
a WeEkly Journal 0f Practical information, art, science, mechanics, Chemistry and manufactures.
$\underset{\substack{\text { Vol. XXXXIV.-No. 2.] } \\ \text { [NEW SERIES.] }}}{\text {. }}$
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 furnish-

Fig. 2

ing the money for its sbare 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.
The building of the immense piers, which stand sentinels pushed foo banks of the East river, has . The tower on the Brooklyn side is entirely finished, save the few cap stonee, which cannot be added until after the cables are in place; the summit of the New York pier has reached a hight of two the summit of the New York pier has reached a hight of two
hundred and eight feet, lea ving thirty feet yet to be erected. hundred and eight feet, lea ving thirty feet yet to be erected.
The anchorage across the East river, in Brooklyn, is practi-

NEW YORK, JANUARY 8, 1876.
cally 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 en gravings 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 travel ing 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 possioly 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 houses and old rookeries, which covered the ground on which
the masonry now stands, began. So rapidly was the work the masonry now stands, began. So rapidy was the work
prosecuted that three months later found an excavation, in prosecuted that three months later found an excavation, in
some places twenty-one feet deep, finished, and 500,000 lineal 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 iong by 116 feet 4 inches in width. The material usea is a good quality of limestone, obtained from along the Hudson river, parts of New Jersey, and the vicinity of Lake Champlain. As soon 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 $4 \frac{1}{2}$ feet apart. Each plate Was cast in a single piece, at Wilmington, Del. To trans a difficult heavy mass from the pier to the anchorage was 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.


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 or bars for the chains is placed. Each chain consists of ten set ing links of each pair of chains contain together about nineing links of each pair of chains contain together about nine-
teen bars. This will be better understood by reference to Fig.


THE NEW YORK ANCHORAGE OF THE RAST RIVER BRIDGE.

3, 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 per orated cirs are in place are in a straight line so that pin 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 bare which constitute tiee links are $13 \frac{1}{2}$ 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 lyying of the masonry was continued, and four courses of blocks of granite were built up above the plates. each stone weigbing 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 im. mense 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 thiok. The bars, moreover, no longer stand parallel to one another, but are set off in pairs, the members of whicb 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 oable 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 fous cales, which will convey the strain to the masonry.
A glance at Fig. 2 will show that the $\in$ ffect 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 tune 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 eaeh 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 $61 \frac{1}{2}$ feet high and 23 feet wide, in rear 22 feet $7 \frac{1}{2}$ inches hieh 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 44 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 forw ard 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 mest all demands. The daily con sumption is on an average something over $100,000,000 \mathrm{gal}$ lons, 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 watersbeds of Putnam county and vicinity direct their streans, there is an abundance of water. The difficul ty 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 diffisulcy; 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 reservoi s in the lower part of the city and keeping them filled with sea water by powerful pumping engines. The principal ob jections urged against this project are its expense and the fact that the reservoirs themselves might not be wholly fret from danger in case of an extensive conflagration in their vicinity. It seems to us, however, that both of these objec tions 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 utiliz tion. We mean the hollow towers of the New York pier of the Brooklyn bridge. This immense structure contains within it two watertight cavities 120 foet 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 Brook]yn 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 bult by the Western Union Telegraph Company and the Tribune, and a few other fire proof structures, and therefore the water could be led under heavy pressure directly to any story.

## ELECTRICITY AS AN EXECUTIONER.

The revolting scenes accompanying the execution of several crimiuals in this vicinity are well calculated to bring to public notice the disadvantages of hanging as a mode of capital punislment.
The $t$ achings of Science are heeded and sought for in the build,ng 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 painlers 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 hrough 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, than 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 hrough 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, pnd 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, next point is its practical accomplishmen
Instead of building a gallows and pro
Iosiff ef erond the powerful Ruhmerf coiland a heary battery would procure ments would rarels need macing and would last indef nitely for other executions. The battery and coil should be of sufficient strength to deliver an eighteen inch spark. case of their being more than one person to be executed, al of the condemned would be conducted with all due ceremony o 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 es cablished from the coll, 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 mis takes. 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 incomprehensi bility and mystery, imbue the uneducated masses with a deeper horror.
J. F. H. says: "I have six volumes of the Scientifio american, in which I can find neat
known as to ongines and maehinery,"

## Srientifir Ammeriam.

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For the Week ending January 8, 1876
table of contents.

ings.

 - ELECTRICTTY, LIGHT, HEAT, ETC. New form for Powerfu
 Allied Substances.- Coumarin and ot
in Minnerals- Analysis of the Lowe Ga
 Shipbuilders, Glas,
society, London.

 Tind



 COMBINED RATES.


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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 receat 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 midocean, 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.
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 depraved as well as a cause of negligence
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; voyage in safety, they pocketed their profits from her cargo;
if she sank, they pocketed their profits all the same from the 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, 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 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 treasury? By similar reasoning of what use are protection against fire to a builaing which the owner knows he has in suredjust 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 a.ttempts at arson, that are com mitted in order to realize the insurance money on buildings. The records of almost any criminal court will show a start ling prevalence of these crines, which even the life impris onment 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 heen victimized; but it goes to streng
what we have said above. Again, we have a fire marshal in this city, charged with the express duty of tracing the origin this city, charged with the exprass 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 incenoiarism; and the records of his office likewise will show that that crime, which in malig. nity 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 ịt originates and in burning his own structure, the criminal equally on-
dangers that of his neighbor and the latter must protect himdangers 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 wealch 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 contingezcy, 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 best of us that, Nero like, we will fiddle when our property
goes to destruction through our carelessness, knowing that 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 re-
straints 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 wel. being of other people) more than compensate for the loss of the very often doubtfully gained "pound of cure" for misfor unes 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 no body can see but the mediums, so that all belief in the reality of Reichenbach's phenomena rests exclusively on outside stimony.
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 auy trace of polarity, but, a this is only a negative proof, and we do not know what fu ture investigations may reveal, it is as yet premature to giv decided opinion.
After considering Dr. Beard's elaborate and masterly expo sition of the phenomena thus far observed, and seeing th experiments which Mr. Edison kindly exhibited before the
members of the Polytechnic Club, with his apparatus of members of the Polytechnic Club, with his apparatus of
three vibratory sounders, charged by six chromic acid bat ery cells, we see no reason to change the opinions we have aready expressed: That,after all, the phenomena may be due to a peculiar form of induction. They prove that the induc tive power of a coil, when charged or discharged by a suf ficiently strong voltaic battery, extends all around to a dis tance of one or more inches, and can not only induce cur rents 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 tha he phenomena are due to electricity ; while Mr. Edison dif fers from him on this point, and is strongly inclined to con
sider the phenomena to be due to a new force, as distinc sider the phenomena to be due to a new force, as distinc
from electricity as light or heat is. Mr. Edison would rathe prefer to consider it as a new form of heat or light than o electricity, and gives, as his principal reason for this view he 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 o experiments
opportunity

## mechanical drawing

The following is from the introductory chapter of "Les ons in Mechanical Drawing," by Professor C. W. MacCord, given in Supplement No. 1
There is probably no other acquirement which so perfectly ombines pleasure with profit as skill in drawing. Even re garding it as an accomplishment only-a source of pleasure
and nothing else-this is of so refined a nature, and so eleva ting in its tendencies, that no better recreation can be sug gested; and leisure time could hardly be put to a more commendableuse than the cultivation and exercise of this art.
The ability to make drawing3, of any kind or in any man ner, is an unfailing source of delight and honest pride to its widelysor; but a feature of greater importance and mor he who extended interest is its great and varied usefulness guage clearer, more direct, and more nearly universal than any expressed by words. And it is useful to every one Whenout exception-of whatever age, of whatever position in individual of either sex who would not be, both directly and individual of either sex who would not be, both directly and
indirectly, the gainer by an acquaintance with this graphic ongue, which is here considered in its most comprehengiv sense.
Natu
Naturally, mechanical drawing is of the most varied an
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 pur-
suits, 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 thatthey 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 be lieve that two other considerations deter a great number from making a beginningoneis a false: impression that a fineand costly outfit of instruments is necessary at the outset; the other, a consciousness that mathematical principles are in volved, 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 drafts an who wishes to esecute 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 drawto the execution of even the most elaborate mechanical draw
ings are in reality few and simple, and one who is not familia 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 coustics and of harmony, but by the practice and continued epetition of exercises which train his fingers, and he is mas er of the mechanical diffieulties before he knows what ing, as he began writing, in a mechanical way: "I dot my 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 a east follow the lead of another; and, once interested in his own progress, it will be strange if, by the exercise of a lit te 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 valuable accuuisition, and one by no means to be neglected by any draftsman, is not what is usually understood by me hanical drawing, in which, not relying on the unaided ey and hand, the measurements are made by scale, and the lines by ruly and compass. Consequently, in order that the bints which we have to give in regard to such drawing may bo of the greatest use to the greatest number, we shall begin with a description of the simplest, yet perhaps the most use fal, of the instruments which the draftsman uses.

