless production of corn, whether shipped directly or fed to hogs and sent away in that form, is exhausting the soil, very surely and not very slowly.

"Five years ago the farmers of lower Indiana had made this discovery, and were changing from hogs to cattle. This shows the depletion of soil in some measure; but to export crude products, like the cereals and provisions, is a bankrupting process, robbing the soil and impoverishing the producers. If continued for two generations, the people will be forced to migrate to virgin lands, there to repeat their destructive husbandry and again leave behind them sterile plains like those of Asia.

"The abandoned cotton and tobacco plantations of the Eastern coast States are evidence of our infancy in economics. A varied industry and the export only of products having the last processes of labor largely incorporated into their substance are conditions of an enduring commonwealth."

The Zodiacal Light.

Those who are interested in the observation of this phenomenon will do well to be on the alert during dark evenings in the winter months. The most conspicuous exhibitions of the light in England during the last few years have occurred in the month of January, the long standing recommendation to expect the most notable displays in the evenings about the vernal equinox having thus been by no means justified in in the result. The light was perceptible for a short time on the evening of November 21, without any yellowish tinge, and the position of axis somewhat doubtful from the indifferent state of the sky. Professor Heis's observations in December, from 1851 to 1870, place the mean position of the apex on the equator in R.A. 349°, or with about 82° elongation from the sun; this refers to the eastern arm of the phenomenon.—*Nature.*

Estimating the Horse Power of Steam Engines.

When steam engines were first introduced, they were largely used to take the place of the horses before employed for raising water from mines. Naturally, people ask, when buying an engine, how much work would it do, that is, how many horses did it represent. The early engine builders found themselves greatly at a loss when this question was first asked. They had at once, therefore, to determine how many horses an engine was equal to. The first thing was to find out how much a horse could do. The strongest English horses, the London brewers horses, were far above the very best that could be found elsewhere. They were found to be able to travel at the rate of 2½ miles per hour, and work eight hours per day. The load was pulling a 100 lbs. weight up out of a shaft by means of a rope. When a horse moves 2½ miles per hour, he travels 220 feet per minute, and of course, at this speed, the 150 lbs. would be raised vertically that distance. That is equal to 300 lbs. lifted 110 feet per minute, or 3,000 lbs. 11 feet, or 33,000 lbs. 1 foot high, in 1 minute. The 33,000 lbs. lifted 1 foot high every minute is taken as a standard horse power. It is much more than any ordinary horse can do, and, therefore, the engine builders were always sure that their engines would take the place of fully as many horses as the horse power would indicate that they should. Of course, 33,000 lbs. lifted 1 foot per minute is much more convenient for calculation than 150 lbs. 220 feet, and therefore the former form has been adopted. The amount of work, or number of foot pounds, however, is just the same in either case. A foot pound represents the amount of power required to lift 1 lb. 1 foot high. It is comparatively easy to estimate the horse power of an engine with a reasonable degree of accuracy, provided we know certain things in regard to it. We must know the pressure in the boiler, the diameter of the cylinder, the length of stroke, the number of revolutions per minute which the engine is making, and lastly, the point at which steam is cut off.

When there is no cut off, steam is admitted into the cylinder during the whole stroke, and a cylinderful of steam at boiler pressure is used at each stroke, as the cut off, when there is one, takes place before the piston has reached the end of the cylinder. If steam is prevented from entering the cylinder after the piston has passed mid-stroke, the point of cut off is at half stroke. If the steam enters the cylinder during three fourths of the stroke and is then arrested, the point of cutting off is at three fourths of the stroke. It is necessary to know the point of cutting off, in order to find out what the average pressure is in the cylinder. In the commoner sorts of engines, not provided with independent cut-off valves, the point of cutting off may usually be taken at from one half to three fourths of the stroke, though sometimes more than this. It may, perhaps, be safe to take the average pressure in the cylinder at about eight tenths of that in the boiler; though where the steam pipe is long and the throttle valve is used to control the speed, the average pressure in the cylinder may be no more than three fourths of that in the boiler. The power will be the distance which the piston under this pressure travels during one minute. Therefore, we have the rule: Multiply the area of the piston by the average pressure per square inch upon the piston, multiply this result by the distance which the piston travels per minute in feet, and the result is the number of foot pounds per minute which that engine can raise. Divide by 33,000 and the result is the number of horse power. The number of feet per minute traveled by the piston is twice the number of strokes per minute multiplied by the length of stroke. This gives the number of horse power sufficiently nearly for all practical purposes.—*Seward's Coal Trade Journal.*

Pneumatic Street Cars.

A trial of a new tramway motor came off lately on the lines of the Vale of Clyde Tramways Company at Govan, Scotland. The car, having been charged with the necessary quantity of compressed air, was made to take its trip among the ordinary cars running from Govan to Paisley Road Toll. Experiments were made to test the power of the machine for slowing, stopping to take up passengers, etc., and it appeared to be under the most perfect control. The noise was scarcely perceptible, while horses alongside did not seem to recognize the car as anything unsightly, or to be feared. Mr. Moncrieff was accompanied by the chairman and directors of the Vale of Clyde Tramways Company. The result of the trial was to impress all present with the complete success of the invention, and its adaptability to tramway purposes

THE ALOCASIAS.

This tribe of plants (belonging to the species known as arads) is now receiving much attention from the admirers of handsome foliage. The variety, *a. intermedia*, shown in our engraving, is a singularly bold specimen, of which some of the more noticeable peculiarities are the size and configuration of the leaf and the mottled cuticle to the stalks. The curled edge of the leaf is an additional distinction, and the venous system shows a high degree of organization. Like its congeners, this plant is propagated by dividing its fleshy rhizomes; and being of vigorous habit, it soon makes a good specimen if potted carefully in a fresh open compost, consisting of fibrous peat, turfy loam, and leaf mold, with sufficient coarse sandstone grit to keep the whole open and porous.

It is worth notice that few arads like a close soil; on the contrary, a rich, free, vegetable mold is what they enjoy. If the thick roots of an alocasia or anthurium be examined, the tips will be found covered with short hair-like processes, which are vigorous and healthy wherever the soil is open, but which soon decay in a wet, stagnant compost. They seem to be of use in absorbing moisture from the air spaces between the nodules of peat and turf rather than from the compost itself; and if a covering of fresh living sphagnum be placed over the tops of the pots, near the root stocks, fresh roots soon make their appearance there, a circumstance which adds considerably to the health of the plants. It is a singular fact that the roots of nearly all the endogenous plants like to grow in living sphagnum moss, a material which may with advantage be added to the compost used for nearly all arads.

ALOCASIA INTERMEDIA.

The Demagnetization of Watches.

Watches worn by students and others in technical laboratories are often rendered useless by being magnetized by the magnets used in such places. Magnets kept in the house often create equal mischief by being laid near watches, and much time and expense are sometimes needed to demagnetize them before they can be made to work. A serious case of this kind of injury recently led Professor A. M. Mayer, of the Stevens Institute of Technology, Hoboken, to experiments which resulted in a very simple method of demagnetization. The magnetized watch was laid upon a table in the neighborhood of a common compass needle. Each hour on the face was then placed in turn before it to discover the location and intensity of the magnetism in the watch. The movement of the compass showed the north and south pole to be located, say, at the figures V and XI, while the neutral points were at VIII and II. The watch was then held in a horizontal position before a large bar magnet, the two south poles being together. A gentle tilting motion was given to it for a moment; and on trying the watch again before the compass, a sensible decrease of magnetism was observed. The process was repeated till the sensitiveness of the watch at that pole was nearly extinguished, when the same thing was tried with the north pole of the watch. After a few trials and comparisons, the magnetic influence was found to be removed, and the watch readily resumed its work.—*Scribner's Monthly.*

THE GUELDER ROSE.

The guelder rose (*viburnum*), or, as we call it, snowball, is one of the most ornamental flowering shrubs which adorn our gardens. The pure whiteness of the blossom, the globular form which each mass of flowers assumes, and the profuseness with which the tree adorns itself in the spring make it a universal favorite where shrubs of variously colored blooms are massed together, to make an effective picture as a whole, as well as by exhibiting variety and contrast of colors. The guelder rose was originally a native of China, and has been varied by cultivation till many species are known, the familiar kind bearing the botanical name of *viburnum macrocephalum*. It yields seeds freely, and can be propagated with some difficulty by cuttings, which should be of young wood and placed in a moist soil under glass. Grafting, however, is the best method, and is the one adopted in China, which, as we have stated, is the native land of the tree.

M. Keteleer, a French floriculturist, has recently introduced a new variety, to which has been given the name of *v. Keteleeri*, but which (says the English *Garden*, from which we select the engraving) should be more properly called the *v. Keteleeri macrocephalum*. In France it grew well in the open air, a cutting being planted by M. Keteleer; and when one year old, it produced a dozen clusters of flowers. It can therefore be more readily propagated in this way than the common guelder rose; and it is sufficiently hardy to flourish out of doors, although it needs some protection in severe weather. Its favorite soil is one that is dry and warm, and of a calcareous nature. M. Keteleer recently contributed a description of the new variety to *La Revue Horticole*, the most popular magazine of botany and floriculture published in France.

