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## PNEUMATIC TRANBMIBSION.

from " mLectriotty and the hlectrio telegraph," by amorge b. prescott
The transmission of messages between the branch and central stations in the large cities, by means of pneumatic tubes, constitutes an important and valuable feature of the modern telegraphic establishment.
air, and for alternate forwarding and receiving through a the roller, $j$, thus opening a valve within the cylinder, $L$, and single tube. The arrangement of the single sluice valves is establishing communication between the reservoir of comshown in Figs. 2 and 3, on page 178. T is the tube which pressed air and the tubes, $M$ and $T$. The carrier is there forms the prolongation of the underground conductor
To receive a carrier at the Central office the lower end this tube is closed by raising the hinge valve, $C$ (which has a
rubber packing); the stopcock, V , is then turned, which es- If the rod, $f$, were connected rigidly with the crossbar tablishes a communication, through $T$ and $S$, with the vacu- $d$, a certain effort would be required to push back the Messages are sent from the Central office of the Western um main. A vacuum is produced in T, and the valve is slider, owing to the friction due to the pressure on the surUnion Telegraph Company, New York city, by compressed kept closed by atmospheric pressure. The carrier, on arri- face of the obturator. This effect is avoided by making the air, and to the Central offlce by exhaust air, the engine, pumps, and valves being at the Central office. In Central office. In
our large illusour large illus-
tration, Fig. 1, is tration, Fig. 1, is represented the receiving and sending station in the operating room of the above named company's building. The tubes on the right are those in which messages are dispatched; from dispatched; from those on the left messages are received. The mode in which the missives are prepared for transmission is described in detail further on. It will suffice to say here that the paper is folded and inserted in a felt-covered in a felt-covered case. A valve is opened and the latter inserted in the lower end of one of the tubes. The valve is then shut, and in thirty-two seconds the case travels through about 2,100 feet of tube and arrives at the Broad street station, the street station, the fact being announced by the sounding of an elec tricbell at the sender's table. To make the journey through the 3,308 feet of tube, between the Central office and the Cotton Exchange, occupies about 55 seconds: the compressed air the compressed air which empties the case being under a pressure of about 9 lbs. Although by using greater press-
ures a higher velocures a higher veloc ity is easily attain able, the above is
practical requirements best. To draw cases from the stations to the Central office a vacuum of some 12 inches is employed. The number of messages transmitted daily between the hours of $8 \mathrm{~A} . \mathrm{M}$. and 5:30 P.M. averages, we are informed, from two to three thousand. The arrangement of the apparatus is as follows: To the pumps are attached two large mains, one for pressure and the other for vacuum. These mains are carried from the engine room to the operating room, where the pneumatic tubes are situated, and are of such dimensions as to obviate the effect of the intermittent action of the air pumps. The valves are of two kinds, single and double sluice, and are so arranged that they can be employed for exclusively forwarding messages by compressed air, exclusively receiving messages by exhausting the tube, T. When this closure is complete, the inclined pressed air, exclusively receiving messages by exhausting plane, $h$, fixed on one of the rods, $g$, meets and pushes back


## PNEOMATIC TRANSMISSION IN NEW YORK CITY.

 rod, $f$, slide in thecrossbar between the limits, $b$ and $l$ for, in pushing it back, the inclined plane first leaves the roller, $j$, and the compressed air ceases to enter the tube then the crossbar meets the ring, $l$, and the rod, $f$, re moves the obtura tor without difflcul ty.
The greater por tion of the parts which form the valves are made of brass. They are at tached to strong boards, the one in a vertical and the oth er in a horizonta position. The latter forms the table, and receives the carrier to be sent, and those which are received from the corre sponding offices.
The accompany ing diagrams show Fig. 4 a back view Fig. 5 a section, and Fig. 6 a top view of the double sluice pneumatic valve. The following is a description of the method of using it and of its action To send a carrier by the forwarding or outward tube, the mode of working is as follows: The car rier containing th message is inserted up the mouth of the pneumatic valve, $P$, Fig. 5, into the mes sage chamber, $M$ until its buffer is held by the contrac tion at C, which is the true diameter of the message tube. (The illustrations show the valve in its normal position. The handle, $H$, is then drawn for ward, carrying with it the sluice valve, $S$, until the mouth of the message pipe ceives upon its arrival destroys its momentum, it is drawn $\left\lvert\, \begin{aligned} & \text {, is closed. By this time the stop, } S_{1} \text { strikes against th }\end{aligned}\right.$ up by atmospheric pressure and suspended against the open- tail of the quadrant, $\mathcal{Q}$, pressing it into the slot, $s$, of the ing, $O$, of tube, S . As soon as valve, C, falls, the operator steel slide bar, $B$; and by the continuation of the motion shuts the stopcock, V , and the carrier, being no longer held necessary to bring the sluice valve, S , to the end of the sluice by the outside pressure, falls out of the tube, $T$, by its own box, $b$, bringing with it the tail of the quadrant, which is weight. To send a carrier from the Central office, it is placed centered at 0 , gives an opposite motion to its other extremiin the tube, T, Fig. 3, and the operator, by means of the ty, which, fitting into the rack, R, opens the top sluice, T. handle bar, $m$, pulls the sliding apparatus, formed by the During this motion an inclined plane, I, Fig. 6, which is rods, $g$, and the crossbar, $d$, which latter meets the ring, $b$, fixed upon one of the side rods carrying the lower sluice fixed on the rod, $f$, and carries this with it. The obturator, passesbetween the fixed roller, F, and the roller fitted upon the pressure valve, $V$, establishing communication between the pressure main and the message pipe; the air thus admit[Continued on page 178.]

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## For the w O. O4, 21,187



## selection applied to man.

The population of our globe is now about fifteen hundred millions, or about an average of thirty to the square mile of land surface. With proper cultivation of both land and
water, and the largest possible reclamation of waste and desert land by irrigation and otherwise, the earth is capable of supporting perhaps ten times as many people: probably no more, as that would require every inch of dry land to be a densely populated as China now is, and a very considerable portion of the earth's land surface is and must ever remain practically uninhabitable.
Assuming such an increase of the world's population to be possible, the question naturally arises: When is the limit likely to be reached-and what then? The contingency may seem at first sight to be very remote, but in reality it is not, pro vided human progress continues at the present rate. The dominant race of to-day is that which is fairly represented by the people of England. The influences of modern civili zation have been felt on that island as manifestly as any where; and we shall not go far wrong if we estimate the progress of the immediate future by the ratio of the immedi ate past. The population of England at the beginning of the present century was, in round numbers, a little under $9,000,000$. It is now not far from $24,000,000$. With the same rate of increase for seven generations more, the English peo ple will equal in number the present population of the entir globel At the end of the fifteenth generation the descend ants of the English people, if they continue to increase a their present rate, will number (if statistics and mathematics tell no lies) fifteen times as many as the world now supports and fifty per cent more than we have set as the limit of the earth's possible population. Inasmuch as the English are not the only people that are rapidly increasing in numbers, it is clear that the struggle for existence among the tribes of humanity is likely to be rapidly and seriously intensified.
Thanks to the advancement of knowledge, scientific and sanitary, the physical conditions of life are becoming more and more favorable; the average duration of human life is increasing, and the plaguesand fevers that formerly scourged the world and kept the population low are being brough under control, if not entirely stamped out. The tendency of civilization is toward arbitration instead of war, and so that means of keeping down the number of the human swarms is likely to be lessened rather than increased; and the same may be said of the increasing abolition of personal strife and individual murder. The means so frequently resorted to by crowded peoples heretofore to keep the natural increas within bounds-the general destructions of infants-grows more and more abhorrent to human instincts, and is no likely to be revived: certainly not by people of the higher types that are destined to inherit the earth. The multiplica tion of facilities for transporting food, incident to modern civilization, with its improved agriculture, combine to make
the famines once so frequert and destructive of lifemore and more rare, more and more impossible. The great scourges of humanity-pestilence, famine, war, and murder, domestic and social-are thus clearly on the wane; and as no substitu tion for them can be foreseen, there is no reason to infer that the present rapid increase in the earth's population is likely to be stayed by natural means. Such being the case, the earth's sustaining cap
What then? Will the fittest survive? If natural selection were the law with man as with brute nature, that would most probably be the result; but it is not. That is, not wholly. Under the influence of charity and other religious sentiments, it is usually the weakest, often the worst, that is most favored in the struggle for existence. The burdens of social and political life fall chiefly upon the worthy, who have to support not only themselves and their own offspring, but the idle and the vicious and their multitudinous spawn.
The artificial selection which religions, governments, and The artificial selection which religions, governments, and sense of responsibility which the struggle for existence cre ates in the minds of the thoughtful tends in the same direc tion, in putting a check upon the natural increase of the higher orders of humanity; while the heedless animalism of the unthinking and the vicious, on the contrary, leaves
them free to multiply without stint, and the superior lifepower of the higher is no match in the long run for the unrestricted fertility of the lower. Our civilization, like all those which have preceded it, thus carries in itself the elements of its own ultimate destruction: or, at the least, elements which make its overthrow possible at any moment, by causing the lower grades of culture to preponderate in numbers and political power. This, of course, on condition that human societies continue through future ages to be regulated by the social laws which now prevail: a condition which, we are happy to believe, must sooner or later cease to hold. The danger is too serious, and the enlightening influence of Science too persuasive. Already there is a growing disposition on the part of intelligent lovers of humanity to break away from the unscientific customs that have come down to us from barbaric ancestors; and the instinct of race-preservation will compel a radical change in many of them, particuarly those which determine our treatment of the physically and morally tainted. Preventive measures are rising more and more above those that are palliative and remediable; charity is becoming broader and more far seeing; the rights of future generations begin to weigh against the privileges of the present; and there is infinite promise of good in the change.
It would be sheer presumption and foolishness to predict
specifically the issues of conditions so complicated as those of existing humanity; but having in view the intensifying struggle for existence in store for future generations, and knowing the immense advantage which a pure and high race must always have over lower races, it is safe enough to predict that the ultimate dominion of the world will rest with that people, whether black, yellow, or white, which will so shape its political and social system as to rigidly favor the perpetuation of its best-which will studiously eliminate every serious moral or physical taint from its life-stem. As all cannot survive, it is becoming more and more the duty of humanity to elect wisely which shall survive, the good or the bad: or more correctly, perhaps, whether the chances of any unborn generation are in favor of physical and moral health or the contrary. To favor the former does not imply or ecessitate the destruction of any life; but it does necessitate uch an interference with individual liberty as shall restrain he vicious and the diseased from being over-represented in enerations to be; and the time may come when it will be vitally necessary to prevent such debasing elements from eing represented at all. At any rate, it is clear that, what ever high-grade people first rises to the moral level of apply ing a proper system of artificial selection to humanity, and steadily purifies its stock by eliminating vitiating strains, criminal or otherwise, that people will lead the world in civ lization and power. It will do more: it will retain that eadership, and develop a type of humanity which will en dure and improve as long as the earth remains habitable All others contain the seeds of their own destruction.

## EXPLOSION OF KEROSENE LAMMPS

A correspondent writes as follows:
"A few evenings ago, a lamp burning in my kitchen suddenly went to pieces; the oil at once blazed up and ran off the table in a burning stream, setting fire to the floor. The oil blazed up two or three feet high, and but for prompt at tention the results would have been serious. The lamp wa of glass, of the flat form, said to be the best; the oil vesse
would hold half or three quarters of a pint; the wick wa long enough to reach the bottom. The flame was turned rather low, but by no means as low as possible, and the lamp had been burning the greater part of two evenings since it had been filled, so that it could not have been too full. It was not exposed to a draft and could not have been upset o shaken; no one had been in the room for at least half an hou previously. The oil was claimed to be able to stand $150^{\circ}$ fire
test; and immediately after the accident some of the oil was tried with a lighted match, but it would not burn. The explosion did not throw any pieces of the lamp more tha a few inches, and the oil was not scattered at all; the nois was so slight that, when heard in an adjoining room, it wa supposed that the chimney had broken and fallen off. Ques tion 1. Why did the oil that ran from the lamp burn as not burn at all? 2 Is any kind of kerosene oil safe, and (3) if so, how can the consumer test it?"
As this subject involves the protection of life and property and as similar instances have lately become common, w think it of primary importance that the causes of such acci dents should be well known, and that some prevailing error should be corrected, as they lead to precisely such catastro phes as the one in question. But our correspondent wa more fortunate than one acquaintance of ours, who, coming home late in the evening, found his house entirely burnt down, the only possible cause being that a servant had left a kerosene lamp, partially burnt out, alight in her room, and as the flame burned down an explosion doubtless followed spread the oil, and set the house in flames.

Our correspondent's accident illustrates the following popular errors: 1. He states that the lamp was of the flat kind said to be the best. Some of the flat lamps have the flame so near to the body of the lamp that the containing vesse and the oil become warm; then the latter easily reaches the temperature of the flashing point, 110, 120, or more degrees This shows that flat lamps are not by any means the safest.
2. He also says: "The lamp had been burning the greater part of two evenings since it had been filled, and so could not have been too full." A full lamp cannot explode; ex plosion is caused by the space in the lamp over the oil which, when filled with air mixed with vapor of the oil, forms an explosive mixture. A barrel full of petroleum can take fire, but will never explode. Not long ago, we had an illustration in New York of the dangers of empty petroleum barrels: A man struck a match, in order to light a pipe, upon an old petroleum barrel, and it exploded at once, nearly kill ing him. The barrel was filled with a mixture of petroleum vapor and atmospheric air, which happened to be in the proportion necessary to make an explosive mixture, namely 1 volume of vapor to about 10 volumes of air. In fact, the addition of 10 per cent of petroleum vapor to common air makes a most dangerous mixture. It is, therefore, an error to suppose that a lamp can be too full; and we advise house keepers to fill them, and never let them burn out, and to void as much as possible any empty space over the oil
3. It is a popular mistake to test the oil at the common temperature. Only benzine and naphtha will take fire unde these circumstances; but if the kerosene is adulterated with the latter, the mixture may be ignited also. Good kerosene when cold, will burn only with a wick; but if we warm it the vapor will first fiash on nearing a flame; if we warm it more, the oil itself will take fire.
We should, therefore, warm the oil when we test it: the implest way is to pour some in a tablespoon and keep it in contact with the surface of hot water, of which the tempera ture can be found with a common thermometer; if the oil is claimed to stand the fire test of $150^{\circ}$, it ought not to burn be claimed to stand the fire test of $150^{\circ}$, it ought not to burn be-
fore being heated to that degree. We published an illustra-
tion of a simple method of testing kerosene on page 402 of our volume XXXIV.
It will thus be seen that our correspondent's lamp exploded because it had burned for a long time since filled, leaving a space over the oil, which filled with its vapor as the lamp, being of the fiat kind, became warm. When the fiame was turned down, the lamp cooled a little, the vapor contracted, and in its contraction drew in air, until enough of it had entered the space above the oil to form the explosive mixture above referred to. This mixture was set on fire by the flame; and, of course, the lamp was broken by the explosion. The kerosene left in the flat lamp became heated by the fiame, being much nearer to it than it would have been in a lamp of a taller or more nearly globular form, and of course was therefore ready to burn, while the cool kerosene in the can was not. The pieces of glass were not scattered much and the explosion made little noise, because either there was not a very large space filled with the explosive mixture, or the exprosion took place as soon as the mixture became inflammable, and before enough air had been drawn in to give the mixture the most effective proportion.
We believe that these remarks solve the difficulties which many readers have encountered; and we will close this article with a few words of advice. 1. Do not buy lamps in which the fiame is too near the body of the lamp. Kerosene can ascend in a long wick; and short wicks only tend to heat lamps and oil, and to encourage accidents. 2. Use the cylindrical wicks, with the draught in the middle; and use a long burner, which brings the fiame to a distance of at least three inches from the body of the lamp. The form of the brass student's lamp is a very safe one, as in this the oil reservoir is at a long distance from the fiame. 3. Be always prepared to test the oil you buy, as already described. You can heat the water to boiling point, and then mix it with cold water until it shows $150^{\circ}$, or any other desired temperature. If people would take the trouble to apply this simple test occasionally, they would largely diminish the number of accidents. 4. Keep the lamp full of oil, and never let the kerosene burn away much, and so avoid the dangerous empty space above the oil, especially when the lamp is fiat and the
fiame not far above it. $\quad$. Never turn a kerosene lamp low; fiame not far above it. 5. Never turn a kerosene lamp low;
rather extinguish it, as, besides the possible danger already described, there is the nuisance of an unpleasant and unwholesome smell given off when the wick is turned lower than it is intended to be used. The cause of this is imperfect combustion, and the consequent evolution of injurious gases.

## a lesson in arcitic navigation.

For a number of years an enterprising Canadian, Mr. E. W. Sewell, of.Levis, has maintained the possibility of safely and profitably navigating the ice-bound waters of the St. Lawrence river and gulf in winter, thus practically overcoming the hitherto unbroken blockade of Canadian ports during half of each year. After long and strenuous efforts, he succeeded last year in persuading the Dominion Parliament to subsidize a line of mail steamers for winter service, and proceeded to build and equip a vessel for the arduous work. The steamer was completed, and her first trip successfully made about the middle of January, between Pictou, Nova Scotia, and Georgetown, Prince Edward's Island, distance of about fifty miles.
The " Northern Light," as the pioneer navigator of Canadian ice fioes has been named, is a small but powerful propeller of 400 tons register, 145 feet in length, and 25 feet beam. She is driven by a pair of compound engines of 700 horse power, and is immensely strong, her horse power per foot of displacement being greater, it is said, than that of any other vessel of the kind. Her screw is twelve feet in diameter, $19 \frac{1}{2}$ feet pitch, and well submerged, it being intended, as a protection against ice, that at least four feet of water shall in all cases cover the upper blades. Her draught varies from eight forward to sixteen feet aft, to enable her to ride upon and break down the ice fioes as well as crush them by her momentum. Very little iron was used in her construction, except a plating $4 \frac{1}{8}$ inches thick for fourteen feet abaft her stern, a $2 \frac{1}{8}$ inch plating on her keel for part of its length, and a massive rudder of solid wrought iron. The rest is sheathed with $2 \frac{1}{2}$ inches of ironwood.
The first trip of the Northern Light demonstrated her ability to overcome the heavy ice fioes of Northumberland Strait, and to make good progress through continuous fields of unbroken ice nearly a foot thick. The only accident occurred in a narrow channel near Pictou Island, crowded with heavy fioes: in charging an unusually heavy mass of ice the iron cutwater was torn from its bolts by the shock, but no other damage was done. A correspondent of the Tribune reports the incidents of the first trip at considerable length, and is naturally exultant at her success:
"We had done what no man has done before. We had sailed in midwinter across the Strait of Northumberland, and shown that with proper appliances men may defy the ice blockade which for nearly two centuries has shut out And if the narrow strait can be crossed, it follows that the wider waters of the Gulf can be more easily penetrated to ports like Gaspé, Richibucto, and Miramichi. With these connected with Halifax, Cape Breton, or Newfoundland, by line of powerful ironclad steamers, the present water solation of Canada will be exchanged for an uninterrupted and profitable, although limited, winter commerce. Who can say that Louisburg's deserted harbor, or Placentia's squalid haven, may not yet become of renewed importance as the depot of the winter exports of the Dominion?'

