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THE HOTCHKISS CANNON. REVOLVER.
It may be presumed that our readers are familiar with the nature and use of the mitrailleuse as an offensive arm. Va


THE HOTCHKISS MITRAILLEUSE.
rious forms of the weapon have already been represented in $\left\lvert\, \begin{aligned} & \text { Attached to the interior part of the frame is a turning table }\end{aligned}\right.$ these columns, and the respective merits of the Gatling, the which connects the cannon to a saddle with trunnions fixed Taylor, the Sigl, and other kindred guns have been fully on the carriage, so that, without displacing the latter, a cerdescribed. While all of these deadly arms will doubtless bear their full share in the determination of future wars, few, we believe, will prove more formidable than the weapon illustrated in the enoravings hereto annexed. It is not a battery of musket barrels, but, as its name indicates, a bundle of rifled cannons which throw explosive shells, or other dle of riffed cannons which throw explosive shells, or other
projectiles, weighing 23.5 ounces, and this at the rate, as projectiles, weighing 23.5 ounces, and this at the rate, as
experiment has shown, of sixty shots in forty eight seconds. No demonstration is needed to point out the fearful execution of which such an arm is capable
The cannon, in exterior form, resembles the Gatling gun but its mechanism, as will be seen as we progress, is essentially different. The working portions may be divided into two distinct parts: First, the barrels with their shaft and frame; and, second, the breech with the firing and charg. ing apparatus. Fig. 1 affords a general perspective view of the gun, from which it will be seen that the barrels are six the gun, from which it will be seen that the barrels are six in number. These are made of cast steel, and are mounted
between two disks which are rigidly secured to a central shaft (A in the sectional view, Fig. 2), which goes through the front of the breech. To the latter is attached the frame, which extends alongside the barrels and supports the shaft, A, at its outer end. It is clear that, if the central shaft be suitably rotated, it will carry the barrels around with it.

tain amount of lateral motion, as well as of elevation, may be given to the gun. Tue breech is composed of a block coltainivg the mectianiam and closed at the rear end by a cover, shown in Fig 2, which is fixed by two set screws, so that it may be earily removed and ready access thus afford d to tle interior portions.
B-ginnirg our explanation with the revolving mechanism B, in Fig. 3, is a pin wheel keyed inside the breech to the end of the statt, A, and carrying six studs upon its r-ar face, arranged parallel to each other. C is a worm whee which is mounted on a shatt at right angles to shaft A, that is, traneverse the br $\epsilon$ ch. The left hand end of the worm shaf curns in a bra, ing within the breech, while its other extremity passes through the latter, and is ac:uated by the crank, the motion of which operates the whole system, a will be seen further on. The worm wheel, C, the grooves in
wi.ich rec. ive the studs on B and so rotate shaft $A$, is of pe wrich rect ive tee studs on Band so rotate shaft A, is of pe-
culizr construction, and is so designed that, at the instant of firitg. the barrelo may be motionless. To this end the di rec ing groove is composed of two inclined parts connected by a straight pirtion which covers half of the section of the cyliuder, so that, wifile a pin of the pin wheel, B, is in this straight $p_{\Delta}$ t, no movement of the barrels during half a revolution of the wheel takes place. Bat as soon as the worm whet bas revolved so far that the inclined part acts upon a pia, the wiefl, B, and with it the barrtle, will be revolved Of couret, ouring the time the pio is traveruing the straigh portion of the gro ve, the firit $g$ takes place
Frou Figs. 3, 4, and 5, the loading mechanism will be tearily followed. The left hand end of the worm shaft, Fig. 3, i will ber coticed, passes tor rugh its bearing within the
 Fis. 4, so tha', at the crank arm revolve, it gives a to-and.fro mution to said slotted pi-ce. which carries with it a rack, F Above, atd nugaging wilh this rack, is a a mall purion, the terth of which also mesh with those of a second rack, $G$ so that, as the rack, F, is carried forward, the rack, G, moves back, and vice vers $\hat{l}$ H is a cylindrical piston connected with the rack, G, by a pin which travels through a slot in the bottom of the conducting trough, so that pi.ton and rack work toyether I, Fiy. 3 is the feed trough in which the cartritges are p'ac. d. as chown, aud in the bottom of which is a little door, J, Fig. 5. When the piston is sutti. iently retract-d. this door falls optn and a cartridge drops into the conaucting trougi by itsown gravity. Subequrntly, as the piston moves forward, in the manntr described further on to drive the charge into the barrel, a stud upon its upper side pushes the door shut, and thus holds it until the proper me for the rectption of another cartridge arrives
As shown in Fig. 4, the crank arm, D, is horizontal. It arrives at this position just as a pin upon the wheel, b, en ters the straight part of the worm; and of course the racks,
as depicted in the lart m+ntioned figure, aredrawn respec. tively forward and backward to their fullest extent. As above notrd, the little door, $J$, is now free to open, and hence a cartridge drops in b-fore the piston. The racks also, in the roition shown, remain at rest for a moment and thisis effected by giving the slot in E, Fig. 4, a circular shape, concentric to the shalt of the crank. The object of this is that at this moment. the barrels arriviog at the end of thrir mo tion, a apent cartridge in one becomes engaged with the large
double hook, K Fig. 4, of the extractor, which is secured to the lower rack, F, and hence, if the motion of the rack were not thus iuterrupted, time would not be afforded to complete the engagemest.
The crank arm, D, we will suppose, continuing its revolu tion, passes the circular portion of the slotted piece, E , and, consequently moving the latter, starts 1 he racks in opposite direction:. Rack, F, pulling on the extractor, drags the car rege shell out of tue lower burrel and to the rear, unt1l it
meets an ejector, I, Fig. 5, against which the cylinder strikes, is detachrd and falls to the ground through the opening shown in the brrech block. Rack G, moving forward and carrying with it the piston, during the next half revolu. tion of the worm wheel introduces the cartridge into its bar rel; the latter, it will be remembered, necressarily stands still. The caltridge is, however, not driven in all the way, but its head is in view of an inclined plane, M. Fig. 5, which is cut into the mttal of the breech, on which it slides when carried around by the movement of the barrels. This completes the introciuction of the charge
The firing apparatu ${ }_{s}$ is omitted in Fig. 3, in order to render other parts more clearly shown, but it is represented very plainly in Fig. 2. N is a cam sccured on the worm shaft and to the right of the worm wheel. It will be remembered that we have supposed the cartridge to be inserted and the
barrels to be revolving; hence, this cam will nowalso be turn ing, and in such a manner as to be in the act of pushing back the long arm, O , which connects with the firing pin, P . The ac ion of the spiral spring, sbown at $Q$, keeps the arm 0 , press-d up against the cam so that, as the pin is forct ${ }^{2}$ back, it compre-ses tiae spring and, in fact, cocks the piece. The barrel, with its clarge. now arrives opposite the end of be pin, the head of the cartridge being at this moment in face of a sterl plate fixed in the breech block, R, Fig. 2.
The shoulder of the cam now slips from und -r the arm, the The shoulder of the cam now elips from und rr the arm, the
pin. P , is driven forword by the spiral spring, strikes the primer of th- cartridge, and expl des the charge. The ob jrct of the steel plate, R , id to recrive the shock, and we ar fring, it uay b be retily changed
We understand the caliber of the barrels to be 1.57 inches, and their length 381 iuches. The total length of the gun is about 489 fett, aud its weigh:, inclusive of saddle, 968 lbs.

Figs 6 and 7 represent, respectively, the form of fixed ammunition used and the percussion iuse. The total wright of the charged cartridge and shell is 263 ounces, and of the charge alone, 28 ounces, and the length is 7.2 inches, The fuse, Fig 7, consists of a case which, in its under part. contains a lead plunger, S , with a brass envelope. The plunger holds the fulminate, and has a little powder cham ber at T. It is fastaned by a safety plug of lead in the un. der hole of the fuse, and it is closed by a plug which has the point against which the plunger drops at a sudden stop of of the projectile.
The elevating screw of the gun is so made that the head is connected to a bearing, movableon an axis near the trunnions, and so anuesed as to provide for a lateral system of pointing. The nut of the screw is a conical gear wheel, and reveives the movement from anoth $t \mathrm{r}$ wheel mo red by a crank placed on the tight side of the trail. The end of the latter is formed into a large friction plate, and the wheels are placed on shoes so that motion of the carriage by recoil is prevented.
Approximate pointing is effected in the same way, by the trail, and nicer range is obtained by the mechanism under the gun.
We notice that a report of recent experiments with the annon at Garve. France, by the Freach Marine Department, states that 500 rounds were fired with perfect success. Forty shots were fired in 30 seconds at argets 5,760 fe-t di-tant and from the explosion of the forty projectiles, two hundred bits were obtained At Turin, further trials are to be made by the Italian Government. We learn t':at the gun has al. eady been fired sixty shots in 55 , and afterwards in 48, se conds.
The weapon is the device of Mr. B. B. Hotchkiss, of 27 Rue de Coniseul, Paris, France, a gentleman already well known for his rifle projectiles and other military inventions For further information address, care of C. C. Dawson, office Congress and Empire Spring Company, 94 Chambers street, New York city

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## new patent conventions.

Messrs. Thacher, Hill, and Blake, Committee of the Vien na International Patent Congress, have, in accordance with their official authority, issued a call, addressed to all who are interested in the effort to secure better patent protection for Americans in foreign countries, for a Convention, to be held in the city of Washington. The Committee say that: "Our friends abroad greatly need the information and aid which we can readily furnish, for we are the foremost nation in the vorld in the liberality and success of our patent system
This characteristic assemblage of American Patent Saints is called for January 15, 1874, for the purpose of discussing this topic, so says the call, and if thought desirable, of organizing a United Statcs Patent Association. We hope the at. tendance will be full, the proceedings harmonious, and the results prartical. This Convention is to have the aid of an other Convenion, recently organized at Boston, called the New England Association of Inventors and Patent Owners. The objects of this association, so far as we can gather from the reports of the proceedings, are to render mutual aid and benefit to the members in the management of their patents, o secure the extension of their several patent monopolies, compel the payment of fair prices for patents by railway companies, and in other ways " to promote the general piosperity of the country.
Mr. Mr. Hamilton A. Hill, who also figures as one of the Com mittee of the Vienna Congress, and as one of the callers of the Washington Convention. He offered a couple of resolutions, one of which was that the association should be rep. re ented at Washington by delegates; the other: "That this Convention heartily eudorses the action of the Congress lately held at $V_{\text {ienna on the subject of patents." Both reso- }}$

Iutions were adopted. We congratulate Mr Hill in haring thus succeeded in getting himself eudorsed by the New Englaud Association. Possibly he may have equally good luck before the Washington Convention.
It is well known to our readers that the resolutions adopted at the Vienna Patent Congress contained hardly a single point or suggestion for change in the existing laws of the leading continental governments, except this, namely: That the laws ought to provide that the inventor shall be com. pell-d to sell his invention and rights under the patent, at such prices as government officers shall dictate. This is not the exact wording of the resolution, which was framed in the German idiom, but we give its real meaning, translated into plain Eaglish. Most of the Americans who were present objected to the passage of the resolution and argued against it strongly. Mr. Hill himself spoke against it, and Mr. R. W. Raymond, wao was present, has publicly stated that the resolution would have been defeated had the Amer. ican delegates alı continued to protest against it with united voice. Bat between night and morning a defection in their ranks took place; Mr. Hill and some others went back on their comrades, and nextday voted for the resolution, which they had previously opposed. Now if the New England A:sociation or the Washington Convrntion supposes that the endorsement of Mr. Hill's obnoxious resolution at Vienna is likely to promote the interests of Amarican inventors in foreign countries, we can assure them that they are mistaken. The very thing that our inventors most need, in foreign countries, is to be freed from government interference. Wuat our people want is the right to coutrol their foreigu patents, in the same untrammeled manner as their home patents. Nothing less than this will satisfy them. On this point the Convention should take a firm stand, pledging itswlf to its ad vocacy, and eeking for it a adoption throughout Europe. But to start off the Convention by resolutions approvatory of the absurd project, first opposed and th $\curvearrowleft \mathrm{n}$ supposted by Mr. Hill, will be likely to impair the usefulness of the Convention, and prevent our countrymen from taking interest in its proceedings.
the prime movers and their recent progress.
The prime movers are those machines from which we ob-
tain power through thir adaptation to the transformation of tain power through thrir adaptation to the transforination of
some available natural force into $\quad$ kind of effort which developes mechanical power. These sources of power are generally classified, according to the form of energy which they yield or which the machinesare fitted to utilize, as muscular power, the weight and movement of fluids, electricity, and heat. Thus, men and animals are prime movers, utilizing muscular power; water wheels and wind mills utilize the fluids water and air; electrical engines make useful the power of che voltaic battery; and gas, air, and steam engines -heat engines, as they are collectively called-transform the force of heat motion into mechanical force. All of these prime movers have received a certain degree of development; and some of them, as the heat engines generally, and particularly the steam engine, have occupied the attention of man for many centuries and have afforded a field for the display of his highest scientific attainments, inventive genius, and mechanical skill; and they today are doirg by far the greater parc of the unintellectual work of civilization. Indeed, they indirectly assist, to a wonderful and inestimable extent, even intellectual progress, by furnishing the material aids essential to its existence and continuance
Muscular power has its origin in heat developed by combustion, probably, as truly as does the power obtained from the generally termed heat engines; and the animal system is simply a machine or apparatus in which a certain quantity of oxydizable material is consumed and a certain quantity of power is developed by its consumption. The animal system is compelled to furnish heat sufficient to keep its several parts in working order, and to furnish supplies also to that
strange and wonderful organ the brain. It is, therefore, impossible to state Low efficient the animal system is as a prime mover, simply, but it is supposed to be far'more efficient than any machine yet constructed by man. Man can do little to improve the efficiency of the animal mechanism, but he can do something. Whether the organism to be used as a prime mover be that of a man or of a beast, the proper treatment by which to obtain maximum efficiency is that by which the natural strength of physique and constitution is cherished and increased. Abundance of plain, wholesome, nutritious food, regular work, never exceeding but always approaching the maximum that can be attained without more than moderate fatigue, comfortable housing and general care will give the animal system its most complete de velopmen: and its greatest effectiveness. It is generally be lieved that working one third of a day, at one third the maximum speed attainable without load, and with a load equal to one third the maximum force which can be exerted, gives the best conditions and highest efficiency.
Having (ffected so much for the prime mover, the next point oo which attention should be turned is the simplicity and effectiveness of the machine through which the work is done, whether a wagon, a treadmill, or a so-called horse power. Probably not less than twenty per cent of the oower of the arimal is generally lost here, in some of the best desigus of these forms of apparatus, and usually occurs through friction. Invention and mechanical skill have not deserted this field, however, and we hope yet to be able to chronicle
The power of falling water and of the winds is utilized by the various forms of water whels and wind milis. Not many years ago, awkward and costly vertical water wheels, with their slow motion and expensive systems of tranemitting machinery, were thought the only proper and economical
forms of water engines. They still remain, as a class, unexcelled in economical efficiency, but they have found rivals in the smaller, quickly working, and far cheaper ard more satisfactory tu

## from the field

The power of prime movers is measured by horse power. Watt found that the strongest London draft horses were capable of doing work equivalent to raising 33,000 pounds one foot high per minute,and he took this as the unit of power for the steam engine. The horse is not usually capable of doing so great a quantity of work. Rankine gave 26,000 foot pounds as the figure for a mean of several experiments, and
it is probable that 25,000 foot pounds is a fair minute's aver age work for a good animal. It would require five or si age work for a good animal. It would require five or six
men to do the work of a strong horse. Watt's estimate has men to do the work of a strong horse. Watt's estimate has
become, by general consent among engineers, the standard become, by general consent among engi
of power measurement for all purposes.

The weight of water flowing per minute, over a weir or dam, being multiplied by the hight of available fall, gives a product in foot pounds per minute, which, divided bj 33,000 , gives the horse power of the stream. Of this power, a certain proportion is always lost through the inefficiency of the machinery of the prime mover which is intended to utilize it. The best overshot and high breast water wheels yield where the available power of the fall is one hundred. The where the available power of the fall is one hundred. The
best turbines have about the same efficiency as the vertical wheels when precisely proportioned to their work. In all wheels, a loss greater than twenty per cent is met with when running on " part gate." There is, therefore, room for im provement in water wheels to the extent of twenty per cent
or more. These losses are to be lessened by more skillfully proportioning the wheels, and especially by some arrange ment which will allow them to work efficiently with varying gate. The prime defects at present exist in the method of adjusting the wheel to do its work with different loads. Hardly less important is the problem of effectively connecting the governor to the wheel gate. Much has been done in these directions, but much remains to be done. Some wheels will do nearly as good work at part gate as at full gate, but usually this efficiency is attained by the sacrifice of simplici ty and of maximum economy. A wheel which will invaria bly yield seventy fiver per cent of the power of the fall unde which it works, and do this under all loads, is yet to be bought into the market. The high tide of progress has culminated in the successful competition of the small, lively, and cheap turbine with the older forms of wheel, which are now nearly driven out of use. By far the most impor are now nearly driven out of use. By far the most impor-
tant work in cheapening the construction of turbine wheels tant work in cheapening tbe construction of turbine wheels
and in making them efficient has been done by American mechanics.
The windmill is largely used on our western prairies and to a considerable extent elsewhere. The improvements lately made on this motor have been principally in the structure and arrangement of the vanes, making them selfregulating, and in so constructing the apparatus that it shall keep itself pointed toward the wind. Abroad, nothing seems
to have been done, but our own inventors have accomplished some good work in this field, the extent and importance of which are not generally appreciated. We have but little in. which are not generally appreciated. We have but little in
formation as to the efficiency of windmills. They are proba bly less effective than water wheels, and their improvement remains a promising task for ingenious mechanics.
The force derivable from electricity has long engaged the attention of most active minds, but we cannot yet chronielc any really well settled and important advance towards its utilization. Indeed we can hardly anticipate its employment to any considerable extent until new methods of generating the force itself are discovered. The available power to be obtained by the consumption of zinc, which is the metal
consumed in the voltaic battery, is estimated, by various consumed in the voltaic battery, is estimated, by various
authorities, at from one half to one sixth that derivable from an equal weight of coal, and the great difference in price between zinc and coal, pound for pound, makes the dif ference in cost of power vastly in favor of coal. A quarte of a century or more ago, many attempts were made, some upon a large scale, to utilize electric force in the production
of mechanical power, but with no success. Our countryman of mechanical power, but with no success. Our countryman
Page, who in 1850 obtained power from a small engine at a cost, as he stated, of about a cent per horse power per hour was the most successful ; but even he finally failed, and no was the most successful; but even he finally failed, and no one has since been more successful. Attempts are still made
and are almost daily brought to our notice; and occasionally a charlatan or a self.deceiver deludes credulous listeners by the claim of wonderful results. We hope that we may find such a claim well founded, in some time to come but we fear that it will be very farin the future, unless some fort unate man shall discover a method of evolving electricity in place of heat, from the oxidation of coal. That done, the problem would be far less difficult of solution, and we should look hopefully for a spleadid development of this field which would have then become most promising.