## the scientific american supplement.

Our many friends will be gratified to know that the issue of our Suprlement, 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 mmediately, which is now going through the press.
For the present we are electrotyping all the pages of the Stpplement, 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 en gaged in other branches of Science and the Arts, namely that the publication of the Surplement supplies us with a greatly increased amount of space, devoted to the informa tion and benefit of our readers. We shall be pleased to re ceive copies of working drawings and specifications of new mechanical or engineering works of specially interesting or otable 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 redit 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 and will afford, to all who desire to acquire this important
art.the most varied exercises and the most carefulinstructions.

## 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 be ing afforded for scientific determinations; but the results are,
failed at times during the test to keep the stream up to th required hight. The Knowles pump consumed $52 \frac{1}{2}$ 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 lbs.; the Blake, 62 lbs.; and the Hutchinson, $60 \frac{1}{2}$ 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, ngravings of which are given No. 3 pump No. 3 pump complete, with boil er. This machine is adapted to general purposes, especially for supplying buildings and railway tanks with water. It is of very simple construction, and in cludesanimprovementinswing
pecially adapted to fire purposes, and known as No. DD 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 ex perience to be one of the best measures of safety. Where


Fig. 3-STATIONARY STEAM FIRE ENGINE

Fig. 1.-STEAM PUMP WITH BOILER.
nevertheless, valuable to engineers, as showing quite clearly ing bolts, and a removable hand attachment, as represented the pump has its own boiler, as above noted, and is isolated the relative efficiency of the machines under conditions of in Fig. 2 . The last mentioned derice is useful for filling from the main structure it is out of the reach of daner, actual use. The details of one of the last competitions, be- boilers when steam is down, washing decks, and for similar tween the victor in the previous contests and the of 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 regardsadvantages of construction, facility of repairs, and similar points. The decisive contest helow 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 fol thats: The pulsometer fol. sumed 103 lbs . of coal, and


Fig, 4.-FIRE PUMP.
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, reser voirs, 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 exami nation will be guaranteed to project the above number of streams to the distance named from hydrants or other sources situated a mile away.
The Knowles pump finds one of its most important applica tions in mines, and two differ ent forms, used for deep min ing, are represented in Figs. 5 and 6. Fig. 5 is a double-act ing 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 stufing 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 plurts. Its principal feature i parts. the absence joints in the water end, and the novel ar rangement of valves by which not only the valve but also the valve seat is instant y remova ble by simply unscrewing the cap nut. These pumps are now working on lifts equal to 1,60 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 wat daily, and of forcing the
same to hights of hundreds of feet.

## 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 tro magnet, the coils of which are so wound that which are so wound that no magnetism is produced in its cores by the passage of an electric current. Use for an ar-
mature a piece of the mature 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 of the magnet. The
standard is to be con nected by wire to one end of a glass rod or 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 raat each contact. It at each contact. It
is here that the is here that the phenomena are sur-
prising, and apparently unexplaina ble. The graphite is not in the battery circuit, nor in any other. Moreover it is separated from the rest of the ap paratus by the glass tube. This alone would seem to prove that the force is not electrical, at least as the term is generally under is generally under stood; and when supplemented by the fact that the most delicate gal vanometer and the chemicals most sen sitive to the electric current fail to note its presence, this conclusion must be accepted. Many experiments have been made with a view of ob taining some defi nite knowledge, bu nite knowledge, but nothing has been the facts above stated, and in addition 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 obsta-


## Fig. 6.-HORIZONTAL MINING PUMP

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 flap ping of wings resembled the sound of a locomotive pulling a long train very slowly." He states that "it appeared to e about sixteen or eighteen feet across the wings as it flew, the body dark brown, the breast white, neck long, and beak ong 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, elose and thick, it is manifestl advantageous to connect hem by mechanical means, so as to save, b the transport of the actual telegrams themselves the multiplication of wires, apparatus, and lerks; and especially so when this can be done with a rapidity equal to that of telegraphy itself. Messages cannot be man pulated or written out a greater rapidity than forty words per minute so that, if it is possible to ransport a telegram itsol rom one place to n a minute not only a minate, not only peed of transmission ob tained, but all sources o error are eliminated. I fact, the average initia delay occupied by mes sages on the shortest line is about five minutes, so that tubes which can con vey the messages bodily within this limit are eco nomical and beneficial The essential element telegraphy is speed ransmission, and it is avident that, when cur

## Fig. 5.-HORIZONTAL MINING PUMP

distance of air equal to the thickness of the dielectric, and is diminished only by wider separation.-Journal of the Te egraph.

## 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 an. 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

Smid
ants 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 abes are essentially economical in the employment taff, for their use reduces the number of clerks require to a minimum. But of course there is a limit to their usefu employment, and a point is reached when, from telegraphic and economical grounds, wires surpass tubes in efficienc and durability. The limit of length is about two miles, fo at this distance telegrams exceed the five minutes interva allowed for their average transmission. Of course, wher rapidity is of no consequence, this distance can be much ex ceeded; but, fortunately for the British public, the one cri terion which its telegraphists have always endeavored to
attain, especially since the transfer of its telegraphs to the fogra ess 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 telegramsin England have increased from six millions to twenty millions.
The first germ of pneumatic tele. graphy 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 :
"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 ele ments,"
This proposal did not take practical form until 1854, when Mr. Latimer Clark laid down a $1 \frac{1}{2}$ 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 ex tended to Mincing lana, 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 itsmode of working. Compressed air was used entirely, and the necessary pressure was ob tained by admitting water from the mains into large air re servoirs. 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 prope or forward the carrier on to the nest place. This mode of obtaining power was found wasteful and expensive, and it has been nearly entirely a bandoned in favor of steam wor ng 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 wasalways kept flowing in the same direction by a doubleacting 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.

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

Venus will be well seen all through the month,and will be very near Saturn on the 16 th, 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 10 h . 55 m . A. M., and set at 10 h .21 m. P. M. On the 31 st , Mars will rise at 10 h . 13 m . A. M., and set at 9 h .43 m . P. M. The moon will be near Mars (apparently) on the 2 d of January, and again on the 30 th.

Jupiter.
Jupiter is still unfavorably situated for evening observers. On the 1st it rises about 4 in the morning, and sets at 1 h 39 m . P. M. On the 31 st it rises at 2 h .18 m . A. M., and sets at 11 h .56 m . A. M.
saturn.
Saturn rises on the 1st at 9 h .56 m . A. M., and sets at 8 h . $5 \mathrm{~m} . \mathrm{P}$. M. On the 31st, Saturn rises at 8 h . 7 m . A. M., and sets at $6 \mathrm{~h} .25 \mathrm{~m} . \mathrm{P} . \mathrm{M}$.
Venus and Saturn will have nearly the same apparent po sition on the 16th, but will be nearer the horizon, and there fore 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 1 st at 7 h .48 m . P. M., and on the 31 st at 5 h .41 m . P.M. On the 31 st it comes to the meridian at $12 \mathrm{~h} .40 \mathrm{~m} .(20 \mathrm{~m}$. before one in the morning) and is then $9 \frac{1}{2}^{\circ}$ west of Regulus, and $3 \frac{1}{2}^{\circ}$ above that star.