Mr. Sewell's scheme involves the winter navigation of the
St. Lawrence river, below Quebec, as well as the Gulf: the beginning being made in Northumberland Strait, not because its navigation is easier than elsewhere, for that route is really the most difficult of all, but because of an agreemen made when Prince Edward's Island joined the Canadian Confederacy, that strenuous efforts should be made for the winter navigation of that channel.

## light and the distances of the stars.

## A correspondent writes as follows

"One of the New York daily papers gives an account of in Great Britain, and reports him to have said that some stars are so distant from the earth that light, traveling at the rate of 185,000 miles a second, would take half a million of years to reach us, and that consequently we would observe now What had transpired on such stars half a million years ago eye travel almost instantaneously along the line of direction of any object within the range of either unassisted human or telescopic vision, and do we not accordingly see what is
transpiring now at any point within such range? Please state transpiring now at any point within such range? Please state
whether this view or that imputed to Professor Grant is correct.'
To point out the error in our correspondent's reasoning we have only to apply it to the propagation of sound and to the ear; and then we may ask, almost in the same words "Does not the ear travel almost instantaneously along the line of direction of any sounding object within the range of either unassisted or assisted human hearing, and do we not accordingly hear what is transpiring now at any given point within such range?" We may ask this with good reason because the natures of the propagation of light and sound are identical, the eye being the organ for the perception of the first, the ear that for the perception of the second. Now the fact is that the eye (or the sight) travels as little toward
the luminous object as the ear (or the hearing) travels tothe luminous object as the ear (or the hearing) travels to-
ward the sounding object; both organs merely receive im pressions from the luminous or sonorous rays. It is perfectly well established that we see astronomical events later than they occur, and it was this fact which taught us that light moves with a velocity of 185,000 miles per second. The eclipses of the moons of Jupiter revealed to Roemer the celebrated German astronomer, this fact; he found an irregularity which no astronomical data could account for and he observed that the periods between these eclipses were
longer when the distance between us and the planet was increasing, while, inversely, the periods became shorter when this distance was diminishing. He found at last, by close observation, that every time that the planet was, say $100,000,000$ miles further off, we see that eclipses happen 9 minutes later then they do when the planet is at its nearest distance. As 9 minutes is 540 seconds, we have only to divid 540 into $100,000,000$ to find the velocity of light per second which is very nearly 185,000 miles. This has been verified
afterward in various other ways; the velocity of light has afterward in various other ways; the velocity of light has
been directly measured (by the help of most ingenious and delicate apparatus) by Foucault and Fresnel ; while the aberration of the fixed stars, which consists in an apparen cisplacement of the same, produced by the yearly motion of the earth in its orbit, fully corroborates the scientific theory. It is, therefore, a positive fact that we see the stars as they them; and we see the sun as he was 8 minutes ago, the near est fixed star as it was $3 \frac{1}{3}$ years ago, and the pole star as it was 36 years ago. Of the other stars, very few are near enough for us to measure their distances; but most of them are thousands of times further off, and therefore we se them as they were thousands of years ago; and when the telescope reveals, in the depths of infinite space, stars thou sands of thousand times further off still, we are convinced that, as their light can only reach us in millions of years, we see them as they were millions of years ago. Perhaps at that remote period, in those unfathomable distances, blazing us, have been created of which the light has not yet reached us, and inversely those may have become extinct of which the light reaches us now: in the same way as when the sound a gun, exploding at a great distance, reaches us, the real explosion is a thing of the past, and may have taken pla
50,60 , or more seconds before, according to the distance.

## THE NEW ENGLISH PATENT BILL.

For the third time, a bill providing for material alterations in the English patent system has been brought before Parliament. In 1875 and 1876, one was introduced by the Lord Chancellor in the House of Lords; at present the bill is under the sponsorship of the Attorney General, and makes its appearance in the House of Commons. The chief feature of the new law is the abolition of the present system of
granting protection, and substituting therefor a system of examination similar to that practised in the United States. That gigantic appendage of wax, with its elaborate attach ment and tin box, known as the Great Seal, is to disappear; and in lieu thereof the patent will be sealed with a simple stamp. The lifetime of a patent is to be twenty-one years; but unless the patentee obtains a certificate of renewal before the end of the third, seventh, and twelfth years respectively, the patent will cease at the end of any one of these periods. One good thing at least is proposed in this bill, and that is he reduction of the expense of an application to one half the present cost. The scale of taxes is to remain the same
as under the previous law: namely, before the end of three years, $\$ 250$; before the expiration of seven years, $\$ 500$; with a further $\$ 500$ before the end of twelve years, thus extending
the full term of a patent to twenty-one years, being seven
years more than are now allowed for the full term of a patent The Lord Chancellor is empowered, under the new bill, to grant a longer time for the payment of these taxes in cases where patents have been accidentally allowed to lapse

Among the other more important provisions is one giving the Crown unlimited powers to use any invention at a price to be decided by agreement of the parties; or where there is no agreement, the "Treasury or some other tribunal" is charged with arbitration. The objectionable feature of compulsory licensing is introduced in one clause, and in an other patentee risks the revocation of his patent if within the three years he fails to use or put the invention in practice in Great Britain. If the patentee does not see fit to gran licenses, the Lord Chancellor has the right to do so. This is an interference with the right of every man to his own property, for which it is difficult to see any justification Lastly, the old system of granting patents to the importer foreign inventions is to be abolished; but the bill does not propose to prevent foreign inventors from securing patents on the same conditions as British subjects, provided the in ventions have not been patented abroad or introduced into the realm for more than six months. The granting of amended or supplementary patents-similar to the French revets d'addition-is provided for.
The above are the outlines of the bill which is now under discussion, and of which the British Government are using every endeavor to secure the passage. Our English contem poraries, in very lengthy discussions of the subject, think that, before it becomes law, several of its provisions will neet with material modification.
In the early days of our Patent Office, say from 1836 to 1850, but few applications for patents were made in a year and as a consequence the range of cases available to the ex aminer for purposes of reference was obviously much smaller than it is now. But since the aggregate of Ameri can patents has reached nearly 200,000 , while thousands have been granted abroad-for nearly every country on the globe now hasits patent laws-it has manifestly become impossi ble for thorough searches to be made, and hence it is almost useless to employ an examining force to decide whether or not a patent should be granted. After thirty years' experi ence in soliciting patents, not only in this country but all over the world, we think we have had superior opportuni ties for observing the working of the various patent systems and as a result, our opinion is that the existing English system of issuing patents presents the fewest objectionable features. To abandon that system in favor of a plan of offi cial examination, similar to the necessarily imperfect one which exists in this country, would be a blunder.

The London Engineer, reviewing the new bill, says
"It is somewhat unfortunate that the existence of the system in the United States should be cited as an argu-
ment in favor of its adoption here, because it is a matter mon common notoriety among those who have taken the
trouble to inquire that the fact of a preliminary examination trouble to inquire that the fact of a preliminary examination being required is in truth not an obstacle to the re-patenting
of old inventions; and the further fact, which we have already pointed out, that during the years 1872,1873 , and
1874 , from 212 patent actions reported in the United States there resulted the destruction of no less than fifty-three pat ents on the ground of want of novelty, is very significan Moreover, the American technical press has constantly complained of the serious defects of the system followed by their Patent Office, a system which, it should be borne in mind, t as been in process of elaboration ever since the year 1836, a history of invention in that country. There is, however, to our mind, a vital objection to any system of preliminary exour mind, a vital objection to any system of preliminary extice can remove, because nothing short of infallible wisdom or omniscience in the examiners would neutralize it. We
allude to the possibility of the destruction of an invention allude to the possibility of the destruction of an invention
almost in its inception, in consequence of the difficulty or impossibility of inducing an examiner, or the Court, to perceive in it the one, perhaps delicate, distinction between it and something that has gone before-a distinction which may be the means of building a great success upon the ruins
of many previous failures. This is not a novel objection, of many previous failures. This is not a novel objection,
but it cannot be too strongly urged. To take an example: but it cannot be too strongly urged. To take an example: In his able paper on the expediency of a patent law, Mr.
Bramwell alluded to Watt's invention of the separate conapplication to an examiner, fully informed for the period at which the in vention was made, is it not more than conceiv able that the examiner would have pronounced against Watt on the score of novelty? His engine resembled other engines, but he separated his condenser from his cylinder, a change which in all probability the examiner would have
said was a mere detail introduced for the purpose of setting up a claim to invention. Again, we have a still more striking illustration in the case of the regenerative furnace, a pating inustration in the case of the regenerative furnace, a pat
ent for which was refused to Mr. Siemens* simply because in an old house belonging to an order of mediæval knights, it had been found that the hall was warmed by means of air drawn through heated stones. The actual apparatus, we believe, consisted of two chambers under the fioor filled with
stones. Each was alternately heated by a furnace and alterstones. Each was alternately heated wy a furnace and ater stracted heat from the stones, was turned into the building Stracted heat from the stones, was turned into the building. No other such apparatus had been Kn . Siemens' stove to be an old invention. Fortunately, the doors of the English Patent Office were open to him, and we know the result.
How often do we find that the novelty of an invention is only determinable after prolonged and costly litigation-litigation which is generally in proportion to the value of the
patent? It should be remembered that the law is satisfied with the barest amount of novelty; and if that little is often so difficult to discover, it is fair to ask what the examiners will do for us, and what estimate we may make of the costs of an elaborate argument on appeal from them.'


handle, H, Fig. 5, is pushed back to its normal position, thus producing a reverse motion of the valves by closing the upper part of the tube before the lower part is opened, and preventing any discharge from the message tube discharge from the the The second and the handle pulled forward as previously explained, again opening communication with the compressed air in the main. The time necessary for this operation being about four seconds, it can be easily understood that in the length of pipe the momentary cutting off the pressure is hardly felt, so that the speed of the frst carrier is not necessarily less frst carrer is not necessariy lessned. It the cock, D, Fig. 4, is always closed.
The foregoing description applies to a pneumatic tube used entirely for forwarding carriers by means of

munication between the pressure main and the pressure valve, V , is first cut off by means of a stopcock fitted upon the tube, E, but lower than is shown in the diagram. The handle, $H$, is then drawn forward, and the stop cock D, cock, $D$, opened, thereby estab lishing communication between the message pipe and the vacuum
main. The carrier inserted at main. The carrier inserted at
the distant end is then pushed forward by atmospheric pressure, until it arrives in the message box, M, and signals its arrival by the sharp noise caused by its striking the sluice valve, S . The handle, $H$, is then pushed back, the stopcock, $D$, having been previously closed; and, by the arrangement already described, the message pipe is closed by means of the sluice valve, $T$ Fig. 4, and the bottom of the tube being open the carrier falls out of the message chamber, M. It will be remembered that be fore the admission of compressed air the forwarded carriers are held at C. The buffers of the received carriers, however, hav ing passed this point, the carrier rest free in the chamber, $M$, and drop out.


Fig. 5.-The pnedmatic valve.

When the tube is used for a
constant succession of carriers from the out station, it is as previously described, and the handle, H, drawn forward. necessary to pull forward the handle, $H$, immediately after The sluice valve, S , first closes the orifice, P , after which the the taking out of any carrier. The short space of time oc- continuation of the motion opens the pressure valve, by cupied in this operation will not have any appreciable effect means of the inclined plane on the slide rod, and the carrier upon lessening the speed of the succeeding carrier. It will is forced to its destination. The handle, H , is, immediatebe seen, therefore, that a number of carriers may be contin- ly on the arrival of the carrier being signalled, pushed back uously passing in succession through the tube. It is, how- sufficiently far to remove the inclined plane from between uously passing in successi-
ever, undesirable to per-
mit more than one carrie mit more than one carrier
to be in transit at the to be in transit at the
same time. Where the
same time. Where the
traffic is not sufficient to traffic is not sufficient to warrant the expense of an up and down tube, one tube only is worked in both directions in the fol lowing manner: The top


Fig. 6.-PNEUMATIC TRANSMISSION SLUICE.


Fig. 7.-CARRIER FOR PNEUMATIC TRANSMISSION.
the rollers, so as to close communication between the message pipe and the pressure main, but not far enough to remove the sluice valve from over the mouth of the message chamber By this means the compressed air which remains in the pipe expands to the atmospheric pressure through the distant end of the pipe only. To receive a sluice, $T$, is entirely thrown out of use. This is done by re- carrier the cock, D. Fig 5, is opened, and a communication moving the plug, $G$. The rack, $R$, is then removed, and the is thus established between the vacuum main and the messluice valve, T, drawn back, and held in that position by a sage pipe. The carrier is pushed forward from the distant small clamp made for the purpose. The tube is then in its end, as in the case of the continuous working, and signals its normal state for alternate traffic, and entirely open to the at- arrival by striking the sluice. The vacuum is then cut off by mosphere.

To forward a carrier, it is inserted in the message chamber closing the cock, D. On pushing back the handle the carrier falls out.


Fig. 8.-MESSAGE COPYING PRESS, DRIVEN BY AN ELECTRO-MOTOR.

A system of electric signals is used between the central station and the outlying stations, consisting of a single stroke bell with indicator, to signal the departure and arrival of carriers, and for answering the necessary questions required in the working.
The carriers or pistons in which the messages are placed are made of a cylindrical box of gutta percha, one sixth of an inch thick and six inches in length. A section of one of these carriers is shown in Fig. 7. The gutta percha is covered with felt or drugget, which projects beyond the open end of the carrier. This part expands by the pressure be hind, causing it to fit the pipe exactly. The front of the car rier is provided with a buffer or piston, which just fits the brass tube. This buffer is formed of several pieces of felt. To prevent the messages getting out of the carrier, its end is closed by an elastic band, which can be stretched sufficiently to allow the message to be put in. At the branch stations, where no apparatus is required, the message tube terminates with the end downwards, above the counter or table, so that nothing can fall into it by accident.

Tubes are made of lead, iron, and brass. In London lead tubes are preferred. In Berlin iron only are used. In Paris both iron and brass are employed. In New York brass tubes are exclusively used.
All messages received at the offices of the Western Union Company for delivery, either by the tubes or by messenger, are written by the operator on the proper blank forms with copying ink, and a duplicate is taken, for filing, by laying a sheet of dampened unsized paper upon the message, and passing the two through a copying press. The latter consists of a pair of rollers, which are turned by steam power, an electro motor, or by hand, according to circumstances. Fig. 8 show one of these presses driven by a Phelps electro-motor. This method of taking duplicate copies is much neater, and is in many other respects preferable to the manifold process employed in Europe, which is only used in this country when a large number of copies are to be taken of the same despatch, as in the case of press news.

## NEW EXPERIMENTS ON MECHANICAL FLIGHT

M. V. Tatin has recently published a report of results of experiments conducted during the past year, the object of which has been the reproduction of the flight of birds by mechanical contrivances. He has studied, by the aid of small models set in motion by rubber springs, the best form of wing, in order to determine the nature of the large wings most suitable for use on a machine actuated by compressed air. After many trials, M. Tatin finds the larger proportion of advantage to be with long and narrow wings. Other investigators have already shown that a wing may be as effective when narrow as when broad, and Professor Marey has pointed out the fact that those birds which have small am plitude of wing movement always have very long and nar row pinions. With this form (Fig. 1) M. Tatin has rendered as short as possible the period during which his artificial wing takes the proper position to act on the air during its down stroke.
As a bird flies the more easily as his wings act upon large masses of air in shorter periods of time, it will be evident that the velocity of maximum translation will be the most advantageous pace in point of reduction of expenditure of power. M. Tatin, not being able to prevent his mechanical birds expending considerable power in order to obtain a useful velocity, seeks to remedy this difficulty by moving their centers of gravity forward. A bird in full flight then keeps the same equilibrium as one that soars, and its velocity is in one sense passive, new bodies of air, as it were, placing themselves under the wings. All the expenditure of power may then be utilized for suspension. In this way M. Tatin has been able to augment the weight of his apparatus without increasing the motive power.
The movement which the wing makes around a longitudinal axis, and which allows it to present always its lower face forward during the up stroke, is obtained by the apparatus illustrated in Figs. 2 and 3, which are respectively side

and rear views. The device consists of a frame of light wood, on the forward part of which are two supports, between which is a shaft bent so as to form cranks at right angles. This shaft is rotated by the untwisting of the rubber spring shown. The forward crank, B, produces the up
nd down movement of the wings, which are movable around common axis, A. The latter is inclined downward and rearward by the second crank, $C$, when the first is passing its dead point, and when the wings are at the lowest position during their stroke.


A New Compressed Air Railway.
Some interesting experiments have lately been made in Ge neva, Switzerland, on a new system of compulsion by compressed air, the invention of M. Gonin. The road upon which the invention is to be practically employed connects Ouchy, on Lake Geneva, with Lausanne, the line following a grade of 12 in 150 . For two thirds of the distance, which is but 4,800 feet, traction is accomplished by metallic cables driven by hydraulic motors; over the remaining third, the vehicles are moved by a piston traveling in a long air tube and impelled by compressed air.
In the recent experiments, a section of the tube, 128 feet in length, was used. The interior diameter was 9.75 inches, and the thickness 0.46 inch. The total weight was 880 lbs . On the upper side a slit was made, with its edges flaring inwards, in which an angular valve fitted. The lateral faces of the valve were covered with leather; and it was pressed against its seat by coiled springs fastened on the outside of the tube. The piston in-

But the wing should not only change position in its en tirety; each point on its area should have, especially during the up stroke, an inclination as much more marked as it is nearer the extremity. The portion nearest the body alone should ${ }_{c}$ keep a uniform obliquity. M. Tatin therefore con-

luded that it would be necessary to produce this torsiona movement by the wrist; and he therefore substituted, for the wings of silk hitherto used, wings of strong feathers,

Fig. 4.

which would not bend like the former, but which would slide one on the other during the torsion. This apparatus worked admirably in the model; but when tested on a larger scale the results were inferior, and led the authorto return to the silk wings, which he now definitely adopts.
By means of many slight modifications in the shape of the wings, extent of their amplitude, etc., M. Tatin has finally brought his compressed air bird to a remarkable degree of perfection. He had previously made the apparatus lift a load corresponding to three quarters its own weight; now it lifts one equalling its weight. The only difficulty seems to be to cause the device to follow a horizontal course; but this can doubtless be adjusted by a suitable disposition of the tail. The value of M. Tatin's results is shown by a comparison of the curves, graphically produced on Professor Marey's registering apparatus by the motion of the wings of birds, and that of the flying machine. No. 1 in Fig. 4 is the curve produced by the up and down movement of a pigeon's wing; No. 2 is that of the mechanical wing actuated by a rubber spring; and No. 3 is that of the mechanical wing driven by compressed air. The analogy between Nos. 1 and 3 is striking. M. Tatin believes that he will soon reach a formula which will show definitely how many foot lbs. per second are necessary to cause the flight of a given weight.

French journals state that M. Henri Giffard is building a teamboat that will make 45 miles per hour.
side the tube was composed of six cast iron disks, with leather washers between them, the latter being cut a little large so as to pack the tube tightly. The piston rod supported three rollers, which served as guides to keep the piston in the axis of the tube. Between rollers and piston, the propelling bar was attached. This was made of such a form as, when the valve in the slit above was lowered, to extend up between said valve and one edge of the slit. Its upper end then came in contact with the vehicle; and thus the motion of the piston was transmitted to the latter. In order to cause the lowerof the valve jut in advance of the bar, the car carried a ing of roller which preased upon a band of metal which rested on the
valve rods, the latter being extended up through the springs.
A small compressing engine supplied air to a reservoir, whence it was drawn at a pressure of about 12 atmospheres. The object of the experiments was principally to determine the staunchness of the valve, and in this respect, the Reoue Industrielle states, they were entirely successful.