THE GUELDER ROSE.

Window Plants.

Professor Maynard says, in the *Scientific Farmer*: Comparatively few persons who cultivate window plants are more than partially successful in their efforts. Among the reasons for this want of success may be given, first, a want of knowledge of the conditions of plant growth; second, a want of time to care for them properly; third, lack of the proper temperature and a pure moist atmosphere. First, very few persons realize that plants may be injured by too much or too little water, and fail to understand when the soil is too wet or too dry. Plants, as well as animals, must have pure air for a healthy growth. Those persons who are successful in growing plants have an intense love for their pets, and soon learn to detect anything wrong in their condition, and apply the remedy. Second, plants require constant care. Their condition must be watched closely and the soil not be allowed to get too dry, nor be watered too much. Their condition must be known at all times; and if a green fly appears it must be destroyed at once by crushing, or by dipping in tobacco water about the color of strong tea, or in strong soapsuds, rinsing the plant carefully fifteen or twenty minutes after dipping. If the red spiders are found, destroy them by sponging the under side of the leaves with cold soapsuds. Their presence is an indication that the atmosphere is too dry. If mealy bugs appear, they should be destroyed by touching with alcohol, or by brushing off with a dry, soft brush. If mildew attacks the roses or verbenas, it must be destroyed by washing or dipping in a solution of lime and sulphur, made by boiling one pound of caustic lime with one pound of sulphur in two gallons of water. This should be allowed to settle, and then kept in bottles ready for use. In using it, take one teaspoonful to one quart of water. One treatment in any of these cases may not be sufficient, and must be repeated as often as necessary. Eternal vigilance is the only price of success. Third, according to the temperature required for the healthy growth of different plants, they may be divided into two classes, namely: Those that grow well at an average temperature of 50° Fah., that is, ranging from 40° to 60°, and those that require a higher temperature, an average of 60°, ranging from 50° to 70°.

The first class will include geraniums, carnations, centaureas, camellias, azaleas, abutilons, ageratums, callas, sweet alussum, English ivies, smilax, mignonette, hyacinths, primulas, stevias, petunias, verbenas, lobelias, and roses. In the second class are begonias, bouvardias, epiphyllums, and all cacti, fuchsias, gloxinias, German ivies, heliotrope, zorrenias, pileas, and roses. Roses are included in both lists, as they will succeed under both conditions.

Plants grow much better where the temperature runs lower at night than during the day. It never should go below 40° Fah. in the first case, or below 50° in the second case. If plants stand near a window, a screen should be made by pasting papers to a frame, similar to that used for mosquito screens, placing it between the plants and the window every night. A screen made in this way can be inserted in a moment, and may consist of several thicknesses of paper.

A moist atmosphere is indispensable to the healthy growth of plants, and is obtained by keeping the pan in the furnace filled with water, or an urn or some other vessel upon the stove. The atmosphere must be free from sulphurous gases, and to accomplish this end the back damper in the stove must be kept open enough to allow its escape, and the windows raised a little every day for a short time when the temperature outside will allow.

If small plants, taken from the greenhouse, be carefully potted in suitable soil, placed in a room with a somewhat moist atmosphere, free from poisonous gases, carefully watered, exposed to the sunlight a part of the day, no insects allowed upon them, and the temperature kept as directed, they will grow and well repay the labor of caring for them, and homes be made brighter and happier by the presence of an abundance of flowers.

The Use of Fallen Leaves.

In the *Gardener's Monthly*, Mr. Meehan says: These have to be gathered up. They are excellent to mix with hot-bed material, and, where practicable, should be saved for this purpose. They do not heat so rapidly as stable manure, and in this have an advantage; as tempering the violence makes manure last longer and maintain a more regular heat. They are excellent material to put round cold frames to protect half-hardy plants. A board is put up to the hight of the frame boards, and about a foot or more from them, and the leaves filled in between. If the plants are somewhat tender, the bottom of the frames may be filled in a few feet with the leaves. These leaves, after having been two or three years decaying, make admirable stuff for potting plants and for flowers in general.

BRIDLES, BITS, HUBS, AND HORSESHOES.

Our extracts, for this week, from Knight's "Mechanical Dictionary," include an interesting series of engravings relative to harness, carriage building, and blacksmithing; and in Fig. 1 we illustrate a number of

BRIDLES,

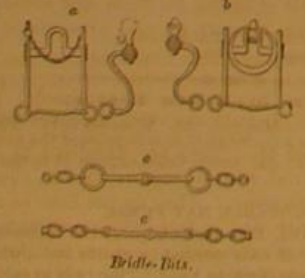
having checking and safety devices. In *a* the driving reins

Fig. 1.

Bridles.

are attached at E by an elastic strap and snap hook, C, to the rings of the snaffle bit. Face pieces, G G', are also secured to these rings, passing upward through the loops, H I, and uniting to form the throat latch, K, to which the hitching strap is fastened. The combined throat latch and face piece prevents the bridle slipping, as the draft upon the hitch strap draws the ring into the angles of the mouth. In driving, a pull on the line stretches the elastic and draws upon the face strap and throat latch, to carry back the bit. The device represented at *b* includes two pairs of branch reins attached to the ends of the driving lines, one, I I, leading directly to the bit rings, and the other, *c c'*, passing over the horse. The lower branches, A, connect with the same rings by a special spring within cases, F. In *c* the overdraw strap, A, and the check rein, B, are secured to the bit ring, C, and the driving rein, D, to a swivel on the bit. The driving rein passes through a ring on the end of the overdraw strap, and is also connected to the check rein. A strong pull on the driving rein throws up the horse's head and prevents him from kicking. The bit ring, F, in Fig. *d*, is suspended on each side from a ring, D, on the check strap, by a running strap, which, connected primarily to the bit ring, passes up and down through the check ring; the running strap is then carried down through the bit ring and connected by

Fig. 2.



Bridle-Bits.

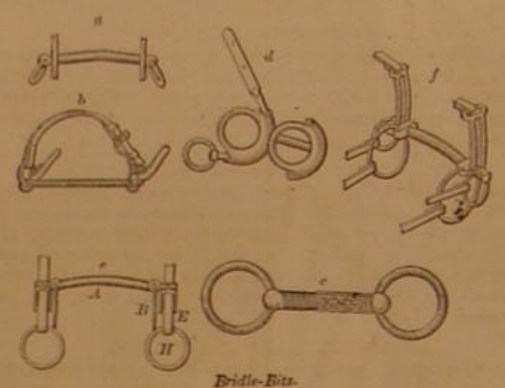
a ring to a safety rein, I. The latter is also connected to the gag rein, K, so that pulling upon the safety rein shortens the gag rein, and at the same time draws up the bit toward the rein on the check strap. As shown in *e*, the driving reins run over pulleys attached to the bit rings and throat latch, and thence pass to the check hook. Stops on the check portion of the rein limit the length of the gag part. The bridle, *f*, has a safety attachment formed by supplemental reins, A, within the ordinary reins, and which, connecting directly to the check straps, pass through the rings of the bit and serve to pull the bit forcibly into the corners of the mouth. In Fig. *g*, the driving rein connects with the cheek strap, which is pulled through the bit ring, and draws the bit up into the angle of the mouth. In *h* a lever jaw, A, on each side, is suspended from the throat latch of the bridle. The jaws are kept apart by a spring, but by pulling on the rein, C, they may be brought together, so as to compress the horse's windpipe and choke him into submission. In Figs. 2 and 3 various forms of

BITS

are illustrated. Fig. 2 shows the bits used in the United States army. *a* is an ordinary curb bit, and *b* is the Mexican bit, in which the curb chain and its strap are replaced by a curb ring. By means of the branches, a leverage is obtained upon the horse's jaw, the chain behind forming the fulcrum. The snaffle, *c*, has two bars, jointed together in the middle of the mouth, and has also rings at the ends for the rein.

In Fig. 3, the stiff bit, *a*, has rein rings at the ends, and is

Fig 3.



Bridle-Bits.