## Neptune.

Neptune rises at 0h. 35 m . P. M. on the 1st, and sets at 1 h . Neptune rises at 0 h .35 m . P. M. on the 1st, and sets at 1 h .
47 m . the next morning. On the 31 st it rises at 10 h . 38 m .
A. M., and sets at 11 h .50 m . P. M. It cannot be seen with out 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. Th photograph of November 18 showed two going off; but be ore the next picture, November 22, they had disappeared n the photggraph of November 23 there appeared a group f spots on the western limb, a group on the eastern limb, followed by a single one, and, near the center, two very smal ones. Clouds prevented photographing on November 23. The pictures of November 24 and November 25 showed only regular motion of the spots seen on November 22. In th hotograph of November 27 there appeared but one large pot on the western limb: the two single ones first observed, near the center, November 22, could no longer be found, and he group which had been seen on the western limb had passed off. The picture of November 29 show the large pot going off, surrounded by faculæ.
Photographing was much interrupted by clouds from Noember 29 to December 12; but when openings in the clouds allowed observations with the telescope, the sun's disk wa seen to be free from spots until December 12, when a small ne was seen coming on, but after that date :t could not be found. On December 14 a large spot was observed on the very edge. In the photograph of December 17, this spot ap peared 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

## CHOrxajpoudeutr.

## Electricity a Mode of Motion.

To the Editor of the Soientific 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 f 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 strtement of facts, namely, that electricity will pass with comment of facts, namely, that electricity will pass with com
paratively little resistance through a (so-called) vacuum, prefer, for the sake of the argument, to admit that he is correct.
The difficulty seems to consist in a lack of apprecia tion 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 transithing aree existing in the metallic conductor. I agree ricity through a space devoid of no transmission of elec tricity through a space devoid of matter; but it seems to me
that, in raising his objection, he should have offered some 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 argu ment to show that a void is possible, and that, being possi ble, 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 mo tion," 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 i mpossible, 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
W. E. SAWYER. shall move.
W. E. Sawrer.

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 circu lated 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 tatement 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 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 ics 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 venomafter five jears' 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 ettling the fact that the serpent cannot inoculate itself, a point which was for a long time disputed. His reports on his subject may be found in the Smithsonian Contributions, 1860, and the New York Medical Journal, January, 868.
New York city.
Henry S. Welcome.

## SEEING DISTANT OBJECTS FROM ELEVATIONS.

A correspondent mentions that it is proposed to build, ni Fairmount Park, Philadelphia, adjacent to the Centennial buildings, a tower 750 feet high, and asks if it is true that, rom 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 $8 \times 90$, 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 ,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 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 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 8 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, 0 . PI is the horizon of are hights fre and $R r$, $s_{s}$, and $i$ $P$, can be seen at different distances, $\mathrm{P} r$, P 8 , and $\mathrm{Y} i$. Without going into any mathematical dem onstration, it is clear that the hights $\mathrm{B} \cdot$. S , and $i$ inchat the far greater ratio than the distances, $\mathrm{P} r, \mathrm{P} s$, and $\mathrm{P} i$; 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 $1^{\circ}$; then the angle, PSO, will be $89^{\circ}$; 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. $89^{\circ}$ As PO is the radius of the earth, 20,691,914 feet, we wil have: SO : $20,691,914=1: 0.9998477$, from which $S O=$ $20,694,954$. From this we subtract the earth's radius, $\mathrm{O}_{8}$ leaving 3,040 feet for $\mathrm{S}_{8}$, 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 | mil | h | 8 | inches. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| " | $\mathrm{Q}^{\prime}$, | " | 2 | * | ، | 2 | feet. |
| " | 3 ', | " | 3 | " | " | 4 | ، |
| " | $0^{\prime}$, | " | 7 | " | ' | 30 | " |
| " | $10^{\prime}$, | " | 11 | ، | " | 88 | " |
| ، | 20', | " | 23 | ، | " | 338 | ، |
| " | $30^{\prime}$, | " | 35 | " | ، | 760 | ، |
| " | 35', | , " | 41 | ، | " | 1,036 | " |
| " | 50', | , " | 58 | " | " | 2,116 | " |
| " | 60', | , " | 70 | " | " | 3,040 | " |
| " | $80^{\prime}$, | " | 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 bighest 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 towors 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.
To prevent water freezing in the gas meter add glycerin. The proper proportion is one pint of glycerin to a gallon of water.

## practical mechanigy.

## ap joshol rosi. <br> numbir 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 he amount of the throw into consideration, and we have therefore to proceed as follows:


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
ine, CC. 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 com pass 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 measure ments 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, $\mathrm{H} g$, 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 othor, 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 trueit up, the too point will scrape over the sand, after leaving the cut and before it strikes it again, to such an extent as to rapidly de stroy the cutting edge, necessitating not only frequent re grinding 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 hubstands, because of the pro jection of the hub; and, furthermore, the marking for the hole and for the diameter can be performed at one operation, which is impraiticable 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 outside face after the chucking: or else, in turning of second chucking will be effaced. The main sonsideration, second chucking will be effaced. The main sonsideration,
however, is that there is only one way to chuck an eccentric to insure its being turned as true as possible; and the mark ing off must, therefore, be made to accommodate the chuck ing, 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 held 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 nlate 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 by such a procedure, the eccentric will be, when finished,
out of true to twice the amount that the face plate is out of 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. From the four poin ts A, B, C, and D, w mark off, on the hub side of the eccentric, center of its diam eter, E ; we then, set ting a pair of com. of throw required $f$ of throw required fo the eccentric, mark of from the center, E,
the line, $F$; then, with a pair of compass cal lipers, placed in each case with one en

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 bole 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 insuffi
ciency of metal in th hole, at A (E being th center of the diameter of
the eccentric, and $K$ the amount of the throw), we first set a pair of com passes to the required radius of the diameter and from the center, E strike the circle, $F$ which will show the mount of metal re quired to be taken of the circumference of the work, and therefore to what degree we are able to throw the hole to accommodat 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 , on small eccentrics, to mark the circle, L, as large a arger the circle, the less a slight want of truth in th hucking will ffect the truth of the work. It will be ob hucking win affect the truth of the work. It win be observed that, in conseque of the above the level of the face (to the ircle, F, in Fig. 186, would be too small i marked with the compasses set to the correct radius; bu since the duty of that circle is to merely indicate the amoun of surplus metal on the outside diameter, it will be suff ciently correct on ordinary eccentrics, to mark it as directed, making a slight allowance of increase in setting the com passes to draw that circle. If, however, it should happen hat the quantity of stock is so scant as to make it question able 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 compass may be set to the correct radius.
The hole being marked, no further marking should be per ormed until the eccentric has had both sides finished and the hole bored, when the diameter should be marked upon he plain side of the work, as shown in Fig. 188. After in erting the center piece, and marking off upon it the exac enter of the hole, we mark the line, C C; and finding th center of its length, as already described, we strike the line, $D$ then we mark on the line, $D$, the amount of the throw, measur ing from the center of
the hole, and we thus
 rain the center, he circle, $G(i$, which only intended to be mployed in setting the work, and need not herefore bo me any particular size The marking will thus e completed, and it will be noted that th hickness of the eccen ric and the hub, and the hight of the latter
have not been dealt with at all, the reason for the omis hem, that it is entirely unnecessary to regar al enough to clean them up) they mey safely be left to he turner, who may accommodate the amount taken off the
arst 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 sometime the case, it should be marked off as shown in Fig. 186.
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 re quire parallel strips or packing wherewith to chuck it, w 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 keywa to be cut. Then se lecting the location of the keyway, we we describe there an other circleof the sam diameter. Placing a straight edge so that one of its edges is jus even with one and th ame side of each cir cle, we draw the line ; and by repeating the operation on the olher side of the cir le, we shall have the sides of the keyway marked. To mar he depth, we make a fine centerpunch mark at the requis ite 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 c rcles, and the othe edge fair with the center of the centerpunch mark, and scribe a line along the latter edge and across the width o he keyway, the operation being shown in Fig. 190, A being he square. When,
however, there are a number of keyways f the same width and depth to be marked. it is more expeditious to make the gage shown (together with its method of applicaion) in Fig. 191, in which A represents he gage, being a piece $f$ ghee, being a piece ne sizterth nch thick the curved line being of the same ne being of the same
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

Piq. 190.
rio. 797

the ends, C D (being depressed), will contact with the bore of the hole of the eccentric and thus serve to keep the gage rue 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.
une
and

## euick Work in a Rail Mill

Inter-Ocean says: "A fow weeks sinee, the North Chieago Rolling Mill Company claimed the championship of the world n the manufacture of steel rails when they produced 1,010 sils 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 $2 \frac{1}{2}$ 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 workslast 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 (blacǐwood) was perfectly sound. In building jett.isi this fact would prove that iron bolts are not as dura ble a reenails of blackwood.