## A NEW KKELY MOTOR DECEPTION

Professor E. Stebbing writes from Paris to the Philadelphia Photographer as follows:
"For the last few days all the élite of Parisian science have been deep in thought, as an engineer has given the news to the world that he had discovered a new power which news to the world that he had discovered a new power which
would revolutionize the art of the engineer. The inventor, M. Charles Boutet, is well known; he is the author of the project of a bridge over the Straits of Dover, which would robably have been finished but for the overthrow of the French Imperial Government. Since the war he has directed his attention to hydraulic machines, and upon the following experiment he has based his idea of a new engine: He takes an apparatus composed of a two-inch bore iron tube, of a yard and a quarter long; to each end is brazed an iron disk, intended to support two india rubber balls in communication, the one with the other, by means of the iron tube. This communication can be cut off at will by means of a tap (see Fig. I.); a small tap is also placed in the tube to inflate the india rubber ball. When this is done the apparatus is pressed down into a large tank of water (Fig. I.). This requires a force which can be calculated at about 10 lbs.
"A charge of 160 lbs. can be placed upon the upper ball; and when the communication cock is opened, the 120 lbs . will be raised up (see Fig. II.). By this simple experiment it is clearly proved that a gain of 120 lbs. of force can be obtained. The author intends to avail himself of this force, and to make a 20 horse power engine for the next Exposition of Paris in 1878.
"Such is the invention of which every one speaks -a constant force obtained without expense. A machine of unlimited power, which feeds itself. No

$A$ is an iron tube; B B areiron disks; CC are india rubber balls; $D$ is號
moke, no dust, no noise, no danger of explosion. Another crown to the glory of the nineteenth century.

To prolong the duration of ropes, steep them in a solution of sulphate of copper, 1 oz . to 1 quart of water, and
then tar them.

## Ciommanicationg.

## The Curve Described by a Rod.

To the Editor of the Scientific American
In your issue of January 20 appears a note from W. H. P., in which he repeats the erroneous statement that the path of a point on the connecting rod, between the crank pin and crosshead centers, is always an ellipse: adding that an instrument constructed on that principle would be a most perfect elliptograph. A trial would convince him of his error, and that would do no harm; but as some one else may be misled into such an experiment, by supposing that W. H. P.'s diagram proves the truth of his assertion, it may be worth while to point out that, on the contrary, it clearly proves its fallacy.
Let the circle in Fig. 1 be the path of the crank pin; if we draw ordinates, AD, JC FG, and bisect them, the curve, RXP, through the points of bisection, is an el lipse: and the equal ordinates, SD, TG, are equidistant from the minor axis. Now let 0 the middle point of the con necting rod, EH , be the trac ng point; then ok will be th greatest ordinate of the de cribed curve, and equal to CX. But it will not be a the middle of $v z$, the length of the curve, nor will equa ordinates be equidistant from it. For instance, $m g, n l$ ar ordinates corresponding and equal to SD, TG. But the triangles, ABD, FIG, having the same hypothenuse and the same altitude, have equa bases; the triangle, HEC, ha the greater altitude, CE, while the hypothenuse is the same therefore its base, HC , is less than B D or I G, and as $g, k$, are the middle points of these bases, $g k$ is greater than $k l$. The curve in question, then, is not an ellipse, nor is it symmetrical with respect to any transverse line; if not "slightly wider" at one end han the other, it is at any rate slightly longer
The deviation from the elliptical form may not be great under all conditions, but it exists in all cases, with one ex ception, and is sufficient to preclude the adoption of what is usually understood by the "crank and connecting rod movement " in an elliptograph. The exceptional case I mentioned in a former note; if the length of the connecting rod be equal to that of the crank, and the stroke of the crosshead four times as great, the described curve will be a true ellipse. Such an arrangement would hardly be adopted in a steam engine, but is perfectly practicable in a drawing instrument. The movement is shown in Fig. 2, which is lettered to correspond with Fig. 1. It is also clear that in this case the tracing point being as before at the middle of the connecting rod, the whole length, $v z$, of the described curve will be $1 \frac{1}{2}$ times RP; and in order to prove it a true ellipse, it will suffice to show that all the abscissas are increased in the same proportion, the ordinates remaining the same as in RXP. Now, when the crank pin is at $A$, the crank and connecting rod, $A C$ and $A B$, form two sides of the isosceles triangle, CAB , whose base, BC , is bisected at D by the ordinate, AD , of the circle: which, itself being bisected at S , gives SD , the ordinate of RXP, to which $m g$ is equal. But A B being bisected at $m$, ms or its equal, $g \mathrm{D}$, is the half of BD or of its equal, DC; that is, $\mathbf{C} g$ is 1 $\frac{1}{8}$ times CD: and so of any other position of the crank. It may be added that the movement of AB , the connecting rod in this arrangement, is identical with that of the pencil bar in the common trammel, which will be seen by prolonging BA to meet the vertical center ine in $W$; for in that case the triangle, CAW, being also sosceles, it is clear that, as B moves to and fro on the horizontal line, W will rise and fall in the vertical line: and if these points be compelled to travel in those lines by the slots as shown, the crank may be removed without affecting the result. The mechanical device of the crank, however, gives some advantages; one of which, it may be mentioned, is that, by altering the length of the connecting rod, the instrument may be adjusted to draw curves which are not elliptical, but very decidedly egg-shaped; Fig. 3, for example, would hardly be mistaken for an ellipse by any one.
It may be of interest to some to note that the result attained by either of the devices mentioned, and illustrated in Fig. 2, may also be accomplished in another manner. If the wheel shown in dotted lines, whose center is $\mathbf{A}$ in that figure, roll within the annular wheel of twice its own diameter, whose center is $C$, the points, $B$ and $W$, will move in the horizontal and vertical lines, and $m$ will trace the ellipse.
Stevens Institute, Hoboken, N. J. C. W. MacCord.
The average weight of 20,000 men and women, weighed at Boston, Mass., was: Men, 141.5 lbs., women, $124 \cdot 5$ lbs.

## Supporting a Ball on a Blast of Air.

## To the Editor of the Scientific American

In looking up some other matters, I came across an ac count of some experiments in the direction indicated by the above title, which may possess some interest, and furnish some suggestions in connection with the experiments of the same character exhibited at the Centennial, and which hav heen discussed in the Scientific American within the last two months. See page 262 , volume XXXV.
In the Glasgow Mechanic's Magazine for July 2, 1825, volume LXXX., page 338, in an article entitled "Account of several experiments, performed with a compressed gas ap paratus, by John Deuchar, Esqr.," occurs the following:
"Experiment 1. When a common brass blowpipe nozzle is put upon the top of the condensing gas-holder, a mahogany ball will be supported upon the column of gas as it is allowed
to escape; and when the ball is at the distance of from one
supported on a column of water. Now, so far as my informe of a boes, Mr. Leslie leaves the far less singular circumstance f water or air to be claimed as the discovery of those earlie philosophers, from whose ingenuity the Swiss and German choolboys (of whom the correspondent in the Chemist speaks so highly) had learned their amusing recreation; but the Pro fessor deservedly, I think, is entitled to the merit of first
proving that a brass ball could be supported upon a column of water or of air, when that column is inclined even to an angle of $45^{\circ}$ from the perpendicular."
In the volume of the Chemist referred to, which I chanc to have also in my library, I find on page 15 the following:
"Hydraulics. - Curious Experiment. -The following ex this country by a celebrated professor. A jet of water, by means of a great pressure, was made to spout upwards, and ear aloft, almost as high as the ceiling, a hollow copper ball as large as an egg; and sometimes an egg itself is used. The water was made to spout up in one unbroken jet, about Striking the ball on the under side, it spread out into a thin shell or fllm, which invested the globular surface on all sides, and afterwards descended in rain or spray. The ball kept playing on the top of the jet, not leaping up and own, side to side, and generally it performed at the same time a slow vertical motion on its
axis. It is remarkable that axis. It is remarkable that it is not necessary for the
water to rise in a vertical water to rise in a vertical
direction. The experiment succeeded, and the ball was supported equally well, when the jet was inclined ten or ifteen degrees."
And on page 175:
We Curious Experiment.We mentioned some months
ago an experiment exhibited ago an experiment exhibited
in Professor Leslie's class in Professor Leslie's class room, in which a hollow brass
sphere was balanced on the sphere was balanced on the made to play up and down, in a manner very striking and
beautiful. We saw the Probeautiful. We saw the Pro-
fessor exhibit subsequently an fessor exhibit subsequently and experiment of the same kivel and singular description. Two or three atmospheres of common air were condensed into a cize which might be conveniently carried in the hand. A stopcock, with a very minute aperture, flxed on the
inch to one and a half inch above the opening, we may in flame the gas, and still the ball will be supported, and per form a double rotatory motion in the center of the flame
(as shown in Fig. 1). Al
 (as shown in Fig. 1). Al-
though this experiment be continued for five minutes yet the wooden ball is not burned, nor even much the motion of the ball, it ha a white ring round it. "There are two causes
which operate here in keepwhich operate here in keeping the temperature of the bustion. The first is the hollow nature of flame; it is on alone outer surface of the gas takes place, for there only it has the necessary supply of oxygen to carry on its com
bustion; the interior, there fore, in which the ball is situated, consists of a mixture of the gas, partially scorched or converted into smoke, united with some that has not been at all changed. And, secondly, the rapid rotatory motion o action of the interior unin

## burning

"Experiment 2. Repeat the last experiment, and, at the the ball surcine the apparatus to one side, and we have
 an angle of nearly $45^{\circ}$ (as shown in Fig. 2), from the perpendicular. The stance- shows how correct Professo Leslie's ideas were with regard to the nature of the phenomenon which he, I believe, first noticed, of a column of air supporting a hollow brass ball at an
angle of $45^{\circ}$; namely, that the ball was enveloped by a sheath of the air; and enveloped by a sheath of the air; and far, unnecessary any mathematical de monstration with regard to that point. "Here is shown, in a very beautiful manner, the inflamed sheath of gas surrounding the ball, by the rapid motion and of gravitation even at the inclination of an angle of $45^{\circ}$; but when we slant the apparatus more to one side, we then find that the attraction of gravitation becomes stronger than the propelling force of the inflamed gas, and we see the ball drop throu
enveloped.
"In alluding to the very curious observation of Mr. Leslie regarding common air, I cannot help stating that, in the been attempted to make it appear that the learned Professor had claimed the merit of discovering that a brass ball could be
the condensed air rushes out in a stream.
If a wooden ball of the size of a schoolboy's marble, or larger, is placed by the hand in this current of air, it is not blown aside or suffered to fall, as we would expect, but continues to leap up and down some inches above he orifice, generally perrorming at the same neme a vertical two experiments perform the same office, they act in a very different manner. The water, thrown up by pressure, rises in one unbroken filament, of the thickness of a slender rod, to the height of twenty feet or more; but the air being greatly condensed, the moment it escapes from the tube its particles exert a lateral repulsion, and, instead of pouring upwarm of an inverted slender in the axis of which, where the rarefaction is great, the ball plays up and down. So securely is the ball confined by the conical shell of air which invests it, that the vessel may be inclined at an angle of 30 or $40^{\circ}$, or carried about freely in the hand, without the ball falling off. The experiment has, in fact, something of a magical effect; for, when viewed at a distance of three or four yards,
so that the whizzing noise of the air is not heard, the ball so that the whizzing noise ond attach itself to the vessel by soems to leap and invisible power of its own.-Scotsman."
The article alluded to as occurring on page 381 is simply a ather uible criticism on something which was not aserted concerning Professor Leslie, and is not worth repeatserted
ing.

Various experiments closely related to the above under the general title of the pneumatic paradox have been frequently discussed and may be found in some text books; but it is curious to see how the supporting of a ball by an oblique blast of air has died out of recollection.
I have encountered in many places a general reference to nvestigations of Faraday on the above subject, but have found no trace of them as yet among the list of his paper civen in the "Catalogue of Scientific Papers" published by the Royal Society, nor have I encountered any publication brofessor Leslie in relation to the matters quoted above

Henry Morton.
Stevens Institute of Technology, Hoboken, N. J.

## A Segmental Parabolic Reflector.

To the Editor of the Scientific American:
The descriptions published of the so-called Balestrieri re flector (repeatedly pre-invented by Americans) have re minded me of an insirument which I designed in 1867, when living in Mono county, California, and which has remained on paper because I had no chance then of getting it made, and have ever since been occupied with other affairs. It is a reflector consisting of concentric parabolic rings or seg ments of copper, coated inside with nickel or silver, which ments of copper, coated and arranged that all solar rays falling upon them parallel with their axis are bent to a common focus. In consequence of the latter being behind the reflector and quite near to the same, manipulations which would be very
difficult or impossible to perform in front of a concave mirror are rendered perfectly convenient. The reflector may be so mounted as to enable the operator to keep its axis directed towards the sun, and thus to maintain a complete focus for a considerable space of time; and means may also be devised for separating the solar rays by filtration through proper absorbing media. Any good physicist will know, without being furnished with a diagram, how to construct the instrument, which may, indeed, be done in somewhat dif the instrument, which may, indeed, be done in somewhat dir-
ferent ways, it being necessary only to give to the concentric rings or segments (which might best be made by depositing copper upon moulds of wood, covered with plaster and cor rectly shaped on a lathe) such a curvature and position tha the parallel rays, striking them at various angles of incidence, be reflected to the same point. There can be no doubt that with a large reflector of this kind, it will be possible to pro duce calorific effects of which we have at present no con ception; and the instrument may not only become an impor tant aid to Science, but may also find some useful applica tions in the arts. By the Balestrieri reflector, which consists of concentric conical rings or segments, the solar rays can of concentric conical rings or segments, the solar rays can
naturally not be brought to a focus, but only be collected in an axial line. Its proper purpose is to cast the light of a focal flame in a certain direction into space, and it must an swer that purpose quite well.
A. Partz.

Paris, France.

## Plant Vigorous Young Trees.

To the Editor of the Scientific American:
On page 70 of your current volume, you advise farmers and fruit growers to buy small trees rather than large ones In a general sense you are perhaps correct; but practica pomologists know that to judge rightly of the value of a tree by its rings alone is quite impossible, there being other con ditious of growth quite as important, and even more so, than the relative size and height of its trunk and branches. Having a pretty extensive experience in the planting and growth of young fruit trees especially, I have found the roots to be the most important consideration, and the best indication of vigor and quality; and were I compelled to purchase trees without seeing them, roots and all, I should much prefer see ing the roots than the trees proper; and indeed, with such evidence of their quality, I could not be greatly deceived A tree with a fine mass of fibrous surface roots of a healthy, vigorous color, and thin, small, rather than thick, broken main roots, is sure to grow and thrive with any sort of fair treatment, and in almost any soil; but without such fibrous roots, and having only two or three large mutilated horns or prongs, and a heavy stub for a tap root, which must from necessity have been broken and skinned in removal from the nursery row, the tree were better thrown on the brush heap than given space and trouble in the orchard. In view of the fact that most of our nurserymen work their trees upon seed ling root stock and leave them standing in the rows where first planted, it is easy to understand why so large a percent age fails to grow and thrive when removed to our gardens and orchards, and why in some cases, with the utmost care and attention, so many years of doubt and uncertainty must intervene before the fruit appears. In the deep fertile soil of the nursery, they send down long tap roots which, if left undisturbed, grow to the exclusion of anything in the shape of fibrous roots; and when the trees are finally removed for sale, this long tap root must of course be cut or broken off and it is thus somewhat miraculous if the tree lives at all.
To buy only small trees will not entirely obviate the diffi culty, although it is in every way ponr policy to purchase or plant very large trees of any kind. But in procuring small trees, it is very important to know various other attending conditions: whether they are small simply from a stunted condition of growth and general lack of constitutional vigor, or becuuse they are young, which of course is the only admissible condition. I have trees of three years which far surpass in vigor and size others of ten. I would certainly prefer even large trees, if vigorous, to small, stunted trees of like age. So it will be seen it is not safe to rely upon smal trees altogether. A better rule would be perhaps to buy young trees rather than small, if, indeed, the matter can be narrowed down to one short invariable rule, which I very much doubt. Show me the roots of a tree, and I'll tell you how it looks above ground. Look at the roots first, then the wood and bark; do not care about the size so much, and you need not inquire very particularly about the age after having made the examination indicated. All reliable nurserymen are well acquainted with these facts, and should not mislead their custumers in their catalogue classifications. The real, true quality of a fruit tree exists in its degree of vigor and thrift; and it is with reference to this, together with age that the various grades and prices should be arranged. Kingston, N. Y.
H. Hendricks.

## sTRAIGHTENING WROUGHT METAL PLATES.

As an example, let us take a plate, say 18 inches by 24, as in Fig. 10. The first thing to do is to ascertain where it is out of straight, which is done as follows: If it is a thin plate, say of 19 gauge, we rest one end of it on the block and sup with the right hand we exert a sudden pressure in the mid dle of the plate; and quickly releasing this pressure, we watch where its bending movement takes place. If it occurs most at the outer edges, it proves that the plate is contracted
in the middle; while, if the center of the plate moves the most, it demonstrates that it is expanded in the middle. And the same rule applies to any part of the plate. This way of testing may be implicitly relied upon for all plates or sheets thin enough to be sprung by hand pressure.
Another plan, applicable for either thick or thin plates, and used conjointly with the first named, is to stand the plate on edge with the light in front of us, but not overhead, as in Fig. 12; we then cast one eye along the face of the plate upon which the light falls, and any unevenness will be made plainly visible by the shadows upon the surface of the plate. The eye should also be cast along the edges to note any twist or locate any kinks. Perbaps our trial by these tests, employed either singly or in conjunction, demonstrates the plate to have the bulge in it, denoted in Figs. 10 and 11 by the inclosure within the line, A. This bulge is called a loose place; and if the plate is bent or springs back and forth a little, this spo will be found to move the most. The plate is, in fact, edge bound, as it might aptly be termed; and hence, to straighten it, we do not attempt to batter the bulge down by placing it, we do not attempt to batter the bulge down by placing side; but we place it on a small block and proceed to stretch the plate at and near the edges, and so remove the bulge or loose place without hammering it at all. The method of at tack is to first hammer the plate, letting the first series of

Fig. 10.

blows be delivered as denoted in Fig. 10 by the marks at $B$ and we then deliver the blows denoted by the marks at $C$ and at $D$ in the same figure. These blows will, if sufficien of them are delivered, remove the loose place. While giving these blows, the workman takes care to hold the plate so that his blows fall solid and do not "drum:" that is to ay, if the spot where the hammer falls does not rest upon the anvil, the effect of the plate is similar to that produced by adrumstick upon a drum, producing no result save to jar the fingers holding the plate. And this jar is frequently sufficiently great to cause severe pain and sometimes injury

to the fingers. In removing the loose place, we shall find in almost all cases, that we have induced contraction in the plate round about the spot marked D in Fig. 10; and this contraction we remove by a few blows, as denoted by the marks at D . In this operation, we have merely stretched the plate where it was necessary to release the loose place.