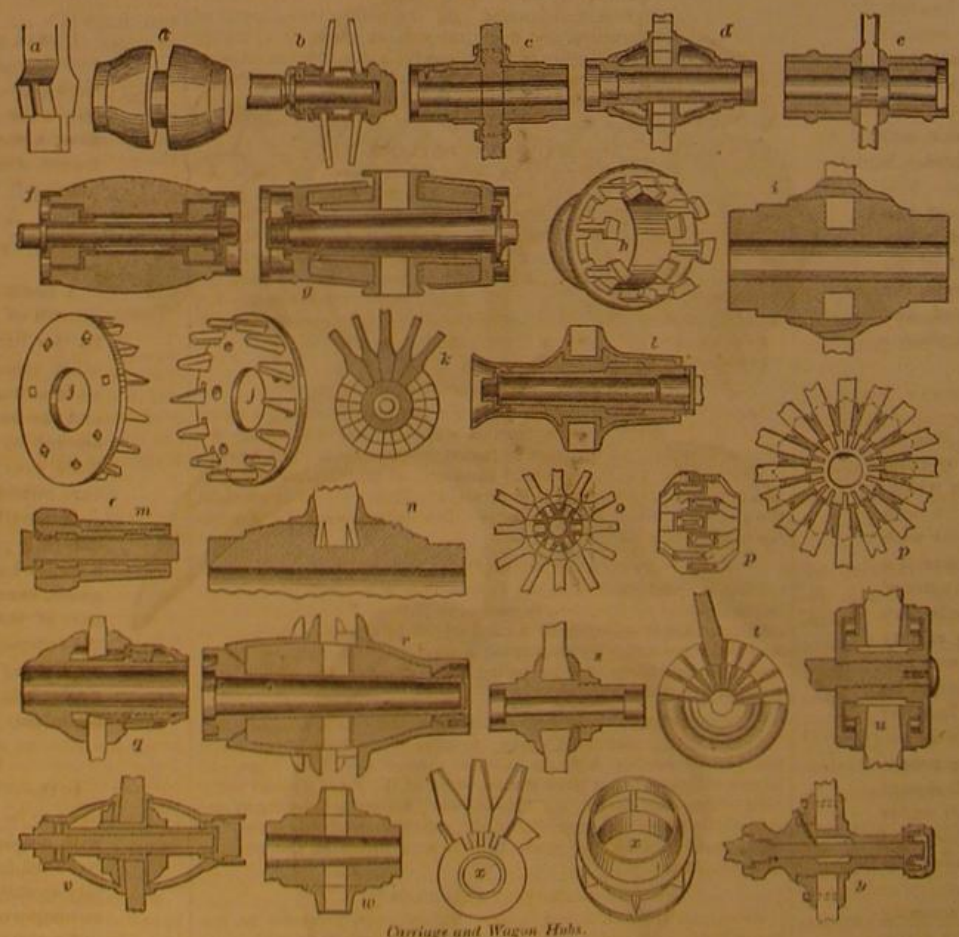
usually without branches. It lacks the middle joint of the snaffle. *b* is a new form of upper jaw bit. It is fastened by a nose strap to the upper jaw, and buckled to the gag-bearing rein. A safety rein passes to the usual bit rings, and is also connected to the bearing rein so as to pull the usual bit back against the jaws, and the upper jaw bit up into the angle of the mouth. The elastic bit, *c*, consists of a chain covered by closely coiled wire, between the bit rings. Another form is made of twisted wire with a soft rubber covering. The bit shown at *d* has tubular rings through which pass the straps connecting the driving reins to the head stall. When the lines are pulled upon the stiff bit is drawn up into the angle of the mouth. Bit, *e*, has a pulley frame swiveled to its ends. The driving reins are buckled to the rings, H; and when they are pulled, the straps, E, run through the pulleys and draw the bit up into the mouth. The bit shown at *f* is so made that one rein is connected to the bit ring and the other to the slotted check pieces. When the latter rein is pulled, the rigid bit slides up the slots and acts on the mouth.

In Fig. 4 we give engravings of a large number of car-carriage and wagon wheel

HUBS.

a is a hub having a circumferential groove, in which the shoulders form a continuous band, while the tenons of the spokes are set in mortices in the bottom. *b* is a metallic hub, one portion of which forms the axle box, around which are

Fig. 4.



Carriage and Wagon Hubs.

nuts on the inner ends of the double set of iron spokes. *c* has two metallic bands, between which the spokes are clamped. *d* has a hollow axle box around which are clamped two hollow disks, which have projecting lugs to form the spoke mortices. *e* has a metallic shell with a depressed center, in which the spoke mortices are formed, and has tubular cases driven in from the ends. *f* has rubber disks around the axle box at each end of the hub. *g* has a central disk forming the spoke sockets, and this is clamped by two outer disks with two intervening hollow cones. *h* has two hollow shells with T-shaped lugs, which interlock to form spoke sockets. *i* has two overlapping morticed hub bands. *j* has two metallic disks with projecting lugs to form spoke mortices; the disks are drawn together with bolts. *k* has a grooved hub with alternate projecting lugs to form dodging mortises. *l* has plaster material run in between the axle box

Fig. 5.

Horseshoes.

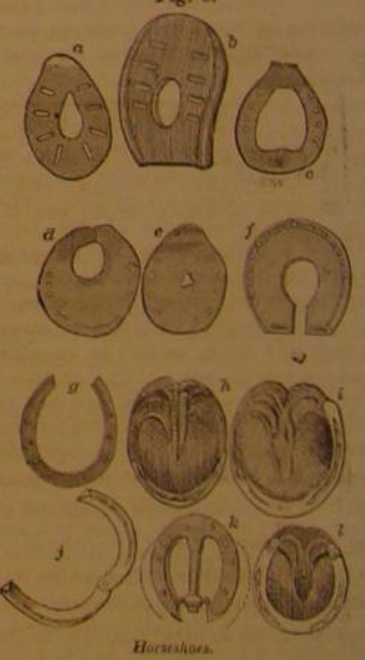
and shell. *m* is of similar construction. In *n* the hub has a dovetail mortice, wedges to prevent the withdrawal of the spokes, and beveled metallic bands as seats for the same. *o* has a morticed hub and metallic bands to clamp the spokes. In *p* the hub band has staggering metallic sockets, and the hub has mortises for the spoke tenons. The inner hub band in *q*, which screws on the sleeve of the outer portion, drives wedges against the spokes. *r* has a metallic shell with staggering mortices and projecting lips to support the spokes. *s* is a metallic hub formed in three parts, the axle box and inner hub band, the outer hub band, and the clamping nut. The circular spoke groove has a dovetail form. *t* has a metallic band with beveled mortice. In *u* the end flanges are screwed in a morticed flange ring, between which and the hub flanges are anti-friction rollers. *v* has a metallic hub shell, within which is a spoke socket formed by sleeve, nut, and projecting lips. *w* has a morticed metallic band on a wooden hub. *x* has a metallic band whose mortices receive the spokes in clusters. *y* has a metallic hub which forms the axle box, and has a lubricating chamber and spoke clamps.

Fig. 6 represents an interesting series of

HORSESHOES,

showing ancient and curious forms. *a*

Fig. 6.



Horseshoes.

is an early Arabian shoe, and *b* an Arabian shoe of more modern date. *c* is the Moorish pattern, *d* the Persian, *e* the Portuguese, and *f* the old English. *g* is a racing plate, *h* a tip shoe, *i* a three quarter shoe, *j* a pointed shoe, *k* a screw shoe, and *l* a calked shoe. Fig. 5 shows a variety of new inventions in this line. At 1 the bifurcated springs, *a a*, clip the hoof, and are attached to the shoe by bolt and nut; 2, countersunk headed screws, parallel to the wall of the hoof, act as fastenings; 3, ridges and indentations are formed on

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the sole of the shoe; 4 is a shoe for contracted hoofs. By means of the screw, *a*, and nuts between the heel clips, the branches of the screw may be spread. In 5, a supplemental roughing shoe is attached to the upper shoe by clips, *a a*, and a sliding screw block, *b*. Pins at the rear prevent lateral displacement. In 6, the shoe is hinged at the toe, and is designed to be permanent; it is beveled on its upper inner edge to receive the flange of a removable false shoe, that is expanded outwardly by a screw. In 7 is a double shoe; the upper one is hinged at the toe and has a jointed crossbar at the heel; curved clips, *a a b b*, fit the walls of the hoof and secure the hoof in place; to this the lower plate, *c*, is secured by screws; In 8, the shoe is attached to the hoof by pieces of leather and straps. In 9, the shoe has a toe cap, is jointed at the sides, and has clips and pivoted catch or connecting bar at the rear, dispensing with nails. 10 has rear clips, *a*, the cap, *b*, and strap, *c*, held by a button on the toe cap, to secure the shoe. In 11, the removable toe and heel calks, *a b*, are dovetailed into plates, *c d*, which are fastened to the shoe by screws. In 12, the toe and heel calks are adjustably attached by screws.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From November 19 to December 2, 1875, inclusive.

BOILER FURNACE, ETC.—H. M. Smith *et al.*, Chicago, Ill.
CARBURETTER.—J. R. Allen, Chicago, Ill.
CLEANING BOILER FLUES.—A. Crosby, New York city, *et al.*
DISTILLING APPARATUS.—J. W. Reford, New York city.
ELECTRO-MAGNETIC MOTOR.—H. M. Paine, Newark, N. J.
GAS MANUFACTURE.—J. W. Beatley, Brooklyn, N. Y.
ICE MACHINE, ETC.—D. Coughlin, Mass.
MAKING CIGARETTES.—A. A. Pope, Boston, Mass.
MAKING PLUMBERS' TRAPS.—F. N Du Bois, New York city.
PADDLE WHEEL.—R. Forward, Cincinnati, Ohio.
POTATO DIGGER.—L. A. Aspinwall, Albany, N. Y.
PRINTING ON GLASS.—J. W. Wells, Philadelphia, Pa.
SACK-SEWING MACHINE.—W. Webster, San Francisco, Cal.
SAND BLAST.—R. A. Tilghman, Philadelphia, Pa.
SCREW NUT MACHINE, ETC.—A. Marland, Pittsburgh, Pa.
SETTING CAR SPRINGS.—T. B. De Forest, Birmingham, Conn.
SHUTTLE AND SPINDLE.—E.M. Stevens, Boston, Mass.
SIGNAL BUOY.—J. M. Courtenay, Cornwall, N. Y.
TREATING OIL SEEDS.—A. B. Lawther, Chicago, Ill.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WORK TABLE.