## IMPROVED RAILWAY RAIL JOINT.

We illustrate herewith a new mode of forming the exWe illustrate herewith a new mode of forming the ex-
tremities of railway rails, so as to produce a joint which obtremities of railway rails, so as to produce a joint which ob-
viates 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 B, as shown at C, in Fig. 1. The is such as to afford abundant play for the slots is such as to afford abundant play for the
rails to compensate for contraction and expan rails to compensate for contractio
sion, without disturbing the bolts.
sion, without disturbing the bolts.
By the use of this joint, it will be evident that the wheels of the vehicles never leave iron ex cept when crossing switches, since, while pass ing 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 continu ous 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 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 may be laid more easily and more rapidly than
others connected only by fishplates, that it is as others connected only by fishplates, that it is as
strong and as durable as the last mentioned mode 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 in ventor, Mr. Geo. A. Mead, North Salem, N. Y.

## 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 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 theinventor 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 cr 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.
Simple and Compound Engines.
Simple and Compound Engines.
At the ordinary meeting of the Glasgow At the ordinary meeting of the Glasgow
Association of Engineering and ShipbuildAssociation of Engineering and Ship Draftsmen, November, 1875, Mr. David ing 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 mem advantages that would take place by a return to the high grade expansion condensing engine, with a higher pressure grade exp
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 Soll.
A correspondent of the Winstead (Conn.) Press, writ regard to a trip which he has recently taken to the says:
$\qquad$ " Through Pennsylvania and in the valley of the A'


MEAD'S RAILWAY RAIL JOINT.
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 appar ently interminable reaches, cross the State till we strike the Mississippi at Quincy. There are fruit, other crops, and arises of course; but corn is the great staple, ar 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
"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 praducts, like the cereals and provisions, is a bank-


## ERDMAN'S FURNACE GRATE BAR

rupting process, robbing the soil and impoverishing the pro ducers. If continued for two generations, the people will be forced to migrate to virgin lands, there to repeat their de 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 common wealth."

## 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 vernal equinox having thus been by no means justified in
in the result. The light was perceptible for a short time on
convenient for calculation than 150 lbs. 220 feet, and there fore 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, th diameter of the cylinder, the length of stroke, the numbe 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 cylin der during the whole stroke, and a cylinderful of steam a boiler pressure is used at each stroke, as thecut off, when there is one, takes place before the piston has reached the end o 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 cut ting off, in order to find out what the aver age pressure is in the cylinder. In the commoner sorts of engines, not provided with indepondent cut-off valves, the poin of cutting off may usually be taken a from one half to three fourths of the stroke, though sometimes more than this It may, perhaps, be safe to take the aver age pressure in the cylinder at abou eight tenths of that in the boiler; though where the steam pipe is long and the throttle valye 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 dis tance which the piston under this pressur travels during one minute. Therefore, we have the rule: Multiply the area of the piston by the average pressure per the piston by the average pressure inch upon the piston, multiply thi
squal square inch upon the piston, mist the piston result by the distance which the piston
travels per minute in feet, and the result travels per minute in feet, and the result
is the number of foot pounds per minute is the number of foot pounds per minute
which that engine can raise. Divide by which that engine can raise. Divide by
33,000 and the result is the number of
the evening of November 21, without any yellowish tinge and the position of axis somewhat doubtful from the indif ferent state of the sky. Professor Heis's observations in De cember, from 1851 to 1870 , place the mean position of the apex on the equator in R.A. $349^{\circ}$, or with about $82^{\circ}$ elonga tion 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 wer argely used to take the place of the horses before employed or 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 $2 \frac{1}{2}$ 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 $2 \frac{1}{2}$ miles per hour, he travels 220 feet per minute, and of course, at
this speed, the 150 lbs. would be raised vertically this speed, the 150 lbs. would be raised vertically feet per minute, or $3,000 \mathrm{lbs}$. 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 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, horse power. The number of feet per minute traveled by the piston is twice the number of strokes per minute multi plied by the length of stroke. This gives the number of horse power sutficiently nearly for all practical purposes.Savoard'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 amon 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 ap peared 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 completesuccess of the invention, and its adaptability to tramway purposes.
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 mot. tled 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 flesby 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 covoring 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.

The Demagnetization of Watches. Watches worn by students and others in technical laboratories are often rendered useless by being magnetized by the magnats 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 de-


## ALOCASIA INTERMEDIA

the new variety to La Revue Horticole, the most popular from $50^{\circ}$ to $70^{\circ}$ magazine of botany and floriculture published in France.

Window Plants.
Professor Maynard says, in the Scientific Farmer: Com paratively few persons who cultivate window plants are mor


Ine first class will include geraniums, carnations, centau reas, camelias, azaleas, abutilons, ageratums, callas, swee alussum, English ivies, smilax, mignonette, hyacinths, pri mulas, stevias, petunias, verbenas, lobelias, and roses. In all cacti, fuchsias, gloxinias, German ivies, helio trope, zorrenias, pileas, and roses. Roses are included in both lists, as they will succeed under both condi tions.

Plants grow much better where the temperature runs lower at night than during the day. It never should go below $40^{\circ}$ Fah. in the first case, or below $50^{\circ}$ 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 pa in the furnace filled with water, or an orn or som other vessel upon the stove. The atmosphere mus be free from sulphurous gases, and to accomplish this end the back damper in the stove must be kept open nough to allow its escape and the windows raised a little every day for a short time when the tempera ture 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 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 rap dly as stable manure, and in this have an advantage s tempering the violence makes manure last longe nd 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 rame boards, and about a foot or more from them and the leaves filled in between. If the plants are omewhat 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

Bridles.
are attached at $E$ by an elastic strap and snap hook, $C$, to the rings of the snaffle bit. Face pieces, $G$ $\mathrm{G}^{\prime}$, 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 puil on the line stretches the elastic and draws upon the face strap and throat latch, to carry back the bit. The device re. presented 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, $c c^{\prime}$, passing over the horse. The lower passing over the horse. The lower brings by a special spring within same $F$. In $a$ ine 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 eachside from a ring, $D$, on the check strap, by a running strap, which, eon. nected 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
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 gagbearing 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, $c$, censists 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 , to the rings, $H$; and when they are pulled, the straps, E ,
run through the pullegs and draw the bit up into the mouth. run through the pullegs and draw the bit up into the mouth.
The bit shown at $f$ is so made that one rein is connected to The bit shown at $f$ is so made that one rein is connected to
the bit ring aud the other to the slotted check pieces. When the bit ring and the other to the

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 holluw 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 spoks sockets. $i$ has two overlapping morticed hub bands. $j$ hae 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 asle box

Fig. 5.

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. 0 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. \& is a metallic hub formed in tbree 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


## Bridlt- Bies

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 cheek 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 sup$p$ ublished in numbers ny Messrs. Hurd \& Houghton, New Tork city.
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 carcarriage 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
is an $\epsilon$ arly Arabian shoe, and $b$ an Arabian shoe of more mo dern 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, $u$ 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
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 onits upper inner edge to receive the flange of a removable false shoe, that is expanded outwardly by a screw. In7 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 In 8 , the shoe is attached to the hoof in 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 int plates, $c d$, which are fastened to the shoe by screws. In 12, the toe and heel calks are adjustably attached by screws

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## 

## NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WORK TABLE.
Jonn Cannon, Lines Hollow, Pa.-A revolving disk under the op of a round table has pookets depending from the outer edge
or holding work or implements. The person using the table can or holding work or implements. The person using the table can turn the pockets
nient to use them.

IMPROVED WAGON BRAKE. Thomas H. Gourley and William R. Lovelace, Talbott, Tenn. is a new arrangement of brake mechanism of simple and inge derstand without, ha back on the neck yoke by the team applies the shoes to the wheels and when
is removed.

IMPROVED DRAFT EQUALIZER.
Hiran Cartwright, Owantonns; Minn.-This is a novel assemblag serving as an evener to equalize the draft among the horses.
improved carriage curtain.
Henry C. Moods, Oswego, N. Y.-This invention is a shade or Henry C. Moody, Oswego, N. Y.-This invention is a shade o
urtain attachment to the front bow of a child's carriage, for ex curtain attachment the the front bow of a ching rain. The curtain is divided at the oenter, and
cluding the sun and
connected at each outer edge and the top to the bow by a cord. connected at each outer edge and the top to the bow by a cord the general arrangem.
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 ump 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 of the body hinged to the cart body and the axle, wechanism, shat 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 and it consists in first introducing into the mold molten metal o 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 section are being cooled, whereby the flaring metal is made to take up th hrinkage.