Let us now suppose that our testing had shown the plate to be twisted. We then carefully note which edge of the plate is the straightest, and which is the one that is bent, and then place our plate upon the anvil, as shown in Fig. 11a, in which that part of the plate on the left hand side of the diagonal line is supposed to be the one that is bent, the bend ly ing downwards (the edge, A, being the straightest). W then attack the plate, if a thick one with the long cross face hammer, and if a thin one with the twist hammer; and in either case we deliver the blows denoted by the marks, the action of the hammer being to lift the plate in front of it. The blows at and towards the edges are always delivered first, the hammering being carried towards the middle, and being also wider apart as the middle of the plate is aproached.
A plate is said to be contracted when the hand bending
process shows the edges to move the most; and in this case all that is necessary to remove the contraction is to strike the plate a few blows about the contracted part, as we did to remove the contraction at D in Fig. 10. The blows in this case, however, may fall perpendicularly, and be delivered (for fine work) with a broader faced hammer.
To remove a kink or crooked place at or near the edge of a plate, we proceed as shown in Fig. 12, laying the plate with the convex side of the kink resting upon the anvil (the shaded part, A, representing the kink), and delivering the blows denoted by the marks at B, in Fig. 12a. We next turn the plate upside down, and strike the blows denoted by the marks or dashes at C, Fig. 13; and the kink will be removed.


To straighten the plate shown in Fig. 9, we place it upon the anvil, as shown in Fig. 14, striking blows as denoted at A, and placing but a very small portion of the plate over the anvil t first; and as it is straightened, we pass it gradually further over the anvil, taking care that it is not, at any part of the process, placed so far over the anvil as to drum, which will always take place if the part of the plate struck does not bed, under the force of the blow, well upon the anvil.

Fig. $12 a$.


We have now explained all the principles involved in straightening wrought metal plates; and no matter in what shape a plate is bent, it can be straightened by the application of these rules, applied either singly or in combination. As a rule, they require to be used in combination: thus a plate may have a loose place and a kink, or a kink and a twist, and in these cases the operation to remove the one is

Fig.18.

performed conjointly wlth that necessary to remove the other, either being slightly modified to suit the other operation. The anvil, it will be seen, must be small enough to permit of the plate being attacked in individual spots or places; for the plate must always lie so that the part being struck is solid upon the anvil. In consequence of this requirement, the holding of the plate becomes an important element; for, with a good helper, the plate may be quickly and readily adjusted, thus saving much time and labor.

EXeg.14.


A rude system of straightening is sometimes performed by the aid of a trip hammer, the finishing process being performed on a large iron block. This plan is crude, however, and is more productive of hammer marks than it is of true work. Very thick plates, those too thick to be readily affected by the blows of a sledge hammer, are made red hot and straightened upon iron blocks larger than the plates. For this operation large wooden mallets with very long handles are sometimes used.
J. R.

Over 13,000 applications for space have already been filed by the authorities of the French Exposition next year; 7,800 are from the city of Paris alone.

## NEW ROTARY PUNP

We extract from the Revue Industrielle the annexed engraving of a new rotary pump, which is quite simple in construction, and which, our contemporary states, has successfully withstood quite severe tests.
Placed eccentrically in the cylinder is a drum, as shown in Fig. 2, to which are hinged three bronze pallets which close into recesses in the drum These, as the drum rotates, draw in the water through the ball valve in the suction pipe below. The drum shaf is mounted independently of the pulley shaft, Fig 1 so tat any strain on the latter hat any bill the latte by the belts, will not tend to hrow the pump mechanism out of line. The connection between the shafts consists simply of the end of the drum shaft entering a socke in the end of the pulley shaft.
The pallets may be easily removed without taking th drum from the cylinder. Th joints of the cover are packed by rubber packing, which fits in a groove made half in the cover and half in the cylinder.

Dyeing Raw Cotton
The following is considered the best and easiest way for dyeing raw cotton. Boil with 22 lbs. extract of logwood or 100 lbs , till it is all well or 100 lbs., tin it is all wel


## HOUYOUX'S ROTARY PUMP.

poil slowly with 10 la rystals; make run the liquor, take out, and keep over aight, or one or two days; then wash well. That is the best and fastest black, and stands well.

## $\triangle$ NEW PHYLLOXERA REMEDY-DECORTICATION.

It was recently announced in the French Academy of


Fig. 1.-SABATE'S DECORTICATING GLOVE.
grape vines is a valuable preventive of phylloxera ravages, and that the vines thus treated also soon showed very per ceptible signs of improvement in vegetation. M. Sabaté now ives, in La Nature, some positive facts regarding the efflcacy of this process, based on actual trials in his own vineyards. He states that a plot of about 20 acres had its vines (white 00 ) 0 ) grape, age 60 years) nearly destroyed in 1875. During the wint of $1875-6$, th vines were barked during the coldest weather. They have since become in a flourishing condition, and last autumn yielded an amount of grapes double that of the preceding year; and 48 acres of other vines (red grape, aged from 15 to 20 years) were similarly treated in February, March, and April. Since then they have not been attacked, and the old phylloxera points of lodgment have not enlarged while a far larger yield was obtained. In ceneral the veretation in both of inepar to at in adoining ones where decortication in practised. Although the ines in the latter were planted in fully as rich soil, and were identical in variety and in age, they are now as badly attacked as

The Cofiee Photographic Process.
A correspondent in Switzerland lately sent some examples of this process, which, by reason of their depth, vigor, and richness, were equal to the best wet-plate photographs; and now both M. Haakman, the President of the Photographic Society at Amsterdam, and M. Victor Angerer, a well known Viennese photographer, bear testimony to the efficacy of the process. M. Haakman says he has given some attention to dry plates, for, as he practises photography simply for pleasure, these are generally more convenient to use than wet films. He has tried, he tells us, tannin tea tohacco morphine and tea, substances in the preparation of his dry films; but none of these, to his thinking, afford such clean and satisfactory films as coffee.
M. Haakman prepares his plates in the simplest manner; and although we have several times published formulæ in regard to the production of coffee plates, our readers may like to know the precise plan followed by $M$. precise plan followed by M.
Haakman. His coffee solution is made up of: Boiling water, 6 cubic inches; pure Java coffee (burnt), 77 grains; white sugar, dissolved in a little water, 39 grains. This infusion, when cold, is poured twice over the sensitized collodion films, which are then lodion
dried.
and 5 lbs. soda |benefit that, by removing the bark, a large number of harm


Fig. 2.-SABATE'S DECORTICATING BOW.

## ful insects, which take refuge therein in winter, are at the

 same time destroyed.The modes of decorticating the vines are represented in the annexed illustrations. The workman wears a glove, Fig. 1, made'of mail or rings of galvanized iron. It weighs about 20 ozs., and with it a man can easily bark 500 large threebranched trunks per day. Fig. 1 shows how the bark is removed by rubbing the branch longitudinally. In order to reach crotchets and sharp angles, the bow, shown in Fig. 2 is used, the cord being a twisted line of galvanized iron wire.

## A Machine Switchman.

About as curious a railway signal as we have ever seen has recently been patented through the Scientific American Patent Agency by Mr. J. D. Hughson, of Prairie City, 111. This inventor believes that, where an engineer might fail to heed the indication of a semaphore or some other purely mechanical apparatus, he would be sure to notice the frantic gestures of a man posted beside the track. As men of flesh and blood cannot probably be found who would be willing to stand on a hige pedestal for indefinite periods of time and wave their arms .t exact intervals, a machine man has been contrived who flourishes a flag, hammers a bell, and displays a changeable light in his hat with unfailing regularity. The man owes his movements to clockwork operated by weights, and the latter are controlled by electricity. When a train passes, it moves a little stop beside the track, which, by a mechanical connection, shifts a switch so that the current from a main line of telegraph wire is diverted into a short circuit. An electro-magnet inside the machine man is thus excited; and as it attracts its armature, the latter releases a detent. The weights then descend, and the man waves his flag and pounds his bell, while the light on his hat changes to red. When the train has passed, the current is broken from the short circuit, but the man keeps on his motions until a wheel in his interior comp letes its revolution and thus allows the detents once more to engage. Of course the time during which he waves his flag, etc., is long enough to allow the train that has passed to travel a considerable distance.

We extract from La Nature the annexed engraving of a new and simple instrument for measuring great sea depths. It is the invention of Dr. H. Fol, and consists of a spherical lass reservoir filled with a liquid very slightly compressible -water, for instance, or, better still, ether. The only orifice to the vessel is a capillary tube whichcommunicates with a small eservoir above, which is filled with mercury The latter at with mercury. The latter, at ep water at the sea bottom, should ust stand at the level with the orifice in the pointed stopper inserted in the large reservoir. The upper surface of the mercury is exposed to contact with the sea water.
In using the device, it is simply lowered by a sounding line. The liquid within the large reservoir will be compressed as the apparatus descends, a given amount for each atmosphere of pressure, and a corresponding quantity of mercury will escape through the orifice and sink to the bottom of the large reservoir. This mercury on the apparatus, being hoisted, is accurately weighed, and its weight indicates exactly the pressure to which the device has been submitted. Thepressureknown, the depth of water is easily determined.

## Do not Allow the Frogs to be Pared.

The frog of the foot of every horse is the natural support of the foot, and should never be cut away except to remove the rough edges which occasionally appear from common wear. At a late meeting of the farriers and horseshoers in Wilmington, Del., there was a great deal said in condemna tion of the manner in which horses are shod, especially in the rural districts. A lecturer, a veterinary surgeon (accord ing to the New York Herald), said tha " the frog of the foot was often pared away so artistically to make a neat job that the tendon or muscle that extended down the leg, over what is known as the pulley bone, and gave the foot its mo tion, was often injured, and then the horse would be weak in the legs, and blunder He severely characterized the habit of burning the hoof with a red hot shoe to make it fit, and said there ought to be a law passed to hang any blacksmith who would use red hot shoes in this way. The shoe should be fitted to the shape of the foot, rather than the foot fitted to the shoe."

An electric battery, famous because it was once owned and operated by Benjamin Franklin and other distinguished philosophers, has been in use at Dartmouth College for years, and is now employed al most daily for class-room experiments.

## A PERSTAN DWRKLING.

There is little to be seen in modern Persia that tends to substantiate the tales of ancient travelers concerning the magnificence and wealth of the cities ruled by the Shah. Colossal ruins attest the grandeur of former days, but centuries of misgovernment have reduced a people naturally industrious and energetic to a mere horde, existing under scarcely more than the semblance of civilization. Persia, or rather her cities, might be termed the abode of shams; for deception reigns everywhere, from the huge paste diamonds of the Shah to the imposing pillars of dust and straw which decorate the wretchedly constructed buildings.
An excellent idea of the exterior of a Persian dwelling of the better class in Teheran is afforded by our engraving. The courtyard, and probably the most attractive portion of the structure, is represented; and the picture shows nothing of the intolerable filthy surroundings of even the finest private grounds. The materials of construction used are sundried bricks, which have little cohesion, and which before long render the walls in a very dilapidated state. The elaborate cornice and columns represented in the engraving are scarcely more stable than so much theatrical scenery, being merely of wood stuccoed over with mud. In some structures stone is used, and tiles are employed for decorative purposes; but this more substantial mode of building is conpurposes; but this more substantial mode of building is con-
fined to the houses of dignitaries, or to the bazaars or mosques. In the latter the relics of past magnificence are yet discernible, and one edifice is asserted to be roofed with plates of pure gold. In view of the acquisitive nature of Persian officials, and the unconcealed corruption which reigns in every department of the government, the statement that so much treasure is allowed to remain unappropriated to some one's private use is rather questionable. Persian architecture, however, is not without its importance; and as it involves the application of the singularly beautiful arabesques known the world over as Persian patterns, it presents suggestions to our designers and decorators, of which at the present time advantage is widely being taken. The arches shown in our engraving are by no means of the conventional pattern, and are exceedingly graceful; while there is a harmony of design between the general form of the building and its flat decoration which appeals strongly to correct taste. To perceive to what excellent use it is possible to turn the Persian arabesque and the closely analogous Moorish designs, the reader has only to examine the archiecture of some of the larger Jewish temples in this city. There-where, as a matter of course, the Gothic and other well known styles which, by custom, are almost wholly appropriated to Christian churches, would not be suitable-
architects have been compelled to seek other sources for architects have been compelled to seek other sources for
every variety of decoration; and the results are adaptations every variety of decoration; and the results are adaptations
of Oriental design, pleasing both intrinsically and because of
their non-conventionality. Workers in other branches of ar have likewise recently resorted, to an unusual degree, to Persian ornamentation, and some of the most exquisite productions in repoussé silver and niello work are based entirely upon Persian patterns.
Individual design apart, the aspect of groups of Persian houses is not inviting, but rather monotonous; and the eye finds its only relief in the courtyards or in the gardens, where trees are allowed to grow. The interiors of the dwellings, especially those of the richer classes, often, however, bespeak an unlooked-for degree of comfort: that is, if comfort can be had in any structure which is liable to fall down unless constantly repaired. The courtyard represented in the engraving is entirely inclosed by the dwelling, and is reached from the street by a narrow corridor. On two sides of i.t are simple blank walls; on the others are the fronts of two distinct buildings (one of which is represented), one belonging to the master of the house and the male portion of the household, the other to the harem. Each consists of a day. large saloon, separatedfrom the courtyard by glass windows, with two smaller apartments on the ground floor, and a balcony chamber above. The flat roofs are reached by an uncovered flight of steps, and are places of frequent resort in the warm season after nightfall. In winter the rooms are heated by jars of charred fuel, half buried in the floor. The houses of the richer classes in Teheran are seldom occupied during the summer, as, owing to its filthy condition, the city then becomes unhealthy. The monarch and aristocracy then betake themselves to tents on the neighboring plain of Sultanieh; while the rest of the population accept the ravages of pestilence with that fatalistic indifference peculiar to Oriental races.

## Some Astronomical Notes for March.

A writer in the New York Tribune says that March is in many respects an important month. The sun, which has all winter long been south, is now rapidly approaching the north, and will cross the equator at 7:16 (New York time) on the morning of March 20. This point is called the vernal or spring equinox. Many of our young readers know that there are two equinoxes in a year, the verbal equinox in March, the autumnal in September. A simple illustration will probably help them to understand better the meaning of the terms equinox and equinoctial points. Take two large hoops. Place one inside the other, and hold them horizontally. Now tilt the inner hoop a little, so that half of it is above and half below the other hoop, which remains horizontal. Let the latter represent the equator; then the tilted hoop will stand for the ecliptic round which the sun travels in a year. A glance at the two hoops will show that the ecliptic can only cross the equator at two points. These are
because when the sun is in these points the days and nights at all places are supposed to be equal. Not that they are exactly equal then, though they would be if the sun were only obliging enough to stay on the equator when it reached it. As a matter of fact, however, the sun's motion north or south when crossing the equator is more rapid than in any other part of his path, and so the days and nights are not quite equal at the equinoxes. Take the equinoxes this year as examples: At New York, on March 20, the sun rises at 3 minutes past $6 \mathrm{~A} . \mathrm{M}^{\prime}$., and sets at 12 minutes past 6 P.M., making the day 12 hours and 9 minutes long. Since the sun sets on the 20th at 6:12, and rises on the morning of the 21st t $6: 02$, the night of the 20 th is only 11 hours and 50 minutes long, or 19 minutes shorter than the day. Again, on Sepember 22, the sun rises at 5:48 A.M. and sets at 5:57 P.M., he day being 12 hours and 9 minutes long. But as the sun rises at 5:49 A.M. on the 23d, the night of the 22d is only 11 hours and 52 minutes long, or 17 minutes shorter than the day.

The place in which the sun crosses the equator in Spring is also known as the first point of Aries. Aries is the constellation of the Ram. But when on the 20th of March this year the sun crosses the equator, it will be in the constellation of The Fishes, almost in a direct line beneath the Alpherat and Algenib in the square of Pegasus. Why do astronomers call this place, then, the first point of Aries? Well, the two points in which the sun crosses the equator are not stationary, but are changing every year. The earth is like a big top spinning around on its axis at a great rate, and at the same time running around the sun along that tilted hoop called the ecliptic. But the top isn't quite steady; as the boys would say, it wobbles a little bit, and the effect of the wobbling is to make the equinoctial points go backward a trifle every year. This going backward-or from east to west-of these points on the equator is called the precession of the equinoxes. But some bright reader will say: "Precession means going before, and these equinoctial points go backward! Why not call it retrogression of the equinoxes?" Well, perhaps that would be a better title; but "precession" here means that the equinox of to-day "precedes" that of to-morrow; that of to-morrow "precedes" or is east of the place of the equinox the next day, and so on. This change of place is constantly going on, but so slowly that it only amounts to $50 \frac{1}{6}$ minutes of arc in a year-a quantity so smal that it will take nearly 26,000 years for these points to go entirely round the equator.
The man who first found out about this precession of the equinoxes did it a very long time ago. His name was Hipparchus. He was a disciple of the great school of Alexan, dria, and lived about 140 years before Christ. And he found it out in this way: Some 170 years before his time anothe astronomer named Timocharis had calculated the distance of


Spica, in the Virgin, from the sun at the time of the autumnal equinox. Hipparchus also measured this distance and nal equinox. He ipparchus also measured this distance and found it to be greater than Timocharis had made it. The
difference between the two measurements was too large to difference between the two measurements was too large to
lead him to suppose that Timocharis had made a mistake, and he was thus forced to the conclusion that the sun and Spica were really further apart than they were a hundred and seventy years before. And he found further that by dividing this difference by the number of years which had passed since the first measurement was made, the annual precession was 49 minutes-which was only a very little wrong. Now, in the days of Hipparchus the sun really was just entering the Ram at the spring equinox, which was then, therefore, the first point of Aries. In the 2,000 years since this point has gone westward nearly 28 degrees, which brings it into the constellation of The Fishes; but the old name has not been changed.
"Hipparchus was a very clever astronomer," says the writer. "It would take too much room to tell all about him, but I may mention one other good thing he did: he made a catalogue of the principal stars-the first of its kind-and calculated their positions. This passed three hundred years later into the hands of another old astronomer named Ptolemy, who made a better catalogue, which has been very valuable in enabling modern astronomers to find out the changes which have taken place in the apparent places of the stars during the past two thousand years."
The first point of Aries is important, because it is the point from which the right ascensions of all the heavenly bodies are reckoned. To mark places on the earth we speak of their longitude and latitude. The position of a star is expressed by its right ascension and declination. Declination means distance north or south of the equator. Right ascension is the distance from the first point of Aries measured on the equator, alwáys to the east, and is usually stated in time, one hour being equal to 15 degrees of arc. In consequence of this going backward of the equinoxes, the right ascensions of all the stars are constantly increasing, and will of course go on increasing till the first point gets back to Aries, or right ascensions are reckoned from a fixed point.
Orion is still the most conspicuous constellation, and may be found in the southwest soon after dark, with Sirius in the Great Dog nearly south. Other prominent stars visible on fine evenings are Mirfak in Perseus, Alcyone in the Procyon in the Little Dog, Castor and Pollux in the Twins, Regulus in the Lion, Arcturus in the Hunter, and Spica in the Virgin. The moon is in conjunction with Jupiter and Mars on the 7th, and will occult one or two of the smaller Mars on the 7th, and will occult one or two of the smaller
stars in the Pleiades a little after 9 o'clock (Washington stars in the Pleiades a little af
time) on the evening of the 19th.