Joan Cannon, Lines Hollow, Pa.—A revolving disk under the top of a round table has pockets depending from the outer edge for holding work or implements. The person using the table can turn the pockets around readily to the place where it is convenient to use them.

IMPROVED WAGON BRAKE.

Thomas H. Gourley and William R. Lovelace, Talbott, Tenn.—This is a new arrangement of brake mechanism of simple and ingenious construction, but which it would be impossible clearly to understand without a diagram. Generally, the operation of holding back on the neck yoke by the team applies the shoes to the wheels; and when the draft is applied to the double tree, the brake is removed.

IMPROVED DRAFT EQUALIZER.

Hiran Cartwright, Owantonna, Minn.—This is a novel assemblage of jointed levers and bars in connection with the tongue, the whole serving as an evener to equalize the draft among the horses.

IMPROVED CARRIAGE CURTAIN.

Henry C. Moody, Oswego, N. Y.—This invention is a shade or curtain attachment to the front bow of a child's carriage, for excluding the sun and rain. The curtain is divided at the center, and connected at each outer edge and the top to the bow by a cord. The general arrangement is such that the curtain is free to slip up and down on the bow.

IMPROVED DUMPING CART.

George B. Wiestling, Mont Alto, Pa.—This invention is an improvement in the class of dumping wagons which, while adapted to dump in the ordinary way, may be also adjusted for shooting the load through a chute, or over the curb stone, into the coal hole, without discharging on to the pavement or into the gutter. The cart has, in addition to the ordinary shaft frame, and an extra frame combined with the cart body and the axle, with the rear end of the body hinged to its rear end; and a ratchet mechanism, shaft, chain, and toggle bar are combined with the cart body.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED METHOD OF CASTING CAR WHEELS.

William Wilmington, Toledo, Ohio.—This invention relates to a new method of casting car wheels designed to obviate chill cracks; and it consists in first introducing into the mold molten metal of the proper temperature, and then introducing metal of a higher temperature, which is allowed to escape from the mold in streams across the flange and tread portion, while the intermediate sections are being cooled, whereby the flaring metal is made to take up the shrinkage.

IMPROVED CAR COUPLING.

Derastus Harper, Hearne, Tex.—The link is placed on the lower projection of one drawhead, and a pin dropped, which balances the link in horizontal position ready for coupling with the approaching drawhead. The pin of the other drawhead is supported on the top part of a swinging gate, which is prevented from swinging to the outside by a top projection, but which is readily carried back by the entering link, so as to release the pin, and drop the same for coupling with the link. On raising the pin for uncoupling the link, the gate drops into vertical position, and supports the pin on a recessed part between arms.

IMPROVED PUDDLING FURNACE DOOR.

Joseph Boyland, Troy, N. Y.—In this invention there are the swing stops on the door frame or furnace wall, and curved ribs on the door with which the stops act to fasten the door shut. The ribs are a little eccentric to the pivots of the stops, so that in case any matters get under the door so as to prevent it from closing down tight the stops will fasten it all the same. The device seems to be capable of easy operation.

IMPROVED MIDDLINGS PURIFIER.

John F. Gandolfo, Dubuque, Iowa.—This is a series of inclined sieves graduating from fine to coarse, in passing through which the middlings are acted upon by a blast which increases as the coarser sieves are reacted. By employing a shoe with an endwise movement, the middlings are propelled forward over the sieves in a straight line with rapidity.

IMPROVED SUBMERGED TIDE AND CURRENT WHEEL.

John J. Hill, Hayden's Ferry, Arizona Ter.—This water wheel has curved vertical buckets tapered toward the outer edge, and having a thicker inner edge coming short of the shaft, a space being thus left around the shaft. This allows of watering entering at one side of the wheel and escaping at the other, thus affording two impulses, and rotating the wheel in whatever direction the current may be flowing.

IMPROVED STOP COCK.

Nehemiah Upham, Athol, Mass.—This inventor proposes an improved valve for water and steam pipes, that may be opened easily with little friction, and manufactured in a convenient manner. It consists of a valve case with sliding valve segment, operated by a pronged and raised spindle and intermediate friction roller, which is retained in place by a spring or its equivalent, when the valve is partially open.

IMPROVED MECHANICAL MOVEMENT.

Ellison Leslie, Brown's Cross Roads, Ky., assignor to himself and George W. Hunt, of same place.—These inventors have devised a simple mechanical arrangement of cranks, pitmen, and lever, by which they claim that loss of motion through the slipping of the belt used is prevented, and power transmitted more effectively.

IMPROVED WINDMILL.

David L. Osborn, Ashland, Neb.—The invention consists in vanes hinged by straps to arms that are outwardly inclined from the hub and in the mode of combining arms, rods, and hub extension. The vanes approximate the form of a screw to a greater extent than when arranged exactly radial and in the transverse plane of the wheel; and an adjustable weight expends its power in keeping them turned sideways to the wind. Other devices increase the resistance of the weight as it rises by increased power of the wind, so that the regulator is graduated to a considerable extent to the force of the wind.

IMPROVED DRAWBRIDGE.

Mitchell Vincent, St. Paul, Minn.—This is an improved pontoon drawbridge for railway and other traffic. It consists of two stationary pontoons supporting the approach bridges, and two pontoon piers carrying the drawbridge, and moving with the same, one being hinged to the stationary pontoon to swing with the drawbridge. The drawbridge is closed by a capstan and chain from the opposite stationary pontoon, and opened from a pier above or below the bridge in case no current for opening in the drawbridge is available.

IMPROVED SELF-LOCKING CULTIVATOR TEETH.

John Harris, Marquette, Wis.—The cultivator teeth in this device are so combined with an ingenious arrangement of springs and levers that, should the teeth strike an obstruction, they will unlock and swing back, and again lock themselves in place as soon as they have passed the obstruction.

IMPROVED GEOGRAPHICAL GLOBE FOR SCHOOLS.

Newbern Norris Browne, Woodstock, Ala.—This inventor proposes a globe made of rubber or other flexible material, which may be inflated by suitable disposition of a tubular axis.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES DRYER.

George W. Green, High Point, N. C., assignor of one third his right to Oliver S. Causey, of same place.—This is a new combination of pivoted bars, which when folded together occupies but little space, and which, when extended, offers a large amount of drying surface. The construction appears to be strong and simple.

IMPROVED FIREPLACE SCREEN.

William C. Williamson, Newbern, Tenn.—The upper section of the mantel is made hollow, and provided with a hinged lid, which is opened and closed by a suitable locking device. A screen winds upon a roller in the hollow space, and passes through a bottom slot to the fireplace below. The lower end of the screen is attached to an ornamental rod, which is locked to the sides of the mantel when the screen is wound up entirely, so that the bottom rod closes the guide slot. The screen is drawn down to cover the fireplace when not used.

IMPROVED CLOTHES DRYER.

Frank M. Clark, South Tamworth, N. H.—This is a series of pivoted jointed arms connected to a morticed block, which may be secured to a wall. There is a simple device for extending and folding the arms. The whole may be compactly folded.

IMPROVED WINDOW SCREEN.

Henry B. Walbridge, Brooklyn, N. Y.—The ends of the gauze are wound around two small rollers, so that it may be adjusted to the width of a narrower or wider window, and said ends are confined by open ring springs slipped upon the rollers. The outer ends of the springs are extended in a tangent to said rollers, so that they may be slipped beneath keepers attached to the sides of the casing, in such positions that the portion of the gauze between the rollers may bear so snugly against the bottom rail of the sash as to prevent the passage of flies, mosquitoes, etc.

IMPROVED CLOTHES DRYER.

Willis Adams, Neelyville, Ill.—This is a new arrangement of pivoted arms and connecting pieces, so constructed that it may be easily folded into a very small compass for storage and transportation, and which can be conveniently folded and unfolded. When unfolded, the device affords a large amount of drying surface.

IMPROVED WASHING MACHINE.

John I. Shotwell, Welland, Can.—The new feature in this consist, in alternately working plungers, that are carried by a revolving crank shaft against an adjustable spring rack with rubbing rollers The spring rack presses the clothes with considerable force against the plungers, so that the thorough cleaning of a greater or smaller number of clothes is produced.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CIDER MILL AND PRESS.

Henry Krumsick, Nashville, Ill.—This is such a combination of cider mill and press that the apples, grapes, or other fruit passing through the mill may be directly conveyed to the press box, and the press be worked in connection with or without the mill. The mill is supported on a frame, that is placed laterally across the press box, and attached to the standards or main posts of the press, the mill-operating shaft being journaled in bearings of the lateral frame, and made detachable with the same and the mill.