## PROGRESS OF THE CENTENNIAL.

With the object of enlisting the cioperation and interes of the people of New York in the coming Centennial, a delega tion from the Board of Finance of that enterprise recently $m \in$ with the members of the Chamber of Commerce of this city The Philadelphia committee deprecated any feeling of section al rivalry and urged, with much earnestness, the view that the exhibition was a national affair, and that it deserved the hearty support of the whole country. The New York mer chants replied in similar strain, cordial expressions of cöop eration were exchanged, and a committee of seven was ap pointed to solicit aid from the people of the State. As re-
gards progress, we find it stated that the Board of Finance
has confined its operations principally to Pennsylvania, in corporations. $\$: 500,000$ have been subscribed by citizens and efforts have been begun in order to raise funds in Delaware and Maryland. The work of construction is to be rapidly pushed during the coming spring. A temporary building pushed during the coming spring. A temporary building
covering from 35 to 40 acres is to be erected, and the perm? nent structure will be commenced at the same time. The former edifice is to cost from two to three million dollars and the latter, half a million. The machinery, horticultural and agricultural halls, are each to cost $\$ 500.000$, and it is
believed that the preparation of the ground, sewage, etc. will use up the remainder of the $\$ 10,000,000$ required
The prospects of foreign participation are very encourag ng. At the assembling of the German Parliament, Prince Bismarck recommended the acceptance of the invitations and also urged the appointment of a plenipotentiary to reside in Philadelphia during the Exposition, and of a commissione for each State of the emvire. Belgium has promptly signi fied ber intention to contribute, and the republic of Ecuado has made an appropriation for the purpose, and already has tions of intended participation have also been received, by the Government, from Mexico and Hayti. Professor W. P Blake, special agent for the centennial at the late Vienna ex hibition, says in his report that he has received assurances of freindly interest from the Emperor of Austria and other high officials. He has already obtained contributions for permanent museum, consisting of Swedish iron ores, and a
valuable collection of terra cotta work, samples of ozokerit etc. China and Japan, it is considered, will be well repre sented, and the Turkish merchants are to erect a grand bazar, coffee houses, bath, and, in some convenient portion of he grounds, a complete Turkish village.
We hope capitalists, merchants, manufacturers, inventors nd every other class of our citizens will take an active in terest in promoting

## EXPERT ENGINEERING

We are constantly in receipt of inquiries as to what are the requisite qualifications for an engineer. This word as it s frequently employed is somewhat of a misnomer. Au ngineer, in the broadest signification of the term, is an ex pert in engineering, one who is practically acquainted with the construction and management of heat engines: who i thoroughly rersed in the physical laws which relate to who can design machinery, and adapt it to the various pur poses for which it is intended. But in common parlance every one who has control of an engine or boiler is known as
an engineer. From this fact, much misunderstanding fre quently results. The proprietor of a factory, for instance, sees no difference between the person who takes care of his engine and the consulting engineer who offers his services in expert cases, except, perhaps, that he looks upon the former as a practical man, and therefore one who is alway certain to think and act correctly, while he considers the latter a theoretical engineer, whose opinions are entirely to visionary to be of any value. We think we have not over-
stated the comparison that is usually made between what are known as practical and theoretical men. But it may be worth while to look into the matter a little, and see wheth er the popular estimate is a just one. The purely practical man, as we understand it, is one who knows nothing bu has not seen and handled, as it were, he will not believe. Now the engineer who is understood to be theoretical has ordinarily enjoyed quite as much practice as the other, but he has labored more understandingly, investigating the prin ciples of the work in which he is engaged, and endeavoring by the application of these principles to effect changes and improvements. There is little doubt that the intellect of
man is his most valuable possession, and that the cultivation man is his most valuable possession, and that the cultivation
of this faculty will give him greater rewards than he can hope to acquire by manual labor. It is true, however, that his theories, if unsupported by facts, are little better than idle dreams, so far as their value to the community is concerned. James Watt, in making his splendid inventions relating to the steam engine, carried theory and practice hand in hand. Starting with a rude model, he determined practically what it would do, and reasoned out what it ought o do if it were a perfect machine, and then turned his atten tion to making it fulfil the conditions called for by his theo retical investigation. Surely the result justified all his experiments and hypothesis.
Professor Rankine, lately deceased, and perhaps the most remarkable engineer that the world has ever known, united, in a most happy degree, the use of theory and practice. The esult of his labors, cut short by an early death, can hardly accurate theory of the action of heat engines, he bas enabled future experimenters and inventors to work with a clear knowledge of the nature of the problems which they wish to we.
We hope we have succeeded in demonstrating to our readers that theory and practice are not naturally antagonistic, and that the professions of engineer and engine driver, both honorable ones, are quite distinct, the former comprising all that is
If we have induced the owner of steam power to alter his opinion of the expert engineer, perhaps we may persuade him hat he can occasionally employ the services of this expert with profit to himself. If every time that steam was raised
ome opening that was plainly visible, he would not hesitate moment to have the leak repaired. We are able to state, rom our own knowledge, that this state of affairs practically exists in many places where steam power is used, with the important exception that the leak is not visible to the ordinary observer. To find this leak is the task of the engineer and surely the owner will be amply repaid if he succeeds, or a trifling amount, in having repairs made which will save him thousands of dollars yearly. The Royal Agricultural Society of England, at their yearly exhibitions, are accus tomed to test the engines that are entered for competition. An investigation of the results obtained from year to year shows a most extraordinary improvement in the engines, as regards economy and workmanship, and there is little doubt that the effect of these tests has been most beneficial to the users of steam power. In this country, comparatively few reports of tests have been made public, and we ere lamentably ignorant in regard to the performance of machinery made even by our best manufacturers. This is a matter in which every user of steam power is directly interested, and we hazard little in saying that all owners of steam engines would find it profitable to have tests made by reliable experts at least once a year. From examinations that we are continually making in the city, and by letters that we frequently receive from abroad, we are convinced that there are many steam engines which stand in need of professional assistance. The steam engine indicator has been likened to the stethocope of the physician, but it should be remembered that either, in unskillful hands, will be productive of but little benefit. There are many cases, besides, in which other tests than those male with the indicator are called for; but so far as our experience goes, the skillful engineer is generally able to find the trouble and devise a remedy, when his services are called into requisition.. Those who are accustomed to read that portion of our paper devoted to questions and answers have doubtless noticed that we receive many letters in re lation to the power that can be transmitted by a belt. It is a very common practice in letting power to calculate the amount furnished from the width and speed of the driving elt. But this is a very uncertain estimate, as in some cases he belt will transmit more and in others less than the rated power. If a few tests were made of the bulk of a pound of sugar, and the article were ever afterwards sold by guess work, the bulk furnished being based, by the seller's eve, on the amount previously determined by experiment, we venture to assert that neither dealer nor purchaser would be satisfied. And yet this is just the course pursued in circumstances where the amount of power can be as accurately determined as the quantity of sugar to be furnished for a pound. Cases have come to our knowledge in which the amount of power actually furnished varied as much as two hundred per cent from that given by calculation.
Some years ago, we heard of a bridge contract being let, in which it was stipulated that none of the material was to be strained, when subjected to the maximum load, to more than one sixth of its ultimate strength. When the structure was completed, a simple calculation showed that the maximum load brought a strain equal to one third of the ultimate esistance. The bridge commissioners performed a simple sum in arithmetic for the benefit of the constructor, worked omewhat in this manner: If a tun of iron costs $D$ dollare, and it would require $W$ pounds to give a factor of safety of six, and the price of the bridge is to be $P$ dollars, if constructed according to specifications, what should its price be it contains only half as much iron, so as to give a factor of three? Payment for the bridge was made according to the solution of this question, to the intense disgust of the contractor. A similar sum might be worked out with coniderable profit to the purchasers of many steam engines and boilers, who find that their machines fall far short of the ower at which they were rated by their makers.
This article has already extended beyond our proposed imits, and we have merely touched upon the benefits that users of steam power can obtain from reliable expert assist -

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we should be glad to receive back the portion of wrapper containing the faulty writing.

The Value of the Scientific Imerican.
One of our esteemed subscribers, in lately writing to us about the renewal of his paper for the next year, says that he has taken the Scientific American regularly for the past twenty-five years, and has the volumes for that long period, all bound. He was recently offered a farm of one hundred and sixty acres of land, free and clear, in exchange for these volumes, but declined the trade. He has derived great benefit from the volumes, and holds them to be of more value to him than many hundred acres of farming land.

One Hundred and Fifty Thousand.
The demand for our special number of the Scientific american has induced the publication of a second edition. Advertisers who were promised the circulation of 60,000
have derived the benefit of 150,000 without extra charge.

## IMPROVED PORTABLE FENCE

The invention herewith illustrated is an improvement in portable fences for farm or other purposes, which, it is claimed, is durable, substantial, and requires very little labo to construct or set up in place.
The panels, composed of rails, A, and posts, B, are fast. ened together by nails or in any suitable manner. The posts may be placed both on one side, or one on each side of every panel. C are the bed pieces, one of which is shown sepa rately in the foreground, in the upper side of each of which a gain is cut to receive the bottom ends of the posts. The atter stand up in the gain in contact with each other, as, in dicated in the engraving, and are fastened together by a bol and nut, $D$, the former of which is made of suitable length, so as to allow of pro per separation of the posts at top or bottom, in case the fence be extended over undulating ground. The same bolt serves o secure the upper ends of the braces, E, which continue be ow the bed piece and enter the earth, as shown by the dotted lines. By removing the bolt, the panels, as well as the braces and bed pieces, are left free and may be readily removed. If desired, the braces may be fastened to the bed pieces in any suitable manner.
This device appears to be a convenient and economical arrangement, which can doubtless be employed in a variety of places by farmers and oth-

Patented through the Scientific American Patent Agency by Samuel S. Porter, of Broad Ford, Fayette county, Pa who may be addressed for further information.

## Hawley's Kiln

We learn that some very important features have been added to the Hawley kiln (for burning brick, tile, pottery, etc.) since our illustrated descriptions published April 27 , 872 ; one of which consists in utilizing the heat to a room ahead, while burning, thus drying off the compartment in dvance of the already burning chamber. This effects a sav ng of the surplus heat. which would otherwise escape up the chimney during the process of burning, and after the contents of the burning chamber have been thoroughly dried off and heated through.
Again, in utilizing the heat contained in the incandescent mass remaining in the already burned chamber, the cooling off process is carried on from above down wards, in the sam direction pursued during the process of burning (instead of by reversing the current of air as previously described); thus exposing the contents of the oven alike throughout, both in burning and cooling.

## IMPROVED TROTTING GEAR.

Mr. Henry Schmalhausen, of Bridgeport, Ill., has recent y patented an elastic trotting gear for horses, the object of which is to enable the animal to trot faster, and raise his eet higher, and also to prevent him from balking kicking backing, or rearin
The apparatus consists of an elastic strap so constructe as to be adjustable in length, and which is passed and plays easily through the hame ring which guides the lines. Th ends of the strap are attached to bolsterea bands, which may be readily buckled, one to the fore and the other to the cor esponding hind leg. The gear may be so applied that the knee joint will be raised to a level with the shoulder joint which throws the fore leg on the forward step into nearly

horizontal position. By shortening or lengthening the ad justable portion, A, any degree of elevation, from a low to a high step, it is stated, may be obtained. The device is claimed to be especially useful for the breaking of colts, as it will develope the formation of the joints, produce a free action of the legs, and give increased strength to the muscles and ligaments.

## Focal Differences in the Eyes.

A writer in Science Gossip speaks of the difficulty which ome persons experience in the use of binucular microscopes, wing to a focal difference in the eyes. In a case mentioned one eye was far sighted, while the other was near sighted. For reading purposes, this person wears a pair of spectacle in which the one glass is made for the far sight, while the other is a plain glass, the left eye being near sighted, and consequently requiring no aid from spectacles with which to read. Instances are cited of persons who, while employing both eyes for ordinary vision, usually employ only one in reading. If any difference of the kind exists between the


PORTER'S IMPROVED PORTABLE FENCE.
visual powers of a pair of eyes, it may be readily detected Hold up a piece of card before one eye, so as to cutoff its field of view, and then look at some object before you with he other. Then gradually bring the card before the other eye, and view the same object. If the object is seen with the same distinctness in each case, then your eyes are per ect as regards the balance of their foci; if not, then there is focal difference more or less decided. It would no doubt e advisable to take account of this very frequent difference of focus, in selecting a pair of spectacles.

## IMPROVED ATOMIZER.

The ingenious little arrangement reprasented in our illustration is designed to distribute perfumes in the form of spray. Its simple and inexpensive construction renders it applicable to the stopper of every perfume bottle, so that the purchaser, instead of buying vaporizer and liquid separately, as heretofore, is now enubled to purchase both together at a cost very slightly increased above that of the extract singly.
There is a hollow collapsible bulb attached to the top of the hollow stopper, by stretching its mouthover a groove in the latter. Extending up from the liquid is a tube, $A$, the end of which is bent at right angles and terminates in a small nozzle which is surrounded by a hollow projection, $B$, of the stopper. It will be observed that there is an opening between the stopper and interior of the bottle atB, so that, on compressing the bulb, air is forced down upon the liquid, which is thereby caused to rise up through the tube, A. A small part of the air pressure only, however, serves this purpose, and hence the greater portion escapes through the projection, $B$, surrounding the fluid, escaping from the nozzle of $A$, with an annular jet of air which converges at a point a little beyond the two nozzles. The effect of this is to break the liquid up into spray or vapor and also to distribute it much more effectually than the similar apparatus depending upon a cross jet to draw up and expel the fluid.
The invention, which we have recently had occasion to ex amine, seems to us a desirable article which might form a profitable addition to the stock of druggists generally.
Patented September 23, 1873, by Mr. John N. Gerard, 139 William street, New York city.

## The Phonix Post not an European invention.

Professor W. P. Blake, in a recent report upon the iron and steel department at the Vienna show, published in the Tribune, mentions as novelties a series of girders over 60 feet long, and hollow iron posts of the same length, and a foot or more in diameter, made of four flanged pieces riveted together. Mr. John Griffen writes to correct the impression given that these posts or girders are of foreign invention; as given that these posts or girders are of foreign invention; as
he very truly says, they are nothing more than the well
known Phœnix wrought iron column, invented and patented by Mr. Samuel J. Reeves, President of the Phonix Iron Company, in 1862. Mr. Griffen says that, during the interal since its invention, this column or post has been largely manufactured at the Phœnix Iron Works, and many thousand uns of them have goneinto the construction of wrought ron bridges, viaducts, depots, warehouses, and other struc tures in various parts of the United States, Canada, Nova Scotia, and in South and Central America. All the top chords and posts of the trusses in the International Bridge over the Niagara river, near Buffalo, are made of Phœnix columns. The same can be said of the Intercolonial and all the new bridges on the Grand Trunk Railway in Canada, the Augusta bridge in Maine, the (iirard avenue bridge over the Schuylkill, the New River and Green. brier bridges in Virginia, the three wrought iron bridges at Rock Island, Ill., and scores of others. Vany important viaducts are composed almost entirely of these columns-as the Lyman and Rapallo viaducts in Connecticut; the Lyon Brook, Deep Gorge, and Blockbouse in New York; Bullock Run and Bank Lick in Kentucky; the Agua Venugas in Peru. Many of these structures are of great length and depth, the last mentioned being 580 feet long, and crossing a gorge 252 feet deep, over which the Lima and Arroya railroad is carried. The overhead Greenwich street rail way, in New York city, rests on a continuous line of these col umns, though not by any means a good type, owing to their flaring tops and bottoms, made to suit the peculiar notions of the contractor of the railway.
To this, we may add that the proposed 1,000 feet tower, which Messrs. Clarke, Reeves \& ('o. have designed, and which is in progress of engraving for these columns, will form one of the most remarkable applications of the celebrated Phœnix posts.

## Railroad Tunnel at Richmond.

The Chesapeake and Ohio Railroad Company have, for two years, been trying to tunnel through Church Hill, in the eastern part of Richmond, but the work has been attended with unexpected impediments. It was supposed it could be completed for $\$ 300,000$, as there were no rocks, and the contract was let at that price. Thetunnelruns 80 or 90 feet be. low the surface, through a slippery blue clay, which has the habit of caving in at the most unseasonable times in the most disagreeable manner. The contractors long ago gave up, and the railroad company was compelled to take the work. Six or seven men have been killed, while the repeated cavings have undermined many houses over the line, which is three quarters of a mile long, and is not yet open.
With one of the tunneling machines, such as were used in boring the experimental section of the Broadway Under. ground Railway, in this city, it would seem as if the above tunnel might have been executed in a veiy short time, with perfect security against caving.

## IMPROVED TOOL HOLDER

This is a useful little device, by means of which a number of different implements, such as fine saws, knife blades, awls, screwdrivers, gimlets, etc., may be carried in a single receptacle no larger than and resembling in form an ordina ry penknife handle, and readily set firmly in place as de sired for use.
The handle has a cover, pivoted, as shown in Fig. 1, which may be easily swung open, or. when closed, is held by a

spring catch, A, in the position in Fig. 2. In both cover and box, just outside the pivot, is formed a jaw, so that, when the parts are closed together, a dovetail socket is made, whic receives the correspondingly shaped ends of the tools. Fig 3 is a transverse section of this portion, and shows the shape of the jaws. This invention was patented February 11, 1873, by Mr. Levi L. Lamb, of Chelsea, Mass.

## sCIENTIFIC AND PRACTICAL INFORMATION.

## researches in santonine

MM. Cannezzaro and Sestini note their investigations of santonic acid, which is much more energetic and more st:ongly characterized than santonine. it is obtained by the combination of one molecule of water with one molecule of santonine by the prolonged action of hot alkaline solutions. The formula is $\mathrm{C}^{15} \mathrm{H}^{20} \mathrm{O}=\mathrm{C}^{15} \mathrm{H}^{18} \mathrm{O}^{3}+\mathrm{H}^{2} \mathrm{O}$. The acid is a colorless substance unalterable by light, little soluble in water at ordinary temperature, but readily dissolved in boiling water, becoming on cooling deposited in the form of fine prismatic crystals. It is very soluble in ether and alcohol, and moderately so in chloroform and acetic acid. It melts between $353 \cdot 8^{\circ}$ and $357 \cdot 4^{\circ}$ Fah., differing from santonine, which melts at $370^{\circ}$ Fah. The reddish violet color, which characterizes the latter substance when treated with alcohol and caustic potash, is not noted in santonic acid. It gives Inite a stroug acid reaction, and decomposes cairbonates dis solved in tepid water with a brisk effervescence.
The same authors give the name santonates to the metal lie derivatives from the acid, and consider that the term santonites should be applied to the compounds that M. Heldet has obtained by treating santonine with metallic hydrates or carbonates. Santonate of soda is made by a warm dissolu tion of santonic acid and carbonate of soda. The salt is de liquescent, and very soluble in water ard in alcohol. Th formula is $\mathrm{C}^{15} \mathrm{H}^{19} \mathrm{NaO}^{4}$. The santonate of baryta is prepared by saturating a solution of santonic acid by hydrate of ba ryta. Santonate of silver is made by heating santonate of baryta to redness in nitrate of silver. This salt is amor phous and quite soluble in water.
tie refining of cotton seed oil.
Dr. Dotch communicates to the Scientific Ampric.in the following method and proportions for refining cotton seed oil : 100 gallons of the crude oil are placed in a tank, and gallons of caustic potash lye, of $45^{\circ}$ Baumé, are gradually added and well stirred for several hours; or the same quan tity of oil is treated with about 6 gallons of soda lye of $25^{\circ}$ or $30^{3}$ Baumé, and heated for an hour or more to about 200 or $240^{\circ}$ Fah. under perpetual stirring, and left to settle. The clear yellow oil is then separated from the brown soap stock, and this dark soap sediment is placed into bags, where the remainder of the oil will drain off ; and the sediment has a marketable value of 3 or 4 cents a pound for soap makers. The potash lye has to be made in iron pots, but the oil and lye may be mixed in wooden tanks.
fo remove grease spots.
In the removal of grease from clothing with benzol or turpentine, people most generallymake the mistake of wetting the cloth with the turpentine and then rubbing it with a sponge or piece of cloth. In this way the fat gets dissolved, but spread over a greater space and not removed; the benzol or turpentine evarorates, and the fat covers now a greater surface than before. The only way to radically remove grease spots is to place soft blotting paper beneath and on top of the grease spot, which spot has first been thoroughly saturated with the benzol and then well pressed. The fat gets now dissoived and absorbed by the paper, and entirely removed from the clothing.

## felting rabbits' hair.

These hairs were formerly treated with a solution of mercury in nitric acid for the purpose of enhancing their felting properties. A misture of nitric acid and treacle is proposed as a substitute.
the depilation of hides with charcoal.
Andersen discovered that pulverized charcoal applied to sheepskins produces the depilation of the hair. Charcoal,as is well known, has the property to take up large quantities of oxygen from the atmospheric air, and the oxygen in this form seems to exert a chemical influence on the fatty substance present in the neighborhood of the glands of the hair roots. An oxidation takes place in the pores of the skin, which destroys the glands and loosens the hair. Finely powdered charcoal is mixed with sufficient water to make a thin paste, and the hides immersed for 4 or 5 days and twel
turned over in the meantime, when the hair can be taken turned over in the meantime, when the hair can be taken
off at once. Hides treated with charcoal do not require further treatment, as is the case now with the lime process: and after being washed with water, they are ready for tanning. This will be a great advantage to the tanning trade,
as leather treated in this way possesses more toughness, solidity and flexibility. The other advantages of this treatment are great saving in time and labor, each hide weighs $\frac{1}{2}$ to 1 pound more, and has less spots, the work is more pleas ant and healthy, the splitting with the machine is more easily accomplished, and the cost price is the same as with lime, as the charcoal can be used over again. Animal or vegetable coal can be ased in any quantity, having no deleterious property whatsoever; and for each hide 6 or 10 pounds, with the necessary quantity of water, are sufficient. The temperature
should be $61^{\circ}$ or $70^{\circ}$ Fah., and can easily be maintained by should be $61^{\circ}$ or $70^{\circ}$ Fah., and can easily be maintained by
introducing steam into the vats. The tanning process is faciitated, as no lime is left behind to neutralize the tannic acid.