## [For the Scientific American.] <br> NEW SPECTROSCOPE FOR DIRECT VISION.

## by professor A. ricco.

This instrument consists of the following parts: $\mathbf{A}$ is a collimator, in which the distance of the slot for the admission of light to the achromatic lens is equal to the focal distance of the latter. C is a prism of dispersive flint glass, which decomposes the light of the beam made parallel by the colli-

mator. $D$ is a prism for total reflection, which sends the decomposed light into the telescope, B, parallel to the collimator, A. If the field of view of the telescope will not hold the whole of the spectrum, the prism, $D$, is made to turn about an axis passing through the middle of the hypothenuse of its base by means of an external lever. By this means the different parts of the spectrum will be successively reflected into the telescope.
On account of its simplicity, this spectroscope is very easily constructed; and by reason of the shortness of the path which the light passes over in the glass, the loss of light is less than that which takes place in a five-prism Amici spectroscope for direct vision.
Modena, Italy.

## Metallotherapy-Another Deception.

When the blue glass believers become tired of their hobby, as many of them doubtless already have of mesmerism and 'movement," " grape," "will," and other "cures," which from time to time have furnished sensations for the gullible or held out vain hope to the afficted, they will find a new field for their credulity in the metal cure lately invented in France, and which, according to one of our best French contemporaries, is working miracles. Here are some examples: A young woman was totally paralyzed over her right side. Her body was utterly devoid of feeling; and a sharp needle thrust in her body attracted no notice. Dr. Burg simply gave her a cylinder of gold to hold in the hand, she being blindfolded. In fifteen minutes, she felt a pin prick, she being blindfolded. In fifteen minutes, she felt a pin prick, then recognized the touch of a plurality of objects, and re-
gained perfect sensibility. Another patient had her left side gained perfect sensibility. Another patient had her left side
paralyzed. This called for a copper cylinder, whereupon paralyzed. This called for a copper cylinder, whereupon
she too was cured. Then a venerable lady, whose jaw was in a similar unfortunate condition, was cured by a lump of iron under her tongue and a bandage of iron plates on her
head. It should be observed that interchanging metals upon these people did not produce good results. Their "systems" required the metals named, and no others.
Cause, of course, electricity, it being the fashion to use that much-misused word to explain anything which is no readily comprehended, from blue glass radiations to love "Electric homœopathy" our contemporary calls this latest deception, while devoting several columns to its grave consideration.

## The Obnoxious Franking Privilege Again.

The Sundry Civil Appropriation bill, which was hurried through Congress during the closing hours of the late session, has been made the means of putting through a measure tacked on as an amendment, which is meeting with the wholesale reprobation that it deserves. It is a resurrection of about the worst feature in the hitherto defunct franking of about the worst feature in the hitherto defunct franking
privilege-namely, that of allowing members of Congress to privilege-namely, that of allowing members of Congress to
send public documents free through the mails. Luckily the period fixed by law wherein the postal service of the country can thus be turned into an express agency for Congressmen expires on January 1 next; so that, even if the measure be not repealed before that date, public opinion concerning it is sufficiently strong to prevent its subsequent renewal.

- We have frequently pointed out how great an imposition on the 'government any such privilege as this is. The mere sending of Congressmen's letters is in itself no particular burden to the mails; but when it comes to forwarding tons of electioneering documents already printed, and now distributed at the cost of the people, or private packages, or even washclothes (as used to be the case), and the brunt of all to be borne by a service already working under a deficit, the practice degenerates into an abuse, and there is no reason for its existence. Now, we suppose, the average member will flood his constituents with Patent Office reports and copies of his speeches in lavish profusion, and in marked contrast to his careful distribution of such favors when he had to pay the postage. Government presses will accordingly be kept running, and the people will lose, not only the member's small contribution to post office expenses, but will pay for the production and transportation of some thousands more useless books, which will follow their usual short circuit from the press to the paper maker.
And that is not all; pension agents, land agents, patent agents, and others doing business in Washington, will probably avail themselves of some friendly member's stamp or signature in mailing broadcast their circulars, etc. This was done before, and human nature has not changed.


## Blue Glass in a Nut Shell.

General Pleasonton's blue glass theory is assailed by the Scientific American. Hisidea that electricity is generated by the passage of light through the glass is declared to be absurd. Nor have colored rays any beneficial effect on life, the reverse rather being the truth, as a pure, white light is best. The only good that can possibly come of blue glass is
in its use as a shade for decreasing the intensity of solar in its use as a shade for decreasing the intensity of solar light.-New York Sun.

## PUBLISHERS' NOTICE.

New subscriptions to the Scientific American and the Scientific American Supplement will, for the present, be entered upon our books to commence with the year, and the back numbers will be sent to each new subscriber unless the back numbers will be sent to each new subscriber
a request to the contrary accompanies the order.
Instead of a notice being printed on the wrapper, announcing that a subscription is about to end, the time of expiration is now denoted in the printed address each week.

In the article on the oleo-margarin industry in our last issue, the statement that " mixed fat of all kinds" is used should read "mixed beef fat"-this being the only variety mployed at the factory described.

Inventions Patented in England by Americans.
From February 3 to February 19, 1877, inclusive.
Artillery Game-W. Rose, New York city.
Cigar-making Machine.-J. S. Winsor, Providence, R. I
CUTTING PIPES, ETC.-A. C. Wood, Syracuse, N. Y.
DRESSING MILLSTONES.- $\mathbf{W}$. Griscom, Pottsville, Pa.
FIRE ARM, ETC.-E. T. Starr, New York city.
Friction Coupling, etc--A. K. Rider, Walton, N. Y GAS STOVE, ETC.-EE. B. Cox, Brooklyn, N. Y.
Lock STITCH SEWING MACHINE.-C. F. Hollis, Boston, Mase. MAKING SAWs, ETC.-G. F. Simonds, Fitchburg, Mass. Paddle Wheel.-W. C. Thompson, Tipton, Tenn. PAPER Pulp box, ETC.--s. Wheeler et al., Albany, N. Y.
Paring Apples, ETc.-G. Bergner, Washington, Mo. PARING APPLES, ETC.-G. Bergner, Washington, Mo.
REFRIGERATOR, ETC.-C. . Riker et al., New York city.
ROTARY ENGINE.J. C. Thomas, Carliniville, IIl. Rotary Engine.School SLATE, ETC.-J. W. Hyatt et all, Newark, N. J. ShUTrLe.-W. Beatty et al., Gray, Me
SPINNIING FrAME.-G. D. Draper et al., Hopedale, Mass.
YARN-WINDING REGULATOR.-S. Jackson, Lawrence, Mass.

## zecent 2 merican amd forcign zatents.

NEW WOODWORKNNG AND HOUSE AND CARRIAGE
BUINDING INVENTIONS.
mproved vehtcle gearing.
David G. Wyeth, New Way, O.-The object of this invention is to pro vide a vehicle gearing in which a reach, fifth wheel, and ordinary form of
bolster are dispensed with. The springs are coupled in pairs, and arranged in a triangular relation to the rear axle. The rear clips and front bearings of the springs are also constructed in a peculiar manner. For particulars,

IMPROVED MACHINE FOR JOINTING STAVES
Edmund W. Gillman, Long Island City, N. Y.-In this device two rotary each disk being provided with knives arranged tangential to a circle of mall diameter described from the center of the disk. A casing surround each disk, which is connected with an exhaust fan for removing the shav ings. Adjustable guide plates are attached to the side of the casing fo supporting the stave, and there is a pivoted frame for carrying the stav centering and clamping apparatus. The machine includes a device fo an adjusting device, by means of which the ends of the staves may be narrowed more proportionately in wide staves than in narrower ones and means for inc
proper bevel.

IMPROVED FLOOR CLAMP.
William H. Tarrant, Eau Claire, Wis.-This clampmay be used for layin single or double flooring. It consists of an eccentric cam and lever that operate jointly a sliding bar for pushing the flooring board and spring acted and serrated cam levers that bind on the joists for securing the clam rame rigidly in position during work.

IMPROVED SNOW GUARD FOR ROOFS.
George F. Folsom, Boston Highlands, Mass.-This consists of a wire ent at right angles at one end and sharpened, so as to be readily drive and formed into a loop of peculiar shape, which projects upward from the roof, and is provided with a tongue which is capable of retaining a plate of metal, which will retain the snow until it melts, thereby preventing the sliding of large quantities of snow in a mass from the roof.

IMPROVED GANG SAW MILL.
Dudley J. Marston, Amesbury, Mass.-This relates to that class of gang saw mills that employ a series of vertically reciprocating saws for cutting number of boards simultaneously from a log. The advantages claimed are exerted equally from above and below. The gates, having oppositely a ranged cranks, counterbalance each other, so that jarring is avoided, and the speed may be increased, and the strain on the frame being lessened, $i$ may be made lighter than the frames of ordinary mills.

IMPROVED MACHINE FOR JOINTING STAVES.
Joseph S. Milton, Bardstown, Ky.-This consists of a swinging stavesupporting or bed frame, with ratchet shaped guides, operated by a hand prsesed against curved adjustable seats and held in bulgedshape by a cam lever and spring ratchet, for being jointed by a plane guided along the table of the machine.

## NEW TEXTITE INVENTION.

softening and cleansing animal and vegetable fibre. William Maynard, New York city.-This invention relates to the use o detergents previous to bleaching, by which cotton, silk, wool, and grasse out boiling and with greater ceonomy of time, labor, and materials. Th process consists in the uee of sulphuric acid, hydrated, mixed with a centralizing proportion of an alkali, but principally sal soda, which mixture is used instead of a solution of the crystallized sulphite salt, and possesse peculiar advantages over the use of the latter in that it obviates the time labor, and expense of crystallization, is much more effective in its actions does not injuriously affect the fiber, and is not subject to the deterioration oxidize and pass into the sulphates.

## NEW MISCELLANEOUS INVENTIONS.

preventing accumulation of carbon in retorts. Watson Karr, Frostburg, Md.-The process consists in using a small in the retort. The hydrogen gas produced from the semi-bituminous coal combines with the carbon from the bituminous coal which would otherwis be deposited upon the roof of the retort. The process saves the labor an time required for removing the carbonformations from the retort in th usual way, and likewise avoids the consequent injury to the retort itself, that its durability is greatly increased.

IMPROVED bALE bAND TIGHTENER.
John L. Sheppard, Charleston, S. C.-The object of this invention is to
provide an improved device or apparatus for bringing together the ends of provide an improved device or apparatus for bringing together the ends of cotton bale bands and taking up the slack while the bales are in the pross. The same consists in vertical sliding bars, attracted respectively to the
front side of the platen and bed of the press, and provided with slots, or front side of the platen and bed of the press, and provided with slots, or
otherwise so constructed as to enable them to clutch the ends of the band, so that when they are slided towards each other the band will be tightened and the slack taken up.

## MPROVED STOCKING SUPPORTER.

E. Louise Demorest and Thomas W. G. Cook, New York city, assignors to $W$. Jennings Demorest, of same place.-This consists in the combinaclips, and a combined clasp pin and buckle that receives the elastic strap which is double. The clasp pins at the lower ends of the elastic strap are fastened into the stocking, and the clasp pin that is attached to the buckle is fastened to the under garments.

IMPROVED TOY WHIRLIGIG.
Charles E. Steller, Milwaukee, Wis.-This toy is so constructed as Chive a rapid rotary motion, first in one direction and then in tie co s. to give a rapiaroury the revolving table or disk
objects placed upon
represent various beautiful and fanciful forms.

Improved veterinary surgical insti:ument.
Lewis Woods Hamilton, Pendleton,Oregon.-This instrument is
adapted for use in castrating animals. It consists of nippers
shaped jaws, and cutting blades which are formed on the $\sigma r$ ac enci of the same levers. Said levers are pivoted together intrri cer a.r if the nip
pers and shears, and the shanks $i$ ite latter loop and gaard.

IMPROVED SAFETY GJ..RD OR JOCLE , A FOR HARNESS.
Fayette W. Knapp anu' Chr' $\quad$ pher Schsinnorn, Fiddletown, Cal.-This consist: in a peculiar constr sion - :ac cockeye which connects the trace with the single-tree. The cye r...ch embraces the single-tree is swiveled to the yoke, which is actached $t r i \cdot u$ trace, and is provided with a spring
actuatcd follower, between $\cdot$ an $c ;$ and the end of the eye the hook which actuatcd follower. between $\cdot a c .3$ and the end of the eye the hook which
is upon the end of tae singlo-tree is embraced. The invention was deis upon the end of tae singlo-tree is em
scribed and illustrated on $\bar{\eta} .18$, rol. 36 .

## IMPROVED FLY BRUSH

Daniel H. Mowen, Greencastle, Pa.-This consists in the arrangement of a vertical shaft carrying a horizontal brush arm, a lever for moving the same, and a clamp for attaching it to a table or chair. The said shaft is
provided with a sprins: for returning it to its normal nosition after it is provided with a sprinf: Tor returning it to is normal ovite on after
moved by the leve:. There is also a new adjusting device, by which the brush arm may be readily adjusted to any height on the vertical shaft, and by which the saic arm may be made to project more or less from the vertical shaft.

## Improved gas torch

Albert R. Weiss, Brooklyn, N. Y.-This consists of a gas-lighting torch worked by a fulminate ribbon, whose pellets are fed and ignited by a suitale mechanism. The latter consists of a sliding sectional piston rod, by a spring of the feeding device.

IMPROVED RELN SUPPORT.
Joseph L. Ryder, Islesborough, Me.-This device is made of a single piece of metal bent to form a central guide piece, eyes, and guard tongues. It prevents the

IMPROVED MIDDLINGS SEPARATOR.
Peter Muller, St. Charles, Mo.-This consists in suspending the frame of a middlings puriffer by straps, and providing it with a cam wheel, pawl, shart, and springs, arranged
improved electric lighting apparatus for hamps. Prof. William H. Zimmerman, Chestertown, Md.-This is a novel construction of self-lighting lamp, based upon the general principle of the in which the battery current heats a platinum wire red hot to ignite the jet of hydrogen, the flame of which latter impinges against and ignites the wick of the lamp. The invention consists, mainly, in locating the gas wick of the lamp. The invention consists, mainly, in locating the gas
generator and the battery in twin supporting sockets attached to the brachial slide carrying the lamp, and in rendering the various vessels to be flled capable of independent support in upright position while being filled;
in addition to which, the invention further consists in novel means for in addition to which, the invention further consists in novel means for simultaneously bringing into operation both the gas generating apparatus
and the battery, and instantly effecting the generation of gas, the flow of the electric current, and the lighting of the lamp. The self-lighting devices may be applied with slight modifications to all forms of lamps as well as may be applied

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSESHOE MACHINE
John W. Chewning, Jr., Shadwell Depot, Va.-The present invention is an improvement upon that for which letters patent of the United States were granted to the same party August 26, 1876 (No. 181,641). The improveent relates to the construction of the contact surfaces of the swaging die cating the swaging die.
improved chain propeller for vessels.
William B. Whiting, Milwaukee, Wis.-This invention is an improve-
ment in that class of chain propellers in which the boat is bisected by a ment in that class of chain propellers in which the boat is bisected by a novelty consists partly in the improved construction of the propeller, deigned with a view to strength and smoothness of operation; and also in necting the two portions chain propeller about an inclined con of the central channel, which compartment, rises toward the stern so as to secure the double result of facilitating the return of the paddles to the forward end of the boat upon the inclined deck railway, as weil as the withdrawalof the paddles vertically from the water, which obviates the carrying of "dead improved quilting attachment for sewing machines. John Douglass, Millport, Mo.-The quilting frame is attached to and pendant from a traveling carriage, which is supported upon an extensible horizontal beam or frame, in such manner as adapts it to be used in connection with a sewing machine. The quilting frame is moved back and orth to carry the quilt under the needle and return, and may be hung up
out of the way when not required for use. The beam on which the carout of the way when not required for use. The beam
riage rons may be easily taken down when required.
improved apparatus for converting motion. Peter Gregersen, Wauzeka, Wis.-This is an apparatusfor converting reciprocating motion to contiuous rotary motion; and it consists in the combination of movable racks with a sliding frame that is attached to the pis-
ton rod of an engine. The device also consists in a mutiated pinion that meshes with the movable racks, and is provided with a double cam, by which the motion of the shaft rotated by the said racks is reversed.
improved machine for shearing sheet metal. George Summers, Niles, 0 .-Threaded rods are provided upon which the means of bolts, and project therefrom at right angles. Gu:de plates are means of bolts, and project therefrom at right angles. Gu.de plates are
fitted loosely to the rods, and are held in piace by means of nuts. Several sets of guide plates may be provided, that increase in height as they are sets of guide plates may be provided, that increase in height as they are
placed farther from the blade of the shears, so that a number of widths may be cut without readjusting the gago.
improved earth auger.
James McCullough, Pensacola, Fla.-By turning the center shaft in one direclion, the auger is opened for work, taking in the sand, earth, and
water, and retaining the same, by turning the shaft in opposite direction and closing the openings of the auger by a valve. The auger is then raised for being emptied, the center shaft being attached to the auger, to prevent displacement of the valve in vertical direction by a collar, keyed to the shaft below the yoke

IMPROVED EARTH AUGER.
Edward Cox and Henry Cox, East St. Louis, Ill.-This consists of a box auger attached, by a yoke, to a vertical shaft, at the upper end of which another yoke is attached that is made to revoive by bevel gearing. The pinion that travels upon a series of cogs formed at the edge of the circular openings in which the yoke is suspended. An endless chain, carrying buckets, passes over a pulley on the horizontal shaft and around a pulley in the yoke that supports the auger. The whole is supported by a derrick, which is provided with a windlass for raising and lowering.

IMPROVED COTTON CLEANER.
James A. Bowers and Milton Adar, Princeton, Ark.-This consists of a ers, combined with a feeding and discharging case in which the cotto feeds from a hopper at the top and escapes at the side, while the dirt and trash which are beaten out of the cotton by the beater cylinder and ribbed concave fall through the spaces and escaps.

IMPROVED WATER ELEVATOR.
John F. Long, Bridgewater, Va.-This consists in the arrangement of
two pulleys, one placed in a curb over a well, and the other at the bottom of the well, over which runs an endless belt carrying buckets that dip up water and deliver it to the spout in the curb.

## IMPROVED WATER ELEVATOR.

Thomas J. Reid, Lexington, Ind., assignor to himself and John Malick, of same place.-This relates to that class of elevators that employ a windlass and bucket for raising water. The windlass has two drums, of differ-
ent diameter, journaled in the upper portion of the curb. Upon the larger drum a rope is wound, by which the bucket is raised or lowered, and upon the smaller drum a strap is wound in a contrary direction, which is at-
tached to a curved lever, by which the elevator is operated. There is also an arrangement of wire guides for the buckets, that extend from the top to
the bottom of the well. A slide runs upon the said wires, to which the bucket is hinged, and a catc
is emptied from the bucket.

## IMPROVED steam gage.

Frederick H. McIntosh, Atlantic, Iowa.-This invention consists of a steam gage, whose pressure-indicating spring rod is guided in a screw cating the correct pressure. A link is screwed on to the threaded end of the pressure rod to apply the scales to the gage.