IMPROVED PEARL BARLEY MILL.

Henry S. Northrup, Quasqueton, Iowa.—The wheat or barley to be pearled passes to the inside of a stationary casing, near the eye or shaft of the revolving grindstone, being conducted by side channels with supply regulating slides, from the hopper at the top. The channels feed a continuous supply of barley to the casing, and keep the same packed full all the time, so that the stone may always act on a uniform quantity of barley, avoiding thereby the getting loose of the same in the case, and the increasing of the speed of the stone.

IMPROVED HONEY PACKAGE.

Lawrence Drake, New York city.—This improved package for honey is a glass jar contrived in form and shape for receiving and inclosing a comb and the frame in which the honey is made. The cover is of glass, sheet metal, paper, or any other approved material. The object is to provide a package that will protect the honey from flies, air, and dirt, and at the same time expose it to the inspection of the purchaser.

IMPROVED PORTABLE HAY PRESS.

Michael McCarty, Pueblo, Col. Ter.—In this press the follower is operated vertically by means of rods worked by chains and a windlass. The improvement consists, first, in jointing the rods to enable the follower to be tilted to one side of the top of the press case, to allow the hay or other material to be inserted; and second, in novel means for fastening the door of the case out of which the bales are discharged.

IMPROVED HARROW.

Henry Meili, Yellow Stone, Wis.—This harrow has adjustable double lock bars, which serve also as guard pieces to carry the harrow sections over obstructions, exposing thereby the teeth in a less degree to violent shocks and injury. The harrow may be folded for being readily placed on a wagon for transportation to and from the fields.

Business and Personal.

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

Notes & Queries

J. O. will find directions for removing moles from the skin on p. 347, vol. 32.—J. F. H. can increase the draft in his boiler furnace and economize fuel by inserting a jet of steam in his shaft. See answer No. 45, p. 396, vol. 33.—Mrs. J. can prevent rust on the bright parts of her sewing machine by following the directions on p. 169, vol. 33.—W. H. H. will find on p. 74, vol. 28, full directions for laying out the sides of a hopper.—O. E. D. will find a description of a speed indicator for railway trains on p. 271, vol. 33.—R. M. can make Pharoah's serpents by following the directions on p. 315, vol. 32.—F. M. can find out the quantity of water which can be delivered by a pipe of any particular size by using the formula on p. 48, vol. 29. Area of a circle = diameter^2 × 0·7854. This also answers P. Q. Sixty feet head of water = 1¾ + atmospheres = 26½ lbs. on the square inch, nearly.—E. T. is informed that vulcanite, as used for jewelry, ornaments, etc., is a patent material. He can clean his printing press blankets by washing them with potash lye.—P. H. G. can glaze his shirt bosoms by following the process described on p. 203, vol. 31.—T. M. D. is informed that full directions for molding in various materials are published on p. 58, vol. 24.—M. M. I. will find full descriptions of the principal forms of the perpetual motion nonsense in vols. 23 and 24.—H. W. H. will find answers as to his questions on the friction and passage of water in pipes on p. 48, vol. 29.—W. K. N. will find directions for tempering rock drills on p. 202, vol. 31.—R. H. H. will find directions for testing the purity of water on pp. 187, 281, vol. 33. This also answers C. L. M.—A. S. will find that greasy cotton waste is very liable to spontaneous combustion. See p. 26, vol. 33.—J. M. P. will find formulæ for calculating the strength of boilers on pp. 116, 165, vol. 28.—W. T. P. will find a description of a calcium light on p. 219, vol. 30.—H. C. will find directions for making friction matches on p. 75, vol. 29.—T. W. can attach glass letters to windows by using the cement described on p. 47, vol. 33.—L. J. T. will find a recipe for black ink on p. 92, vol. 33, for purple ink on p. 315, vol. 33, and for blacking on this or the following page.—E. D. D. M. should read the SCIENTIFIC AMERICAN, and he will then be aware of the impossibility of perpetual motion machines.—S. W. M. will find directions for hardening millpicks on p. 170, vol. 25.—J. G. A. is informed that the plaster composed of gypsum (plaster of Paris) and marshmallow root does not possess the virtues claimed for it.—G. P. A. can nickel plate his iron castings by following the directions on p. 235, vol. 33.—S. L. J. can clean marble by following the directions on p. 330, vol. 32.—G. A. M. can fasten rubber to wood with good glue —A. W. should put a tablespoonful of brown sugar into a quart of flour paste, and use it to fasten paper labels on tin cans.—C. S. R. will find a good recipe for sealing wax on p. 251, vol. 28.—T. H. H. will find a description of the manufacture of vinegar on p. 106, vol. 32.—E. J. S. will find full directions for making plaster molds on p. 58, vol. 24.—A. M. D. S. will find directions for silver plating without a battery on p. 408, vol. 32.

(1) L. E. McK. & J. W. K. ask: Is it healthy to keep plants in a sleeping room? A. Plants in a sleeping apartment are not considered as conducing to health, and some of the medical authorities claim that they are very injurious.

(2) M. E. D. W. asks: By what means can I detect petroleum or cotton seed oil in so-called linseed oil? A. Petroleum may be detected by its property of imparting a fluorescence to animal or vegetable oils, and by its aromatic odor on burning. An oleometer may be used to distinguish cotton seed oil from linseed oil.

(3) J. H. T., of Flekkefjord, Norway, asks: Am I running any risk in using tubs made of old petroleum barrels for washing underclothes in, or can I in any way make them fit for such use? A. In a short space of time, by the use of soap, the barrels will become deodorized and will suit your purpose perfectly.

1. What is the cause of a person's finger nails becoming concave, warping, cracking, and splitting? A. It shows an impoverished condition of the blood. Dr. Bean claims that certain diseases can be foretold by the condition of the nails. 2. Is there any remedy? A. Consult Wilson "On Skin Diseases."

(4) B. says: It is claimed that if a small quantity of common salt be put into a kerosene oil lamp, the danger of an explosion is lessened, and the illuminating power of the oil is increased. Is this so? A. The statement is entirely without foundation.

(5) N. M. A. asks: What is damp, newly precipitated alumina? In the manufacture of certain commodities, I am recommended to use oxalate of alumina, prepared by dissolving damp, newly precipitated alumina in a concentrated solution of oxalic acid. A. In one vessel prepare a strong solution of alum in water, and at the same time, in another vessel, dissolve a quantity of chloride of ammonium (sal ammoniac) in equal parts of water and strong aqua ammonia. Add the latter solution to the former and stir well for a few moments. Then allow to settle for a short time. Decant the liquid, wash the precipitate in clean water, and digest with hot solution of oxalic acid until solution of the precipitate is effected.

(6) W. V. J. asks: By what process can I transfer decalcomanie pictures to paraffin wax? A. We do not think it probable that you will succeed in employing paraffin in the way you propose. Try softening the paraffin on the surface by the aid of heat, and when ready, press the picture tightly against the surface until the paraffin has hardened again.

(7) J. W. R. says: In your issue for October 9 are directions for making a weather glass. I have followed them with great care and nicety (being well used to chemical manipulations) and succeed only in obtaining a colorless and limpid liquid, which remains entirely unaffected by the most sudden and severe atmospheric changes. Can you give any probable solution for my failure? A. You have employed either too much of the solvents or else your alcohol was not of the desired strength. We have constructed several of these instruments according to the recipe given, and have had no difficulty.

(8) A. A. H. says: I bought a bottle o clock oil: and having a small perfumery bottle with a ground glass stopper, I poured the oil into it. I suppose the bottle was not washed clean, for it turned the oil to the color of soapsuds. What can I do to the oil to purify it? A. This was probably due to the ammonia usually present in these perfumes. Treat with a little oil of vitriol, decant off the oil, and then wash with clean water.

(9) F. F. asks: 1. What is the best method of raising the poppy, and how is the opium extracted from it? A. Opium is the dried juice obtained from the unripe capsules of the white poppy (*papaver somniferum*). For properties, etc., see Pereira's "Materia Medica," also an extensive article by Dr. Eatwell in *Pharmaceutical Journal*, 1852, London, England. 2. Will it flourish in Central Illinois? A. We consider it very doubtful.

(10) B. C. S. asks: How can an oval cylinder be turned in a common iron lathe? A. By putting on a cam to move the slide rest in and out at every revolution of the lathe.

(11) J. says: I am building a sheet iron circular tank about 8 feet in diameter and 5 feet deep, and I wish to know how great is the tensile strain that tends to tear apart any portion of the lowest 12 inches of the sides. If there is no question of resolution of forces, I make out that this strip 12 inches wide has to bear a tensile strain of 3 to 4 tuns, which seems high. A. The pressure will be 36 times the weight of a cubic foot of the liquid in the tank.

(12) E. F. says: I am very much troubled with my hands becoming very rough from constant use of copperas water. Can you suggest a remedy? A. You may avoid this by wearing a pair of india rubber gloves, so as to avoid contact with the iron solution. Use a little good glycerin or glycerin soap as a remedy.