## A Handy Device for Teamsters.

In a short time, winter will have so far set in that our country roads will become well blocked with snow and mud, rendering the hauling of heavy machinery, wood, stone, or other large loads, no small burden upon ordinary teams. A great deal of labor and hard tugging may be eaved if overy wagon or truck is provided with 100 feet of stout rope and a single pulley. A snatch block is the best arranged with a strong hook, and the usual constraction for slipping the
tight of tho rope under the strap to the sheave instead of waiting to reeve the line through on end. If a wagon gets stuck in heavy mud or in the snow, the driver has only to stuck in heavy mud or in the snow, the driver has only to
fasten his block to the tongue, reeve the rope through it,and fasten his block to the tongue, reeve the rope through it,and
attach one end to a tree or post and let his team pull on the attach one end to a tree or post and let his team pull on the
other. Their work is of course just halved, or rather they bring twice as much power to bear in dragging the wagon clear. There are plenty of other applications of this simple device, which will readily suggest themselves. With a couple of skids for an inclined plane, heavy logs could be easily drawn on a sleigh by the unhitched team. Another case where it is likely to be useful is when loaded sleighs attempt where it is likely to be useful Although the horses draw the load very easily over the snow, they are often unable to start it over the generally denuded wooden flooring of the bridge, and hence would be materially aided by the tackle hitched on as we have described.

## metaline.

The accompanying engravings and description are designed o call the attention of our readers to a substance which is now offered as an absolute substitute for every kind of lubri

Fiy. 1


Metaline, for such is the name of the body under considration, is a dark colored soft material resembling, though not necessarily coutaining, plumbago in certain forms. The basis is a white and brittle alloy, to which, when ground into an impalpable powder, is added the other components in quantities in direct proportion to the degree of hardness desired. The mixture completed, the substance, still in a dry powder, is placed in suitable molds, in which, under a pressure of hundreds of tuns per square inch, it is made into small cylinders, one of which is shown in Fig. 1. The remainder of our engravings represent the various modes in which the metaline is applied. The general plan, as shown in Fig. $\mathcal{Z}$, is to bore into the inner periphery of the box a series of shallow cavities, into which little plugs of metaline are fitted. The two parts of the bearing are brought together, set upon end, and a reamer, forced down through the opening, pares off the projecting and irregular portions of the plugs, leaving the interior surface perfectly true and smooth.
In Fig. 3 is represented a bearing, part of which is cut away to show the manner of introducing the metaline, in section. At A, in the same figure, is a collar, which revolves with the shaft and of course rubs against the edge of the arrangement of metaline disks, as already described, is here indicated, the plugs being inserted directly in the sides of the collar. Fig. 4shows how the metaline is applied in cases where the inner periphery of the bearing is inaccessible. A collar, Fig. 5, of suitable size, is made and fitted with disks as represented, and inserted in the bearing, which is suitably enlarged to receive it. This proceeding is applicable to very small shafts, as mill spindles, etc. In certain cases where it might be preferable to avoid altering the learing, the shaft is slotted and the metaline forced in under strong pressure, in the positions depicted in Fig. 6. Lastly, Fig. 7 represents a step for a mill spindle or any upright swiftly rotating shaft, notably of the kind used in supporting the cutter heads in wood working machinery. Here a conical cup of brass is fitted with plugs as shown, and secured in a suitable cavity in the heavier portion. The mode of application must necessarily vary greatly with the construction of the machine, and other attending circumstances; and we may add that many varieties aro made, to adapt the material to different speeds, pressures, weights, etc.
At the workshops of the company in this city, various kinds of experimental machines are now in motion, and, among others, there is a mill spindle, rotated at the rate of 8,000 revolutions per minute. The shaft is of steel, and the bearing is of similar metal, fitted as closely as can be done. Metaline is introduced in slots in the shaft. We examined the apparatus carefully and could detect no heating. Four sewing machines are also continuously running at full speed, the needle bars of some at the rate of 1,200 revolutions per minute. No oil or other lubricant but metaline is in use, and there is clearly no cutting or heating. A five horse power Baxter engine we also found running, at the rate of about 150 revolutions, without a drop of oil,and we were informed that it had been in daily use since May 1. Our attention was also called to the countershafting in the machine shop, the also called to the countershafting in the machine shop, the
journals of which had been cut down to a length equal to journals of which had been cut down to a length equal to
one diametfr of the shaft, as shown in our engravings, Figs. 2 and 3; and such indeed was the case with all the. journals to which the metaline had been applied. We need not point out the saving of expense and material thus effected. Since January, 1870 , the substance has been in use on a slotting machine, in the works of Todd \& Rafferty, of Paterson, N. J. It bas never been renewed, and according to the engineer, the bearing always cut with oil. The pins of the drawbridges of the Central Railroad of New Jersey, over the Passaic and Hackensack rivers, were fitted with metaline three years ago, and, as we are informed, now exhibit no signs of wear. Specimens of lirasses and also of shafting shown to us, which ran for a continuous period with the lubricant, appeared to be perfectly smooth and polished like a mirror; while judging from our examination of machinery which had been in actual motion for several months, there seemed to be no working up of the substance ; and so far from there being any dirt in the bearings, the revolv:ng shafts barely soiled a white handkerchief.
Lack of space forbids our entering in greater detail into the applications of this invention. Doubtless the simple assertion that to all appearances it both obviates the use of oil and completely prevents the wearing away of rubbing parts, will at once suggest to the reader its infinitude of adaptations. It is the invention of Dr. Stuart (Gwynne, and was devised some three years ago, when it was introduced in the localities above noted and in various other piaces in this country and in England, and was also made the subject of a commendatory report, now before us, of Chief Engineer Clark Fisher, United States Navy, to the Secretary of the Navy. By direction of the latter official, certain gunboa
were to be fitted up for trial; but the burning of the compawere to
ny's factory, together with difficulties between interested ny's factory, together with difficulties between interested
parties, resulted in the temporary withdrawal of metaline from the market. At the present time it is aggin offered to the public in improved form, and is manufactured by the American Metaline Company, No. 61 Warren street, in this city. Our readers can examine the experimental machinery for themselves at the above mentioned address, or may obtain further information by letter.

Coatings of lead oxide and salts on pottery are apt to diesolve off in acid liquids, thereby threatening the health of those who use them. Several successivo coatings with a lation of sodic silicate and then exposure to a brigbtred heat in a furvace, prevent the trouble.
least it may be said that the new substance has claimed for it, and to all appearances on substantial grounds, advantages which may render it, for a number of obvious reasons, an invention of no ordinary importance.

## C゙orrespondemte.

## Concerning a Telescope of Unlimited Potver

To the Editor of the Scientific American
In connection with $D$.'s communication, on page 368 o your volume XXIX., it may be observed that the mercury revolving in the manner described, will have a stability due to its motion, above that belonging to it whiie in a state of rest. The same principle applies alike to the motions of atoms and of suns, and a very striking illustration is af forded by the rigidity imparted to a stream of water is suing from an orifice under great pressare. (See Mr. E on's communication, page 340 of your iter is unable). the exact stability of mercury due to different velocities; but the exact stability of mercury due to different velocities; but
after a rough estimate, it is safe to say that, if the basin of after a rough estimate, it is safe to say that, if the basin of
20 feet diameter be made to revolve at the rate of 200 re 20 feet diameter be made to revolve at the rate of 200 re-
volutions perminute (which speed is practicable), the mercuy near the circumference of the basin will have a stability greater than lead. Now, unfortunately, the velocity at the center of the vessel will be 0 , and consequently the stability at the center will be only that due to mercury in a state of he center of the mirror; perhaps some one will be kind nough to tell us how much, if any, may be dispensed with, enough to tell us how much, if any, may
without seriously impairing its efficiency.
The great amount of power required to operate the neces sary machinery would preclude the possibility of using weights for imparting motion, and the next best thing that we have is an accurately balanced water wheel, imparting we motion through friction wheels. After reducing the possibility of fricti on to a minimum by accurate balancing, etc., we may obviate still further difficulties arising from vibration nd inequalites of to act as a reflector, in another vessel olso containing mercury. The motion would then br imalso containing mercury. The motion would then brs im he mercury in the inner vessel. The consequences of this arrangement are obvious.
In regard to the plane mirrors, will some one well ac quainted with the principles involved be kind enough to in form us if it is necessary that they should be quite as large as the parabolic reflector?
The oxidation of the mercury would be an item requiring attention. It might be prevented by covering the metal while at rest, with a suitable oil, which would separate itsel from the mercury while in motion.

Join Linton. Baltimore, Md.

## Heat and its Origin.

To the Editor of the Scientific American:
The origin of the heat developed during combustion has hitherto been a profound mystery. In the beginning of this century, it was suggested that a portion of the specific or of the latent heat of the bodies consumed was set free during the process of combustion ; but this idea was soon overthrown, as it was found that the products of combustion often possess more specific heat, and almost more latent heat, than the bodies themselves did before burning, that is, before chemically combining under evolution of heat. Hence
arises the question: Whence comes all this intense heat arises the question: Whence comes all this intense heat
of com! bustion, and the subsequent great amount of latent of com! bustion, and the subsequent great amount of latent specific heat than its elements before combination? It is curious to remark that, in this case, the most eminent phy sicists concluded that combustion must be an electric phe nomenon. That ignorant persons, knowing nothing of elec tricity, attributed the so-called spirit rappings and similar manifestations to its agency may le readily con:prehended but that scientists who have studied its laws should use thi word as a pretext for explaining fire, solar heat, volcanoes and even earthquakes, seems almost incredible. Physics form a positive science, which does not admit of vague sug-
gestions, and a phenomenon cannot be ascribed to the work gestions, and a phenomenon cannot be ascribed to the work
of electricity unless it is clearly shown that the well known laws and properties of electricity, when applied, explain every peculiar phase of the same. Notwithstanding that tha laws of heat and electricity have been thoroughly investigated we are as yet not sure of their ultimate nature; one thing only appears certain, namely, that both are not peculiar fluids nenetrating matter, but mere motions of the molecules or
goms of ponderable matter. Therefore, it is inappropriate to speak of imponderable matter,on account of the contradic tion in terms, as the first property of matter is to be pondera ble; we may have imponderable forces, or, better, caloric and electric forces. The so-called ether, whicl fills the planetary space and propagates heat and light, is probably ponderable matter; it is an atmosphere surpassing hydrogen in l,rightness more than hydrogen surpasses platinum, and of so small a gravitating force that millions of years wil elapse before it is condensed on the planets. In fact, the
spectroscope shows that, in the stmosphera of the planets ind even of the sun, the materials of our carth's atmosphere are present, including water or its elements. Recent inves tigations of the sun and other heavenly bodies, by means of this wonderful apparatus, have besides revealed the fact that all matter may be in a more than gascous condition, in candescent gas of so high a temperature that the elements are dissociated, that is, that all chemical affinities are de stroyed, and each element exists separately in its uncombined condition, notwithstanding that it is intermingled with others A descent from this exceedingly high temperature to that in which the chemical affinities can manifest themselves re sults in the combination of the gases. The chemical affinities of the different elementary substances manifest them.
selves only between a comparatively limited range of temperature, below and above which they do not operate. Even as at an extreme cold no combinations can take place, so a the extreme heat, of say $8,000^{\circ}$ Fahrenheit, not only no combustions take place, but all compounds are separated into their ultimate elements. On cooling and reaching $4,000^{\circ}$ or $3,000^{\circ}$ or thereabouts,'the volatilized substances or gases will again combine; the chemical affnities come into play, and combustion will ensue, the heat of which will egain originate
partial new dissociations. This is what continually appears partial new dissociations. This is what continually appears
to take place in the san. It has been proved that the work to take place in the san. It has been proved that the work
of dissocistion is strictly analogous to that of evaporation In imparting to a liquid, water, for instance, the property of gaseous elasticity, steam, a definite quantity of calorific energy is manifested in the newly acquired expansive power and therefore is not displayed as temperature; in other words heat is made latent when changing water into steam. In like manner a still larger amount of temperature is converted into the force necessary to separate the vapors into their component gases; here a greater quantity of heat is made atent, and this is that which is set free and appears in com-
bustion when the gases combine by burning, just as latent heat is freed when gases condense into a liquid, and again when the liquid cools int? a solid. In regard to the tempera. ture of the sun, we know now that those substances most promineint on our earth exist there in a state of vapor Iron, lime, soda, potash, etc., are there in that condition,and also steam in the dissociated state of oxygen and hydrogen. Therefore the actual temperature must be several thousands f degrees, in fact, such a heat as we cannot practically produce. Direct measurement caused Sir Isaac Newton to
conclude that the sun was thousands of times hotter than conclude that the sun was thousands of times hotter than
melted iron, while Sir John Herschel supposed that it was a solid or liquid body, radiating from its surfase only, and that its temperature ought to exceed thirteen million degrees
Fahrenheit. Modern discovery has shown, however, that Fahrenheit. Modern discovery has shown, however, that miles, and that the gas is all incandescent, luminous, and hot.
Moreover, incandescent gases and flames are perfectly ransparent for light and heat from lower strata, and therefore the solar rays not only come to us from the surface, but we receive the accumulated rays from layers of incandescent gases several thousand miles in thickness. From the effects of these gases, the surface of the sun is continually being disturbed in a manner compared to which the more violent hurricanes, thunderstorms, and volcanic eruptions on our earth sink into utter insignificance.

## The Prismoldal Rallway.

To the Editor of the Scientific American:
Observing in your journal of December 13, 1873, an aricle, opied from the Publc Ledger, referring to Crew's prismoidal railway, we beg to call your attention to an error which we will thank you to have corrected. The error lay in the tatement that "the track upon which the trial was made, ontained 36 feet lumber and 18 pounds of iron to the lineal oot;" it should read "lineal yard." We beg further to in orm you that, by consent of the President of the Atlanta and West End Street Railway Company, Atlanta, Ga., for
whom the locomotive was built, Mr. E. Crew, the patentee, whom the locomotive was built, Mr. E. Crew, the patentee,
has been allowed its use in odder to demonstrate its power nd the principle of his railway on a track of 500 feet circum ference, now building at the Chestnut street rink in our city, which he has rented for that purpose; where, in the course of a couple of weeks, he intends to bring it directly before the attention of railroad men and corporations. The prism of this trial railway is 24 inches wide at base, with 18 inches hight to top of cone, with au 18 lbs . rail on its apex. The curves will be of 37 feet radius, and he purposes to demonstrate his principle, starting on a trip of 500 miles.
We enclose you a photograph of ti.e "Atlanta" locomotive which is now at the rink. It is 11 feet long, 4 feet wide, and has two 24 inch drivers, with cylinders $5 \times 8$, and weighs only 4 tuns.
We contend that, by the use of the prismoidal railway, rapid transit can be insured between the cities of New York and Pliladelphia, and the time reduced to $1 \frac{1}{2}$ hours. Philadelphia, Pa. Geo. W. Grice \& Co.

The Relative Efficiency of Engines and Boilers. To the Editor of the Scientific American:
The question of the relative economic efficiency of modern engines as compared with that of boilers, as they are now constructed, is being agitated among engineers in this city, and it has occurred to me that it is a subject that will interst the readers of your valuable journal. The discussion rose from a statement, made by one engineer, that, whereas he best modern steam engines have frequently developed
from 75 to 85 per cent of the power actually furnished by he boiler, the boiler does not develope more than 15 per cent of the power actually contained in the carbon fuel. This was objected to, the reverse being claimed as being nearer the truth. Discussion on this subject in your valuable journal would be highly appreciated by the public, who well know that you are desirous of obtaining as much light as possible on all scientific subjects, and especially on steam which enters so largely into all concerns of our daily life. Boston, Mass. Consultina Enaineer.
Remarks by the Editor:-The subject here suggested is one of interest, and we invite correspondents to give their views.
The Parisian pharmaceutists have contrived to incorpor te cod liver oil with bread. Each pound of bread contains a little more than two ounces of che oil.