## improved car coupling.

Derastus Harper, Hearne, Tex.-The link is placed on the lower rojection of one drawhead, and a pin dropped, which balances the link in horizontal position ready for coupling with the approaching part of a swingling 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 cessed 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 stops on the door frame or furnace wall, and curved ribs on the door with which the stops act to fasten the doar shut. The ribs are ters 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 capa ble 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 coarse
sieves are reacted. By employing a shoe with an endwise move ment, the middlings are propelled forward over the sieves in straight line with rapidity

IMPROVED SUBMERGED TIDE AND CURRENT WHEEI
John J. Hill, Hayden's Ferry, Arizona Ter.-This water whee has curved vertical buckets tapered toward the outer edge, and having a thickerinner edge coming short of the shaft, a space being side of the wheel and escaping at the other, thus affording two im pulses, and rotating the wheel in whateverdirection 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 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 movemen'r.
Ellison Leslie, Brown's Cross Reads, 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
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 When arranged exactly radial and in the transverse plane of the wheel; and an adjustable weight expends its power in beeping them turned sideways to the wind. Other devices increase the rethance of the weight as it rises by increased power of the wind, 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 sta-
tionary pontoons supportiog 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. being hinged to the stationary pontoon to swing with the draw bridge. The drawbridge is closed by a oapstan and chan 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-loceing cultivator teeth.
John Harris, Marquette, Wis.-The cultivator teeth in this device are so combined with an ingeDious 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 proe inflated by suitable disposition of a tubular maxis.

## 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 f pivoted bars, which when folded together occupies but little pace, and which, when extended, offers a large amount of dryin urface. The construction appears to be strong and simple

IMPROVED FIREPLACE SCREEN.
William C. Williamson, Newbern, Tenn.-Theupper 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 n 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 uide 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 ecured to a wain. There is a simple device for extending and foldng 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 pre vent the passage of flies, mosquitoes, ctc.

IMPROVED CLOTHES DRYER.
Willis Adams, Neelyville, Ill.-This is a new arrangement of piv ted arms and connecting pieces, so constructed that it may be easily folded into a very small compass for storage and transportaunfolded, 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 The spring rack presses the clothes with considerable force agains the plungers, so that the thorough cleaning of a greater or smalle number of ciothes is produced.

## NEW AGRICULTURAL INVENTIONS.

## mproved 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 the press be worked in connection with or without the mill. The mill is supported on a frame, that is placed laterally across th ress box, and attached to the standards or main posts of the pres the mill-operating shaft being journaled in bearings of the latera rame, and made detaciable 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 grindetone, being conducted by side chan nels with supply regulating slides, from the honper at the top he channels feed a continuous supply of barley to the casing, an aeep the same packed full all the time, so that the stone may alway loose of the same in the case, and the increasing of the speed of the stone.
IMPROVED HONEY PACKAGF.
Lawrence Drake, New York city.-This improved package for nclosing a comb and the frame in which the honey is made. The ver is of glass, sheet metal, paper, or any other approved mate from tlies, air, and dirt, and'at the same time expose it to the in spection of the purchaser.
improved portable hay press.
Michael McCarty, Pueblo, Col. Ter.-In this press the follower is lass. 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 ar discharged.
Henry Meili, Yellow Stone, Wis.-This harrow has adjustable double lock bars, which serve also as guard pieces to carry the har ow sections over obstructions, exposing thereby the teeth in a les degree to violent shocks and injury. The harrow may be folded fo Ifields.

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J. o. will had directions rorn from the skin on p. 347, vol. $32,-J$. F. H. can in-
crease 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 ma-
-W.H. . \}will find on p .74 , vol. 28 , full directions for laying out the sides of a hopper.-O. E. D. Win trains on p .271 vol. 33.-R. M. can make Pharoab 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 particule size by using the formula on p. 48, vol. 29. Area of a circle=diameter ${ }^{2} \times 0.7854$. This also answers
P. Q. Sixty feet head of water=144+atmospheres P.Q. Sixty feet head of water=14\% 1 atmospheres
=263/2 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 bis
prinuing press blankets by washing them with pot prining 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 .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 ,
on
or. 24 . - . M. . . will find full descriptions of the vol. 24. - M
rincipal fo in vols. 23 and $24 .-$ H. W. H. will find answers as to his questions on the friction and passage of wa-
ter is pipes on p. 48, vol. 29.-W.K. N. will find diter in pipes on p. 48, vol. $29 .-$-W.K. N. Will find di-
rections for tempering rock drills on p. 222 , vol. 31 . rections for tempering rock drills on p. 222, vol. 31.

- R. H. H. will find directions for testing the purity of water on pp. 187, 281, vol. 33. This also anwaste is waste is very liable to spontaneous combustion
See p. 26, vol. 33-J. M. . . will find formule for calculating the strength of boilers on pp. 116, 185 , vol. 28.-W. T. P. Will And a description of a cal cium light on p. 219, vol. $30 .-$ H. C. will find direc tions for making friction matches on p. p . 5 , vol. 29.
$-T$. W. can attach glass letters to windows by using the cement described on $p .47$, vol, 33 -L T. will flad 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 on this or the following page. - E. D. D. M. should
read the Scirnitic American,and he will then be aware of the impossiblity of perpetual motion machines.-S. W. M. Will find directions for hardformed that the plaster composed of gypsum (plaster of Paris and marshmallow root does not pos
sess the virtues claimed for it.-G. P. A. can nickel sess the virtues claimed for it.-G. P. A. can nickel
plate $b$ isiron plate hisiron eastings by following the direction for
on p. 235, vol. $33 .-\mathrm{S}$. L. J. can clean marble by for on p . 235, vol. 33.-S. L. . can
lowing the directions on p. 330 , vol. 32 .-G. A. M. can fasten rubber to wood hin good klue-A.W. 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 . 25 , vol $28,-\mathrm{T}$. H H. will
 find a description of the manufacture of vinegar
on p. 106, xol. 32.-E. J. S. will find full directions on p. 106, xol. 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 ery on p. 408, vol. 32.
(1) L. E. McK. \& J. W. K. ask: Is it Plants in a sieeping apartment are not considered
as conducing to health, and some of the medical authorities to health, and some or ine mead
(2) M. E. D. W. asks: By what means can I detect petroleum or cotton seed oil in so-called lisseed oil? A. Petroleum may be detected by its
property of imparting a fluorescence to animal or property of imparting a fluorescence to animal or
vegetable oils, and by its aromatic odor on burnvegetable oils, and by its aromatic odor on burn-
ing. An oleometer may be used to distinguisb ing. An oleometer may be use
cotton seed oil from linseed oil.
(3) J. H. T., of Flekkefjord, Norway, asks Am I running any risk in using tubs made of o can I in any way make them fit for such use? A.
in
In a short space of time by the use of soap, the 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 spitit-
ting? 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 in 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, nemly 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 strong solunon 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 liguid, 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 transfer decalcomanie pictures to paraffin wax
A. We do not think it probable that or will suc ceed in employing paraffin in the way you pro pose. Try softening the paraffin on the surface by tightly against the surface until the paraffin has rdened again.
(7) J. W. R. says: In your issue for Octo ber 9 are đrrections for making a weather glass.
I have followed them with great care and nicety 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? you give any probable solution for my failure?
A. You have employed either too much of the solvents or else your alcobol 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 oill : and having a small perfumery bottle with a ground glass stopper, I poured the oil int it. I suppose the bottle was not washed clean, fo it turned the oil to the color of soapsuds. Wha can I do to the oil to purify it? A. This was probperfumes. Treat with a little oil of vitriol, decant the 1 , and then wash with clen wis
(9) F. F.asks: 1 . What is the best method r raising the poppy, and how is the opium ex racted from the A. Opum is the dired Juce o pr (papaver somniferum). For properties, etc, Pereira's "Materia Medica," also an extensive article by Dr. Eatwell in Pharmaceutical Journal
1852, London, England. 2 Will it flourish in Cen ral Illinois? Englana. 2 Wider it very doubtful. (10) B. C. S. asks: How can an oval cylin der be turned in a common iron lathe? A. By out at every revolution of the lathe.
(11) J. says: I am building a sheet iron cir cular tank about 8 feet in diameter and 5 feet deep that tend to tear hort gren portion of the strain hat tends to tear apart any portion of the eowe
12 inches of the sides. If there is no question resolution of forces, I make out that this strip inches wide has to bear a tensile strain of 3 to
tuns, which seems high. A. The pressure will be 36 times the seems high. A. The pressure wili in the tank.
.(12) E. F. says: $I$ am very much troubled with my hanas becoming very rough from con stant use of copperas water. Can you suggest
remedy? A. You may avoid this by wearing 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 consult in order to obtain the most exhaustive in ormation concerning the practical details fo compensating the pendulum? A. You will find he principal forms of compensatiog pendulum do not know of any apecial treatise on the sub ject. 2. In a recent publication a pendulum is deseribedin 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 way of bob) a hollow leaden cylinder. If the rod
be about 16 inchese long, and the cylinder 14 inches, be about 46 inches iong,and the cylinder 14 inches,
it will vibrate nearly in seconds." Do you call that a good pendulum? A. It would answer fo s. 3. What should be the dian 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 ro feet a minute.
(15) J. P. says: We wish to run a shaft at revoutions per minute. On the shaft is a ca that strikes a plunger, which can be driven for ward 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 634 inches. W ance wheel, the balance wheel being the driver Can we gain more power or momentum by put-
ting a 30 inch pulley on the shaft at the side of the balance wheel, and belting on to the 30 inch pulle instead of the balance wheel? In either case, the speed of the balance wheel would be 60 revolu nuch advantage would result from the change.
(16) C. B. H. says: A friend and myself are claim that, to do so, it would be necessary t throw her lever back to the farthest noteh and open her throttle in the same proportion, but he of the center, and leave the throttle open. Whic right? A. Youare
(17) C. R.says: In your issue of Octobe 20, you say: "Experiment has shown that the ve ocity of the shell whenit 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 28,200 feet, Consequently the wurk actually done by the powder is equal to 21,000 foot pounds. Will you give the formula by which this result is attained? A. It is the produc of the weight of the ball multiplied by the high wo to the velocity.
What pressure per square inch is necessary to
press separate pieces of ice into one homogeneous press separate pieces of ice into one homogeneous
mass, which shall display no joints? A. At ordinary temperatures, a very considera ble 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 di tilled water from $39 \cdot 2^{\circ}$ to $41^{\circ} \mathrm{Fah}$.