(13) A. F. O. asks. 1. What book must I consult in order to obtain the most exhaustive information concerning the practical details for compensating the pendulum? A. You will find the principal forms of compensating pendulums described in any good text book of physics. We do not know of any special treatise on the subject. 2. In a recent publication a pendulum is described in the following words: "A wooden rod, dried and varnished, carrying at its lower end (by way of bob) a hollow leaden cylinder. If the rod be about 46 inches long, and the cylinder 14 inches, it will vibrate nearly in seconds." Do you call that a good pendulum? A. It would answer for ordinary purposes. 3. What should be the diameter and weight of the leaden cylinder? A. The cylinder should weigh from 8 to 10 lbs.

(14) C. M. B. asks: At what speed should an ordinary wood-turning lathe run? A. At about 700 feet a minute.

(15) J. P. says: We wish to run a shaft at 80 revolutions per minute. On the shaft is a cam that strikes a plunger, which can be driven forward only by great force. We have on same shaft also a balance wheel weighing 2,100 lbs., with a diameter of 52 inches and face of 6¾ inches. We belt from a 24 inch pulley on a counter to this balance wheel, the balance wheel being the driver. Can we gain more power or momentum by putting a 30 inch pulley on the shaft at the side of the balance wheel, and belting on to the 30 inch pulley instead of the balance wheel? In either case, the speed of the balance wheel would be 60 revolutions per minute. A. We do not imagine that much advantage would result from the change.

(16) C. B. H. says: A friend and myself are discussing how to give a locomotive her full speed. I claim that, to do so, it would be necessary to throw her lever back to the farthest notch and open her throttle in the same proportion; but he says we ought to place her lever on the first notch off the center, and leave the throttle open. Which is right? A. You are.

(17) C. R. says: In your issue of October 30, you say: "Experiment has shown that the velocity of the shell when it leaves the mouth of the cannon is about 1,300 feet per second. The hight from which the projectile would have to fall to acquire this velocity is 26,800 feet. Consequently the work actually done by the powder is equal to 219,000 foot pounds. Will you give the formula by which this result is attained? A. It is the product of the weight of the ball multiplied by the hight due to the velocity.

What pressure per square inch is necessary to press separate pieces of ice into one homogeneous mass, which shall display no joints? A. At ordinary temperatures, a very considerable pressure, more than can be applied without special apparatus, is necessary.

What is a calory? A. It is the amount of heat required to raise the temperature of 2·2 lbs. of distilled water from 39·2° to 41° Fah.

(18) J. E. asks: Is there a process for uniting wrought iron with cast iron? A. We know of none.

(19) J. E. S. says: 1. We are building a steamer, 22 feet long, 5 feet wide, and 3 feet deep. Will an engine with a cylinder 6x3 inches have power enough to run it? A. The engine will answer very well. 2. What size of upright boiler will it take? A. Make a vertical boiler 30 inches in diameter and 4 feet high. 3. Will a three foot wheel, placed in the middle of the boat and having a six inch dip, be large enough? A. Yes. 4. At what speed could we run her? A. Probably 4 or 5 miles per hour. 5. What pressure would the boiler stand? A. About 120 lbs.

(20) H. P. M. asks: What is the best method of hardening malleable iron? A. See "Wrinkles and Recipes," published by H. N. Munn, at this office.

(21) C. R. C. says: A pane of window glass may be cut into pieces by being rubbed by a small portion of the white ash obtained from the ignition of certain woods in contact with air. The ash is to be placed on the glass and briskly rubbed over it with a flat piece of wood. Are the cutting particles crystallized carbon, and can they be utilized? A. When plants, etc., are burned, a portion of the silicic acid (sand) and soda, lime, or potash become fluxed together by the heat to form minute particles of hard glass.

(22) S. G. P. asks: Does a feed tank to a steam boiler need stay bolts in the heads, to carry with safety 100 lbs. to the square inch? It is made of ¼ inch iron, and is 24 inches in diameter and 40 inches long, singly riveted. A. It would be better to stay the heads.

(23) T. H. asks: Should a pulley with curved arms be so put on the shaft that the working strain tends to straighten the arms, or the reverse? A. The former. 2. When the arms have two curves, should the pulley be put on so that the working strain tends to straighten the part of the arm next the hub or that next the rim? A. The former is best.

I want to make a model that will require a considerable number of very small, thin castings. Can you tell me of a composition that will flow quite freely at a not very high temperature, will be about as strong as ordinary brass, and will file drill, tap, etc., comfortably? A. You describe the properties of good brass.

Can you tell me of any easily got and easily applied solvent for borax, to clean it off work where it has been used as a flux for brazing? A. It is best to scrape or file the joint.

(24) J. S. asks: What thickness of cast iron should a hollow globe of 18 inches diameter be, to sustain a steam pressure of 120 lbs. to the square inch? A. About ¼ inch.

(25) S. & H. G. P. say: We are using a 40 horse power tubular boiler, for the purpose of pumping oil wells. Four wells are worked by the boiler. One steam line (1¼ inch pipe) extends up a hill to a well 1,150 feet from the boiler. Another line (2 inch pipe) extends in another direction, on almost level ground, to a well 1,078 feet from the boiler. Another well is 300 feet from the boiler on the 2 inch pipe, both engines taking steam from the same line. The fourth well is near the boiler house, and the engine (in the boiler house) supplies the boiler with water. We use about 2,700 gallons of water every 24 hours. We carry 100 lbs. steam pressure, and run our engines 55 revolutions per minute. Our steam pipes are laid in 8 inch square boxes, packed with sawdust, and are tight. The connections with the engines and the safety valve are also tight, so that there is no escape of steam except through the several engines, which are in ordinary good working order. We use for fuel principally natural gas from the wells; but at times the flow of gas is not sufficient, and we have to use some bituminous coal. Now W. W. S. claims that, if we reduce the pressure in the boiler to 40 lbs., it would not take so much water nor so much fuel to do the same amount of work. I claim that it would take more water (because we would not work our steam so dry as at present) and consequently more fuel, as we should have an increased amount of water to heat. Which is right? A. Your consumption of steam and of water will, in proportion to the work done, be more economical at the higher pressure.

(26) C. R. says: There is a pipe, 2 inches in diameter inside and about 800 feet long, with 4 or 5 feet fall. The water will run for 4 or 5 days and then stop. There is no leak in the pipe. What is the cause? Is it not the friction on the inside of the pipe? A. Probably air collects at a high point.

(27) J. C. P. H. says, in reply to a correspondent who asked if there was a gain in power in having the area of the sails of a windmill equal to the whole area of the circle, over the old style of 4 sails: You answered: No. In a technical point of view you are correct; but I hardly think you mean to state that the full leverage area of any given diameter does not contain more power than the same diameter or area, only half or quarter filled with leverage area or wind surface. Do you so mean, and upon what principle is the statement based? A. If a windmill could utilize all the power in a cylinder of wind with a diameter equal to that of the sails, of course it would be well to give the sails the greatest area possible. As this is not practicable, however, it is easy to see that there will be an area which is best for any given case. This area might possibly be determined by analysis; but it is generally fixed by experiment.

(28) M. A. asks: 1. When was power first obtained from electricity? A. Page's magneto-electric engine, described in Silliman's *Journal*, vol. XX, 1831, was probably one of the first constructed in this country. 2. Which is the best direction in which to cover magnets with wire? A. Dr. Joule's very powerful electro-magnets were wound in the direction of their length.

(29) W. L. P. asks: Is there any difference between one inch square and one square inch? A. No.

(30) M. A. G. says: We desire to put a lightning rod upon a church spire, 120 feet high. About 12 feet of the top is a galvanized iron finial, which terminates in a point covered with gold leaf. Would you advise us to carry the rod above the finial, or would it be better attached to it, so that the finial will constitute a part of the rod? If the latter is the best plan, how would you attach the rod to the galvanized iron? Would it be well to simply put the rod around one of the waists of the finial? A. The rod should be attached to the base of the finial by a firmly soldered and riveted joint, so as practically to make an unbroken connection. All joints in the rod should be firmly soldered and secured against separation. If the soil is dry, you will need a large amount of conducting material placed underground in connection with the rod. See p. 400, vol. 33.

(31) J. W. P. asks: Is there anything that may be added to collodion for ferrotype plates, that will make it hard enough to stand a brush after the picture is taken? A. There is no foreign matter that can be added before the picture is made: but a collodion made of long fiber cotton, with an excess of ether, will usually answer best. If this will not do, flow the plate while wet (after the picture is taken) with dilute albumen or gum arabic.

(32) I. O. A. says: I am straining my eyes by working in white wood and reading by lamplight. I want to use spectacles, but I am told that if I once use them I must always use them. Is this so? A. Spectacles of the proper kind may be used to assist the eyes to see indistinct objects; but if there is not light enough to see well without them, their use would certainly be injurious.

(33) A. E. asks: How can I make a good washing fluid? A. Make a strong solution of washing soda, and render it caustic by the addition of quicklime.

(34) W. C. asks: How can I cement emery together? A. Use the best glue.