## ALUMINA, FROM THE CLAY TO THE SAPPHIRE.


Alumina is the oxide of the metal aluminum. It occurs in nature as corundum, which is an extremely hard mineral, ranking next to the diamond, its specific gravity being 40 . It consists of 53 per cent aluminum and 47 oxygen. The precious gems sapphire and ruby are the representativcs of
pure alumina, the first of a blue and the othor of pink or rose red color. If they possess a stellated opalescence, when viewed in the direction of the vertical axis, resembling a star, they are called star sapphires or rubies, which were known to Theophrastus and Pliny in the first century. The mineral corundum occurs in very fine crystals of the blue and red colors in many localities of the United States, such as New York furnishes at Amity, New Jersey at Newton, Pennsylvania at Unionville, and North Carolina. At Franklin, an extensive quarry of the crystals is now mined, one cry:tal weighing 30 tuns. Georgia gives red supphires, of which C'aiifornia and Canada both furnish fine specimens. The minerals gibbsite and diaspore are hydrates of alumina; but the mineral emery, which stands near corundum in hardness and is the most useful material in the arts, containing the alumina and magnesia in about equal proportions, was origi nally brought from Asia Minor, but is now extensively mined at Chester, in Massachusetts. Alumina is also con. tained in a vast number of minerals. (lay is the result of the decomposition of aluminous minerals, and is, strictly speaking, a mixture of silex or flint, with at least one fourth of alumina, and has a peculiar earthy odor when breathed upon; and the mineral shale, which differs but little from clay, is extremely infusible and insoluble, and is also the companion of the silicated minerals: any earth which possesses sufficient ductility, when kneaded up with water, to be fashioned like paste by the hand, is called clay. These clays vary greatly in their composition, and are nothing more than mud derived from the decomposition or wearing down of rocks, as we see ly the rain drop impressions, ripple marks, or mud cracks, which bear marks and evidence of exposure above the water, indicating plainly the long time which was required for the decomposition of the felspathic rocks, mostly contained in granite, and of granitic and yrneissoid rocks and porphyry. In some regions where these rocks have decomposed on a large scale, the result:ng clay remains in vast beds of kaolin mixed with pure quartz or silex, and sometimes with oxide of iron from some of the other mine. rals present, such as we find extensive beds of in the tertiary formation, as in New Jersey, Virginia, and South Carolina.
Before proceeding further to state what function the component parts of granite, which are the quartz, felspar and
mica, occupy in the aluminous silicates, let me say a few mica, occupy in the aluminous silicates, let me say a few words on the classification of rocks according to their or:gin and age, meaning the earth's crust, of which but a small portion is accessible to human observation. All rocks are divided into four great classes according to their different origin. The first are the aqueous; second, volcanic ; third. the plutonic; and fourth, the metamorphic. Each of these four distinct classes has originated at many successive periods. It was formerly supposed that all granites, together with the crystaline or metamoryhic strata, were first formed, and were called, therefore, primitive rocks, and that the aqueous and volcanic rocks were afterwards superim. posed, and would rank, therefore, as secoudary in the order of time. The aqueous rocks are also called the sedimentary or fossiliferous, and cover a larger part of the earth's surface than any others ; they consist chiefly of mechanical deposits. such as pebbles, sand and mud, but are partly of chemical and some of organic origin. especially the limestones; they are called the stratified rocks, meaning strata which have
been produced by theaction of water. We have adopted these names of formations, such as the stratified and unstratificd, fresh water and marine, aqueous and volcanic, ancient and modern, metaliferous and non-metaliferous formations.
The volcanic rocks are those which have been produced at or near the surface, whether in ancient or modern timesnot by water, but by the action of fire or subterranean heat. These rocks are, for the most part, unstratified, and are devoid of fossils; they are the results of volcanic action and of craters more or less perfect ; they are composed of lava, sand and ashes, similar to those of active volcanoes; and streams
of lava may be traced from high summits or cones into adjoining valleys; and earthquakes have produced erosions, fissures and ravines (whereby we can detect porous lava, sand and scorix), dikes or perpendicular walls of volcanic rock, such as are observed in the structure of Vesuvius, Etna, and other active volcanoes. The basaltic rocks, forming the rocks of Staffa and of Giants' ('auseway, are all volcanic; they have in their mineral composition much resemblance to the lavas, which are known to have flowed from the craters f volcanoes.
The plutonic rocks, which comprise mostly the granites, etc., differ much from the aqueous and volcanic ; they are, in common with the next class, highly crystaline and destitute of organic remains; the plutonic comprehend all the granites and certain porphyries, which are nearly allied in some of their characters to volcanic formations. The metamorphic rocks, however, are stratified and often slaty, and are called by some the crystaline schists, in which are included gneiss, micaceous schists, hornblende schists, statuary marble, the finest kinds of roofing slate, and others. All the various kinds of granites which constitute the plutonic family are supposed to be of igneous and aqueo-igneous origin, and have been formed under great pressure at a considerable depth in the earth, or under a certain weight of incumbent
ocean. Like the lava of volcanoes, they have been melted
and afterwards cooled and cryetalized, but with extreme slowness and under conditions diffrrent from those bodies cooling in the opan air; they differ from volcanic rocks not alone by their cryetaline structure but by the absence of tufa and brecias, which are the products of eruptions on the earth's surface or beneath seas of little and inconsiderable depth.
The metamorphic or stratified crystaline rocks form the fourth and last great division of rocks, comprising the gneiss, mica schist, clay slate. chloritic schist, marble and the like, the origin of which is mose doubtful than that of the other three classes They contain no pebbles or sand or scoriæ, and no traces of organic bodies, and are often as crystaline as granite, yet divided into beds correrponding to sedimeutary formations, and may be called stratified. The materials of these strata were originally drposited from water in the usual form of sediment, but were subsequently so altered by subterranean heat as to assume a new texture. It may be proved that fossiliferous strata have exchanged an earthy
for a highly crystaline structure, even at some distance for a highly crystaline structure, even at some distance
from their contact with granite; hard clays containing veg from their contact with granite; hard clays containing veg
etable or other remains have been turned into slate, called the mica schist or hornblende schist, and every vestige of the organic bodies bas been obliterated.
All the crystaline rocks are of very different ages, some imes newer than the strata called stcondary, and we must nfer that some peculiarity must exist which is equally attrib utable to grauite and gneiss, or in other words to the plutonic and altered rocks, which are distinguished from the volcanic and the unaltered sedimentary rocks; and that the granite and gntiss and the other crystaline formations are hypo aqueous, or rocks which bave not assumed their fossil form and structure at the surface, and occupy the lowest place in the order of superposition.
The composition of granite, as already stated, being quartz, mica and felspar, the two last named ingredients contain the alumina in the form of silicate of alumina in nearly equal proportions, and some contain also some alkaline in gredients; likewise mica consists of a silicate of alumina and another alkali, differing somewhat from those contained in the felspar; we have, for instance, the anorthite, a lime fel spar, the labradorite, a lime and soda felspar, the oligoclase a soda lime feispar, the albite, a soda felspar, the ortho clase, a potash felspar; while the mica group, such as the phlogopite, biotite, muscovite, lepidolite, and others contain about twenty per ce of alumina, and about thirty per cen magnesia in their compositions. Felspar, like adularia amazonstone and labradorite, when polished, form orna mental minerals; the garnet, likewise a silicate of alumina when cut and polished, forms a gem; so is the lapis lazuli a silicate of alumina, an ornamental stone furnishing the natural ultramarine blue colors. The turquoise, one of the
genus, is of blue color, but is a phosphate instead of a silicate f alumina, while a nother inter sting mineral, called wavel lite, contains this alumina. The beryl and emerald are silicates of alumina oxygenated, the latter colored with oxide of chrome; and the first, when cut and polished, has the name of aqua marina, and is a fine gem.
A vast number of minerals composed of alumina and silica are found in nature, which find much useful applica tion in the arts and manufactures; the mineral cryolite from Greenland, which is an aluminate but not combined with silica, is a fluoride of aluminum and sodium, is ex ported to many parts of the world and furnishes the materi lor alumina compounds
Common slate, fuller's earth, pumicestone, marl, loam, ocher, umber, and sienna are more or less clays or silicate of aluminum, the three latter being colored by oxides of iron and manganese.
The topaz, a beautiful gem, is a silicate and Hluoride of alumina. The great family of zeolites, which are composed of hydrous silicates and represent a very interesting class of minerals, are all chemical compounds of alumina with silica; most of them contain also a considerable portion of water, and lime, soda and potash.
Clay, which is found in nature in very extensive de posits, and if of very fine quality and texture is called kao in: and the other varieties, such as common pipe clay, fine clay, Stourbridge, marl, or loam clay, and claystone: is of the same chemica emmposition as regards the silicate of alumina; some contain more iron, and some contain lime and the alkalies soda anc potash; all, however, owe the ir existfnce to the decomposition of the granitic rock which,
through many causes, either chemical or mechanical, or through the action of atmospheric air for many ages, has gradually become disistegrated; and as Brogniard found in France the granitic rock in such a condition, he called it "la maladie du granite." The rock may gradually wear down either by variation of temperature or glacial action, or by congelation of water wichin the rock, gradually producing a split and expansion. In a chemical peint, water its-lf may produce a powerful metamorpbosis; as it contains carbonic of the decomposing granitic rock, while the silicate of alumi na ard the free silex would subaequentiy be separated by the action of water; the former, ceing so much lighttr would sonn be washed away from tiee heavier silex, and af ter separation the clay is deposited. Very striking demon strations of the decomposing granitic rocks may be seen in New York city, particularly in the upper part; there is a
ledge of granitic rock extending from east to west, begin. ning at 31st street west to 60th street north; the Croton aqueduct in 42 d street and Fifth avenue has been built from a granite quarried near 48th street and Tenth avenue; wh:le on the east side, above 50 th street, the gneiss rock caps the
granite.

## inside a chorch organ.

It is questionable whether any more magnificent apecimen of human mechanical skill exists than the grand organ. The builder must unite, in his single person, the three capacities of artist, of scientist, and of workman: of the first, in order that he may possess the delicacy of ear to appreciate mincte shades or variations of musical sound; of the second. that he may know and investigate the principles of acoustics which govern the productions of melodious vibrations, and the theories to be followed in constructing the apparatus
from which the eame may be elicited; and lastly of the from which the eame may be elicited; and lastly of the
skilled artificer, in order that he may contrive and invent devices for rendering the harmonies, latent in his assemblage of pipes, levers, and keys, responsive to the touch of the musicia.. It may seem almost a shatiering of one's favorite mental idols to break down the divinity which, as the king of instruments, h-dges around the organ: indeed. the dry details of levers, springs, and bellows, seem inap propriate and incongruous in connection with those grand tones which peal forth in the sol-mn chords which excite our reverential feelings as we kneel in the sanctuary; but Science is utterly destitute of sentiment. With imper turbable caln nessshe mercilessly resoives the daintiest melodies of Mendelssolhn or Scbumann, or the most majestic of choruses of Handrl or Beethoven, into mere vibrations of the air, prolonged through cestan intervals and in certain tubes, or leads us off from the reverie into which we fall tver some exquisite harmony of the great tone masters into abstruse calculations as to tho percentage of power due to the food absorbed by the organist plus the blower, which,
converted into heat, is reconverted into motion by muscular converted into heat, is reconverted into motion by muscular
action, which is again communicated to levers, etc., and which ultimately reappears in the ehape of sound, and is a jain converted into motion when vibrating the auditory nerves We recently spent a pleasant half hour inside an organ. We climbed ladders and mounted platforms, and enjoy $\epsilon \mathrm{d}$ he novel sensation of standing in a small grove of tubes, where big pipes were the large trees, and the little ones, the under brush; and looking back it seems as if we investigated nough levers, springs, and rods to establish a moderate sized piano manufactory. We puzzled over the arrangement of pedals, couplers, and stops, and becane hugely impressed with the skill which enables a single mortal of ordinary construction to play on so many things at once; and finally dis. covering some novel and really ingenious appliances which, the builder informed us, were not furnisbed to organs in general. we obtained through the kindness and courtesy of that gentleman the following interesting particulars:
Let us premise by observing that the instrument which formed the object of our visit is located in the church of the Holy Communion, corner of 20th street and Sixth avenue, and that it has just been completed by Mr. Hilborne L. Roosevelt, of No. 40 West 18th street, in this city. Mr. Roosevelt is ne of the youngest of American organ builders; but if we may judge from the magnificent tone and almost perfect mechanism, coupled with dovices of no mean inventive ekill, which we find in his latest production, we may fairly assume that he has reached a foremost place in bis arduous profession. His plan is to combine the best points of all schools, English, German, and French; and hence the brief sketch which we give of the arrangement of the organ in question may perbaps be considered as including many of the latest mprovements of the manufacture.
Every one knows that if power be communicated indirectly, the nocessary mechanism for turning corners, etc., necessitates a certain amount of friction al loss and resistance, the motur. course, than if the force was applied directly and moreover, acts at a disadvantage, and an outline may be gleaned of the difficulty of actuating the multitudinous valves aid levers of an organ, by compound levers connecting with sey boards, say forty feet off, governed by the fingers of the organist. There is both a strong resistance to digital presure, necessitating great exertion on the part of the performer, and also there exists an appreciable lapse of time be-
tween the touching of the key and the evolution of sound. tween the touching of the key and the evolution of sound.
The improvement which avcids this trouble is called the "pneumatic lever," and its effect is such that the keys are as easily manipulated, even with the full power of the instrument in action, as those of an ordinary pianoforte, while the interval of time between touch and sound, is barely $\frac{1}{8}$ second, which is of course practically inappreciable. In the church bove noted, the organist's seat is on the ground floor, while be instrument is in a gallery. The levers from the inner stremities of the keys pass down under the Hooring to a box directly beneath the loft. Here,arranged in framework, a 2 series of little bellows,one for each key of the organ; and in one end of each of which is a valve. operated by a l-ver leading from the key board. This is so adjusted that, on
pressing down a key, compressed air enters the correspond ing small bellows and iuflates it. As the bellows enlarges, it pulls upon a lever that opens the valve connecting with the proper pipe. It will be noted that no pressure is needed on the key, escrpt such as is necessary to lift the small bellows vaive, which is of course a very inconsiderable mount.
This set, or rather these sets, of bellows, for there are two one belonging to each bank of keys, must not be confounded with the rain bellows which supplies the air blast. This apparatus is situated in the loft near the organ, and is operated by man power, forcing a powerful current of air, not directly to the pipes, but into another bellows which serves as a regulator, securing a constant, instead of an intermittent, blast, and thus preventing the dieagreeable, whetzy, nd unequal tooting sound often noticeable in old and imperfect instruments. The blast is finally driven into a re
presently to be described
Each key board, and there may be several, belongs to an entirely separate organ, so two or mort instruments may, by ingenious inter-adjustmeut,be combiced in one and the same case. In the organ in question, there are two key boards proper, though the pedals, worked by the feet,may be termed a third; and there is another called the tectro-melody, so that in fact, with two key boards and one set of pedals, the playrr performs upon four separate and distinct organs at will, any combination of that number, or all together. The pedal organ is merely an assemblage of low pitched pipes; and on its mectani-m, it is unecessary $t^{\prime} d$ dwell. The great organ is the lowest bank of keya, which connect, as before noted, with pneumatic levers. Just alove the recep. before noted, with pneumatic levers. Just alove the recep-
tacie for the wind is the wind chent, which may be likentd to a long sballow box, divid•d by numerrus longitudinal partitions, making tr ugbs. In th-re partitions are set the pipre, each longitudinal row of which is called a regiter. The iow-r ends of each set communcate with a compartment of
the chest, and the aptrtures are closed by spring valves the chest, and the aptrtures are clostd by spring valves. Now, if there w.re but one ret of piper, each key wou'd those valves, and henct would neces-arily sound but a single tube; but there are, as we nave ulready stated, many rows of pires, and hence one key not only works one valve, but sev. eral, ranged in a transverse line directly across the wind chest. Tuat is, while a single key may sound tirst a funda mental note belonging to a chrrd whirh is found in on re
gister, it may open simultaneously valves belonging to tub-s in other registers parallel thereto, so as to admit air, and thus produce notes laving certain harmonc relation $t$, the key note; so that in fact by a single pressure of the finger, if we so desire, we may pioduce a chord or portion thereof. instead of a single note, as on a piano. Each trough in the wind chest of course brlungs to one set of piper, and has its own valve, so that the organist, by means of handles uear his key board, called "stops," may admit the blast into one or any number of the channels, and thus sound any register or regist rs he may desire. The total compass of ea $\cdot \mathrm{h}$ register, in the great organ portion of the in trument we are de scribing, is 58 pipes, and there are twelve stops. allowing a selection of any of that number of $r$ egisters. But these latter all differ in quality of tone; for instauc-.one is a barmonic flute, another a trumpet, a third a clarion; in fact each has its own voice, due to the construction of the pipes. The pedal stops are arranged in similar manner, and number five in all, while the swell organ, which is oper ated by the secoud or higber key board, has a timilar number of pipes, with a set of eightstops peculiar to it-elf. The swell organ must here be explained, as used for diminuendo or crescendo effects. It consists in mechanism similar to that already described, but enclosed in a tight box, the sides of which are made like Venetian blinds. By opening these shutters, more or less, the organist can allow the whole sound to emerge, or can confine it, and so deaden it in the closed case. The electromelody organ is an ertirely novel invention of Mr. Roosevelt, of which it would be hardly possible to convey a clear idea without engravings. It is, as we bave stated, a separate little organ by itself, and is designed to carry the not-s of a melody or air, in a tone easily heard above the accompaniment, and so prove very uspful in congregational singing. It is connected tothe upper half of the key boards,and with a Leclanché battery. Each key,on being pressed, establishes a current which magnetizos an electro-magnet and so opens the valve of the, proper pipe.
The pecuiar point however, lies in d - vice which prevent The pecuiar point, however, lies in d+vices which prevent any but the upper cr melody nite being hadd. Tinus, if we strike the chord C E G C, the upper C alone could be bearl, if we allowed that note to rise, then only the G, and thus throw out any number of tones. This in irntion is lighly ingenious, and though really very simple, quite difficuli to There first sight
There are many other appliances which we may briffly notice in conclusion. Among them are four couplers, by which the pedal great, and swell organs are connected, as may be de-ired, by a mere pressure of the finger of the organist
on a butt'n just above his key board. Ther. are besides five combination pedals, for drawing out the full power of the instrum-nt, or full or part power of each integral portion. Then here is the usual tremolo arrang-ment, and vatious other refinements, which, though intere-ting to the musician might fail to be appreciated by the geteral reader.
One of the most interesting applications of cl. ctro magnetiem, it may be remark +d , is to the church orgau, atd we are a ware of instances of its use to much larger extent than in the electro m.lodic sub organ no ed above. In fact, one of the principal ehurches in this city has two enmplete
organs, one being on each side of the clipnc 1, and entirely ditioct from the on each side of the chenc-1, and en inely
dingle keybnard communicates directly with one, but operates the otlurr by the +lectric current and magnets actirg on the valves; fo that if d-sired, the choir may be divided, half on each side, and yot both pa ties he enabl-d to sing in corr ct uvisen with the instrument. There are othrr points relating to organ imprements and manufacture, which epare prevents our hr re dwelling upon, and to which we shiall sllude at an early date.

The Balloon Advertising Dodge Rejected.
The Commissinner of Patents las rej-cted au application for a patent for the broad idea of attachng ad virtisem $\mu$ nts to balloons, for the reason that a billon is a crmmon oijject, upon which every person bas the sight to stick or paint advertisements if he wishes. In order to support a patent, the applicant mart have invented romething. It is not invention merely to put adrertisements on balloons.

BARROW IN FURNESS, LANCASHIRE, ENGLAND. The enormous development of the iron trade, which has taken place in the last twenty years, has been as noticeable in England as in this country. In this time the whole district of Miudlesbrough has come into existence as an iron field; the works in the neighborhood of Glasgow have been increased with astonishing rapidity; and on the west coast of Lancashire, a new town has lately sprung up, which, from the extent and quality of its production, is as remarkable as either of the other industrial centers.
The Cumberland iron ores, which abound in the neighborhood of Barrow, had been but little worked previously to the establishment of Mr. Bessemer's system ; but they are ow found to be tho mineral particularly adapted for the now found to be the
production of Besceproduction of Besse. steel," as it is sometimes called. This fact, and the enter prise of many local manufacturers, aided by the capital of two territorial magnates, have created a town, which, in 1847, had a population of 395 wich commenced it cor orate existence only in 1867 , and now has 30,000 inhabi tants and produces 5,000 tuns of metal chiefly steel, weeìly On the opposite pag we give a birdsey view of this interest ing and important town.
In 1864, Mr. Jame Ramsden, manage and secretary of the Furness Railway Company, projected and formed the Bar row Steel Company
which erected large works for the purpose of converting the produce of those furnaces into Bessemer steel, and then manufacturing the valuaile material into rails, axles, tyres, and the other hundred forms in which Bessemer steel is now used. It very soon after became apparent that the two operations of smelting the ore and converting it into steel were so nearly allied in interest as well as in locality that an amal gamation was proposed between these works and those owned by Messrs. Schneider and Hannay, and was effected in 1866 under the title of The Barrow Hematite Steel Company (Linited). The Duke of Devonshire became chairman and Mr. Ramsden managing director, and it was virtually only an offshoot of the original enterprise of the railwa company. They now possess twelve. blast furnaces complete, and in connection with these one of the largest Besse mer steel works in the world. These twelve furnaces stand close to the sea shore, being arranged in one straight line but forming two groups of different sizes. The slag is tilted direct into the sea, and has already given a large increase of hand on the sta side, upon which whole series of stores, work shops, and othar aicessory buildings, have been erectel. For the present weekly production the quantities of 10,000 producticn, the quantities of 10,000 tuns of ore and limestone and What would poor Dud Dudley (asks the Practical Magazine, from which we extract the engravings), who first introduced the use of coal for smelting purposes into England, have said to this, whes, scarcely more than 200 years ago, he writes complainingly "Some of the now going Furnaces with Charcole do make two or three l'un of Pigg or cast iron in 24 hours, which quantity of cast iron, with pit cole and Sea cole at one Fur nace I desire not but am contented with half the proportion!'
The Barrow steel works, shown it our Fig. 1, are the largest Bessemer steel works in Great Britain; and the company own several productive mine their profit in 1872 was not much under $\$ 3,750$, 00
At the time Mr. Ramsden was first mooting the idea of the steel works, his mind was engaged also on an undertak ing of but little less magnitude and utility, namely, the for mation of such docks as should make Barrow altogether un rivalled as a seaport town on the large seaboard between Liverpool and the Clyde. The construction of two large docks was commenced in 1864. They were formed simply by inclosing the channel separating the town from Barrow Island by an extensive quay, forming the dock wall on the main land side. The cost of actual formation was, owing to the natural facilities of the site, only $\$ 1,000,000$. All these enterprises had given au immense impetus to the growth of the town. Private enterprise has not been slow in utilizing the advantages of the new docks. There is a line of ocean steamships from Barrow to Montreal, and another between

Barrow and Rotterdana. Timber is imported at the rate of one hundred cargoes annually.
The Devonshire dock is thirty acres in extent, the Buccleugh dock thirty-three, and outside of this latter there is a splendid timber pond. The entrances are sixty feet in width, and the depth of water maintained twenty-two feet. The stone quays are one and a half miles in extent; the wharves adjoining, one hundred acres, while there are at least ten miles of railway sidings. Cranes and capstans worked by hydraulic power were supplied by Sir William Armstrong, and the original warehouses, having a floor area of 17,000 square yards, have more recently been augmented by the erection of a gigantic warehouse by the side of the Devonshire dock, divided into two blocks, each block
ving dock is now in process of completion, which will afford the company the means of making repairs in a more sul stantial manner than was hitherto possible. These work already employ more than two thousand hands, and will, when in full movement, demand at least six or seven thou sand men. The company have already contracted with th Barrow-in-Furness Ocean Steamship Company for six first class steamers, each of which will be about 400 feet in length, of 4,000 tuns burthen, and 500 horse power. They are also building five steamships for the Ducal line of steam ers trading to India, Ceylon, and the East generally, the in auguration of which line has taken place so recently and so successfully. These vessels will be about 380 feet long, 38 eet beam, and 26 feet depth of hold, 500 horse power, and 4,000 tuns burthen. Corn mills, rolling tock factories, rail way shops, newspaer offices, theatres bath houser, a yacht club, and other indications of rapidly increasing population and public spirit, have followed. The public baths were built by Mr Ramsden at his own expense, and presented o the town.
stroll through the worke and streets of Barrow gives one as true a picture as may be of a teeming hive of modern in. dustry. "Not'arms and the man,' but ools and the man, is he true epic of dern times!" says Mr. Carlyle ; and liere we have the very nuı cry of tooldom. Tall cbimneys all around
Fig. 1.-BARROW HEMATITE STEEL WORKS. moke; huge furnaces
ories in hight, and each possessing a floor area of 5,000 quare yards.