(18) J. E. asks: Is there a process for uni | $\substack{\text { ting w. } \\ \text { none. }}$ |
| :---: |

(19) J. E. S. says: 1. We are building steamer, 22 feet long, 5 feet wide, and 3 feet deep,
Will an engine with a cylinder $6 \times 3$ inches hase Wil an engine with a cylinder $6 \times 3$ inches have
power enough to run it? $A$. The engine will an swer very well. 2. What size of upright boiler will it take? A. Make a vertical boiler 30 inches wheel, placed in the middle of the boat and having a six inch dip, be large enough? A. Yes. . At what speed could we run her? A. Probably
or 5 miles per hour. 5 . What pressure would the boiler stand? A. About 1201 bs ,
(20) H. P. M. asks: What is the best meth od of hardening malleable iron? A.See "Wrinkles
and Recipes," published by H. N. Munn, at this and Re
offce.
(21)
(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 igni-
tion of certain woods in contact with air. The ash is to be placed on the glass and briskly rubbe
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 minite particles of hard glass.
(22) S. G. P. asks: Does a feed tank to a team boilier need stay bolts in the heads, to carry of 14 inch iron, and is 24 inches in diameter and 40 nches 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 re
verse? A. The former.
2. When the arms have wo curves, should the pulley be put on so that th working strain tends to straighten the part of the arm next the $h$
I want to make a model that will require a con siderable number of very small, thin casting 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, te comfortably? A. You describe the rnat
Can you tell me of any easily got and easily ap-
plied solvent for borax, to clean it oft wor Where it has been used as a flux for braziog? A. tis best to scrape or flle the joint.
(24) J. S. asks: What thickness of cast iron ustain a steam pressure of 120 lbs. to the square ch? A. About $1 / 4$ inch
(25) S. \& H. G. P. eay: We are using a 40 horse power tubuiar boiler, for the purpose of pumping oil wells. Four wells are worked by the
boiler. One steam line ( $11 / 2$ inch pipe) extends up
 ine (2 inch pipe) extends in another direction, on almost level ground, to a well 1,078 feet from the boiler. A nother well is 300 feet from the boile on the 2 incn pipe, both engines taking steam from house ado. Ho in well hear the boll house, and the engine (in the boiler house) sup
olies the boiler with water. We use about pallons of water every 24 hours. We carry 100 bs
pind team pressure and run our engines 55 revolution per minute. Our steam pipes are laid in 8 inc 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, whic
are in ordinary good working order. We use fo 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 w and consequently more fuel, as we should have a ncreased amount of water to heat. Which is right? A. Your consumption of steam and of wa ter will, in proportion to the work done, be more (26) C. R. says: There is a pipe, 2 inches in iameterinside and about 800 a peng, with 4 or then stop There is no leat in the pipe what the cause? Is it not the friction on the inside of the pipe? A. Probably air collects at a hig
(27) J. C. P. H. says, in reply to a corres pondent 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
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 the diameter does not contain more power tha alled withiameter or area, only half or quarte so mean, and upon what principle is the statement based? A. If a windmill could utilize all the 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 therewill be an area which is best for any
given case. This area might possibly be determined by analysis; but it is generally fixed by experi
(28) M. A. asks: 1. When was power first obtained from electricity? A. Page's magnetoelectric engine, described in Silliman's Journal,
vol. XX, 1831, was probably one of the first constructed in this country. 2 which is the best di rection in which to cover magnets with wire? A. Dr. Joule's very powerful electro-mag
wound in the direction of their length.
(29) W. L. P. asks: Is there any difference A. No.
(30) M. A. G. says: We desire to put a lightning rod upon a church spire, 120 feet bigh. 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 a ttached to it, so If the latter is the bestrute a tach 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 frmly soldered and riveted joint, so as practically to make an unbroken connection. All joints in the rod should If the soil is dry, you will need a large amount of conducting material placed underground in con-
nection with the rod. See p. 400 , yol. 33 .
（31）J．W．P．asks：Is there anything that may be added to collodion for ferrotype plates ter the picture is taken？A．There is no foreign matter that can be added before the picture i made ：but a collodion made of long flber cotton， with an excess of ether，will usually answer best． if this will not do，how the plate while wet（afte he picture is taken）with dilute albumen or gum rabic．
（32）I．O．A．says：I am straining my eyes by working in white wood and reading by lamp Ight．I this so？A．Spectacles of the proper kind may be used toasgist the eves to see indistinct objects；bu f there is not light enough to them，their use would certainly be injurious．
（33）A．E．asks：How can I make a good washing fluid？A．Makea strong solution of wash quicklime
（34）W．C．asks：How can I cement emer 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， 6 part 16 parts．Dry them perfectly，mix，pa
（36）J．E．J．asks：Has it ever been ex plained how the common turkey buzzard is able to mount up without flapping
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 enablea 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 spy glass which will give you good deflition with pood deal more．
． by burning bituminous coal？A．The larger part is carburetted hydrogen；carbonic oxide and car 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 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 qualitied 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 A．Terra cotta（Italian）means＂baked earth，＂and
is the name for ware made of a paste of white is the name for ware made of a paste of white
clay，fine sand，and pulverized broken crockery， clay，fine sand，and pulverized brok
slowly dried，and baked to hardness．
（39）T．T．Y．asks：1．What are quaterni ons？A．＂A quaternion is the quatient of two divided right lines in space，considered as depend－ as expressible by an algebraical symbol of quadri－ nomial form．＂－Sir William R．Hamilton．2．Where can I and analysis of them？A．See three admir－ able letters of the above－named author．You may find them in Nichol＇s＂Cyclopædia of the Physi－ cal Sciences．＂
（40）J．G．S．asks：Can you give a good of my fingers and thumbs are badly cracked，and although kept as clean as possible，glycerin being applied，
ointment．
（41）W．B．H．asks：Please give me a re A．Takeivory 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 flal dilu tion） 64 parts．Mix well．
（42）Z．Q．Z．asks：What substance is best to use on the back of postagestamps，edges of en velopes，etc．，to makethem adhesive？A．Try a solution of gum dextrin（see p．zai，vol．29）with little refned sugar 1
（43）K．says：When throwing the spec－ 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， and prisms．
1．Will there be any disadvantage in mak ing up a battery of 12 one gallon Bunsen cup nd 40 one quart Grove cups？Is there any loss of 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 xternal resistance of the circuit is of any consid rable magnitude，the best efect will be obtaine by uniting all the cells in series．The latter com tential．2．Please give full iustructions for settiog p the Chutaux battery；mentioned in your pape of May 22，1875．A．There are several modifica tons of the Chutaux battery，one form is made a ollows：A glass or stoneware jar is perforated a the hole．Single plates of zaucer placed ove the hole．Single plates of zinc and carbon ar sheet of tin or other thin metal placed in the mid le（between the zinc and carbon）．The side con aining the zinc plate is flled with sand，the oppo
te side，containing the carbon，with pounded
oke，after which the metal partition is withdrawn nd a thin layer of sand spread over all．The ex－ citing fluid is contained in an inverted jar ove he 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 bichro ate of potash， $1 / 6$ of sulphide of mercury，and f sulphuric acid，to form the solution．
（44）K．asks：1．What is the best sized cel use for a battery to produce the electric
ght？$A$ ．With an equal number of cells，the arger of two sizes gives the most heat and light． In amalgamating zincs with mercury，will it do immerse the zincs in mercary，or would this
ive them too much mercurs？A．It is usual，af er the zincs have been properly cleaned，to place them in a shallow dish and pour the mercury ove hem with a spoon．They should be carefully brushed afterwards to remove the excess of mer ury．3．How long should the nitric acid last in come so weak when the nitric acid become weak？A．That depends upon the intensity of chemical action．With a given quantity of acid， inc，etc．，a certain definite quantity of electricity or shorter tived．This we may obtain in a longer circuit iargeor by making the resistance of the ery becomes hort time．4．Does not the current depend en irely upon the decomposition of the zinc？A．The urrent is the resultant of all the chemical action which take place in the battery．5．As platinum ned when passing thr，is not the current weak from the nitric acid to the zinc？Sometimes the trips become so hot as to almost boil the acid in the batters．A．Anything that adds resistance portionately．
（45）P D．S．asks：Is there anything that will destroy the attraction of a magnet whe
placed between it and steel？A．No；but the at traction may be partially neutralized by interpos ng a heavy piece of iron．
（46）N．S．asks：1．Should all spirals，fo lifting electromagnets，induction machines，mag neto－electric machines，relays，and sounders，be
nsulated and wound on bobbins？A．All wir or electro－magnets，etc．，should be insulated；e pecial care must be taken in this particular fo electro－magnet is small，it is often covered with paper，and the wire then wound on the core it self．2．If I should wind flat spira＇s by commenc ing at one end of the bobbin，and wind a single flat spiral of the requisite diameter，then dro down to the shaft of the bobbin，the wire remain ing unbroken，and then wind annther flat spiral good secondary for an induction coil，if I insulat properly between the coils？Or if I take a piec of insulated wire，commence at its middle，an wind both ways with opposite ends，and so wind the flat spirals，and continue each way from cente of bobbin toward the ends till filled，will this be qually good？Which is the best of these two bobbin in two parts．Then place it in a lathe put one end of the wire through the dividing disk，an wind back and forth continuously until one end of the bobbin is full．Turn the bobbin end for end onnect with the flished coil by the wire passin through the dir．
（47）A．S．F．asks：1．Does it make any dif－ erence in the power or the wear of a horizontal engine whether it runs over or under？A．No． Is a speed of 125 revolutions per minute too fast 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 o．3．Is it entirely safe to run a line shaft，of $23 / 2$ or 234 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 diame－
ter and of 16 ic ches face，at a speed of 300 revolu－ ons per minute，face，aft being firt 300 revolu espects and carefully put up？A．Yes．4．Would be safe to use 20 horse power from such shaft，at he farther end from the engine？A．Yes，if its
（48）J．C．says：There is a pump in a well 5 feet deep；the pump is situated 65 feet helow he surface（ 20 feet from the bottom of the well）． The pipe above the cylinder is 65 feet long and 11／4 nches in diameter．The cylinder of the pump is $4_{4}$ inches in diameter，and the length of the stroke the plunger is 6 inches．The pump will pump akes 40 strokes a minute and is worked by a rank．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， at that the plunger should make a larger number of strokes；and if it does this，he thinks it will ork more easily．A．Your pipes，especially the asily if they were a little larger in diameter．
（49）T．J．S．says：How can I quarter the of quartering do you mean？
（50）J．B．F．says：In a recent issue，you roducing simultaneously in an electromagnet two north or two south poles．I send you herewith ketch，showing several waysin which this may be are experimenting in electro－magnetism．Fig． net，coiled in the usual manner，but with the ter other at + ，the current will divide，one half pass
ing through each coil in the same direction，pro