IMPROVED WATER WHEEL.
Elisha B. Shattuck and Isaac Stahlman, Mount Pleasant, Mich.-In this Elisha B. Shattuck and Isaac Stahlman, Mount Pleasant, Mich.--In this
device it is claimed that increased power is obtained, the water freely discharged, and a larger percentage of the water power utilized. The inven tion consists of a double wheel, in which the buckets of the upper whee connect with an inner tube and spiral buckets around the shaft, while the
lower wheel connects with an outer cylinder or tube. The wheel is conlower wheel connects with an outer cylinder or tube. The wheel is con-
caved or dishing, and provided with vent holes at the top to accelerate the caved or dishing, and $p$
discharge of the water.

## IMPROVED PILE DRIVER.

John Gregg, Riverton, Iowa, assignor to himself and James Miller, of same place.- When this device is used as a pile driver, guy-ropes are fixed in eyes attached to the ends of the bolt, on which the pulley sheave works,
and the derrick is inclined, so that its top is directly over the place when the pile is to be driven. A clamp is then loosened, and guides are allowed to swing into a vertical position, where they are secured by the clamp en gaging braces. The weight is raised by turning the windlass by means of a lever, a rope being attached to it, and running over the sheave, and at hed to the hammer moving in the guides,

IMPROVED METHOD OF PROPELLING BOATS.
Albert Belz, Appleton, Wis.-The paddle wheel shaft is provided with dinary paddle wheels. A spur wheel, which is keyed to the shaft and takes its power from a similar wheel, which is fixed upon the shaft.
Cranks are placed on opposite ends of the shaft, and are worked by hand levers. The whole apparatus may be easily detached from the boat whe desired.
improved balanced valve for steam engine.
William Jackson, Millerstown, Pa.-This consists of a valve the back of
which is beveled, and whose central or exhaust space extends to the rea which is beveled, and whose central or exhaust space extends to the rear
in a beveled cover placed at the back of the valve, between which and the in a beveled cover placed at the back of the valve, between which and the all of the the valve moves. The whole is inclosed in the stram chcst, and that the valve is balanced, and little power is required to move it.
mpROVED ROTARY ENGINE.
John C. Thomas, Carlinville, Il.-The wheel or disk within the casing has deep transverse grooves in which radial pistons work, the rods of which pass through stuffing boxes in the wheel. The rods are attached to hollow boxes in which are springs which act upon bars. Said bars pass
through slots in the boxes and through slots in the radial bars or spokes of the wheel and connect

IMPROVED HEMMER FOR SEWING MACHINE.
Charles L. Goethals, Los Angeles, Cal.-This is an improved adjustable emmer for sewing machines, by which folds of different widths may be started. The the .abric fed negular manner to the needie after bein that folds and feeds the fabric to the needle, and a pivoted guide piece that regulates the folding of the fabric.

IMPROVED PUMP
Swan Petersen, Knoxville, III.-The lower and the upper pump stock are coupled together by a tube joint. A rim extends around the tube inter
mediately between the ends of the pump stocks, which are tightly seate against the rim by packing rims. The strong and rigid connection of the pump stocks is obtained by projecting metallic lugs, secured by bands ex punding around the ends of the pump stocks. The lower pump stock is
secured to the walls of the well by a brace, which is rigidy wedged in secured to the walls of the well by a brace, which is rigidly wedged in
place. The convenience of releasing the brace and taking out the lower place. The convenience of releasing the brace and taking out the lower
pump stock for repairs, as well as the reliable and effective working of the pump when properly coupled at the tube joint, furnishes a pump of sub stantial, durable, and convenient construction.

IMPROVED ROTARY ENGINE.
Hodgen I. Willson, Harrisville, Tex., assignor to himself and L. J. Rus sell, of same place.-The operation of this rotary cngine is as follows Steam passes through a passage in a rocking valve on the upper side of the
cylinder, and through one or two passages in said cylinder into the steam cylinder, and through one or two passages in said cylinder into the steam
chest; thence through a port in a side valve, and through a passage in a guide, and into the cylinder by way of a passage in the abutment. When the piston has moved through a half revolution, a cam quickly shifts the rocking valve, so that steam is admitted to the other of the two passages. The steam actsupon the piston, shifting the abutment, and admitting stea to the cylinder, forcing the piston through the remainder of the stroke. While this takes

IMPROVED WATER WHEEL
Nelson L. Greene, Edmeston, N. Y.-By new devices in this wheel, a
body of water of varying cross section may be thrown without obstruction or diminution of power on the wheei. The escape of water at the top of the casing is also prevented, and a full utilization of the reaction of the water at the lower part of the wheel is claimed to be obtained.

IMPROVED TRUSS BRIDGE
Lyman W. Densmore, St. Joseph, Mo.-The principal novel features of their ends extended past each other and through the girders or coupling , and fastening them upon the opposite sides of said girders or couplings by means of nuts; the chord rods being increased in number toward the cen-
ter, but always arranged about a common center of tension; and secondly, the fastening of one of the tension rods in each panel, whose strut carrie a cumulative horizontal thrust to an independent angle block carryin said strut; and thirdly, the particular arrangement of a de'achable girde beneath the couplings.

## NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN HARVESTER.
James Plenkharp, Columbus, 0 .-The corn stalks are severed close to armed shaft, and a vibrating carrier provided with hooks of a rotating The platform is made in two parts, of elliptical form, each of which turns horizontally, and tilts to discharge the "shock " upon the ground.
platform is tilted by a suitable device under the control of the driver.
improved seed planter.
James $\mathbf{H}$. Sale, Boydsville, Ky .-This invention belongs to that class of seed planters in which a given quantity of seed are lifted from the hopper by means of a pivoted reciprocating seed cup, and are dumped into a pipe or
chuteleading to the furrow. The improvements consist, mainly, in the particular construction and arrangement of the feed bars, hollowed out at the upper ends to form seed cups, which bars are pivoted below to the crank tom of the seed box, in which openings they loosely slide and about which point the feed bars also oscillate as a fulcrum from the revolution of the
cranks carrying the bars below, so that the upper ends of the bars, pro vided with the feed cups, have a compound motion which causes them alter nately to rise and move forward to dump the seed, a
the center of the box and descend to be filled again.

ImPROVED RECIPROCATING CHURN
John Henry Sheffer, Cairo, Ky.-This relates to gearing for converting
the rotary motion of a hand crank into the reciprocating motion required for driving the dasher. It consists in a crank disk that is motan require shaft that is journaled in a standard attached to the churn cover, and driven by spur gearing turned by hand power. There is also a slotted
cross head that is driven by the crank, and is connected with a jointed cross head th
dasher rod.

## IMPROVED HARROW

Charles Keehner, Roseville Junition, Cal.-The new feature here is harrow section formed of converging rods connected by cross rods, th other rods having their nearer ends hooked, and the inner having thei
farther ends hooked. The middle rod is provided with a hook at one an eye at the other end, so that by alternately reversing the sections they may be connected at the sides as well as in alignment.

IMPROVED CORN PLANTER.
August. J. Hintz, Lemont, III.-In using this planter, the jaws are thrust to the soil up to a stop attached to a stationary jaw. The upper end o we planter is then carried forward. which swings the stationary jaw back
ward, allowing the seed to drop into the soil, and, at the same time, loose ing the soil, so that it will fall into the hole formed by the jaws as the sam are withdrawn. As the jaws are withdrawn from the soil a spring close the said jaws, ready to be again thrust into the soil, and, at the same time draws forward an arm, bringing the dropping hole within the body, to b again filled with seed.

IMPROVED CORN PLANTER.
Jesse G. Stokesbary and John H. Stokesbary, Millersburg, Iowa.-This corn planter is so constructed as to drop the seed automatically as the
machine is drawn forward. It is easily controlled, and enables the hills to planted in accurate check row.

IMPROVED HAY GATHERER.
Harlin Butner and James J. Ray, Clarence, Mo.-This is a rake for collecting the hay and drawing it to the stack. It is so constructed that the weight of the load will raise the points of the teeth frum the ground, so load when desired.

IMPROVED SHOVEL PLOW
Thomas H. C. Dow, Tampico, Ill.-Thisimplement is so constructed tha it may be adjusted for use as an ordinary shovel plow, or turned towar either side to form a right or left hand plow, as the particular work to b one may require.
improved cotton planter and fertilizer distributer. Joseph A. Shine, Mount Olive, N. C.-This machine is so constructed a
to open a furrow, distribute cotton seed and guano into it, and cover the to open a furrow, distribute cotton seed and guano into it, and cover the
seed. It includes a new construction of the hopper and attached seed. It includes a new construction of the hopper and attache mechanism.

IMPROVED FARM FENCE
Charles Cremer, Red Bluff, Cal.-This fence is made without posts 0 nails, and is so constructed that it may be used as a stock fence, as a pro-
tector for young hedges, and as a sheep shed. It is not liable to be pushe or blown over. To the notched outer edges of the supporters the sid or bards are attached. Said boards are beveled at their ends to overlap eac other edgewise in said notches, and are secured to each other and to said supporters by wires.

## NEW HOUSEHOLD INVENTIONS.

## IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.-It consists of a chair having the rear legs an ack made in one piece with a seat hinged to the same at the rear and fre to fold upwarily at its front; in connection with which elements ar arranged a set of front legs with tenons at their upper ends which ente mortises in the chair seat, the said front legs being connected with th part of the seat, and the back of the chair, and provided with an upwardly folding toggle joint whereby the parts of the chair may be folded com pactly, and in such manner as to stand alone upon its four legs.

IMPROVED FRUIT JAR.
Adam Dicker, Middletown, O-This is a fruit jar composed of black opaque glass, which excludes light from its interior. It combines all of
the advantages of transparent glass, metal, and earthenware, with none of their disadvantages-i.e., it prevents the fading and deleterious cffect of light upon the fruit incident to transparent jars, obviates the corrosiv action and metallic taste produced by the acids of the fruit upon meta cans, is free from the clumsiness of earthenware jars, and the objection ble action of the acids upon the glaze on the one hand, or the difficulty o removing the germs of ferment on the other when left porous.

IMPROVED BUTTER DIBH.
Westel E. Hawkins, Wallingford, Conn., assignor to Simpson, Hall, Mil er \& Co., of same place.-In this butter dish the cover of metal is made i lwo parts, pivoted at their angles to the opposite sides of the body of sai dish, so that they may be turned down upon the outside of said body Segmental gear wheels at the angles of the parts of the cover cause said
parts to move together upon their pivots. Suitable devices are provided for fastening thecover in desired position.

## IMPROVED BLANKET

Nathaniel Wickliffe, Waterproof, La.-This consists of a couple of ligh lankets of wool with a lining between or outside of them of paper, laid o ing by the handling of the blankets. The paper and the cloth layers are suitably fastened together detachably by buttons, to take them apart to re move the paper for washing the cloth. The paper, being of such close text ure as to prevent the passage or air, makes the blanket much warmer for given weight of material.

IMPROVED WASHBOARD.
Westly Todd, Wauseon, $\mathbf{O}$., assignor to himself and H. H. Williams, of same place.-The object here is to improve the construction of the wash board for whichlecter and more durable without increasing the 18,1876 so as make it stronger and more durable without increasing the costo formed along the side edges of the zinc facing, between orwithin themai corrugations.
improved rocking chair.
William Shaub, Nashville, Tenn.-This consists of a rocking swing, made of round rockers secured centrally to the posts of the seats, and he ends to the extended foot and seat rests. The seal rests are braced by le from place to place.

IMPROVED WASHING MACHINE.
John W. Modlin, Albion, Iowa, assignor to himself and Simon C. Gilles e, of same place.-By means of a lever, a corrugated rubber is caused to ork over a concave bed of rollers. By suitable construction the rubbe
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Hyatt \& Co.'s Varnishes and Japans, as to price, color purity, and durability, are cheap by comparison than any others extant. 246 Grand st., N. Y. Factory, New
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Chester Steel Castings Co. make castings twice a strong as malleable iron castings, at aboy
price. See their advertisement on page 189 .
Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey \& Co., Seneca The Zero Refrigerator was awarded a grand Centen-
nial medal. Send for book. Lesley, 226 w. 23 st St., N. Y nial medal. Send for book. Lesley, 226 W. 23d St., N. Y
See Boult's Paneling, Moulding, and Dovetailing Ma chine at Centennial, B. 855. Send for pamphlet and
sample of work. B. C. Mach'y Co., Battle Creek, Mich

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H. B., Jr., will find a good recipe for aquarium cement on p. 202, vol. 28.-C. R. is informed
that the apparent spontaneous cracking of glass tumblers is by no means an uncommon occurrence.-P. B. B. will find directions for brazing band saws on p. 194, vol. 31.-
C. H. B. willfind directions for removing inkstains from clothing on p. 410, vol. 32. For polishing castings, se p. 57, vol. 34.-F. B. S. does not send data enough as to
his engine. He will find a formula for ascertaining the the dimensions of a, vol. 33. For a rule for calculating N. will find a recipe for prepared glue on p. 43, vol. 32 For a recipe for mucilage, see p. 27, vol. 34.-R. P. C. is informed that the only non-conductor of magnetism is a sufficient interval of space.-E. G. will find an explanation of horse power on p. 33, vol. 33.-A. J. will find
something on tempering chisels, etc. something on tempering chisels, etc., on p. 220, vol. 31.

- H. L. H. should address a pump manufacturer.-H. H. will find directions for making shoe polish on $p$. 107, vol 36. To season timber of all kinds, follow the direction power of coal gas on $p$. 65 , vol. $32 .-$ C. H. B. will find $d$ rections for removing inkstains on p. 410, vol. 32. Brass castings can be polished by following the directions on
p. 57 , vol. 34 . Steel can be etched by the p. 57 , vol. 34. Steel can be etched by the process de-
scribed on p. 250, vol. 2r.-F. J. S. should send un a will find a description of making gas with a hydrocarbon fluid on p. 65 , vol. $32 .-\mathrm{R}$. W. K. will find answers to his
queries as to ice boats in No. 63 ScIENTIMF Amerions SOPPLENENTT.-U. D. M. is informed that oxychloride of zinc may be used to cement silica together; but we do
not think he will succeed very well with the material o
the process described on p. 251, vol. 28. To mend rub-
ber boots, follow the instructions given on p. 203 , vol 30 . ber boots, follow the instructions given on p. 203, vol 30 .
-A. L. F. will Ind on p. 119, vol. 28 , a recipe for a ce-
ment for mendingleather shoes.-C A A. ment for mending leather shoes.-C. A.D. will find a recipe for red fire on p. 171, vol. 36.-J. D. will find direc-
tions for fireproofing clothing on p. 282, vol. 32.-A. D A. will find directions for mounting chromos on p. 91 , A. will find directions for mounting chromos on p. 91 ,
vol. 31 . This also answers T. S. R.-G. K., who asks as to the U. S. Coast Survey, should sign his letters with his name and address.-E. C. S. will find on p. 319, vol.
35 , a recipe for a cement wash for woodwork.-A. B. C. 3s, a recipe for a cement wash for woodwork.-A. B. C.
will find formulæ for the passage of water through pipes on p. 48, vol. 29.-W. L. B., A. J. W., W.G. L., E. K.,
C. F. W., J. G., N. T., W. P. B., and others, who ask
us to us to recommend books on industrial and scientific
subjects, should address the booksellers who advertise fo our columns, all of whom are trustworthy firms, for
(1) T. A. D. asks: 1. What kind, diameter, and focus should a lens be for a photographic camera to take photographs $41 / 2$ inches by $31 / 2$ inches, princi-
pally landscape views? A. An achromatic of about 11 nch diameter and 5 or 6 inches focus. 2. At about what distanceshould the lens be placedfrom the photographic plate A. Where the image will be sharpest on a ground
glass, placed where the photographic plate is to be. 3 . if stops or diaphragms are used, what kind is necessary and where should they be placed? A. If the instrumen placed midway between the lenses. If a single lens, place it in front. A piece of cardboard with a round
hole in the center is all that is wanted. The smaller the diaphragm, the sharper the picture will be, and the exposure
(2) F. I. E. says: I have several photographic lenses; and wishing to form some kind of instrament on rouble or expense, I would like to know how the mack are arranged, and what kind of light is best? A. Your 1/4 portrait lens is just what is wanted for the objective. Then, in addition to this, you need two condensing
lenses, and (if gas or oil is used) a reflector behind the enses, and (if gas or oil is used) a reflector behind the
ight, the same as in a magic lantern with the "Wonder"
(3) A. B. C. asks: Can stereoscope lenses or the lenses of a small spyglass, be used in constructing
the home-made magic lantern? A. The usual stereothe home-made magic lantern? A. The usual stere
scopic lenses cannot be used, because they are ground scopic lenses cannot be used, because they are ground
thicker on one side than the other. The lens of a small spyglass would do if not of too long focus. It will make the picturesmall unless the lantern is placed at some dis ance from the screen. A lens of about 6 inches focus
is the best; and in small rooms, even shorter focus is is the best;
preferable.
(4) E. J. B. asks: Will a photographic cam era, with three lenses and four inches focus, do as an
objective for a magic lantern? Will the "Wonder" amera as described in Science Record for 1875 do Could the object glass of an opera glass be used for the purpose? A. If the photographic combination wa phragm, then it will answer the purpose very well. Also the opera glass objectives may be used, either singly or
in combination. If one will make the picture on the in combination. If one will make the picture on the
screen as large as you wish, it will give you more light screen as large as you
than the two together
(5) J. L. K. says: I would like to make a 1 inch hole in a window pane, and have tried several
ways, but broke the glass every time. How can it be ways, but broke the glass every time. How can it be
done? A. Bore a hole in the center by means of a hard steel drill moistened with turpentine. Cut the circle of copper wire centered in the hole just bored, and by means of cuts radiating from the center to the circumerence divide the circle into numerous small sectors Then, with a small piece of metal, tap the glass on th posterior side gently, following each cut throughout it stent. When this has been properly done, fasten oce the glass and while holding the putty the the glas on the other side firmly in the center of the circle. Too nuch pressure on the diamond will cause it to scratc without catting the glass.
(6) E. B. asks: 1. How shall I treat hick ory to prevent its becoming powder-post, as we term it?
A. The trouble is due to a diseased state of the timber, which reduces its substance to a mass of dry dust, by the decomposition of its fibers. It is caused by the growth of a species of fungus in those parts of the
timber which have not been properly dried or seasoned. timber which have not been properly dried or seasoned of corrosive sublimate forced into the pores ofthe wood of means of an air pump. 2. When shall I cut it? A.
It is best to cut the timber in the late fall or early
(7) E. T. says: In speaking of leaky roofs, you say that the best job would be to put on a new ti oof in small sheets. Which kind of tin is most durabe, the leaded or dark lead-colored tin or the brigh
light-colored tin? A. Use the best charcoal tin, which is right-colored, and solder the joints securely.
(8) J. H. W. says: We have had an exploion in our foundry that we are not able to explain. Th hop is a frame building 50 feet square. We had not proceeded to drop the bottom as usual, the instant the roceeded to drop the bottom as usual, the instant the ing some 250 panes of glass. It tore a door that was eard at a distance, shaking the windows in house quares away. Our shop is quite open, and two door were standingopen at the time. The prop that the cu ola man used in dropping the bottom was some 10 fee hough it had been struck by lightning. There was oongh it had been struck by lightning. We under the cupola at the time; but we threw, as we thought, sufficient sand on it to prevent the iro coming in contact with it. Are such explosions of commonoccurrence in foundries? A. We imagine that ex plosions of such violence are not usaal, although those
of similar kind are not uncommon, when heated iron comes in contactwlth moisture. Possibly some of our
readers may have knowledge of explosions quite as vio-