## transit shed

It was thought that some employment should be afforded to the numbers of women and children who congregated idly and uselessly in a town where employment had only been provided for the male members of the community. With a view of opening another branch of industry, Mr. Ramsden, towards the close of 1869 , matured plans for the Barrow Flax and Jute Company (see Fig. 2), having for its object the erection of works at Barrow for the purpose of spinning and weaving flax and jute, and the manufacture of coarse cloths, sacking, bagging, wrapperings, etc. The scheme was soon successful, and at present the mills, employing some fifteen hundred hands, form one of the most conspicuous ar chitectural ornaments of the town. Business reacts upon business, one trade upon another, and the establishment of


Fig. 2.-BARROW FLAX AND JUTE MILLS
this manufactory has now a very beneficial effect upon the commercial interests of the port. The company have for ome time regularly imported their own jute direct from In dia, and are about to establish a regular service from Calcut ta. Dundee must look to it, or it will needs have to take shes with its sackcloth
The year in which the jute mills were regularly opened for business also saw the establishment of another large indus try, scarcely inferior to the steel works in outlay or ambition This was the Barrow in-Furness Iron Shipbuilding Compa ny; and in this, as in all the other enterprises, Mr. Rams den was the leading and directing spirit. The company se cured a large tract of land on Old Barrow Island, admirably adapted for launching purposes; while on the Devonshire dock side, the sits was immediately connected with the rail way system. I'here is here accommodation for the construc tion of from twelve to fifteen vessels at one time. A gra
pouring out by iron; the heavy thud of the steam hammer; the sharp, ringing clangor of conflicting metals; the perpetual puffing and whistling of the locomotives, and the rattling of the railway wagons laden with hematite and coal. These, and more than these, tell us something of the power and the ashievements of the Age of Iron.

A New Exploration of the Libyan Desert
I'wo baggage wagons recently passed through Leipsic en route to Trieste, the enormous hight and unusual appearance of which attracted general attention. They were destined for the expedition which has just begun the arduous labor of exploring the great Libyan desert. Among ofher odd fittings, the two vehicles carried some five hundred empty iron boxes, intended for water tanks. Each vessel is enameled inside and has a cap:acity of about fourteen gallons, so that a supply can be transported, sufficient to render the travelers independent of the casual finding of wells or springs.

The Viceroy of Egypt, it is under stood, is to defray the expense of the expedition, and this in addition to the large sums, amounting to some $\$ 500$, 000 yearly, which he has given for some time past to aid the labors of Sir Samuel Baker, the German traveler Schweinfurth, and the zöologist Hoekel. As to results, it is probable that our geographical knowledge of the eastern portion of the Desert of Sahara will be materially increased, and that the characteristics of an untraveled portion of the globe, as large as the whole of central Europe, will be made known.
The party left Egypt during the be हinning of December, starting for Ta rafieh. The objective point is Koufra in the center of the lesert, which, it is expected, will be reached by the last of January.

## Preserving Brickwork.

The exclusion of damp from brickwork has long been an important problem with builders. It is stated that one of the most effective methods of accomplishing this object is the following: Three quarters of a pound of mottled soap are dissolved in one gallon of boiling water, and the hot solu. tion spread steadily with a flat brush over the outer surface of the brickwork, care being taken that it does not lather; this is allowed to dry for twenty-four hours, when a solution, formed of a quarter of a pound of alum dissolved in two gallons of water, is applied in a similar manner over the coating of soap. The soap and alum form an insoluble var nish, which the rain is unable to penetrate, and this cause of dampness is thus said to be effectually removed. The ope ration should be performed in dry settled weather.
Another method is to use eight parts of linseed oil and one part of sulphur, heated together to $278^{\circ}$, in an iron vessel.


THE NEW EXPLORATION OF THE AMAZON RIVER
BY PROFESSOR ORTON.-.OVER THE ANDES.

## routes from the amazons to the pacific.

Three routes are open to the traveler from the Marañon to the Pacific: 1st. Up the Huallága to Tingo Maria, \& canoe voyage of a month or more, thence to Lima by mule ciñ Hu-
anues and Cerro de Pasco. 2d. Up the Huallága from Yurimaguas to Chasuta by canoe, eight days, thence by mule to Moyobamba cié Tarapóto, one week. 3d. From Yurimagua by canoe up the Parana-pura to Balsa Puerto, one week, thence on foot through the forest to Moyobamba, six days From Moy obamba to Cajamorca, viâ Chachapoyas, is a mule ride of $t$ welve days; and a railway, nearly finished, comes up from the coast within one day of Cajamorca. The time here given is that of actual travel, but the delays in procur ing canoes, peons, and mules more than double it.
We chose the Balsa Puerto route. Whichever route the traveller takes, he wislies he had taken another. We left Yurimaguas in a long canoe with five Indians, providing thera with salt fish, plantains, and chicha, and ourselve with more civilized food, for a six days' journey. Descend ing the Huallága a short distance, we turned up the Parana pura, one of its main affluents. The first day we had a comedy whica might have been a tragedy. Our old "pope ro" or steersman fell overboard, dead drunk; another In dian tumbled out twice for the same reason, and a thir droppec down into a heap in the canoe. A cold bath and a long sleep brought them to, and we had for the rest of the voyage an efficient crew.
a polar expedition at the equator.
Patdles were of no use on the rapid Parana-pura, our In-dians-four in front und the comicel genius behind-poling the whole distance; and every night we camped on the sandy beaches, called "plaias," under palm booths. A few pueblos break the solitude of this river. At Lemón is the spacious residence of Mons. Jules Juan', built of chonta slats and surrounded with a great variety of tropical fruit trees. Here, too, on the edge of the forest; we found another Frenchman, who amuses himself in tracing correspondences between the Quichua and Sanscrit languages. He is the au thor of Amérique Equatoriale, published in Paris, in which he styles himself "Don Enrique Vte. Ouffroy de Thoron Ingénieur, Emir lul Liban par acclamation générale en 1840 , Ancien Commandunt ou Chef Cles Maronites, et Clef d'Etat, Major Generale de l'armée Turro Maronite sous le Grand Vi zier Izzet Muthomet-Pacha, Vice Ror: de Syrie et d'Egypte. Ascending the tributary, Cachiyácu, we passed two large distilleries, provided with the finest apparatus we have seen in the country. On the sugar mills we saw the well known names of "Mirelees, Tait \& Watson, New York." We ar rived at Balsa Puerta, six days from Yurimaguas. This lit the village of four hundred Indians, dwelling in nailless bam boo huts, that went up without the sound of a hammer, is
the chief port of Mayobamba. It manufactures nothing. and the state of society is expressed in fandangos by nigh and in street fights by day. During our stay, ten of the chief men eat down before forty-seven bottles of porter; and soon after we saw the drunken governor, Antonio Rios,
knocked down twice before his own door. With such an knocked down twice before his own door. With such an official to aid us in obtaining r eons to carry our baggage to Moyobamba, we were detained five days. The second day out, one of the Indians dropped his load and decamped, and $t$ wo others afterward followed suit.
a Tramp through the fores
Procuring others, we continued our toilsome journey on foot, picking oar way through the thick forest, climbing ove precipitous mountains, and wading across the furious Cachi yacu and its tributaries seventy-five times. The road, not withstanding the expenditure of $\$ 200,000$ upon it, is nothing but a foot path, and after a rain impassable; but it is the paradise of the botanist and entomologist. The geologis also finds employment, for he crosses the lofty Cerro de Icu to, consisting of saliferous red sandstone; while the stream bring down from some unknown source fragments of fossil iferous limestone, containing ammonites, brachiopods, etc. 'Tae sandstone appears to underlie immediately the Amazo nian clay formation.
Nineteen days from Yurimaguas, we reached the city of Moyobamba. The situation of this city is surprisingly fine, built on an isolated plateau that stands in the midet of a luxuriant plain, through which winds the turbid Mayo, and around which rise picturesque mountains-the worthy be gimnings of the Andes. With an altitude above the sea of
2,500 feet, and a mean annual temperature of $77^{\circ}$, the climate is delightful. Nature is so prodigal that anybody can get a living-except physicians. The oranges of Moyobamba are equal to the best (fuayaquilian; while the coffee and cacao are praised in Lina. The ordinary ills, all due to imprudence, are intermittent fever, erysipelas, and worms The only case of drunkenness we have seen was that of a
priest. We visited two mineral springs in the vicinity priest. We visited two mineral springs in the vicinity. One
is a hot spring, slightly ferruginous, the temperature of is a hot spring, slightly ferruginous, the temperature of
which we found to be $106^{\circ}$, that of the air being $75^{\circ}$. On the slope of the Cerro, about three miles from the city, is a copious sulphur spring, forming a little lake thirty feet in diameter, with a temperature or $84^{\circ}$. Were this brought down to the city, and respectable roads made to Huallága and to the coast, Moyobamba would become the Suratoga of the south. At present, the city is poorly supplied with wa ter, all coming from a few feeble springs at the foot of the plateau. It is a novel sight to see the long procession of women, who are the water carriers of the city, descending
and ascending tbee deep barrancas at eveutide, with pitcher
on their heads, while the young Lotharios lie in wait to mak ove to their Rebeccas.
Transportation to and from the city is dificult beyond de cription. Nearly all exports and imports come from or go to the east; and everything must be carried on the backs of Indians over the horrible Balsa Puerto road and in canoes on the Parana-pura. The Indians do not care for money; so hat when a traveler or merchant wishes peons, he notifie o seize such as they can find and compel them to bear the burdens. The route to the coast $v i a ̂$ Chachapoyas and Caxa marca is traveled by mules, but these are dificult to hire. There are no duties on foreign goods entering Peru by the Amazons; but the freight is enormous, the loss on liquors being two hundred per cent and on other goods twenty-five A box of flour from the C nited States weighing 80 lbs. eell or twenty-two soles, or thirty cents a pound; while a roll of bread weighing three ounces costs ten cents. English but er is worth one dollar a pound; Colgate's soap, of which 6,000 lbs. are used annually, brings 50 cents a pound, and ron, of which 500 lbs. are sold yearly, sells from twenty to orty cents a pound. Beef comes from Chachapoyas, and is sold for ten cents; cattle are kept in the surrounding cha caras, but neither for beef nor milk, but for the pleasure of owning them. A few sheep are raised, but solely for meat not for wool. Of bome productions, pork is worth twenty cents ; lards thirty cents; coffee, $\$ 2$ an arroba; tiles, $\$ 50$ a housand: brown sugar ('c chaucaca'"), five cents, refined wenty-five. There is not a plow in the whole province but almost everything that is planted yields beautifully in three months. August is the usual time for planting. Cof ee, cacao, rice, maize, mani (peanuts), oranges, pine apples, bananas, and sugar cane are grown, but only for home con sumption. Grapes (a small black kind), sursaparilla, vanilla rubber, and copal, grow spontaneously, but are not gathered Abundance of fine timber (especially cedar and "moyna") covers the slopes of the cerras, with plenty of water powe thand; but there is neither a saw mill nor a chimney west f Iquitos. The Moyabambinos, 9.000 in number, are con tent to dwell in mud hovels, tiled or thatched. Boards are cut out with Collins' axes, 10,000 of which are sold annua $y$; the only fault found with them (by the merchants) is that they are too good and last too long. The value of a day's work, from six to six, is twenty cents and food, or $\$ 5$ a month. There are seven foreign merchants in Moyobamba, of whom Mr. Sisly, the chief, has sold as much as $\$ 40,000$ orth of goods in eight months. Tr

The
The Department of Loreto, of which Moyobamba is the apital, stretches from the eastern cordillera to Tabatinga and has a population of 60,000 . The main villages west of the Huallága are Tarapóto $(8,000)$, Lámas $(6,000)$, Chasúta $(1,500)$, and Jevéros $(1,000)$. The main exports are straw hats, ucuyo (coarse cotton clotb), salt, aguardente, tobacco, beans, coffee, and limestone. The tucuyo is made in Tarapóto for the Indians solely ; and an imitation is now manufactured in England, which sells at the same price (twenty cents) and is preferred by the natives. It takes six days to spin one ound of cotton thread, and eight days to weave one yard of ucuyo. The principal salt mines are at Callana-yacu, nea Chasuta, Pillnana, and Cachi yacu, near Balsa Puerto. The are situated in red sandstone, along with gypsum, and sup
ply the whole Marañon region. Aguardente is made wherply the whole Marañon region. Aguardente is made wher-
ever the sugar cane grows. The best tobacco comes from Jevéros; and limestone boulders from up the Huallága are shipped from Yurimaguas at $\$ 40$ a tun.
oyobamba and the manufacture of straw hats.
But the great business of Moyobamba and the surrounding villages is the manufacture of "straw" hats. These are made of the same material as the so-called Panama hats f Ecuador and New Grenada. It is the undeveloped leaf of he " bombonáje" (carludorica palmata of science), which i a screw pine rather than a palm. The trunk of this plant is only a yard in hight, but the leaf stalks are two yards in length. The bark of these leaf stalks is woven into baskets, and the expanded leaves are used for thatching. It is the leaf before it has opened that is prepared for the manufacture of hats. It then consists of a bundle of plaits about two feet long and one inch in diameter. The green outside of this "cogollo" or bunch is stripped off; and then by an instrument called a " picadera,' resembling a pair of compasses, with legs set half an inch or less apart, according to the fineness of the straw required, the leaflets are made into strips of uniform size with parallel sides. The cogollo is then boiled to toughen the fiber, and hung up in the sun to dry and whiten, when the leaflets run up into cordlike strands, which are then ready for use. The longest straw which can be procured from the bombonáje is twenty seven and a half inches. It takes sixteen cagollos for an ordinary hat, and twenty-four for the finest; and a single hat is plaited in from four days to as many months, according to texture. We saw a fragment of one begun which, if fin ished, would bring $\$ 500$ in Lima. Fortunes lave been made in the hat trade; but a change of fashion in Brazil, Europe, and the United States has reduced the number exported rom 100,000 to 50,000 , and the price from $\$ 40$ a dozen to $\$ 15$.
Bu
But Moyobamba is as famous for its execrable roads as for its bats. The traveller who survives the journey from the road longer than the city. Three regions intervene between the Great River and the Great Ocean: the Montaña, extending from the Huallága to Chachapoyas; the agricultural valley of the Upper Marañon; and the mining district
between the western cordillera and the coast. The lower
part of the Montaña is covered with a rich forest, but
from Moyobamba westward the road, or rather mule path, or the most part wind over boggy valleys, bleat parame and barren mountains. The distance from Moyobamba to Chachapoyas is forty leagues; for one hundred miles of which on a stretch, there is not an inhabitant, so that the tra tier must carry bedding and provisions and sleep in cheer less tambos.

## crossing the cordilleras

The highest point on the road is the Puna Piscognañuni meaning "the place where the birds die"), riving $11,0 \div 0$ feet above the sea. Geologically, it consists mainly of black slate, in which we discovered hosts of ammonites. It is this range which divides the waters of the Upper Marañon from he affluents of the Huallága, and which, meeting the more westerly sierra, forms the terrible cataracts above the Pongo de Manseriche.
Ascending and descending many a rocky staircase and winding through a deep and picturesque ravine beside the rushing Ventilla, and between towering treeless mountains of red sandstone, the weary traveller suddenly and as gratefully finds himself in the city of Chachapoyas, of which will speak in my next.

James Ortox.

## improvement in biving Apparatus.

An interesting series of experiments has been carried out in the Medway, off Chatham dockyard, by the officers and men of the Royal Engineers, under the dirention of Major E. D. Malcolm, the head of the torpedo department of the School of Military Engineering for th +p purpose of testing the merits of an invention by Mr. Maudlin Vinter, for enabling divers, when employed at any depth, to hold conversation with those at the surface of the water. Hitherto an insu. perable difficulty has been experienced by divera, in being unable to communicate verbally with the attendants above, the principle usually adopted by divers when carrying on their operations being to give preconcerted signals by so many pulls on a single line. This, however, according to Engineering, a ppears to have at length been overcome by Mr. Vinter in the invention submitted by him to the Government. In the trials just completed in Chatham Harbor, Corporal Falconer, an experienced diver of the Royal Engineers, equipped in the Siebe and Gorman improved diving apparatus (which has gained the prize medal at Vienna), made the descent; and during the whole time he was under water was enabled, by means of the new apparatus, to converse freely with those abova, every word spoken by him being distinctly heard and understood. Mr. Gorman, who was $\begin{array}{r}\text { resent dur- }\end{array}$ ing the experimental trials, stated that the invention would be further improved upon so as to facilitate its use in all diving operations connected with harbor works, and for lay ing stone blocks, etc., in connection with subaqueous opera tions. The apparatus can, it is stated, be easily applied to any description of diving dress. The value of the invention will be readily understood and appreciated by every one in terested in the science of diving, from the simple fact of the great confidence a diver will gain from being, in his isolated position, enabled to speak directly to those in whose handshis life, for the timebeing, is lite-ally placed.

## Tlighman's Sand Blast.

Some new and interesting applications of this invention were lately described at a meeting of the students of the Polytechnic College, Philadelphia, Pa :
Samples of raised lettering on marble, also of ground uncolored and of stained glass ornamented by the process were exhibited. Samples of thick plate glass, perforated by the sand blast with well defined holes $\frac{1}{4}$ inch in diameter, were shown. The holes for the axles of the glass plates of electrical machines can be safely cut in this way
The lettering of the block of marble had been done by first grinding and polishing one of its surfaces, attaching the stencils (letters of the size and shape required cut out of plate metal), and then blowing sand, by means of a jet of steam, on the surface, until, where unprotected by the stencils, it is cut a way to the required depth, leaving the letters in bold relief. The stone to be cut is placed upon a smal struck, and then removed backward and forward upon a horizontal table, directly under the nozzle through which the sand is blown. The nozzle, which stands vertically over the table, has the pipe for the sand, entering the upper end passing in the line of its axis, towards its lower opening The pipe from the steam boiler enters through the side of the nozzle near its upper end, so that, when in operation, steam surrounds the tube through which the sand runs. The latter is connected by a rubber pipe, with a box of sand set about it. The machine is in operation daily at the stone yard of Messrs. Struthers \& Son, who are cutting by the sand blast the sculptured design on the blocks of Cleveland stone or the walls of the grand staircase leading from the entrance hall of the new building for the Philadelphia Academy of Fine Arts, now erecting on Broad street. The design on cach stone is about 20 inches by 10 inches, representing foliage, and is cut to the depth of five eighths of an inch in ten mivutes. When cutting glass, the sand is compelled by a current of air from a reservoir, kept under pressure by a small blowing engine. In such a case, the stencils need not be of metal. Rubber, and even thin muslin, will protect the glass.

Electrical Gas Regulator.-Mr P. Mulzinger, gas engineer of the Pascal Iron Works, Phiiadelphia, Pa, has devised a system whereby the flow of gas from the works into the mains can be regulated and controlled automatically by establishing electrical connections between any point of the gas main and the works where the gas is manufactof the
ured.

## 




## Thisis. an appilication for apatent for an allegedimprovement in suspender straps. The appolicaton was









## NEW BOOKS AND POBLICATIONS.

The " Worksiop for December contains a continuation of the paper on
he "Jienna Exilibition in Connection with Art Industry." There are a number of ine wood engravings, of original design in in siller ware, fresco-
Ing, etc. toget her with hant Ing. etc., toge ther with hnts and short paragraphs usefult to the decorative
artist. This magazine deserves much pralse for its excellent tspography and the constant variecty of beautifill representations of the best produc
Hons of European industrial artists which it sets before tits readers. Each number contains a large sheet of working drawings, from which many 0 the hansomest designs may be reproduced. Published by E. Stelger, Nos. 22
and 24 rrankfort strect, Yew York. Subscription price, 8 万. 40 per year.
Purifrivg Middlings is a subject which is now attractung consider ant examiner in the Patent ofllce, has published a mamall book. giving photo engravings, and the claims of existing United States patents a:d


## Inventions Patented in England by Americans. Complied from the Commssisioners of Patents, Journ From inishing Frits.-J. F. Greene, Brooklyn, N. Y.   ionss Collar.-J. Heywood, Michigan. LA INY Mo Mrer.-W. Sellers, Haverhill, Mass. Pheserning Wood.-C. P. N. Weatherby (of New Yorl city, London, Eug   

## Value of Patents,

and diw fo obrin rinil Practical Eints to Inventors.

PROBABLY noln vescment of a smalis sum of money brings greater return than the expense incurred In obtainng a patent
even when the tivention is but a small one. Larger inventions Mre Pound to pay correspondIngly well. The names of Blanchard
Morse, Bigelow, Colt, Ertceson, Howe, McCormick, Hoe, and
others, who have others, who have amassed immense fortunes from thet Inven
tions, are well known. And there are thousands of others who haverealized large sums from their patents.

 of assistants, mostly selected from the ranks of the Patent office: men ca pable of rendering the best service to the inventor, from the experlence
practically obtained while examiners in the Patent offlce: enables MuNN HOW TO HOW TO


 hustiness, and have all the work done over agaln. The best plan is to sollcil
proper advice at the begloning. If the parties consulted are honorable men the tnventor may safely condde his Id eas to them, they will advise whethe

## needful to protect his rights. How Can I Best Secure my Invention? <br> This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally 18 as followe

 some expertand correct

Construct a neat model, not over a foot tin any dimension-smaller if pos
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at hand, to construct a model, make as good a pen and tnk aketch of the

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## Preliminary Examination.