ducing at $a a$ two north poles．If we change the onnections of the battery，reversing the current oth cores at $a a$ will become south poles，and in epresents B will be a consequent point．Fig． tinuous line that the current shall flow aroun both cores in the same direction．When connec－ poles will be of similar name，say north；and he connections are changed，both poles will b alike but opposite to those last named，and in bot cases $\mathrm{B}^{\prime}$ will bea consequent point．Fig． 3 repre ents similar cores，but so coiled that the curren Shall flow around each core in opposite direction and a neutral point at $\mathrm{B}^{\prime \prime}$ ．Fig． 4 represents straight bar magnet with each end coiled in oppo site directions；when connected with the poles of the battery，both ends of the cores will show simi－
lar polarity，while the center will be a consequen point．In order to understand how these effec are produced，I think it is only necessary to refer to the electric force circulating around a wir that the direction of this force or influence is du to the direction of the current in the wire．To how this in the most simple form，place a galvano meter needle over a wire through which an electric current is passing，and the needle will be deflecte in one defnite direction；now place the need posite direction．Now confine the needle in the direction opposite to that in which the curren deflects it，and its polaritywill soon be reversed by the action of the current．
（51）A．S C．says：W F．C．deserves credit coming forward to support the theory which which drives it，but his diagram carnes a confu tion upon its face．He says that，with the sail set to an angle of $45^{\circ}$ ，the bolt，which represents the d ection of the wind but not its forse，if pushe through an interval of 1 inch，will cause the vessel
to move forward a like amount．True；but then gain he says．Make the angle of the sail $2211^{\circ}$ in tead of $45^{\circ}$ ，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 ne－ Does he suppose that the wind，at a known prese ure，after doing its full duty in driving the vesse at a certain rate，can be made to double that duty by increasing its resistance twofold，which does by lessening theangle of the sail one half？ at were true，what is to prevent his attaining，by minishing the angle sunciently，a speed infinite traveling faster than the wind should，like its twin sister＂negative slip，＂be relegated to the twin sist
shades．
（52）E．D．C．says，in answer to a query as why the railway gage of 4 feet $81 / 2$ inches wa was originally 5 feet，and the flange of the whee was on the outside．Phat not working satisfac orily，the flange was changed to the inside，

Mintrals，etc．－Specimens have been re ceived from the following correspondents，and xamined，with the results stated：
E．W．P．－They are scales of mica．－C．W．D Both contain pyrites．By exposure to the air， hate of iron．－W．J．S．－The glistening powder is ulphuret of iron；the black is hornblende．Nei－ her is valuable．－J．K．S．－It is flbrous steatite or oapstone．－G．P．－No． 1 is quartzite．No． 6 is fer ruginous quartz．We do not find the other speci－ mens spoken of in your letter．－T．H．A．－The examination．Try aniline red，or madder red，or red lead．

## COMMONICATJONS RECEIVED

 The Editor of the SCIENTIFIC AMERICAN acr knowledges，with much pleasure，the receipt oforiginal papers and contributions upon the follow－ log subjects：
On the Etheric Force．By W．E S． On the Yellows in Peaches．By P．H 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 in On the Laws of Proportion．By I．H．H．\＆S． On Heating Cars．By G．W．P On Layivg Out a Square．By J．M．D．
On Gravity and Matter．By W．I．L． uso inquiries and answers from the following： P．G．G．N．－A．M．J．－S．D．S．－F．E．B．－W．C．－
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## NDEX OF INVENTIONS