## ent as the one

(9) J. M. L. says: I wish to build an air give me the proportion existing between area of stack at bottom and top and height, and the areas of the flues
from furnaces? A. It will be sufficient to make the rom furnaces? A. It will be sufficient to make the cross section of the stack equal to the combined cross
sections of the flues. You can decrease the cross section towards the top if desirable, but there will probably be no advantage in doing so. Build the chimney at least 40 or 50 feet in heig
as is convenient.
(10) J. J. says: 1. I wish to make a pair of sleigh runners. I have been told that the rim of a wagon wheel steamed and straightened out is very good
to make them out of. But I do not know how to straighten them. Could not Iget two pieces of oak, of
the same thickness and width of a rim of a wheel, the same thickness and width of a rim of a wheel,
and bend them? A. When the wood is softened, secure it by clamps to a former. Perhaps it cannot be bent into shape all at once, but must be heated several times. runners be at the bottom, and how far at the top? A. Distance between runners, 30 to 36 inches at top, and
(11) W. S. says: 1 . I am building a ditcherfor (1) W. S. says: 1 I am building a ditcherfor cient number of times around a capstan to prevent its slipping, thefreeend being wound on a reel. The capstan is to be 18 inches in diameter, and the levers 12 feet
from center of capstan to where the horses are hitched. What kind and size of rope will be best if two horses are used, and also if our horses are used? A. You can nches in diameter for 4 horses. $\quad$ 2. If wire rope shonld break, how can I mend it? A. By splicing.
(12) E. L. L. asks: Do the rubber covers tibly? A. No.
(13) C. F. A. asks: 1. What size of boiler shoold I use for an engine of $1 / 1$ inch bore and 4 inches
stroke? A. Make one 12 inches in diameter and 20 nches high. 2. Can you recommend to me a book on the construction of the marine engine? A. We do not know any work that covers the construction of the mod-
ern marine engine. You will find much that is usefolin ern marine engine. You will find
Bourne's and Burgh's treatises.
(14) G. F. asks: 1. What I wish to know is ow much power could $I$ expect from an engine $2 \times 5$ nches, 60 lbs. pressure, 150 revolutions? A. From $1 / 2$ to 4u of a horse power. 2. What size of boiler would re-
quire if it were a plain cylinder, set in brickwork? A. Make a cylinder boiler with about 11 square feet of heating surface.
(15) W. H. K. asks: Which will bear the greater weight, applied laterally, a round or a square
od of metal or wood, of the same circumferences A. The round one.
(16) J. N. A. asks: What has been the highest result in foot lbs., by any steam engine, per 1 lb . of is among the best results; this corresponds to foot lbs. er pound of coal.
(17) C. P. P. says: What size of boiler would run to best advantage an engine $3 \times 11 / 2$ inches? oiler, made of wrought iron, 10 inches in diameter and 8 inches high.
(18) C. R. W. asks: Please tell me how to pondere the number of yards of excavation in digging pond or lake 100 feet by 80 , in form an ellipse, 9 feet Add together the top area, the bottom area, and the area of their mean proportional, and multiply the sum by depth
(19) W. L. F. says: I am making an elec tro-magnetic machine for medical purposes. I made hollow cylinder $3 / 4$ of an inch in diameter, containing a bundle of iron wire. Por the first coil, I wound about 50 feet copper wire (insulated No. 16) around this, and separate from it. I wound about 500 feet silk insulated wire, No. 22. I connected the ends of the primary coil with 1 cell of carbon battery, but could not get a secndary current. Please tell me where the difficulty lies? by breaking and making the primary. If you require and use more battery
(20) A. S. asks: I have a battery with two opper cylinders 8 inches and 3 inches in diameter, and
zinc cylinder 16 inches in diameter. What must $I$ put in it to make it work? A. Blue vitriol and water.
(21) L. G. W. says: In making a Camacho lectro-magnetic engine, can I construct the tubular wire used in making magnets? A. It is not worth while to make the magnets less than an inch in length. Wind each tube separately and then place one over the other.
No. 23 silk covered wire will do. The turns on each tube should be in the same direction
(22) J. S. W. asks: 1. Which will give the ongest spark, an induction coin made with 2,000 feet of No. 32 wire or with 2,000 feet of No. 36P A. One with the 2,000 feet No. 36. 2. Will 4,000 feet No. 32 give a
longer spark than 3,000 feet No. 36 A. No, not with sager spark than 3,000 feet No. 36? A. No, not with
same primary. 3. Which is best for the primary coil, of the core and battery used Make the resistance of primary about the same as that of the battery. 4. How ong a spark ought 2,000 feet of No. 32 wire to give? A.
Up to a certain limit, about 1 inch spark per mile of secndary can be obtained.
(23) A. R. asks: 1. Does the Atlantic telegraph work upon the same principle as do telegraph is drawn from the cables. A. The batteries are not connected directly to the cable, but to one side of a con-
connected to the cable. 2. What is the strength of the current used? A. Ten or twelve cells is about the num ber used to charge the condenser. 3. What is the at the sending station? A. About $99 \cdot 5$ per cent after 3
(24) H. S. C. says: In youranswer to F. H., you say that an engine generally works more economic-
ally when running at its full capacity. This is undoubtedly true of single valve engines, as a single valve cannot cut off at less than $3 / 4$ stroke without choking the exhaust and impairing its eflciency in a greater or less
degree, according to the point of cut-off. But with an automatic cut-off, or even with a fixed one, I think it can be demonstrated theoretically, as it has been demonstrated practically, that there is great economy in having considerable surplus power in your engine. A. You
have misunderstood our reply to F. H. The idea we inhave misunderstood our reply to F. H. The idea we in-
tended to convey was, that under given conditions there tended to convey was, that under given conditions there
is a point at which an engine will work most economically. This is the point at which it should be run, a point probably far within its full capacity.
(25) I. H. D. asks: 1 . Why is a chamber used in a condenser for the exhaust steam to flow in? $A$.
With a view to economy of space and efficiency tion. 2. Could not the steam be condensedin an exhaust oipe, and this pipe be connected with the air pump? A.
Yes. 3. How much pressure must be given to a jet of Yes. 3. How much pressure must be given to a jet of
water in the combining tube of an injector, so that it will gain velocity enough to enter a boiler, without flowing back into the overflow? A. It depends upon the prowill readily force water into the boiler from which it draws its supply of steam, and could be arranged so as
to force against much higher pressure than that under to force against much hig
which it was working.
(26) G. F. asks: 1. How large an engine could I supply steam to from a plain cylinder boiler, 9 feet long and 14 inches in diameter, of $\frac{1}{4}$ inch iron? A. You can use an engine of from 2 to 3 horse power. 2.
Is a plainboiler safer than one with flues? A. Not neessarily.
(27) G. L. K. asks: 1. Can steam from a boiler with 60 lbs . force water into a cold boiler? A.
Yes. 2. Is it possibe to get a pressure in the cold boiler above the steam pressure in the steam boiler? I have boiler having hat is said to have forced water into a ated from a boiler with 20 lbs. pressure. A. Yes. The philosophy of the matter is that a great deal of steam is
used, and comparatively little water is forced into the used, and comparatively little water is forced into the
boiler. It is somethinglike a steam pump in which the water cylinder is only as arge as the steam cylinder, so that the water pressure can be 5 times the steam
(28) H. C. asks: 1. What pressure will a lo6 inches in diameter, double riveted, stand? A. 40 lbs. 2. How large an engine will it run with firebox $8 \times 8$ inches and 8 inches high, and 22 half inch tubes 12
inches long. A. Make one $2 \times 3$ inches. 3. Which of these two engines, $5 \times 6$ or $4 ? \times 8$ inches, is best for a oat 25 feet long and of 6 feet beam, drawing 6 inches at bow and 24 inches at stern? A. If you wish to compare
them when running at the same power, we think the first is preferable on some accounts.
(29) O. A., Jr., says: 1. I have a steam enbore by 9 inches stroke. Steam ports are $\frac{2}{2}$ by $5 \frac{1}{\frac{1}{2} \text { inches, }}$ exhaust port is 1 inch by $5 \frac{1}{\frac{2}{2}}$ inches. Valve travels $1_{1}^{\frac{1}{1}}$ inch; lead of valve is about $\frac{1}{1}$ inch, lap about $\frac{1}{1}$ inch,
cutting off at about $\frac{8}{4}$ stroke. Engine runs about 240 cutting off at about $\frac{3}{4}$ stroke. Engine runs about 240
revolutions per minute with 70 lbs, steam. Can I get more power out of the engine by changing those proportions? A. We do not think, from your account, that turn flue boiler is the most economical in fuel and water: the boiler that will hold $11 / 2$ barrel of water or the boiler that will hold $4 \frac{1}{2}$ barrels, the heating surface being the same in both boilers, and each being of 10 horse
power? A. We imagine thedifference, if any, would be nimportant.
(30) G. W. A. says: We use 60 lbs. steam on a $12 \times 20$ inches engine, running three burrs. If we
keep just 60 lbs., it is pretty hard work; and it seems easier to let the engine stand and generate 80 lbs . What pressure decreases the steam used per horse power, so that although it takes a little more fuel to make 1 lb . of steam at the higher pressure, there are fewer lbs. used
to do the same work, and the high pressure is the most
(31) J. R. B. says: I propose running a boat by a screw. She is to be 16 feet long and of sharp Dow; of how large a diameter should the screw be? A.
Make one 18 to 22 inches in diameter and of $21 / 2$ to 3 feet Make one 18 to 22 inches in diameter and of $2 \frac{215}{2}$ to 3 feet
pitch, with a length of blade of 5 or 6 inches. Run it at pitch, with a length of blade of 5 or
000 or 400 revolutions per minute.
(32) C. W. H. says: A boat is 100 rods rom a stationary stump. A man in the boat is pulling 50 lbs. on a rope attached to the stump to pull the boat ods apart. Each man is pulling 50 lbs. on opposite ends of a rope between the boats to pull the boats together. The two boats are of equal weight, and all other
conditions are equal. Will the one boat arrive at the stump sooner, later, or at the same time as the two boats come together? If not at the same time, how much the two boats wold aproach sach other twico es fast as the single boat approaches the stump-for the reason hat the rope is hauled in twice as fast in the first instance, as there are two men hauling it in, one at each in rope, at one end, at the same rate as is employed by
(33) J. J. T. says: I wish to build a locomotive engine with vertical boiler 2 feet high. The cyl-
inders are to be $2 \frac{1}{2}$ inches bore by 5 inches stroke. What diameter will the boiler be, and how many 1 inch tubes should I use to get the most power? How much thlisuch a boiler, with all attachments and full of wa-
ter, wh? How much power will it develop, if well
 by which you can cal.
tions on p. 2225, vol. 33 .
(34) S. D. C. asks: What is the complete formula for finding the radius of the earth at any place, when the force of gravity at that place, and at the equa,
 formula for the radius, at the latitude L , is: radus
feet $=2888625 \times(1+0.016742 \times$ cos. 2 L$)$. As we under they are correct
(35) W. S. says: 1.1 am building a model oiler for it gine ${ }_{1} \times 1$ inches, and wish to make a boiler for it capable of 65 lbs. pressure. What should
be the size and the number of fues? A. You can make flues 1 inch in diameter, or less. 2 . What would be the
beestsped to run it at, in order to get the most powere best speed to run it at, in order to get the
(36) J. N. W. asks: How much suction power has a fan 2 feet in diameter, with four wings, 8 b 14 inches, revolving 2,000 times in a minutes The in duction orifice is $1 \times 2$ inches. How many lbs. press-
ure can I produce at the orifce?
A. If you wish more pressane than 1 lb. per square inch,
(37) J. F. \& G. W. M. says: There are two tanks for water located 900 feet apart. Each holds ne is 11 fee making25 feet from top of tank to level of ground. A pipe runs from this tank down into the ground, to suffi-
cient cient depth to prevent freezing, and thence along on a
level, 90 feet, to the other tank.
Thebottom of the level, 900 feet, to the other tank. The bottom of the
last-named tank is 3 feet above top of the frrst-named tank, or 28 feet from level of ground. What size o
pipe must I use to empty the water of the second tank into the first tank in 12 hours? What size of pipe will
it take to do the same in 24 hours? A. To discharge the it take to do the same in 24 hours? A. To discharge the
second tank into the first in 12 hours will require a pipe second tank into the frrst in 12 hours will require a pipe
of 2 inches diameter, and in 24 . hours 1118 inches diameof 2 inches diameter, and in 24 hours
ter. The bends in the pipe should be easy, and no contractio
lowed.
(38) W. J. M. asks: Do steam heating pipes consume the oxygen of the air, or is a degree oof heat before the consumption of oxygen begins? Why is it that in an offlce, if doors or ventilators be closed for a
few minutes only, the air becomes very oppressive and few minutes only, the air becomes very oppressive and
stupefying, while the temperature is yet not very high, and not as high as could be borne without any discom fort in a well ventilated room? Would a ventilating
shaft, constructed so as to draw from a register in the shaft, constructed Bo as to draw from a register in the a man's hand, remain undisturbed and oppressive? $A$ Air when heated expands and becomes less capable e
supporting animal life, because of the limited quantit of oxygen it then contains in a given volume. The breathing of persons engaged in a sedentary employment is slow, and a dense air would afford greater ali
ment to the blood in their case. There is no reason to ment to the blood in their case. There is no reason to
believe that steampipes, when heated, consume the oxygen of the air to a greater extent than other heating surfaces. But there is, without doubt, a minute quantity of moisture driven from the pipes by the internal press-
ure, which soon renders the air humid, and this has the ure, which soon renders the air humid, and this has the
effect of making breathing more diffcult. It is easily inferred from this that supplying fresh air brings no remed,
preserved in this stateng dense air thus admitted
a heated pipes. By gradually accustoming yourself to adopting the plan of the open fireplace, you may be able the more effectuaily to preserve the air of your room in its natural
for easy respiration.
(39) A. B. asks: What are gold and silver
 coinage is io pure gold and $\frac{1}{5}$ alloy. The alloy consists
of ${ }_{51}^{10}$ iliver and ${ }^{10}$ copper. The silver coinage also conof $\frac{1}{10}$ silver and hicoper. The silv
tains $\frac{1}{1}$ alloy, which is copper only.
(40) J. McT. says, in reply to M. G. P., who asks if meerschaum pipes, after they have been
used a time, are not subjected to some process to bring used a time, are not subjected to some process to bring
out the color: I have seen meerschaum and imitation meerschaum pipes colored by the following the height to which you wish to color. Leave the re mainder of the tobacco in the pipe, and do not empty it
or disturb it for several weeks, or until the desired color or disturb it for several weeks, or until the desired color
is obtained. When smoking, put fresh tobacco on the is obtained. When smoking, put
top, and smoke to the same level.
(41) E. McD. asks: 1 . What quantity of oil of vitriol should be used to the gallon of water, for
sprinkling guano for artificial manneq $A$ Diute the sprinklingguano for artificial manure? A. Ailute the
strong acid with about 30 parts of water.
2. Is itne cessary to distribute the dilute iliquid throughout the
body of material or merely sprinkle the surfaces body of material, or merely sprinkle the surfaceq If
the latter, how deep should the layer beq A. Spread the guano into a layer about 3 inches in depth, and sprinkle then put together again. 3. What quantity of the dilute liquid would be required for 100 buskels? A. This de-
pends upon the amount of ammonia or its pends upon the amount of ammonia or its volatile salt
which are contained in the guano. If $i$ it contains 6 per cent, it will require about 32 pints of the acid solution, about 2 gallons to the ton. 4. Would superheated or
dry steam do as a dryer? A . Heated air would be more dry steam do as a dryer? A. Heated air woonla be more
suitable. 5 . Would it be advisable to make the deposit perfectly dry, or to allow a amall percentage of meisture to remain? A. You cannot hope to expel ail the moist
ure; and it is betternot 6 . If the natural state of the deposit is 50 per cent water and 6 per cent ammonia would not the evaporation of the water double the per centage of ammonia? Yes. 7. After the depositi is
dried, could it not be put up in bags and shipped without fear of deterioration? A. If not exposed to the
weather or very moist air, it will not absorb moisture af ter drying to any extent if tightly packed in strong
(42) M. B. says: Given two lamps, one with a round and the other with a flat wick, the same num
ber of threads in each, ania everything else equal, is
avor of the round $i$ a.
(43) H. C. asks: Is there a way of soften ng rams' horns so as to be able to mould them? A
There is no practicable method whereby this may be complished.
(44) E. E. C. asks: What acids are most destractive to steel dies? A. Nitric, muriatic, and sul phoric acids attack and dissolve the metal most rapidly
Nitric, or a misture of nitric and muriatic acids (aqua regia), are the proper solvents.
(45) T. H. S. says: 1. I am using a liquid made of 1 lb . sal soda and $1 / 4 \mathrm{lb}$. lime to 1 gallon of liquid $I$ use 2 or 3 spoonsful for washing of a boiler of ciothes of the capacity of 8 or 10 gallons, with plenty of water. Will the liquid be injurious to the fabrics? A.
Under the conditions, the washing fluid will not injure he fabric to any extent. The fluid may be made stronger by boiling with excess of lime and carbonate of soda (sal soda). 2. I use chloride of lime in a liquid state for ing water for an hour or more. Will the chloride water be injurious to the cloth? Please give a formula to make the chloride water of the proper strength. A. Pass the
loth first through a very dilute bath of sulphuric acid, nd immediately through a bath of bleaching powde (chloride or hypochlorite of lime), made by dissolving
che powder in 24 parts of cofd water and hang in a cloge he powder in 24 parts of cold water, and hang in a close ible. When properly bleached, wash well in water and
(46) C. H. B. asks: How can a sword blade e frosted? A: Clean and polish the metal, flow point is reached, wash well in running water.
(47) V. S. A. asks: 1 . What will soften rushes after they are used in varnish or French dryer?
A. Steep the brushes for 24 hours in good benzole and then, if necessary, purify by washing them with soap and warm water. 2. How can I preserve photograph proofs? A. Wash them well in cold running water, dry,
and keep in a dark place. Or, after washing, fix them and keep in a dark place. Or, after washing, fix them
by immersing for a few minutes in a strong solution of by immersing for a few minutes in a strong solution of
hyposulphite of soda in water and wash or soak in a cohyposulphite of soda in water and wash or so
pious supply of cold water for 10 to 12 hours.
(48) A. P. asks: Can you furnish me a recipe to make a solution for setting the color of crayon
drawings? A. Use a dilute aqueous solution of gum arabic in
(49) A. R. asks: What can I use to repair a lass bath, that will resist nitrate of silver in strong soluformly, and join with fused gutta percha. The edges should be pressed firmly together and allowed to $\begin{aligned} & \text { and } \\ & \text { in the clamp for an hour, or until perfectly cool. }\end{aligned}$
(50) C. asks: Will you give a chemical analysis of ox blood? A. In 100 parts of ox blood cor are: Hœmatin (with iron) $16 \cdot 75$, globulin and cell membrane 28.222 , fat $0 \cdot 231$, extractive matter 0.260 , minera substances (without iron) $0 \cdot 812$. The minerals are: Chlo-
ine $0 \cdot 1686$, sulphuric acid 0.0066 , phosphoric acid $0 \cdot 1134$, ine 0.1686 , sulphuric acid 0.0066 , phosphoric acid $0 \cdot 1134$ potassium $0 \cdot 3328$, sodium $0 \cdot 1052$, oxygen 0.0667 , calcic lood corpuscles are suspended in a liquid containing in 100 parts: Water $90 \cdot 29$, fibrin $0 \cdot 405$, albumen $7 \cdot 884$, fa
(51) C. F. M. asks: Is there anything tha will give raw hide a fine finish and at the same time be waterproof? A. Steep them in a strong, hot decoc
tion of sumac, alum, and logwood, and dress with a mixture of beeswax, soap, oil, and ivory-black.
(52) P. S. K. W. asks: How may paper be prepared so that linseed oil will not soak into it and that the paper will remain flexible? A. Pass the paper rap-
idly through strong sulphuric acid and wash quickly daly through strong sulphuric acid and wash quickl With a copious supply of water. After drying, pass
through an aqueous solution of dextrin, and then bethrough an aqueous solution of dextrin, and then be-
tween smooth rollers heated to $500^{\circ}$ Fah. The rollers
(53) C. B. W. asks: 1. Is it true, as a gen ral thing, that dress goods, wall papers, etc., in which reen color predominates, are poisonouss A. No brilliant hue, is often used as a pigment in painting and designs on wall papers, but not so frequently on dres goods. 2. Is it necessary to use poisonous matters to yed with some ot the aniline colors have, at times, prouced poisonous effects, especially where they have Dee permitted to remain for any length of time in direct con-
tact with the moist cuticle; but not otherwise. 3
Whence came the ides that all green dyes are poisonous
Whence came the idea that all green dyes are poisonous? erdigris, and like compounds containing copper or ar senic (the prevailing color of which is green) have been so numerous that all similarly colored pigments, dye
tc., have gradually come to de considered with more o less of distrust by the uninformed.
(54) J. A. W. asks: Is there an acid chemical which will corrode paper postage stamps, bu
will not corrode gum arabic? A. No. (55) G. W. S. asks: How can I make a loaf bread which, after a year or so, I can lay my hand on and squeeze it down, and it will rise up again the same when fresh baked? A. If the bread is not intende dinary way, but with the addition of a little sulphate o copper (a very minute quantity only), glycerin, and copper (a very minute quantity on a y ),
trong aqueous solution of salicylic acid.
(56) W. W. asks: What is the best cove ermin-proof, and cheap? A. Try the following: Tak any coarse fabric, steep it for a few hours in a strong face with a thin covering of tar.
(57) G. R. asks: 1. Will a soft metal, like copper, lead, or zinc, hold heat longer than a harder metal like cast or wrought iron of equal weight and the
same shapes A. The loss of heat does not depend so much upon the hardness of the metal as uponits conductivity and the condition of surface. If the suraces of the metal be bright and polished, it retains its
heat much longer than if it be dark and rough; or in other words, the less rapidly will it part with its heat by radiation. The poorer the heat conductivity of the metal, the longer it will retain its heat, other conditions
being the same. The conductivity of silver being 100 , being the same. The conductivity of silver being 100 ,
that of copper is $73 \cdot 6$, zinc $19 \cdot 9$, tin $14 \cdot 5$, steel $12 \cdot 0$, iron that of copper is $73 \cdot 6$, zinc $19 \cdot 9$, tin $14 \cdot 5$, steel $12 \cdot 0$, iron
$11 \cdot 9$, lead $8 \cdot 5$. The time required to cool a large mass of 11.9, lead $8 \cdot 5$. The time required to cool a large mass of
hot metal is proportionately great compared with that equired to reduce the temperature of a smaller mass the retain heat as long as soft or hard metals? A. Yes.
(58) C. A. B. says: I have eight or ten st was then very good and would clean paper very nicely. it. well as ever? A. No. The hardening is due to oxddation (59) 0 quality canc
(59) O. H. N. asks: Is there any way of cleaning sulphur off horseshoes? When I weld the toe
calk on, the sulphurgets under the toe calk, and I cancalk on, the sulphurgets under the toe calk, and I can
(60) H. \& M. say: We wish to test the quality of different lots of coal oil sent from refineries. ity of different lots of coal oll sent from refineries.
Could you give us a mode of doing this? A. Inexpensive instruments for this purpose are sold by dealers in thermometers, hygrometers, chemical utensils, etc. All that is necessary for ordinary purposes is to determine
the specifc gravity and point of ignition. The former accomplished by means of an instrument resembling of the oil in which the bulb of a thermometer is im mersed to indicate the temperature, and a small ignited taper, held close to the surface of the oil, ignites the same when the temperature has risen sufficiently.
(61) M. N. asks: Is there any metal or composition which would stand the same usage as a cane,
and could be moulded hollow? A. Steel or bronze would answer the purpose, if we understand you aright.
(62) C. B. P. asks: How can I platinize the silver plate of a Smee battery? A. Dip the plate in a strong solution of chloride of platinum, and expose it
for a short time to the action of a stream of hydrogen or for a short time to the action of a stream of hydrogen or
coal gas. 2. How can I prepare sulphur for making casts of coins, etc.? A. Fuse the sulphur and heat it to the point of sublimation, and while in this condition throw into cold water
(63) A. J. S. says: I have a lot of emery heels that have been almostcovered with japan dryer. . Remove all you can by mechanical means, and then reat the parts with strong oil of vitriol (sulphoric acid) for a few minutes; then wash well, but quickly, in a
stream of water. Repeat this treatment if necessary stream of water. Repeat this treatment if necessary,
and rub well with sawdust. The acid should not be permitted to remain for any length of time in contact with he stone, as it will injure it
(64) C. W. C. asks: How can I keep lemons or 6 months or more? A. Packing them in salt and ven this will not always suffice.
(65) C. H. J. says: Some specimens of lime mens taken out during the spring quarry. The speci were allowed to season, answered admirably, but those taken from the quarry during or just previous to a cold nap cracked by the action of frost. Can you suggest means by which these stones may be tested, other than by subjecting them to extreme colds A. The cause of the cracking of the stone may have been the molecular
energy of freezing water contained within cavities in the rock; but it is more probable that the rupture was due to the relazation of strain to which the blocks had been subjected while in the quarry. Splitting up of locks from this canse is by no means infrequent in some
quarries. If the breaking is attributable to the action of frost, there is no other means than those you men-