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## To Make an Application for a Patent.

The appicant or a patent should ardisha model of his invention if sue. vention be a chemical production, he must furntish samples of the ingred ents of whtch his composition consists. These should be securely packed,
the inventor's name marked on them, and sent by express, prepaid. Small the inventor's name marked on them, and sent by express, prepald. Smal
models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to
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vertence, accident, or mistake, without any fraudulent or deceptive inten

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## Foreign designers and Design Patents.

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the like; and it consists of a couple of strong screws screwed into a center plece from opposite directions, and having a large head, which are screwed in opposite directions egainst the sides of the bank so
ađjusted, as to leugth, for ditches differing conslderably in width.

Improved Package tor Granulated Tobacco
orough Robinson, Louisville, Ky.-This invention rela
Goldsborough Robinson, Loulsville, Ky.-This invention relates to the consists in the application of the leaves of corn shucks for that purpose.
Around the usual aceket or packet in whitch the cut tobacco ts placed, a a series of leaves are wrapped spirally, the second binding the first and the
third the second. They are folded over at the ends, provided with a tie hird the second. They are folded over at the ends, provided withatie ribbon, and then sealed at each end. The leaves of the corn shuck possess
a water-repellent property and a flexibilty whichmake them even preferable to paper, foll or cotton.
Eugene M. Morris, Baltimore, Md.-This Inventio
Which contotns the meter and service pipe of a Which cons of insuring a perfect drip of the water which remains after
novel means of the gasis shut off and whicll results from condensation of aqueous vapor As soon as the valve is closed in order to shut off the gas, any liquid in the
valvechamber immediately descends through a tube futo the drip vessel, valvechamber immediately descends through a tube into the drip vessel,
whence it can be drawn off at suitable intervals by the removal of the in solution by water, to remain in the valve chamber and make a denosi Which will work in between the tube and bottom, or
bottom of the valve chamber to freeze about the tube

Improved Plastering Machine
and
Gustavus Stevens and James H. Watson, Tawas City, Mith.-This inven.
ion relates to plastering the walls of buildings, and conests an a ton relates to plastering the walls of buildings, and consist in a machine
so constructed and organized as to lay on and spread the mortar at one operation, thereby greatly economizing time, doing the work uniformly
well, and greatly lessening the ordinary cost.

Improved Grain Cleaner.
William Houghton, Great Grimsby. England.-The grain is supplied to Arst separator sleve, which retains all stones or matters larger than the
grann, whence it passes on to the second separator, which removes loose stand small seeds, both separators being moutcd and oper crank, in the ordinary manner. The grain passing over the second separa
tor is dellvered through a chute into a spout, whence it meets an upward current of air, whitch, passing through it as it falls, removes any loose
smut balls and other light impurities before the grain enters the scourer curtain is placed, together with a damper, which may be closed, wore less, as required, to cause the heavier particles to be deposited in a bor while only the very light dust is carried on to the fan. The grain being fed
to the scourer is subjected to the action of the beaters, which throw it off gainst the steel clothing of the cylinder, whereby the adherling smut to de ached, the resulting dust betng carried away by the a a draft through the perforations in the cylinder to the fan by side passages. The grain gradu-
ally passes down through the scourer to the bottom, whence it escapes b y the exit, which carries it into a second exhaust spout, where, as it falls, it 1s again subjected to a current of air, whereby the remaining impurities ar
separated and carried upward into a second exhaust box, in which the hea vier particles, consisting principally of unsound grain, are deposited, the
remainder passing on to the fan. There is a spout through which the remainder passing on to the fan. There is a spout through whith the grain Is passed directly into the exit when it is desired only to separate and clean
it without subjecting it to the action of the scourer, and a ralve which

Improved Machine for Riving shingles
Charles Shelmandine, Jefferson, N. Y.-The object of this invention is to dly and economically rived into blanks; and it consists of two or mor sly and economicaly rived into blanks; and it consists of two or mor
eets of movable knives or blades, a set of stationary ones, and a movable table, and operating devies for the table and the movable knives, all com. forced against the stationary knives and split on the sides to remove the spalt; then a set of movable knives will move down and split the block Into two or more pleces; and then the next set will operate in the same in order that the knives will not bind in the block, as they would if the whole gang were forced through it simultaneously.
lmproved Harvester Rake.
Edward Lippoldt, Brighton, Ill.-The manu features of the rake, its form and manner of operation, do not difter from rakes already in usc, ard the
invention applies exclusively to the rake arm, which is made to sweep over the apron of the machine in the usual manner. The common rakearm is ordinarily so rigid that it is very liable to be broken, and thereby occasion part. A sing the parts together by a hinge, a wing being attached to one projection in the hinge. When the arm is forced back by the strain apon it
prest it is forced against the power of the spring, and the back motion ceases
when the spring becomes straightened, so that its center strikes the spring When the spring becomes straightened, so that tis center strikes the spring
bar. When the pressure against the arm ceases, the spring lar throws it to its normal position.
Improved Sarety Pocket Attachment. Box 830, New York city.-This invention consists of a little spring.actuated oo that a winedwiththin plates of metal, having a round notch in the edge back, will be confined in said notch by the hook when let go. The plates
bith are adapted to be sewn or otherwise fastened to the pocket lid of a vest or
other side pocket, so that the chain will naturally drop fnio the notch when the watch is
then be pulled object-say, a pocket book-ma ybe secured the same way by belng attached In connection with a short chain, the latter being connected to the panta loons, by one end, at the top of the pocket, and the end with the button being fastened in or on the lid of the pocket. A little projection of the hook rises up through or above the pocket lid sunficiently toapply the thumb or flinger so as to push it dack readily whe
chain to get the watch or to open the pocket.
lmproved Fire Extinguishing Water Pipe Attachment.
Thomas Muller, New York city.-Tbs invention consists in attaching limbing pins for a fire escape. They may either le tapped directly into the pipe, or into ollars, clamped o

## Improved Retrigerator

Erastus S. Root, Providence, R. I. This invention is an improvement in round a central ice or cooling chamber. The improvement consists in the construction of the cooler, to be placed within the ondinary rectangular tin lined box, and which has a central space provided with shelves and sur.
rounded by a concentric chamber which is flled with small lumps of fee rounded by a concentric chamber which is flled with small lumps of fiee
Thts chamber is partly surrounded at its upper half by the other segmental concentric chambers, which are also flled with lumps of ice. Tne inner its lower surface the outer box, while the upper segmental chambers are more espectally designed to keep the box at the required temperature
Improved Railway Switch.
Willam A. Slingerland, New York city.-One pair of short tracks ha
witchralls pivoted at one end, and frogs placed at the other; and another switchralls plvoted at one end, and frogs placed at the other; and another
palr of tracks has the switch ralls at oneend, and the frog rails at the other; while a third pair of tracks has switch rails at one end. and inturned frog thonary plate and a movable one in the usual manner. Byplacing these parts in this relation to each other, every train moving one way is compelled to take the middle ralls, which always connect with the main or s'de track
whlle a train moving in the opposite direction from elther track will pass it is claimed, be accidently thrown from the track by the cares a train the switch teader

Ygnaclo Co Improved Adjustable Hat.

1. Ygacco Casiano, San Antonio, Texas.- To the hat, of any approved
pattern, Is applled at the inside, near its connectlon with the brim, a band arranged In four parts of concave shape to correspond to the shape of the
head, with interstices of sultable size separating the parts. It 18 slotte $d$ to be produced as 1 lght as possible, and covered with the perforated leather. Each part of band is provided with one or more band springs, of brass
or other material, beent in U E shape, which springs are attached with their
 of cork or other materal is Introduced between the legs of the band
spring, which wedge ts pushed up or down as 1 t 1 desired to make the hat sprlng, which wed
larger or smaller.

Improved Corn Coverer.
Joel A. Moore, Salem. N. J.-Sultable handles gulde the coverer and con trol the thickness of the layer of earth to be placed over the seed. A
 placed under sultable angle toward the longttudinal axis of the coverer.by means of whtch the earth 1 s thrown over the corn to cover the same, form ng, also, a rldge or elevation, which is then spread out level with the hind
roller. The quantity of earth to be thrown by the hoes over the seed may Toller. The quantity of earth to be thrown by the hoes over the seed may
be regulated as the soll or clrcumstances require it, the roller ylelding free. ly to the pressure exerted on the handles.

## Improved Refriserator.

Richard Armiger. Baltmore. Md. -This invention 182 refrigerator so chamber. The tee chamber is formed in one part cf the top of an inner
box, and the bottom of which 18 made tnclined, so that the ice water may fiow off as fast as the tce melts. The tee water tank is also placed in the upper partor the the water may be recelved and held to the sald tect amber, , that the ice water may be recelved and held in the sald tank as it drips
from the sald tice chamber. In the space above the tce water tenk tis se. cured a pan in which articles to be kept cool are placed, and which is made detachable, to allow the water tank to be conventently cleaned. In the
space below ihe cee chamber and water tank are placed shelves of pertorated peet ine chat

## Improved Milk Cooler.

Charles A. Douglas, Frankiin. N. Y.-This invention consists in protectIng the metal water pan of a milk cooler by a paper, felt, or other non-con
ducting cover or envelope for the bootom and sides, to prevent the cold water running through it for cool of the atmosphere from the outsde, the sald paper or other no
ing cover belng held up to it by any sultable frame or support.

Improved Bale Tie.
Landon Carter. Hunt tysille, Ala. -In connection with a block and a cllp
r socket plece, both astached to one end of the band and bor or socket plece, both attached to one end of the band, and havlng flanges
bent in ward over the latter, 1 tis proposed to employ a wedge, which 18 cut
 Improved Fly Trar.
Herman L. Chapman, Marcellus, Mich.-A tin casing forms two sidesand the top of the trap, and 18 open at the bottom. Laterally connecting tin the files get killed. Feet of sufficlent hight to admit the files below the troughs. The open sldes of the trough along the trap are closed by slldIng plass panes, which may be easily taken out and which ft closely to the
sides of the troughs so that no fly can escape. The bat ts placed inside the casing the bottom opentng of which is shaded mere the casing, the bitom opening or which is shated more or eess by the thi
casing, so that the fles, after once belig in the trap, do ont crawl out the same way, but fiy to the light toward the glass panes, and get drowned in
the troughs.

Improved Flower Maker's Grass Cutting Machine.
Theophllus Millot and James Millot, New York city. This invent consists of a cutting board and a shirting gulde for it, combined with a cuttung machnne of the kInd commonly used for cuttIng paper, so that the pack of cloth pleces to be silted and cut oftin blancees, the or cinary way,
sald board, may be led along under the cutting blade, in the ordin for slitting, and then shifted laterally for cutting of the ounches of grase blades. The invention also consists of a potnt trimming blade, arranged on a novable support, so that it can be operated to bevel the corner of the pack of the cloth pleces whlle sald pack is to the pasitlon for the cut thg off and silttIng blade to act, and which sa1d support 18 soarranged
that, when the siltting blade moves down, an inclined plane thereon will that, when the siltting blade moves
move the polnt cutter out of the way,

Improved Balanced slide Valve
Chartes H . Hutchinson. part works an top of the valve ta a short oyllinder. The balancing part works steam tight agannst the steam chest top, and sald top works up and down within the cyllidier. The part work-
ing agsinst the steam chest face excludes the steam from the topof the
 face by the steam pressure on shoulders.

I mproved Tilting Stand for Carboys.
or rocking stand for tillting carboys when pouring out the con a tilting or rocking stand for tilting carboys when pourlng out the contents; the
object belng to enable the operator to turn the carboys both down and up with a gentle and regular motion, so that the actid will not be spilled or forcibly e ecected by the awashing of fit by the irregular and sudden motions
common to the ordinary way of handling carboys. The etand, beling left to common to the ordinary way of handling carboys. The stand, beling left to tself, will remain upright with the carboy on it.
Frank Stowe, Huro, O.-A recess 18 cut into the ordinsry bolt of a door
latch, which 18 deeper near the profectung part of the same. A dog 18 pro vided with a socket having a rubber cushion, and at tits lower end with a lug, which profects under the bolt, sllding along the recees as the bolt 1 is
moved in elther direction. $A$ band spring 18 applied, with one end secured moved in elther direction. A band spring 18 applied, with one end secured
to the outer plate of the latch, whtle its other end pressee itrmly on the dog and lug. The socket part of the dog slldes between a casing of the cover
 yond the casing and the dor, when the bolt is drawn back by the knob and
the lug locks the bolt in position Inside of the face plate. On closing the the lug locks the bolt tin position Inside of the face plate. On closing the
door, the cushon atrikes nolselessil against the jamb of the door, the dog door, the cushion strikes nolselegsly a agalnst the jamb of the door, the dog
forces the spring back, releasing the lug from the wider part of the recess causing it to silde along tits narrower part, and allow, therebs, the boit to lock into the catch plate without neceessitating the forcling back of the
bolt by the eame. The erating notse inclient to the friction of the bolt on bolt by the same. The grat Ing notse fnctident to the friction of the bolt on
the catch plate. as well as that caused by slamming the door, 15 almost the catch plate as well
entrely done away with
Robert R. Crawford, Improved Wame Thablee. game table, called the "Dexter Table," and which ts between a bagatelle table and a ten pin alley, having some of the charactertitics of each, and
upon which variousgames may be played. In play ling, the plas are placed placed upon the rear part of sald platforms and struck with a cue, the obJect beling to knock the pins from their places. Numbers placed at the
sdes of the spots from which the pins are knocked are added, and ther sides of the spots rom which the pins are knocked are added, and their
sum 18 consldered the nuber of point made sum is considered the number of points made.
 n schools and other places, so constructed that it may be ralsed and low. ered to adjust it to the hight of the person using it, and according to the part of the board to be used. One part of the board, when filled, may be
ralised and the operation continuei upon the other part. The tivention ralied and the operation continuec upon the other part. The tnvention
consitsts in the comotiation of two blackboards and a suspention cord with a frame, grooved upon the inner surfaces of lts side bars to recelve the edges of the said blackboards, and in grooves of one on boards to be re mored and tarred.
 Journals of the axle, to which are secured the handles which are connected
by a crose bar which serves to operate the machine. Guards are provided, designed to prevent the plants, when small, from beting covered or infured by the soll thrown by the plows. The plows may be adjusted wider apart or closer together, or readily attached or detached as may be required. side edgee, to emooth oft the soll in forming the tills.

Improved Combined Stubble Shaver and Scraper. Henry Von Phul, Jr., and James Mallon, Holly Wood, La.-This invention
is for grubbing or shaving aid scraplng sugar cane stubble. The vertical side frames are rounded up to adapt them to serve as rnnners, and have shoes attached to them, which, at the front ends of the frames, are extend ed upward, and are attaened to the top bars of sald frames. The knlves
are bolted to the horizontal arms of angular bars, and have an edge forned upon both of their side edges, so that when one edge becomes dull the knives may be detached and reversed. The bars are so formed that thetr
horizontal arms may facline to the rearcard to bring the knlves good working position. Sultable construction enables the kntives to be conventently ratsed and lowered, as desirect; and by another arrangement the knives and a scraper are ralsed and lowered at the esme time and by the
same operation. Guards are attached to the trames to overlap the tner ends of the knlves and prevent them from becoming choked with stubble or other rubbish. A cutter is also , to split the ridge In advance of the knives and scraper to enable them to perate more easily and with better effect.

## Improved Plow.

Richard A. Brown. Oakland, Miss.-The plow has a rear land side exten sion, and ts secured to the foot of the standard, and the latter 18 connect-
ed with the beam by tenon and mortise (the former having a rounded pitch or or, so that to th may be adjusted In a vertical plane at a greater or less with the standard, and am. A forwara incined bace stor nearly the same tnclination as the standard, is plyoted to the land side extenslon, and passes through the rear end of the beam. The upper ends of
the brace rods are screw-threaded, and nuts are applled thereto, so that by adjusting them the lower end of the standard, and with it the plow, can be moved for ward or back to vary the pltch of the later, and thereby govern
the depth to whlch 11 will enter the soll. By this arrangement of parts the pitch of the plow 18 readilly varied ; and it it so braced by the rod that only
an ordinary gcrew bolt is reaulitte to secure it to the stand an ordinary screw bolt to requilitit to secure it to the standard, and the lat terdoes not require to be specialiy y atrong or of pecullar form. The lipp
ment tis designed for use mainly as a furrowing and barring off plow.

## Improved Spoke Setting Machine.

Willam R.Greene, Juda, Wis.-The matin frame of the machnne consists of a base rame and vertical standards, which are aterally connected by a
top plece. Incllned braces carry laterally a detachable shaft, on which the top plece. Inclined braces carry laterally a detachable shaft, on which the
hubs are. keyed for spoke setting and other operations, and which c con. gulde pleces, in which sildes a lateral setting frame, which 1s carried up and down by the action of a screw bolt, and actuated by sultable gear wheels. The setting frame consists of of
a strong top plece, with a socket for the screv bolt, slldidig pleces and
ot. a strong top plece, with a socket for the screv bolt, Bllding pleces and bt-
furcated clamps, which are plvoted to the lower ends of sllde plecees. The clamps sarry, In connection witt a pin, a sieeve of cast fron, Into which the sleeve are of wedge shape, and are embraced by the prongs of clamps, which riglaly hold the sieeve tin position. The upper lug-shaped end of the sleeve is introduced into a recess and adjusted there to the incllnation under which the spokes are to be set Into the hub. The frame slldes with
the sleeve down toward the hub, which is adjusted in position for 1 t, and the sleeve down toward the hub, which 18 adjusted in position for 1 , and
sets each spoke with accuracy and dispatch. On the return of the frame horizontally projecting rods force the clamps may be inserted. The spokes are then realy to be tenoned at
ende, which is accomplished by a sultably arranged burr. After all the spokes are tenoned at their outer ends, the fellles are put on, and the wheel
18lastly turned by the treadle mechanism, and the sides of the fellites and 18 lastly turned by the treadle mechanism, and the sides of the fellies and
the ed ge of the same produced as nearly round as possible.

## Improved Carriage Wheel.

Henry Gwynn, Balttmore, Ma.-
 tions, with wedge-shaped projections and with suitable flanges.

Improved Tool Holder.
Lewis Reder, Wilmmgnton, Del.-This Invention relates to tool holders
or lathes, and consists in comblining therewith a washer and shoe having corresponding fuclines.

Improved Spark Arrester.
Gustaf Swenson, Hackensack, N. J., absignor to himself and Peter Bogart Jr., of same place. -This Invention relates to the arrangement of devices
within the hood of the smoke stack, for directing the course of the withln the hood of the smoke stack, for directing the course of the alr and
products of combustion entering and passing through the same. Tapering pipes are a atached, larger ends up ward, to the opposite sides of the upper part of the stack, and are extended downward as close to the roadway as posible. The upper ends of the pipes and stack are covered with a hood,
which is made in the form of a double cone. In the forward side of the Which is made in the form of a double cone. In the forward side of the
lower part of the hood are formed two holes, in which are inserted two flaring tubes. Within the hood, and in front of the upper end of the etack part of the hood. By this arrangement the tubes and the plate, as the 10 comotive movea forward, gather the alr and discharge it through the upper
end of the hood so as to increase the draft through the smoke stack, and end of the hood, so as to tncrease the draft through the smoke stack, and
thus counteract any tendency of the gulde spout to check the draft.

## Improved Revolving Sample Case.

John F. Randolph,Edwarabuurg, Mich.-This invention is an Improved evolving siow case formed of a polygonal base wtin vertcal partitions arranged radially aronnd the shaft, and triangular remorable trays, sup.
ported between sald partitions in an incllined position by slde and front

Improved Process of Manufacturing Paper from Grains.
Improved Process of Manufacturing Paper from Grains.
Charles $V$. Stehlln and Joseph stehlinn, New York cetty, and Helnrich A . Hana, Brooklyn, N. Y. -The object of this invention to to utllize the rest.
due of the malt, atter the process of brewing, for the purpose of producing the short tibers of the same and applytng them to the manuracture of paper. The barley grains and hops, as recelved from the brewertes, are thoroughly
soaked in water to a mashy consistency and carrited over a gulde frame of wire eauze through rollers, which press and brulse them, and partly sepa-
rate the rate the starchy substances from the fibers. The fiberous parts s re carried
on over the guide frame. The starch dissolved in water passes through the wire gauze tnto suita ale receptacles, and is carrled off for condensation
and extraction. The fiberous parts are submitted to a thorough mashing process, and then carried over a wire sleve, so that the watery solution of
the estach the exception of the rolling process, as the fibers of the hops are of such thin structure that the presure of the rollers would Injure them. The fibers thus obtanned are macerated in a solution of ctustic lyes. A pulpy masd is gradually obtalned, which, after betng bleached by chlorne, may be manu-
factured directly, or by misture with other fibers, into the different sorts factured directly, or
of paper as destred.