(35) L. J. T. asks: How can I make a good baking powder? A. Take tartaric acid 5 parts, sesquicarbonate of soda 8 parts, and potato flour 16 parts. Dry them perfectly, mix, pass through a sieve, and keep free from moisture.

(36) J. E. J. asks: Has it ever been explained how the common turkey buzzard is able to mount up without flapping his wings? A. We think not. See p. 292, vol. 32.

1. When will Saturn and Mars be in conjunction again? A. About 4 o'clock A. M., July 28, 1877. 2. Would an achromatic spyglass of 50 powers be of any use for astronomical observation? Would it enable a novice to discern Jupiter's moons and Saturn's rings? Would it show the globular form of any of the planets? A. If you have a spyglass which will give you good definition with a power of 50, you can see all you speak of and a good deal more.

1. What is the proper name of the gas generated by burning bituminous coal? A. The larger part is carburetted hydrogen; carbonic oxide and carbonic acid gas are also present. 2. Is it poisonous? A. Yes, slightly.

(37) J. H. asks: 1. How do engravers lay the design on the plate before they commence the operation of engraving? A. They coat the plate with a thin layer of whitening in water, and then use a red transfer paper, tracing the design with a steel point. 2. In drawing the engraving tool over the face of a copper plate, will it not leave a rough or feather edge? A. Not if the copper is of the right quality, and the tool is sharp and in the hand of a qualified operator.

(38) J. R. C. asks: Can you give me the meaning and derivation of the word *terra cotta*? A. *Terra cotta* (Italian) means "baked earth," and is the name for ware made of a paste of white clay, fine sand, and pulverized broken crockery, slowly dried, and baked to hardness.

(39) T. T. Y. asks: 1. What are quaternions? A. "A quaternion is the quotient of two divided right lines in space, considered as depending on a system of four geometrical elements, and as expressible by an algebraical symbol of quadrinomial form."—*Sir William R. Hamilton.* 2. Where can I find analysis of them? A. See three admirable letters of the above-named author. You may find them in Nichol's "Cyclopædia of the Physical Sciences." We do not know the publication you mention.

(40) J. G. S. asks: Can you give a good cure for cracks in the skin of hands? The points of my fingers and thumbs are badly cracked, and although kept as clean as possible, glycerin being applied, they will not heal. A. Try spermaceti ointment.

(41) W. B. H. asks: Please give me a recipe for making oil paste shoe blacking for shoes. A. Take ivory black 16 parts, treacle 8 parts, oil of vitriol 4 parts, diluted with water 2 parts, oil 2 parts, gum arabic 1 part, soft water (for final dilution) 64 parts. Mix well.

(42) Z. Q. Z. asks: What substance is best to use on the back of postage stamps, edges of envelopes, etc., to make them adhesive? A. Try a solution of gum dextrin (see p. 251, vol. 29) with a little refined sugar in it to prevent the paper from curling up when dry.

(43) K. says: When throwing the spectrum of vaporized metals on the screen, is it usual or best to use the condenser, as in the magic lantern, besides the focussing or condensing lens on the stand just before the prisms? A. Yes. Place the condensing lens between the lantern and prisms.

1. Will there be any disadvantage in making up a battery of 12 one gallon Bunsen cups and 40 one quart Grove cups? Is there any loss of tension or quantity by uniting Bunsen's and Grove's in the same circuit? A. No, unless the resistance of the circuit outside of the battery is very small. In the latter case the 12 one gallon cups alone will give the stronger current. If the external resistance of the circuit is of any considerable magnitude, the best effect will be obtained by uniting all the cells in series. The latter combination always gives the highest tension or potential. 2. Please give full instructions for setting up the Chutaux battery; mentioned in your paper of May 22, 1875. A. There are several modifications of the Chutaux battery, one form is made as follows: A glass or stoneware jar is perforated at the bottom, and an inverted saucer placed over the hole. Single plates of zinc and carbon are then arranged on opposite sides of the jar, and a sheet of tin or other thin metal placed in the middle (between the zinc and carbon). The side containing the zinc plate is filled with sand, the opposite side, containing the carbon, with pounded coke, after which the metal partition is withdrawn and a thin layer of sand spread over all. The exciting fluid is contained in an inverted jar over the battery; another jar beneath catches the liquid after it has passed through the sand and coke. Take 15 parts, by weight, of water, 1 of bichromate of potash, ½ of sulphide of mercury, and 2 of sulphuric acid, to form the solution.

(44) K. asks: 1. What is the best sized cell to use for a battery to produce the electric light? A. With an equal number of cells, the larger of two sizes gives the most heat and light. 2. In amalgamating zincs with mercury, will it do to immerse the zincs in mercury, or would this give them too much mercury? A. It is usual, after the zincs have been properly cleaned, to place them in a shallow dish and pour the mercury over them with a spoon. They should be carefully brushed afterwards to remove the excess of mercury. 3. How long should the nitric acid last in the Grove battery? Why does the current become so weak when the nitric acid becomes weak? A. That depends upon the intensity of chemical action. With a given quantity of acid, zinc, etc., a certain definite quantity of electricity will be evolved. This we may obtain in a longer or shorter time by making the resistance of the circuit large or small; if it is very small the battery becomes perceptibly weakened in a very short time. 4. Does not the current depend entirely upon the decomposition of the zinc? A. The current is the resultant of all the chemical actions which take place in the battery. 5. As platinum is a very poor conductor, is not the current weakened when passing through the platinum strips from the nitric acid to the zinc? Sometimes the strips become so hot as to almost boil the acid in the battery. A. Anything that adds resistance to the circuit necessarily reduces the current proportionately.

(45) P. D. S. asks: Is there anything that will destroy the attraction of a magnet when placed between it and steel? A. No; but the attraction may be partially neutralized by interposing a heavy piece of iron.

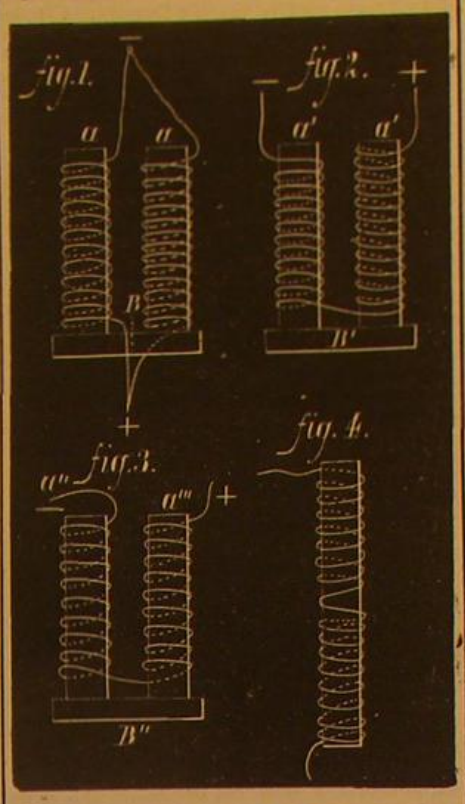
(46) N. S. asks: 1. Should all spirals, for lifting electromagnets, induction machines, magneto-electric machines, relays, and sounders, be insulated and wound on bobbins? A. All wires for electro-magnets, etc., should be insulated; especial care must be taken in this particular for secondary coils of induction machines. When the electro-magnet is small, it is often covered with paper, and the wire then wound on the core itself. 2. If I should wind flat spirals by commencing at one end of the bobbin, and wind a single flat spiral of the requisite diameter, then drop down to the shaft of the bobbin, the wire remaining unbroken, and then wind another flat spiral, and so on till the bobbin is filled, will I have a good secondary for an induction coil, if I insulate properly between the coils? Or if I take a piece of insulated wire, commence at its middle, and wind both ways with opposite ends, and so wind the flat spirals, and continue each way from center of bobbin toward the ends till filled, will this be equally good? Which is the best of these two? A. For medium sized coils, it is better to divide the bobbin in two parts. Then place it in a lathe, put one end of the wire through the dividing disk, and wind back and forth continuously until one end of the bobbin is full. Turn the bobbin end for end, connect with the finished coil by the wire passing through the dividing disk, and wind as before for the second coil.

(47) A. S. F. asks: 1. Does it make any difference in the power or the wear of a horizontal engine whether it runs over or under? A. No. 2. Is a speed of 125 revolutions per minute too fast for an engine of 14 inches diameter of cylinder, and 24 inches stroke of piston, said engine being well and carefully constructed with a view to such speed? Band wheel is 8 feet in diameter and of 18 inches face, and weighs about 3,600 lbs. A. No. 3. Is it entirely safe to run a line shaft, of 2½ or 2¾ inches diameter and 140 feet long, receiving the power of a 70 horse power engine at one end, and carrying pulleys as large as 42 inches diameter and of 16 inches face, at a speed of 300 revolutions per minute, such shaft being first class in all respects and carefully put up? A. Yes. 4. Would it be safe to use 20 horse power from such shaft, at the farther end from the engine? A. Yes, if its bearings are not too far apart.