Letters Patent of the United States wer December 7， 1875 AND EACH BEARING THAT DATE．

## Adding machine，D．L．B．Butt

Alarm，burglar，A．A．Budd
Animals in giving birth，alding，w．Dulin
Bag，knitted，J．D．Culp
Baggage seal．J． S ．Crep
Barrel，L．E．Sunderlan
Barrel－polishing machine，H．s．Smith
Barrel－8haping machine，H．S．Sm
Basket，Meinikheim and Chase．．．
Bath tub seat．J．W．Nye．．．．
Bath waste valve，w．S．Carr
Battery，galvanic，R．M．Lockwood
Bearings，Inning for machine，Lath
Bearings，1ining for machine，Lat
Bed bottom．spring，E．Barton．
Bed bottom．spring，E．Bart
Bed lounge．D．J．Powers．．．
Bedstead，Invalld，J．Crosby（r）
Bedstead，sofa，G．J．Henkels
Bedstead，sofa， $\mathbf{G}$ ．N．Se
Bee hive，E Armstrong．
Brd
Bee hive，E Armstron
Brd cage，G．Gunther．
Brd cage，C．F．Holde
Bird cage，hanging，G．W．Fuller
Boat－detaching apparatus，J．Patterson．
Boller Injector，steam，W．T．Mesing
Boller Injector，steam，w．T．Messinger．．．．．．．．
Boot－polishing machine，Place and Cunningha
Boxes，machine for making，E．J．．．．
Boxes，making cushons for，B．S．Den
Brace，back and shoulder，H．R．Allen
Brace，hip and thigh，H．R．Allen．
Brick dryer，E．
Brick machine，Mitchell and Kenned
Brick machine，A
Buckle，A．Dyke．
Buastle，A．Carte
Butter carrier，B．F
Can，palnt．M．Bray
Can－seaming machine，w．J．Gor．．．．．．．．．．
Cane gun，c．Melaye．．．．．．．．．．．
Car axle washer，W．H．Fitz Geral
Car coupling，J．T．
Car coupling，J．T．A．Lewis．．．
Car for one rall railroads，R．Sto
Car ventilation，G．H．Storey ．．．．．．．．．．
Car wheels，casting，w．Wilmington．
Carding engine feed，J．G．Freeman
Carriage axles，collars on
Carriage axles，collars on，J．Kritch．．．．．．．．．．
Carriage bows，setting，J．H．McClymonds．
Carriage wheel．S．W．Ludlow．．
Cartridge primer，w．s．Smot
Cartridge ehells，heading，Sallsbury and Wells．
Chandelier．J．Matthews．．．．．．．．．．．．．．．．
Churn，reclprocating，W．McKinley．
CIgar，M．Rosentha
C＇garette mouth
Clgarette mouth piece．D．Marquis．．．．．．．．
Clay pulverizing machine，J．N．Kerper
Cleanigg compound
Clevis，J．G．Miler
Clothes dryer，H．J．Brown．
Clothes line prop，C．C．Schwaner．．
Coal chute，portade，R．R．Hoopes
Coal chute，portable，R．R．
Coal oil motor，F．Bürger．
Cooking utensil
Coolers，etc．, stand for water，W L．．．．．．．．．．．．．．．．
Coolers，etc．，stand for water．W．L．McDowell．
Corn drill，J．R．s．B．and G．W．Rude．．．．．．．．
Corn sheller feed belt etc．，w．R．Quartob

## ${ }^{\text {ron，} 28}$

 170,905
170.827
170,790 170.827
170,90
6,799
 170,914
170,988
170,909 10,7095
170,752
170,709
102 170,709
170,864
170,747言萝另高容安
 70,756
70,765 170,767
10,859


Corn uncoverer, H. H. Gilchrist...
Cotton gins, power for, L. B. Stith. Cotton openers, beaters for, R. Kits Countershaft, W. Frech
Cultivator. E. B. Moore............................
Cultivator, rotary spade, D. W. Brodnax Curry combs, C. A. Hotchkiss... 170,733, 734, 73 Curry comb, C. W. Saladee (r) Curtain roller bracket, H. L. Judd Cuspadore, J. B. Connoily Demiljohn, D. H. Shourds. Devaporizing apparatus, L. K. Fuller Dish washer, M. E. Whitesid
Door spring, W. H. Myers. Drop light, R. M. Shouls. Drying apparatus, $\Lambda$. Wilder. Elevator, hydraulic, Elevator, hydraulic, T. Stebins Engine, ire, G. E. Barker ...
Equalizer, draft, L. F. Equalizer, spring, w. Smith.
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Jelly cup. E. F. Cash..
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Kitchen ventilator, J. V. Montgom Ladder, ure escape, J. A. Groshon Lathe for spools, w. R. Landfea Lathes, planers, drilling machines, J. M
Lighter, au:omatic gas, Stock well et al Lithographic damper, H. Voirin.. icator, L. R. Norman Lock, time. S. W. Hallen (r)................
Locomotive feed water heater, w. Halsted Loom for weaving blinds, B. R. Murphy. Loom, ribbon, P. Schwartz.. Loom temple, J. C. Thiekins Lunch paill, H. W. Schussler. Meat cutter, G. W. Rawso Meat cutter, G. W. Rawson.............. Medical composition, I. T. Thrash.
Motor, coal oil. F. Burger.......... Motor, coaloil.
Mowing machine

Oil, mat for pressing, T. H. Murphy
Ont tanks, man hole eover for, W
ore concentrator, J. Longmaid
Ore separator, P. Osterspey.
Pannter or 3 mstle, R. Biering
Paper box, E. W. Dennison.
Paper drying machine, C. S. Clark..
Pavement, stone, J. McBean
Photo printing in fatty inks, P. A. Despaquis
Photegraphic eye rest, S. M.
Plate stand, A. Moody.
Pltman connection, G. H. Earnest.
Plaiting machine, M. M. Macdonald
Planing machine cutter head, H. H. Baker.
Planter and distributer, seed, M. P. Curle
Planter, check row, w, H. Johnson
Planter, corn, Gmelier \& Schëtler
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Planter, hand seed, T. J. Hubbell.
Planter, hand seed, T
Plow,J. Phillips.....
Plow, gang, T. M. Shaw
Plowing and seeding, D. McVaw.
Printing press, perforated, J. C. Forman
Propeller,
Propeller, screw, N.
Pump, w. McBarnard
Pump bucket coupling, N. D. Davis. Pump valve, Hubbard \& Hart
Radlators, air vent for steam, W. Witmer.. Rall holder, c. W. Matthews Ratchet wheel, J. F. Thomas
Refrigerator, E. B. Jewett..


 Sand and dravel heater, $J$
Sash fastener, B. Fitcher.
Sish holder, P. Lu Luenenell
Sisw in
Saw, croscut. J. E. Emerso
Saw set, F, C.


Separator, graln, D. A. Caswe
Separator, ore, P. Ostergpey
Sewer basin Brady $\&$ Ward
Ing button to cloth, et
Sewing mentine, J. Keth.
Shaving cup, schauble \& Doh
Shears for metal T.
Shears for metal, T. Berridge
slead child s , H. N. Tucker.


Speaking tube, R. H. Hooper.
Spectacles, F. Yelser.......

spining ring holder, G. D.
spoke ocket, H. A. Hott.
stereoscope, W. H. Lewwis.
Stulls, condenser for, etc., M. Harris
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Stove,
Sooking

Stove register, White \& Lewin.
Stove ash sifter, A. C. Corse
Stove asin sifter, A. C. Corse.
Swing, W. P. Rogers.........
Table, Ironnng, J. Finfrock.
Table, Ironing, W. P. Hali....
Tables, corner for,
Tack, E. P. Hincks.
Tag fastener, J. M. Goodrldg
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Tuing, ininining metainc, H. R. Benwell.
Twine cutter, etc., J. Ettel............
Valve, afety and rellef, J. W. Melling
vane weat her, w. He.
ventilator, J . Faxon.
Vent

VulcanzzIng apparatus, J. D. Helge
Wall paper, trimming. . C. Bou
Washing and wring Ing machine, cilley etal.
Washng machine, J. F. Lawson
Water meter, F. Phillppl.......
Water meter, F. Pbillpp1....
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Whiffetree fastenin,
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