Willam H. Bowman, London, o.-This inventio
washer, connected ind London, O.-This invention is an edge-perforated washer, connected and turning only with the bolt, and projecting laterally

Improved Fastener for Meeting Rails of Sashes. This invention relates to the ordinary sash fastener which prevents the window from belng opened, and consists in a binged plate, comblned with overt they are locked. Thid is the most perfect sash fastener that has come
before this ollle for some time

Thomas Andress, Aurproved Car coupling
rrangement of the coupling plas with spring slides, which ared d from the draw bars by sultable treadle mechaninsm, and produce the
coupling of the links by the simultaneous action of rods attached to the dra wbars and coupling links on intermedtate pivoted levers.
Improved Car Coupling.
$\begin{aligned} & \text { Samel Reed, Literty, Pa.-ThIs invention consists of a drawbar or } \\ & \text { coupuling box, with slili parts hinged to the rear part, and conncected frmly }\end{aligned}$ by a hook frame, which is detached by the coupling linkin case of eceldent and produces the givting way of the sides and the uncoupling of the link. The couplng pin 18 hnged toa frame, with lever, laten, and gate, of which
the latter is struck hy the link, carrying the pin down for coupling. For

Willam T. Shipp, Charles J. Peterson, and Robason L. Mc Lurd, Brevard
 run at different depths in the soll, by changlng the angle or inclination of
the standard and shoc or shovel to the beam, also of the share or shovel to the standard a
the standard.

Improved Vehicle.
Martin V. Xichols, osage, Iowa.- The wheels and frames bear agalnst They are incased upon the iniaer side, no part of the wheels being in silght. xcept the part that projects beneath tie body of the carriage. The forward end of the carriage is supported upon a single small wheel, or two
small wheeels placed close together, and the ends of the journal of which socket attached to the front platform of the car body, and in whith is
placed a colled spring. To the formard end of the frame is jointed the
tongue, and to to ts rear end are pivoted two gulde rollers, between which passes the semticircular gulde rod, the ends of which are attached to the forward end of the carrlage body. In the upper forward part of the car-
tlage body ts a box contaning an endless strip passing over rollers. The driver can readlly ad just this strip ; and as suitable names are printed upon it, he
next.
Improved Wood Sawing Machine,
a power sawtng machne, suspended by a couple of swing bars, one of provided with a lever by which the saw is ilfted up and let down. as required, in the progress of the work. The lever is arranged to be manipulated by the operator while in the position for turning the crank. The invention
also constists of a saw bench for receivlng the plece cut off arranged on a pivot and connected by an arm and rod with a hand lever, so that the attend ant can throw off the plece by a quick movement of the lever while stand.
ing at the place for attending to the driving gear and the saw-adjusting

Nachine for Removing Suow and Ice from Roadwaye.
Charles G . Waterbury, New York ctty, -This sinention consists of appa ratus in a portable machine adapted to run along the road way, so contrived that it will sprinkle the surface of the roadway with hydrocarbon sub. stances, at the same time converting some of the sald substances into
vapor and burning it in a space above, and causing the flame to impinge pon the surat with the snow and tce

Improved Hominy Mill.
Jacob L. Toner, Edinbargh, Ind.-The corn is admitted to the mill through a hopper, and is immediately subjected to the action of the teth of a rap-
idy revolving cyllider, whereby the hulls and hearts of the kernels are knocked off and separated from the corn. The kernels of corn are also broken more or less, and dust and meala are made from the fragments which
are thrown, by centrifugal force of the revolving cyllider, through the per-

## Improved Subsoil Plow Jacob Jacobs, Fredertcktown,

John R. Turner and Jacob Jacobs, Fredertcktown, Mo.-This invention ts a subsoll plow so constructed as to run easily and steadlly through the
 ble it to pass readily throught he egrund. The base of the cutter is made formed a notch or recess, into which is itted the convex apper side of the shovel, wh
the plow 18


Improved Folding Pail.
Abelliard Du Chateau and John D. Willom, Green Bay, Wis.-This invention consists of a foidng pall composed of an tndia rubber or other
sultable elastic tube for the body, a metal hoop or band at the top and bot. tom, a wood, rubber, or other fultable bottom, and brace rods connecting
the top and bottom hoops. These rods are jointed to the hoops and the top and bottom hoops. These rods are jonted to the hoops and
jointed together, so that, when the pall 18 to be used, they can be extended to extend the tube, and will hold it in the extended condtion. They can also be folded down so as to fold the tube into a amall, fat, compact pack-
age for conventence in carrying it in a wagon for use in watering horses and the like. The brace rods are arranged on the outside of the tube, and Connected to the upper hoop by the same connection by which the bail 18

$$
\begin{aligned}
& \text { Improved Furnace for Desulphurizing Ores. } \\
& \text { Edward C. Hegeler and Fredercick W. Matthisesen. La salle, Ill. }- \text { This in. } \\
& \text { ant }
\end{aligned}
$$

 troughs, from the bottom of the furnace to the top. When the Inclined plate or trough at the bottom of the column is empty, the ore of the trough next above it thows down into it unt11 1t is ililed, and this process takes
placealong the whole column of Incllined plates or troughs to the top of the furnace, where the reservor is placed. The remoral of the ore from the bottom trough causes a simultaneous movement of the ore from each
trough above to the one below, and s sidding of the ore takes place along the whole column to the top reservorir of the furnace, and from the reser. volr into the uppermost trough, and this movement is arrested or made emptted. The fncllned plates are also so constructed as to allow the pas. emptrec. The tnclined plates are also o constructed as to allow the pas.
ageo of the ascending heated zases under and next to the column of ore, where the heat is applied most effectually in contact with the ore in the
trough. Finally, the invention consists in a modifiction of the postion of the plates with the 1 ise of conducts or pockets along the inner walls of the
furnace for conveytng the gases, from one horizontal passage to the other,

Improved Fire Indicator and Alarm.
ett, East Boston, Mass. - This Invention conslsts
John Fawcett, East Boston, Mass.-This invention consists of a little cate of wire or periorated sheet metal contanling a card of mathes, or
other easily gnitable substace, arranged under a string holding a trip iever, with which a wire is connected. The wire ex ends to the indicet or
and alarm in the offlce or occupled room of the building, and 18 attached to a whel, whtch, when let free by the burnnno of the string in the aforesald
cage, is turned by a spring, and caused to trip the mechanism of an alarm apparatus, and at the same time present to the sight hole through the case tectors can be arranged in a room, in different points, and connected with the tndicator and alarm.

Improved Walk Edzer.
d Joseph C. Higging, Millston
 this invention 18 to provide conventent means for edging walks in yards and awne cuttIng turr stralg ht and square for that or other purposes; a nd it con the surface of the waik. At the other end is a drum which runs upon the turf. A circolar catter, mane of thin steel, is attached to the side of the
drum, anda plowshare follows the cutter and reverses the sod 86 the latter ris cut. A gage is a ta' hed to the plow beam for regulating the dopth of.
the plow.

## Fusiutss and tertura

 The Cnarge for Insertion under tuss nead to 81 a unv.

 or cits oun Co.), who oopy our erreular
 Finday, Oho
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 Steam Fire Engines, R.J.Gould,Newark, N.J.


## R2

Two slight corrections are necessary to our In line $29, \mathrm{~T}$ W should be $\mathbf{T} \mathbf{U}$; and th ine 58 , for " from J. B. H. can make green ink by dissolving
btnacetate of copper in water, or verdgris in vinegar Inacetate of copper in water, or verdidgris in in inegar
or better still, 1 disolve freashl prectptated hydrated diled water.-G. s. T. will fnd that drying killin are ded scribe in in our advertisting columns., J. J. .... IIs sinformed

 Can produce a arystallilzed appearance on tin plate by applyng to it in a heated state some dllute aqua regia
for a few seconds, then washng it with water, drylng, and coating with lacquer.-C. E. W. proposes an Impos-
ibility.-D. C. does not send data suffictent to explain his meaning.
 canized rubber, and will it be flexible afterit is fnished?
A. The vulcanized cannot be dissolved as easily as the
E. J. M. asks: What is the proper solder by weight, of tin, 1 one thousand six hundredth of
opper, and 1 one thousapd six hundredth of lead.
E. D. S. asks: Will a vessel, sinking in mid
cean, go to the bottom? If not, what is the reason? cean, go to the bottom? If not, what is the reason?
It depends on the welght of the vessel. Water is A. It depends on the welght of the vessel. Water
silghtly compressible, and hence becomes heavier as the long as its welght is greater than that of an equal bulk
 Is it any good? 2. What are the proper dimensions for
a bolting reel to bolt 15 bushels per hour? A. 1. We
do not recommend it. 2 . We advise you to correspond with a manufac!urer.
F. H. K. asks: How can I temper spiral J. T. D. asks: In re-boring a cylinder, is it
eest to make new heads? If not, how are the old ones best packed? Iq it necessary to make a new pliston? If
it
bent 30 , what am I to do? Shall I busl the exhaust? A. Or dinarily the old heads and piston can be used. It would
probably be better to bush some of the leaks than to ontra
C. A. B. asks : How are direct acting hydrau-
ic elevators balanced so as to have the same power When 50 feet high as when 2 feet high? A. They pore gen
He erally balan
of pump.
C. T. H. asks: 1. Will cotton do as well as
ilk to wind the wires of an electro-magnet?
2. How can I prepare the impression of a medal in wax for plat not with the impression. A. 1. Cotton answers very well, but ellk is considered the better. 2. The wax im-
ression must be dusted with the finest plumbago and G. F. A. J. asks: Is there any known chem-
cal, or com sination of chemicals, which would be effecual in counteracting the smell of wood alcohol when
used for the manufacture of varnish? A. Wood alcohol is distilled from crude pyroligneous acid or wood spirit Berzelth a fatty oif to remove empyreumatic matter, and
wit next with chloride of calctum.
C. A. C. says: 1. What is coal tar naphtha? 2. What is a good recipe for starch polish? . What ce
nent is used in uniting plass brackets? A. i. Coal ta naphtha is a mixture of various volatile hydrocarbons
obtained from distilling coal tar. By repeated purif. nost important constituent of coal tar naphtha, is ob talned. 2. Put a small plece of parafflu about the size of
a hick ory nut into a bowlful of starch. This is sald to Sive a polish to the starched articles. 3. Soak istnglass
a watir and then dissolve it in alcohol 3 ozs., adel the n watir and then dissolve it in alcohol ozs., ade the
hottoms of mastic varnish (thick but clear) $13 /$ ozs.; mix
well. Set the phisi in bolling water when the cement is
R. S. B. says: If the moon looks larger
when near the horizon because of the pecullarcondition
of the atmosphere, the angular size would be greater of the atmosphere, the angular size would be greate
near the horizon ; but with an accurate instrument, if any difference were found, it would be that the moon is
arger when near the zentth. The cause, instead of be ing in the atmosphere.1sin the eye, betng an unconsclous
greater allowance for distance in one case than in the gieater allowance for distance in one case than in the
other. A. The moon at the zeuith 18 4,000 miles nearer
to the earth than at horizon, one sixtieth of the whole tistance.
dis.
dis.
C. M. B. asks: 1. Would a sheet of india to mercury under a pressure varying from 5 to 15 lbs. pe
square inch, at a temperature of $110^{\circ}$ ? Would the na ture of the rubber be in any way affected by betng sub
jected tio this action for several months? 2. When mer cury is kept in an iron vessel, is the nature of etthe
metal affected by the contact? A. 1 . We do not thin pure rubber will be affected. 2. Not under ordinary ctr A. B. H. asks : How can I dry glue in win
ter without haviug it frozen? Could you tell me the name of a work on the manufacture of glue and sand
ner paper? A. Glue is dried on the large scale by exposing
it to the air for 2 or 3 days, and, when sufficlently firm completing the process by drying in a stove. See arti-
W. McK. asks: Is there a premium offered gate to close fields, etc., through which they pass? A.
$\underset{\text { works, in a mill which has } 150 \text { feet or more fall from the }}{\text { C. M. says: We use water from the water }}$ eservolr, and we have a great deal of more fable with the pipes bursting from so great a pressure. Will the pres-
sure be as great on the plpes if the gate or valve half sure be as great on the plpes if the gate or valve hal
Way between the mill and reservorris partly closed, sup posing we are not drawing water below the gate? A.
We think the pressure will be just the same, in this case. Your best plan will be to use a stronger pipe.
G. E. asks: Why do veneers, which seem
arm and solld when nirtst put on, peel of when they have
 the glue is manufactured, which destroys the life of the glue, or else the glue is adultera ted to make it heavr. It
has every neer and stock are as decertbed, we know of no reaso why blue properly preperared ana, appplied should not ad
here, unless 1 t 18 of poor qualty or has been adulterated There 18 a prefudice among some workmen in favor of
a dark colored glue, wth somewhat of a strong odor a dark colored glue, with somewhat of a strong odor.
These propertles, however, are indicative of Impurty These propertles, however, are Indicative of impurty
and bad preparation. The best glue ts pale colored, hard and solld, and has a brilliant fracture. It should merely without dissolving the deeter generally morett swell It should be bronen nito small pleces, allowed to soak
for some hours in cold water and for some hours in cold water. and then put into a boil-
ing water bath, but never boiled itself. It
it
often injured by the use of too much lime in its preparat tion,
and to and phosphate of llme.
M. W. H. asks: Would any given load require more pounds presesure to punghi be miles per h haur (minus resistance of the atmosphere) will it require propel a light car, wetghing a tun, on a smooth level
track? ${ }^{\text {. If steam be confined, what will be its pressure }}$ at $300^{\circ}$, at $400^{\circ}$ and at $500^{\circ}$ Fah. ? 4. What speed should run, to sow the fastest? 5. The fast motlon powe lathe will not saw as fast as the slow motion; why
this? A. 1. Yes, under the circumstances stated. 2 About 8 1bs. 3. You will find rules, by which you can
answer this question. on page 81, volume 29. 4. 9,00 feet per minute is the speed generally recommended
for the rims of circular saws of all sizes. This woul give about 6,000 revolutions per minute as the speed for
your saw. 5. We cannot tell, from your meager stateyour saw. 5. We cannot tell, from your meager state
ment, why you do not get good results by increasing the
$\underset{\text { Phite metal of United States and continental coppes }}{\text { P. T. Re }}$ colns, and of all kinds of anclent colns and medals, and
be on the safe fide of the law? 2 . What 18 the best methor making copies of colns and medals in soft meta 3. May any one make coples of any kind of medals tha
do not show on their face that they are copyrighted? a. . We do not think there is any law against making
ach coples. Much expense is required to enable one to make fine castings of cotns and medals. 2. A fusible al.
loy, which melts at a low temperature, is used. This an be made by melting together 8 ozs. blsmuth, 3 ozs should first be poured into a box, of the size of the coln, and the latter is to be pressed upon it just before
it soldidifes. 3 . Unless the fact that an arttcle is copyrighted is marked
against an infringer.
R. H. W. A. asks : 1. How can I cement glass
metal? 2. How can I dissolve enamel, used in enam ellng jewelry, so that when applied it will harden? How can I remove tin solder from gold or silver? 4 .
How cau I amalgamate the zinc plates in a Smee's voltaHow cau I amalgamate the zinc plates in a Smee's volta
ic battery? A. 1. Mix together equal welghts of white lead and red lead, for the cement requ vitrifable com pounds, that Is, such as form a glass by exposure to heat.
You cannot dissolve this enamel or apply it in any other You cannot dissolve this enamel or apply it in any other
way. . You can melt it, and scrape it off without injury to the other metals. 4. Wet them with dilute sulphuric acld, and at the same time
till a bright coating is produced.
C. says: I am running an engine, of which ol governor does not work well. There is no place to
onl the valve, and it sticks. I say that it would help it to put a lubricator in the plpe to ofl the valve. Another
man says that it will do no good. Which is right? A. ably caused by having the valre stem packed too tightly by some imperfection in the connection.
J. H. P., of Pa.-Minifie's "Mechanical ing," price $\$ 2.00$, are the two works you need. They may be had of Baird,
trand, New York clty.
D. E. B. says: Having read of the primeval
copper tools found in the old and new world, I should
 2. What is the texture of the hardened part? 3. Is the
tool hard all along, or is it like our cold chisels, only tempered at the point, or where needed? 4. Does heat
destroy the temper? 5. What are the electric and magnetic powers? A. We are not able to glve you much
information on this subject. It is true that the ancleuts made tools and instruments of bronze, which seemed to possess all the hardness of those made of steel, but the
process of manufacture is purely a matter of conjecture.
A. F. asks: Is there any process by which aitrogen can be separated from the oxygen in atmos-
pheric air, and if so what is it? Is the oxygen thus separated lighter than common air? A. Nitrogen can be
separated from oxygen in the atmosphere by burning eparateg from oxygen in the atmosphere by burning
the oxygen out of the air. This is accomplished by setting fre to a suall plece of phosphorus contained in a sman vessel hoating on the surface of water, and invert-
Ing a bell glass over it. The phosphorus will burn out
or chemically combine with nearly all the oxygen con. rained in the jar, leaving the nitrogen behiud. This can be afterwards freed from impurity and dried by pass-
ing it first through water and afterwards through con. cen rated sulphuric actd. Nitrogen is lighter than the
cen air, itt specifc gravity being 0.9713 , while free oxygen is
a ittle heavier, weighingabout one tenth more than the
O. S. says: I am trying to heat my house With a hot air furnace; and in order to avold the trouble heat by separate and distinct flues to every room, I purwhich is in the cellar. Then three ventilating register verhead are to warm three rooms which are right a bove.
Can I do this successfully? A. Experiment shows the Can I do thls successfully? A. Experiment shows that
the most satisfactory results are obtained in the operation of a hot air furnace, by keeping the ascending
current of air as independent of one another as possible. Heated air is sometimes conveyed from a furnace to hird story room through a plpe which also supplies
portion thereof to the first and second story rooms by means of a separate register in each of these stories but this arrangement is seldom satisfactory. We under-
stand the plan of our correspondent is to recelve the stand the plan of our correspondent is to recelve the
whole volume of warm ari into a first story room, and the same air into three rooms in the ocecond story.
pass through the openings in the celling; but if open, and provided with open ventilators in the fre flues, a
caprictous supply may be obtained. The passage of
sound, however through these opentng will meke ound, howerer, through these openings will make them
ery disagreeable. If ventilation is provided for the irststory room, the warmairmay pass out in this way nd not ascend to the upper rooms; but without ventilla. on, all the foulalir of the first story must ascend to connace illustrated on page 295 of our volume 29 is one hat is planned more strictly in accordance with this
dew than any other. In this furnace, the cold air itself divided into separate pipes before it enters the 1 urnace ; and the air, warmed in the pipe, is kept separate
rom the other currents until discharged at its destina tion. Our correspondent will find it best to have sepa-