(48) J. C. says: There is a pump in a well 85 feet deep; the pump is situated 65 feet below the surface (20 feet from the bottom of the well). The pipe above the cylinder is 65 feet long and 1¼ inches in diameter. The cylinder of the pump is 2¼ inches in diameter, and the length of the stroke of the plunger is 6 inches. The pump will pump water, but it is very hard to work it. The plunger makes 40 strokes a minute and is worked by a crank. Is the pipe containing the pump rod large enough to take the quantity of water as fast as it is pumped? A friend says the pipe is large enough, but that the plunger should make a larger number of strokes; and if it does this, he thinks it will work more easily. A. Your pipes, especially the suction pipe, would enable the pump to work more easily if they were a little larger in diameter.

(49) T. J. S. says: How can I quarter the driving wheels of a locomotive? A. What sort of quartering do you mean?

(50) J. B. F. says: In a recent issue, you state to a correspondent that you know no way of producing simultaneously in an electromagnet two north or two south poles. I send you herewith a sketch, showing several ways in which this may be done, as it may interest those of your readers who are experimenting in electro-magnetism. Fig. 1 represents the cores of an ordinary electro-magnet, coiled in the usual manner, but with the terminals of each coil connected as shown. Now, if if we connect one pole of the battery at −, and the other at +, the current will divide, one half passing through each coil in the same direction, producing at *a a* two north poles. If we change the connections of the battery, reversing the current, both cores at *a a* will become south poles, and in both cases B will be a consequent point. Fig. 2 represents similar cores, but so coiled in one continuous line that the current shall flow around both cores in the same direction. When connected with the poles of the battery as shown, both poles will be of similar name, say north; and if the connections are changed, both poles will be alike but opposite to those last named, and in both cases B′ will be a consequent point. Fig. 3 represents similar cores, but so coiled that the current shall flow around each core in opposite directions. This will produce one north and one south pole, and a neutral point at B″. Fig. 4 represents a straight bar magnet with each end coiled in opposite directions; when connected with the poles of the battery, both ends of the cores will show similar polarity, while the center will be a consequent point. In order to understand how these effects are produced, I think it is only necessary to refer to the electric force circulating around a wire through which a current is passing, and to state that the direction of this force or influence is due to the direction of the current in the wire. To show this in the most simple form, place a galvanometer needle over a wire through which an electric current is passing, and the needle will be deflected in one definite direction; now place the needle under the wire, and it will be deflected in the opposite direction. Now confine the needle in the direction opposite to that in which the current deflects it, and its polarity will soon be reversed by the action of the current.



(51) A. S. C. says: W. F. C. deserves credit for coming forward to support the theory which allows an ice boat to travel faster than the wind which drives it, but his diagram carries a confutation upon its face. He says that, with the sail set to an angle of 45°, the bolt, which represents the direction of the wind but not its force, if pushed through an interval of 1 inch, will cause the vessel to move forward a like amount. True; but then again he says: Make the angle of the sail 22½° instead of 45°, and the space passed through by the boat will be double that passed through by the bolt or wind. This result would be equally true with the first, had he not neglected to state that four times the speed or force of the wind was necessary for its accomplishment in the same time. Does he suppose that the wind, at a known pressure, after doing its full duty in driving the vessel at a certain rate, can be made to double that duty by increasing its resistance twofold, which he does by lessening the angle of the sail one half? If that were true, what is to prevent his attaining, by diminishing the angle sufficiently, a speed infinitely greater than the wind? This theory of a boat's traveling faster than the wind should, like its twin sister "negative slip," be relegated to the shades.

(52) E. D. C. says, in answer to a query as to why the railway gage of 4 feet 8½ inches was adopted: My book of reference says that the gage was originally 5 feet, and the flange of the wheel was on the outside. That not working satisfactorily, the flange was changed to the inside, which makes the measurement 4 feet 8½ inches.

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

E. W. P.—They are scales of mica.—C. W. D.—Both contain pyrites. By exposure to the air, some of the pyrites has been converted into sulphate of iron.—W. J. S.—The glistening powder is sulphuret of iron; the black is hornblende. Neither is valuable.—J. K. S.—It is fibrous steatite or soapstone.—G. P.—No. 1 is quartzite. No. 6 is ferruginous quartz. We do not find the other specimens spoken of in your letter.—T. H. A.—The amount of substance was too small for chemical examination. Try aniline red, or madder red, or red lead.

COMMUNICATIONS RECEIVED.

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

On the Etheric Force. By W. E S.
On the Yellows in Peaches. By P. H. F.
On a Hydro-Pneumatic Puzzle. By C. K.
On Diphtheria. By J. P.
On a Boiler Explosion. By T. E. K.
On the SCIENTIFIC AMERICAN. By S. S. B.
On the Laws of Proportion. By I. H. H. & S.
On Carbonic Acid as a Preservative. By C.W.S
On Heating Cars. By G. W. P.
On Laying Out a Square. By J. M. D.
On Gravity and Matter. By W. L. L.

Also inquiries and answers from the following:

P. G. G. N.—A. M. J.—S. D. S.—F. E. B.—W. C.—J. A.—W. E. D.—N. E.—C. T. W.—J. B. E.—R. P.—G. B. R.—J. G. S.—W. C.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells Portland cement? Whose is the best shingle-splitting machine? Who sells collections of minerals? Who sells machinery for making school slates? Who makes *papier maché*? Why do not the makers of the sand blast apparatus advertise in the SCIENTIFIC AMERICAN? Whose is the best tile-making machine? Who sells the best photographic lenses?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

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DESIGNS PATENTED.

8,820.—MONEY BOX.—J. G. Baker, Philadelphia, Pa.
8,821.—CASSIMERE.—C. Clarke, Rockville, Conn.
8,822.—STOCKING.—M. Landenberger, Jr., Phila. Pa.
8,823.—TRIMMING.—C. Lindenthal, New York city.
8,824.—GLASSWARE.—F. S. Shirley, New Bedford, Mass.
8,825,8,826.—EMBROIDERY.—W. Steinhaus, New York city.
8,827.—GLASS DISHES.—J. S. Atterbury, Pittsburgh, Pa.
8,828, 8,829.—EMBROIDERY.—E. Crisand, New Haven, Ct.
8,830.—INKSTANDS.—E. FINNEY, Philadelphia, Pa.
8,831.—INKSTANDS.—G. E. Hatch, East Cambridge, Mass.
8,832.—TOY CHARIOT.—E. R. Ives, Bridgeport, Conn.
8,833.—INKSTANDS.—H. S. Kerr, Philadelphia, Pa.
8,834.—FRAME CORNER.—C. P. Poinier, Boston, Mass.
8,835.—SHIRT FRONTS.—V. H. Rothschild, New York city.

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 Pateats..... $20
On application for Reissue..... $30
On filing a Disclaimer..... $10
On an application for Design (3½ years)..... $10
On application for Design (7 years)..... $15
On application or Design (14 years)..... $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, December 1 to December 4, 1875.

5,444.—J. M. Cooley, Hamilton, Ont. Side plaiter. Dec. 1, 1875.
5,445.—T. Webb, Elyria, Ohio, U. S. Feed cutter. Dec. 1, 1875.
5,446.—C. C. Robertson, Hamilton, Ont. Combined corset, shoulder brace, etc. Dec. 1, 1875.
5,447.—L. N. Fontaine, Ottawa, Ont. Liniment for rheumatism. Dec. 1, 1875.
5,448.—A. Chambers, Marylebone Road, London, Eng. Pneumatic signal. Dec. 1, 1875.
5,449.—W. L. Scott, Montreal, P. Q. Stamping with rubber type, etc. Dec. 1, 1875.
5,450.—I. H. Culp *et al*., Clifford, Ont. Carriage. Dec. 1, 1875.
5,451.—W. P. Plant *et al*., London, Ont. Gang plow. Dec. 1, 1875.
5,452.—J. H. Holland, Aurora, Miss., U. S. Land roller and seeding machine. Dec. 1, 1875.
5,453.—F. L. Blakely, Clinton, Iowa, U. S. Lap robe. Dec. 4, 1875.
5,454.—J. H. Morrell, New York city, U. S. Water supply and ventilation of buildings, etc. Dec. 4, 1875.
5,455.—S. H. Ghent, Hamilton, Ont. Drum beater. Dec. 4, 1875.
5,456.—A. D. Cable *et al*., Montreal, P. Q. Apparatus for rendering doors and gates self-closing. Dec. 4, 1875.
5,457.—B. Temple, Hamilton, Ont. Combined tube kettle and cooking apparatus. Dec. 4, 1875.
5,458.—H. E. Van Benschoten, Hillsdale, N. Y., U. S. Boot sole and heel protector, etc. Dec. 4, 1875.
5,459.—J. C. Schoomaker, Geddes, N. Y., U. S. Lightning rod standard. Dec. 4, 1875.
5,460.—H. Bailey, New York city, U. S. Tubular flues for steam boilers. Dec. 4, 1875.
5,461.—C. A. Scadding, Toronto, Ont. Printer's galley. Dec. 4, 1875.
5,462.—J. B. Relyea, Hicksville, Ohio, U. S. Neck yoke leather. Dec. 4, 1875.