J. H. B. asks: How can rubber be reduced
alinuid state, so that it willalways remain so? I have d wood alcohol; the latterl find to work ried lingeed oil, setting it in the sun. I wish to dissolve the rubber without heat. A. The diffculty is that most
of the solvents of caoutchouc are volatile, and those that are not, like linseed oll, require heat. We would aliquid disstilled from india rubber, and while liquid dding linseed oll, and stirring untila homogeneous fiutd As obtained, as the oill 18 also dissolved by caoutchoucinc. til thick enough
J. S. S. says: Please answer through your net that will lift : 8 ibs., and what will be its probable
net wetght? 2. What force would it exert at a distance of
one sixteenth of an fnch from the poles? A. 1. From any good maker of physical apparatus. Horse shoe mag.
nets of 1 lb . weight have been made to sustaln more than
J. P. C. says: I have a engine house some
ixteen feet from a well. The wellhas a cucumber pump in it, and is 26 feet from platform to bottom. If I tap a stationary tube or box, and carry the pipe into the engine house, and there attach a lift and force pump, will proposed plan will not work sat sfactorlly. We never
ecommena any particular make of machinery in these recomme
columns.
B. asks : How can I make alloys of metals
that will meit at $315^{\circ}$ and $323^{\circ}$ Fah. respectively The rule for making these alloys is as follows: Melting point of alloy $=$ per cent by weight of first metal $\times$ its temperature of fusion + per cent of second metal $\times$ its
temperature of fusion, + etc., if more metals are used. It is found, in practice, that this rule does not always give
the inelting point with accuracy; and it will probably the melting point with accuracy; and it will probably
be necessary for you to experiment a ittle, using the
$\underset{\text { S. A. says: A dispute has arisen between at }}{ }$ r when under a steam pressure. A says that water bolls at $212^{\circ}$ at the pressure of the atmosphere, and the
higher the pressure the higher is the bolling point of the water. B. says that the bolling point does not rise, that ratio of the increase, If any? A. A is right. You will nd the rate of increase given in a formula on page 81
H. A. S. asks: How can I make a soft solder
or cans, that can be easily cut with a knife? A. The ror can plan, when it is desired to fasten on a cover that
usual
can be easill removed ts to use very thin plate for the over, and fasten it with a small amount of common
oft solder. J. G. Savs: I am running a $8 \times 12$ inches
engine at 100 revolutions per minute. Steam varies from 5 to 70 lbs. on the gage. The boller is an upright, 42
nches diameter and 7 feet high, with 36 three inch fues. In the month of September I burned 190 bushels of soft milnons coal in 2 trdays of 10 hours each ( 80 lbs . 10 the
bushel). How many lbs. of coal per horse power per is ar am I burning? Is the engine dolnggood duty? It
is alain sidde ralve engine withlap cuttingoff at about yor the stroke. Answer: From the data sent, we ar no way of determining the mean and back pressure.
Send us a sketch of your valve and ports, with note of dimensions. If the point of cut-off is a sstated, y oumus M. asks: Given a rotary air pump of ordi-
ary construction, by what simple rule can I
calculate how to increase or diminish the size,keeping the different proportlons correct? A. We do not think there is any
safe rule by which you can calculate the detalls of a pump of larger or smaller size
dimensions and different size.
E. A. says: Sheet iron pans are
the evaporation of sap; a pan 8 feet long $x$ would give 24 feet heating surface. How much would
it add to its evaporation to put in 14 three inch flues and et the fire pass through the put in 14 three inch flues an Ing surface? Would it make any difference how close
together the flues were? Would smaller be any better? A. The proposed plan would work well, if it did not heat the sap too much. It will make little
difference what size and number of flues you employ, if to ensure
E. S. A. says: 1. The atmosphere at the equator to the velocity of the trade winds. Let usassume, however, that it is the same. The force of gravity at the ugal force, and decreases as the square of the distance
from the center of the earth. The centrifugal firce in from the center of the earth. The centrifugal force in
creases as the distance from the center of rotation. Is here then tain a hight (from the surface of the earth) of $61 / 2$ times the semi. dlameter of the earth? 2. If the atmosphere
were infuerced solely by the two forces above menis, the ple highest part would be over the equator, tha would colnclde with the plane of the celestlal equator But when we consider the influence of the attrac-
tion of the sun and moon, and the extremely moblle
 the plane of the equator towards the plane of the eclip. tic, so as to almost colnctde with it? 3 . What is the av erage veloclty of the trade winds? I do not fnd it state n any of my books. 4. In what work will I find these sub
jects most thoroughly discussed? A. The earth, whe jects most thoroughly discussed? A. The earth, when
luid, assumed its present form of equiltbrium, an oblate spheroid. Therefore the atmosphere would be of uni-
form depth, as regards cenirifugal force, if the earth
continued to turn uniformly, 2. The Signal Serytce will
dectid the question of arrial tides. 3. We do not now. dectide the question of arrial tides. 3 . We do not know.
4. The "hyysical Geography of the Sea" 18 a superticlai ough interesting
S. S. asks: How can I calculate the torsional strain, or ultimate resistance to rupture, of a wrenchand wrought iron, the length of the lever to which the
force is applied being known? A. Let $S=$ one side in orce is applied being known? A. Let $\mathrm{S}=$ one side in
nches, $s \Rightarrow$ other side in inches, $\mathrm{L}=$ leverage in inches. or cast iron: Torsional strength in lbs. $=12.000 \times \mathrm{S}^{2} \times 8^{2}$ $\sqrt{\sqrt{\overline{S^{2}+8^{2}} \times \mathrm{L}}}$ For wrought iron: Torsional strength in lbs. $=\frac{15,000 \times \mathrm{S}^{2} \times 82}{\sqrt{2}}$
E. A. S. asks: How can I make ink that will clange to a deep black? Answer: There are various
 good authority: Aleppo galls (well brulsed) 4 ounces, bottle ten days or two weeks, with frequent agitation. Then add gum arabic (dissolved in a wineglass full of water) $1 / 1 /$ ounces, lunip sugar $1 / 2$ ounce, mix well and fterwards furth radd sul hate of iron (green copperas) rushed fine, $11 /$ ounces; agitate occasionally for two or the whole digest together two or threeweeks. Product one quart, pale at first but soon turning intensely black.
J. E. A. asks: Are talles ever moved in the
presence of so-called mediums, without contact with auy erson or mechanical device whatever? A. Statements to that effect have frequently been made, but we should
require stronger evidence than has yet been presented oinduce us to credit then.
A. M. S. says: A. H. on page 363 , inquires
how he can renedy the lack of power in a 25 feet breast wheel. The only remedy is in running it faster, not lower, using as much (ana a littie more) water in proportion as it runs faster than before. Let him reduce
the 8 feet drum so as to give the wheel a little advantage over the present arrangement. He will not get so good a result from the water as formerly, and will consequent y need to make a little allowance for that. I should say hat if the 8 feet drum was reduced to 7 feet, or if the
pulley driven by the 8 feetarum was lagged in proportion, he would be enabled to get speed. There might be

Minerals, etc.-Specimens have been received from the following correspondents, and examined with the results stated:
J. I.. E.-From our recollection of the small specthouzh graphite is sometimes conteminated with clay, It generally occurs in quartz, granite, gnelss, or carbon,
ate of lime. Many clays take a pollsh from the finger ail: and when dark, as blue clay, the luster is metallic resent. Graphite, again, when disseminated in primipresent. Graphite, again, when disseminated in primi-
tive or transition rocks, occurs in minute scales or nodules of different sizes not difflcult to distinguish. Should it occur in small masses with clay, it could be suspended clay, the plumbago sinking to the bottom of he vessel.
J. II. S.-The tar enclosed is a hydrocarbon of the na-
ure of liquid bitumen, and the substance from which it as been obtained is probably (judging from the mineral enclosed) a limestone impregnated with bitumen. The
mineral is limestone, containing a small quantity of iron rittes. From the indications disclosed, and the fact that oil is found floating on the surface of ponds in the cinty, we shoula juage t a sufticient dept
J. II.-This ore is micaceous oxide of iron. so called
from its heing easily broken and reduced to ecole like mica. It is often found in connectio with common specular iron,and is sometimes assoctated with the red oxide of fron, but is rarely in sufficient quantity to be explored by itself. It yields about $i 0$ per cent
of good izon.
W. M. L.-Selenite, a pure varicty of crystalized sul. hate of lime or gypsum.
A. M. B.-Carbonate of irou, or aparry tron, a com.

A correspondent sends us the following problem: 1 is a piston, $6: 55$ square inches in area, moving
airtight in cylinder 3 . 218 a piston, 12.56 square inches 25 square inches in area and of at least 31 nches stroke. 4 is an annular space 1 fnch deep between the head of he cyllider, 5, and the piston, 2. 5 is a cylinder 12.56 ith cock and pipe, through which 5 may be filled with

fuid by opening the cock 10 to let adr out-filling first by
removing plug. 9 , and nliling up to dotted line $b$, then replacing plug. $\tau$ and 8 is a bent tube of $6 \cdot 25$ square inches area, attached to cylinder 5 . 9 is a plug to stop mouth of $>$ airtight. 10 and 11 are ordinary cocks. 12 and 13 are ordinary piston rods. If $3,4,5,6,7$ and 8 , beting full of water or mercury and all the cocks closed, pistons being and weights are so placed as to overcome the friction of the piston, will they fall? If so, with what velocity, and how far? "We think our readers will have no diftculty in solving this question, as it is capable of rigid
demonstration, If welghts of the moving parts and the iquid are given. We shall be glad to have replies. liquid
EDS ]
F. C. L. asks: How can I make an emery placeed in the Great Eastern steamer stillin use ?-C.A. B
paper and job printing?-S. A. T. asks: How did the old
Romans calculate sums by numeral letters? For exam. ple, how did they divide MDCCCLXXII bs XXIV, o
multiply DCCLII by XXIV?-R. C. C. asks : How can
makecolored transparent pictures for the magic lantern
mat

## COMMUNICATIONS RECEIVED

The Editor of the Scientific American cknowledges, with much pleasure, the re ceipt of original papers and contributions pon the following subjects
On Magic Squares. By G. B. M.
On Sewage. By G. H. T.
On the Diameter of the Earth. By A. F. On the Percentage of Work. By E. W. On the Nickel Mines in the United States By N.
On Coal Tar Products. By J. T. P.
On the Labor Question. By N. A. W On Ramming the Mold. By B. W On Magnets. By'C. H. M
On Solar Heat. By J. G.
Also enquiries from the following
C. X. P.-J. M. W. C.C. L.-A. L. B.-A. B.-H. \& Co.

Correspondents in different parts of the country ask Who makes the best foot power jig saw? What is the
best work on short hand writing? Who sells the best post hole augers? Makers of the above articles will probably promote their interests by advertising, in re ply, in the Scientific american. conufespondents who write to ask the address of certain also those haviug goods for sale, or who want to find partners, should send with their communtcations an mount suffcient to cover the cost of publication unde evoted to such enquiries

## [OFFICIAL.]

## Index of Inventions

 for whichLetters Patent of the United States December 9, 1873, and each bearing that date.

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Bale tles, forming J. Meard.
Bands, making endless, L. Binns
Bed, sofa, E. N. Doring.
Bedstead, E. Morris
Bedstead, sofa, J. B.
Bec hive, L. Adams
Belt, endless driving. J. F. Relgar
Billard cushion, M. Delaney, (r).
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Boller, wash, W. W,
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Car coupling, A. 1 train
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Car, rallway,
Car starter, A. Whittemore..........
Car wheel lubricator, W. A. Bullard Carriage, child's, J. N. Hazeltp. Carriage curtain fastening, F. Baumgartner.
Carriage spring, J. Bullock. Carrlage spring, J. Bullock.
Carriage spring, R. Walser
Cart loading scoop, A. Vreelan
Churn dasher, G. W. Barker....
Cigar box, H. Fowler.
Cock, gas, E. M. Morri
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Coop, folding, E. P. Lawrence.
Corn sheller, J. Marshall
Corpse preserver, C. O. Peck..
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Cotimping machine, L. P. Lum.
cultivator, wheel, G. Bradley.
Curtain fixture, C. C. Moore...
Cutter, angle iron, H. McGufte
Dental filling, E. E. Blake.....................
Dental purpoeses, metallic forl for,. E. Blake
Drill, rock, W. Roberts, Jr.
Drill, seed, R. H. D. Morris
Egg carrier, W. A. Laverty.........
Engine. rotary steam, w. F. Mood
Engine, steam and air, F.
Engine, vapor, w. Wells
Equalizer, draft, Colling \& Stles
Explosive compound, C. Dittmar.
Eye and lung protector, G. A. Crofu
Faucet, bung, G. D. Lee.........
Filter for wine, , W. Farctot.
Fire brick stove linings, etc., E. H. Richter
Fire extinguisher, w. L. Drake
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Furnace for reducing iron ores, J. Wilison

Furnaces, etc., Inning, A. E. Bates
Game apparatus, R. E. Bean
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Gas, water, E. J. Jerzmanowski

## Gate, M. Loomi

Gate fastener, J. H. Nichols.
Glue, manufacture of, B. F. Shaw.
Gratn cleaner and crusher, N. Thielen
Grare, stove, G. R. Moore.
Harness loop, F. Hickman
Harvester dropper, A. J. Hodges..
Hat linings,
Hat lininge, label for, T. W.
Hay loader, C. E. Warner.
Heater, water, $\mathbf{A}$. Spenc
Hides or skins, sweating, w. M. Mason
Hinge, stop, G. C. Thomas.
Hoop bending machine, E.
Horse power, D. Woodbury
orses, device for detaching, E P .......
Horseshoe, G. H. Todd....
Horseshoe nalls, H. D. Co
Hoee, flexible play pipe for, J. Greacen, J Hydrant, W. H. Graham
Ice creeper, I. H. Earle
ngot mold, N. Churchman..
Inkstand, A. . D. Judd
Iron and steel, welding, J. J. Popping.
Iron, manufacture of, w. J. Taylor.
oint, ball and socket, M. W. St. John (r)
ournals, etc, packing, S. Baxendale
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ithographic press. B. Huber.
ithogre phic prints on glass, etc., O. P. Wolf ock, H. Steln..
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Lounge and chair, M. P. Ry . . ison....... Marble. etc., artificlal, F. H. Hall...... eat holder, S. Beissel. Mechanical movement, J. S. Cres.
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rgan valve, pipe, W. Scluulke.
Oil cloth, prisiting, W. E.
Ore washer, R. Solliday..
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Planoforte action, $\Lambda$
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Plow, subsoll gang, C. Myers..............
Press, copying and folding, s. W. Odell..
Printer's perforating rule, C. w. Ames.
Printing inkingapparatus, M. England
Propeller for vessels, J. D. Frase
Railway rall joint, w. G. Dunn..
Railway rall joint, w. Thompson.......
Railway signal, pneumatic, W. E. Prall
ailway electric signal, F. L. Pope \& Elmer.
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Sash bslance, R. Faries...
Saw gumming mach
Screw, J. Frearson
Separator, ore, H. P. Minot............
Sewing machine. Fanning \& Nugent. Se wing machine shuttle, G. W. Hunter..
Sheet metal ware, handle for, J. Fallows Shitt, S. S. Gray,..... ................. Sifter, flour, F. G. Ford. Signal, pneumatic railway, w.............
Signal, switch, C. W. Spayd. Skate, C. W. Jenkins. ......
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imoke stack, T. F. Conklin
Soap cutting machine, J. B. Ultsch................
spinning machine, C., S. M., \& H. M. Williams.
 Stone, artifictal, T. Chrimes...
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Tubing, making metallic mbrella, G. W. Pressey............... Urinal, J. C. Garnse
Vessels, construction of, H. Hirsh
Water wheel, M. H. Heylman
Water wheel, J. Taney (r)....
eaver's harness, mang, J. H. Crowel Wheel, vehilele, A. Buchholz
Wheel, rehicle. D. B. French. Wheel, rehicle. D. B. French.. Windmill. M. T. \& M.
Wire, G. D. Dudley.. Wood bending machine, H. Hanna. Wrench, ratchet, 1. C. Colbert... Yokes, bow pin for ox, W.J. Ive
Yoke bow fastener, etc ,ox, E. Zinc, apparatus for granulating, E. H. Richter

APPLICATIONS FOR EXTENSIONS. Applications have been duly filed andare now pending
for the extension of the following Letters Patent. Hearhgs upon the respective applica

27,438-Blackwashing Mold.-W.Ferguson et al.Feb. 25
27,477.-Timber Bending Chain.-L.Heswood. Feb. 25. 27,447.-Timber bending Chain.-L.Heswood.
27, Turing Latie.-W. Sellers. Feb. 25. 27,485.-LANTERN.-A. Tufts. Feb. 25.
27,515.-Fitting Sinks.-J. Ingram. March 4 $27,594 .-$ Sewing Machine.-L. W. Langdon. March

## EXTENSIONS GRANTED

26,408. - Fire Kindler.-E. Bellinger.
26,410.-Sked Planter.-W. Blessing.
DISCLAIMER.
28,244.-RTFFLE.-G. B. Arnold.
DESIGNS PATENTED
7,018.-Butt Hinge.-W. Gorman, Jew Britain, Conn. ,019.-Door KNob lose.-W.Gorman,New Britain,Conn 7.030.-Door Knobs.-W. Gorman, New Britain, Conn.
7,021.-Escrtcheon.-W. Gorman, New Britain, Conn. ,021.-Escutcheon-W. Gorman, New Britaln, Conn.
,02:-Grinding Mill frame.-J. G. Lane et al., Mill. brook, N.Y.
7,023.-LAMP SHIDE.-W. L. Libbey, Boston, Mass. 7,021.-FLY Wheel.-J. G. Baker, Philadelphia, Pa
 ז,034.-Carpet.-H. Knight, Philadelphla, Pa
7,035 to 7,037 - FI.oor Oil Clotis and Carp Meyer et cll., Bergen, N.J.
,038 to 7,043.-Carpets.-E. J. Ney, New York city
 ,047.-SHOw CASE STove-

TRADE MARKS REGISTERED.
1.565.-Soap.- R. M. Blshop \& Co., Cincinnati, Ohto.
1,566.-CURED MEATs.-W. H. Davis \& Co.,Cincinnati, o,
1,567.-Corset Springs.-F. L.Egbert, Wateriury, Conn. , $568 .-$ Whisky.-E. A.Fargo \& Co., San Francisco, Cal. 1,559.-FErTiLizer.-J. M. Rhodes \& Co.,Baltimore, Md. 1,570.-Cotror Gix.-Brown Gin Co.,N.London, Conn. 1,571.-Carpers.-J. Dornan, Philacelphia,
1,5i2.-Whiskr.-E. Howe, New York city.
1,5i2.-Whiskr.-E. Howe, New lork city.
1,533.-Oysters.-O. W. Miller \& Co., Baltimore, Md
SCHEDULE OF PATENT FEES. On each Trade Mark
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On application for Extension of Patent
On granting the Exteusi
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On application for Design (14 years)........... 830
CANADIAN PATENTS.
List of Patents Granted in Canad December 15 to Decembeir 17, 1873. ,933.-J. H. Smith, Arlington Square, Middlesex county Eng. Improvement on shat le se wing machines, called 1873. ments on heating stoves, ca
Base Burner." Dec. 15, 1873 .
2,935.-J. L. Thurston, Douro township, Peterborough county, Ontario. Improvement on corsets, called
"Thurston's Improved Elastic Corsets." Dec. 15,1873 2,936.-A. A. Herriman, Greens borough, Gullford county called "Herriman's Acme Turbine Water Wheel." Dec. 15, 1873.
 2,938.-F. Jessop. York, York county, Pa., U. S. Im provement in rotary steam motors, called "Jessop's Rotary Steam Motor." Dec. 15. $15,7.3$.
2,939--N. Phaneuf, Montreal, P. Q. Machine a presser et
a polir les talons deschaussures, called " Cne Rome Bruna polir les talons des chaussures, called "Une Rome Brun-
issoir." Machine 1or pressing and polishing heels of issoir." Machine 1or rressing
boots and shoes. Dec. 15,1873 .
2,910.-D. E. Rice and A. W. Mitchell, Detroit, Mich., U
S. Improvements on water gages for steam bollers, called "Rice's Boiler Gage." Dec. 15, 18;3.
,, $411 .-$ M. T. Boult, Battle Creek city, Calhoun county chines, called "Boult's Wood Working Machine." Dec. 15, 1873.
2,942.-C. W. Palmer, Cleveland, Cuyohoga county, o. U.S. Improvements on portfolios, called "Palmer"
Novelty Music Rest and Portfolio." Dec. 15, 1873. 2,943.-M.Stephens, Brooklyn, Kings county, N. Y., U.S ans.
Improvements in cement lined metal pipes., called
"Stephens' Cement Lined Metal Pipes." Dec. 15, 1873 2,944.-J. IH. Thorp, Chicage, U. S. Lmprovements on
portable ourglar alarms, called "Thorp's Portable portable ourglar alarms, calle
Burglar A:arm." Dec. 15, 1873.
2945.-I. Erb, Buffalo, Erie cou
provement on washing machines, called ". ". Erb's Im
Im proved Washer." Dec. 15,1873 .
2,946.-Jas. Foley, Montreal. P. Q.
2,946.-Jas. Foley, Montreal. P. Q. Extension of a pro-
vinclal patent, beting No. 2,614, old law for the manufacture of the extract from hemlock, oak and othe barks, for tanning purposes and as a mordant for
printers' and dyers' use, called "The Non-Atmospheric printers' and dyers' use, called " The Non-Atmospheric
Process." Dec. 17, 18i3. 2,94i-O. Mei.jh and II. Voelter, Paris, Frauce. Process ter for the manufacture of paper, card board and othe analogous products, called "Meljh and Voelter's Pro-
cess for Preparing Wood for tne Manufacture of Pacess for Preparing woo
per, etc." Dec. 17, 1878 .
2,948.-G. Lowden, Browklyn, Kings county, N. Y., U. S
Improvement on portable gas apparatus, called " Low Improvement on portable gas apparatus, called
den's Portable Gas Apparatus." Dec. 17, 1973. 2,999.-C. K. Knowlton, Rockland, Me., U. S. Improve
ments in car couplings, called "Knowlton's Car Coup ling." Dec. 17, 1873.

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