(66) M. asks: Can you give me a recipe for making concentrated starch? $\mathbf{A}$. We do not know of preparation by this name.
(67) G. S. says: I have some specimens of I use to take it off? A. If it is really verdigris, a little (68) C. V W (68) C. V. W. says: Some of your corre
 method of finding when the chord and iven. Igive them a very simple form wala based upon the ty of the right an $=1 / 2$ chord, $b=$ height or versed sine, and $x$ and $x=$ ra
$a^{2}+(x-b)^{2}=x^{2}=\frac{a^{2}+b^{2}}{2}=x$ or $\underline{1 / 2 \text { chord }^{2}+\text { height }}$
(69) J. H. M. says: I am running saws of oches diameter, and smaller. I wish to know at what
of run them in order to make the smoothest work? A. Nine thousand feet per minute, that is nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: a saw 12 inche nches in diameter, or 6 feet around the rim, 1,500 revoutions; 3 feet in diameter, or 9 feet around the rim, 1,000 revolutions; 4 feet in diameter, or 12 feet around the around the rim, 600 revolutions. Of course it is under tood that the rim of the saw will rin a little faster the
more than three times as large as the diameter. Shingle and some other saws, either riveted to a cast iron collar very thick at the center and thin at the rim, may be (70) D. B. says; I notice an article stating hat Dr. Siemens had succeeded in producing permaweight, by mixing with steel a small 20 times their own weight, by mixing with steel a small proportion of tung-
sten. Can this be so? A. Yes, so far as we know; small artificial magnets have been made to sustain one hundred times their own weight.
(71) C. W. C. says: If a telegraph wire


## (72) J W T asks

(72) J. W. T. asks: Is there any electric battery that will heat and keep a $1 /$ inch wire red hot or nearly so? A. The question is very indefinite, as everything depends upon the length and material of which
the wire is composed. Probably a Bunsen cell could be made sufficiently large toheata short length of platinum
(73) V. W. S. asks: If a dwelling is surounded by trees, from 10 to 25 feet higher than the ridge or the chimney tops, and within one or two rods distance from the house, are not these trees some pro-
tection against lightning? And if not, would not conductors in the trees answer a better purpouse than is se cured by the usual mode of attachment to the building A. Properly constructed rods on the building are much (4)
(74) T. B. A. says: What size of wire do I want to make an induction coil, to be used to heat plati-
num wire? A. Use a Grove or Bunsen battery. Fither is better than a coil.
(75) A. A. W. says: I have a book that gives a rule for finding the safe working pressure of any Multiply the thickness of iron by 0.56 or 0 . as the boiler is single or double riveted, multiply this product by 10,000 (safe load), then divide this last prod uct by the internal radius less the thickness of iron.
The quotient will be the safe working pressure in lbs. per square inch. A. Calling $C$ a coefficient 0.56 or 0.70 , a the case may be; $T$, thickness of boiler in fractions per
inch; $\mathbf{R}$, internal radius of boiler in inches; $L$, safe load inlbs. per square inch. Working pressure $=\frac{\mathbf{C} \times \mathbf{T} \times \mathbf{L}}{\mathbf{R}}$
(76) J. P. asks: How can I make old copMer and brass coins stick to a board without using tacks? Melt or asphalt and gutta percha. Apply hot. Clean
coin with a little dilute nitric acid or oil of vitriol.
(77) J. Z. R. says: I inclose a small piece will be the bests A. As the carpet already contains so many dark colors, it would be impossible to dye it any color butblack, without first having bleached it; and this, in the present instance, is impracticable. My kitchen ceiling blisters and scales off. It has been whitewashed sometimes with lime and sometimes with
whiting. What shall I do with it9 A. This is very whiting. What shall I do with its A. This is very is to clean and paint the walls.
I want to make a photo background. What is the best
color to uses A. Any of the aniline colors may be used orthis purpose, you can pared and with instructions for use, of any druggist. Any oil paint may be rendered flexible, when dry, by
rubbing it up with a little soap and glycerin over a
(78) A. S. C. asks: 1 . What amount of carof these soaps, that we have examined, contained about three per cent of the crude phenol in combination as a soda salt. 2. How is it mixed? A. In the coarser varieties of these soaps, the phenol is added directly to the ye during the latter part of the saponification; but in these cases the acid is very incompletely distributed
through the body of the soap. A complate and uniform dissemination of the phenol may be obtained by dissolving soap and carbolate in hot spirits of wine or wood naphtha, and evaporating the solution to dryness.
(79) B. F. W. says: Joshua Rose says, in Itation to sawing staves for cylinder or pipe patterns: It will save time to resaw the pieces to give them the
equired bevel, which may be done by canting the saw table." A better practice is to cant the table before
sawing at all, and then the staves will be of the right sawing at all, and then the staves will be of the right
shape, with a saving of nearly two thirds of the sawing nd considerable timber.
(80) C. H. says: We have in our possession an old-fashioned range; and whenever we draw hot wa-
er the water has the appearance of milk, but after tanding a few minutes it regains its regular color. We o the precipitation of the lime contained in the water. Lime is less soluble in hot than in cold water. It is not generally advisable to use water from the hot faucet for culinary parpo
(81) J. A. K. says: 1. I use oxalic acid for preparing pale leather water). The mixture sometimes becomes a brownish color. Do you know of any kind of acid which would do instead of oxalic? A. Try
moistening the leather first with oxalic acid, as usual, and then with a strong solution of chloride of lime (hypochlorite of lime) in cold water. 2. Do you know of nything to put in ink to $g$
(82) J. W. P. asks: What will remove Wash well with a little soda, moisten with very dilute ulphuic what bleaching powder (chloride of lime) and expose for an to bright sunlight. Then wash well in water
(83) X. Y. Z. asks: Can the skins of birds tanned with the feathers
(84) E. W. W. asks: How can holes be readily piered, or small holes enlarged. in rubber corks
for the ftting of glass tubing? A. Force the stopper for the fitting of glass tubing\% A. Force the stopper
into the neck of a task or large glass tube which it will just ft into, and use a well sharpened cork borer with gentle pressure and even turning. If you desire to en
large a former hole, Afrst plug it tightly with a piece o glass rod and proceed as before.
finities by any table published of relative chemical ar Inities by which one maty get at the amount of force
necessary to dissociate the elements in certain com-
(85) W. A. H. says: I have a relay of the box pattern, containing a magnet of about 40 ohms.
There is a certain peculiarity $I$ notice, which I would like to have you explain. I notice that whenever the current is broken by opening of the key, a peculiar
jump is heard, a kind of kick or hammering. At first tight as possible, it acted in the same manner. A. The noise isoccasioned by a change in the molecelarar condi-
tlon of the iron core when magnetized and demagnet tion
ized.
den
(86) S. I. asks: 1. What length and size of insulated wire isrequired to wind the magnets of a re
lay, such as is used on ordinary tele, eraph liness lay, such as is used on ordinary telegraph linesp A
About 1,000 feet of No. 32 . proper dimensions? A. The core can be $11 / 4$ inch lon
and about 3 inch
(87) H. L. J. says. Makers of telegraph ap paratus use a kind of lacquer or varnish on their brass
work which prevents tarnishing, while it is so thin as to work which prevents tarnishing, while it is so thin as to
avoid muffiting the soound. What is it, and how is it gredients, colored by gamboge, saffron, turmeric, etc About 2 gallons alcohol to 1 lb . shellac is the propor tion.
(88) G. W. H. says: 1. I am making an in duction coil to throw 11/ inches spark, to light gas.
what diameter and length shall I turn my bobbins Use about 2 miles of No. 36 wire for the secondary. What size of wires shalk I use? A. Make the core Inch or an inch in diameter and about 8 inches long. 3 .
$I$ have some tinfoil 5 inches wide to make a condense with; how much in length will it takes A. One hundred feetof the foil will probably be enough.
(89) C. C. S. asks: Can I conduct the smoke and exhaustfroma a or 6 horsepower farm engine through
tile laid underground (on a constantly ascending grade to a stack 100 or 125 feet distant? A. This is frequently to a sta
done.
(90) A. V. V. says: Two boilers, one 8 feet In diameter and the other 6 , each containing the same number of flues and each having a steam gauge indicat
ing apparently the same number of ing apparenty the same number of liss. of steam; which
boiler has the most steam in it? A . If the larger boiler has the most steam room
greatest weight of steam.
(91) W. H. L. asks: Why is it objectionable to raise the safety valve of a boiler in case of low water and danger of explosion? A. It is not desirable to do
anything that may cause the water to rise and come in contact with overheated iron.
(92) R. M. asks: How can I raise a valve by change of temperature? A. There are numerous devices
of this kind in common use. By inserting a notice in the "Business and Personal" column, you can probably gain full infotmation.
(93) A. B. says: Please give me the scientific deinition of the word "inertia?" A. Brande says material world, that all bodies are absolutely passive or indifferent to a state of rest or motion, and would continue for ever at rest, or persevere in the same uniform and rectilinear motion, unless disturbed by the action of
some extrinsic force."
(94) A. B. S. asks: Will a pump draw wa ter any easier by having the pipe to the well larger than
the connection to the pump, and will an injicctor lift the the connection to the pump, and will an injector lift the
water any easier by having the suction pipe in the well 'argerthan the pipe to the boiler? A. By using a large pipe, the friction is diminished.
(95) J. D. S. asks: What is the best manner of determining when a minf, or straight edge covered with red paint, which will show all the high spots.
(96) E. M. P. asks: What are the best methods of reversing motion? A force is used to accumulate or store up a certain amount of power, then that
stored-up power is desired to produce or exert its force. By what mechanism can this be effected? A. Sometimes a flywheel is used, a spring may be compressed, a weight may be lifted, or a reservoir may be filled with water.
Flywheels, springs, and weights are among the most common means employed.
(97) C. W. asks: What would be a safe steam pressure to carry in a cast iron cylindrical shel
of 10 inches inside diameter and 5 sin thick, with heads $3 / 8$ thick? A. You can carry 200 lbs . if the casting is sound; but cast ironboilers frequently have points of weakness that render
little value.
(98) W. L. M. says: Astronomers tell us that it has been calculated, from the rapidity of the ro-
tation of the earth, that, if the earth were suddenly intation of the earth, that, if the earth were suddenly in-
tercepted in its motion, sufficient heat would be genertercepted in its motion, sufficient heat would be gener-
atedto melt the earth instantaneously. What would be atedto melt the earth instantaneously. What would be
the generator of this heat? A. According to the modern the generator of this heaty A. According to the modern
theory of heat, a unit of heat and 772 foot lbs. of work are m.
(99) T. A. asks: Can a turbine or other water wheel be considered an hydraulic power? A. It may be spoken of as steam power. Strictly, the term
mone applies to the power furnished by the motor.
(100) Y. M. asks: 1. What is the meaning of the mass of a body, when the weight is divided by
the gravity to flnd it? A. It is a measure of the quantity of matter, and in order togive the same results with the
same body at all places in the earth's surface. 2. What
isa circularinch? A. It is the area of a circle havin is a circularinch? A. It is the area of a circle having
a diameter of 1 inch. 3 . What is a cylindrical inch? diameter of 1 inch. 3 . What is a cyindrical incla diameter of base 1 inch, altitude 1 inch.
(101) C. F. says: When the water in my boiler stands between the two gauges (about 3 inches
above top flues) and I start the engine, the water will instantly rise from 6 to 8 inches or nearly up to the dry bace. As soon as 1 stop the engine, the water drop
back original position. We know it is not foaming, as we have blown off the boiler several times, and
it is perfectly clean. We use soft water. A. The rise of the water is probably due to insufflcient steam room, or possibly because the fire is forced too much. W
jugge from your account, that no injurious action judge, from your account, that no injurions action takes
place. There are several other reasons that might be effective in causing the water to rise, but those give the most probable.
(102) I. W. L. says: 1. I have been told that I can make a battery for gold ana silver plating as fol $\frac{1}{4}$ inch thick, and a piece of zinc of the eame size. A tach a copper wire to each in a glass vessel $\frac{1}{2}$ foll with a piece of bluestone. The zinc is to be on the top. These
wires are to go to the bath. Is this right? A. The plates should be much larger to give good results, and the cop
per need not be so thick. 2. How can I make the bath A. Make a solution by dissolving cyanide of gold in cy anide of potassium, about $\frac{1}{2}$ oz. of gold per gallon. anide of potassium, about $\frac{1}{2}$ oz. of gold per gallon
Connect the article to bepplated to the zinc of your bat tery. 3. How long should the áricles be in the bath? A Until the deposit is of the desired thickness.
(103) W. S. W. says, in answer to M. P. who asks for watch oil: Put 1 oz. pure olive oil in a tum
bler, add 2 ozs. of 96 per cent alcohol, stirring well; se bler, add 2 ozs. of 96 per cent alcohol, stirring well; se
it away in a dark place for 24 hours or more, well cov cred, then pour into a clean bottle containing 10 ozs. dis alled or clean rain water. Shake violently for 5 minute with salt and ice You will find a good article of fin limpid watch oil, perfectly fluid, at top. Draw off with a siphon.
(104) L. G. says: A string or cord being at tached to a piston rod directly, the engine being of one horse power, what weight must I put on the cord to test
the strength of the engine? A. This depends upon the the strength of the engine? A. This depends upon th the work of lifting 1 lb . 33,000 feet high in a minute, o 33,000 foot pounds per minute; so that if you divide
33,000 by the speed of the piston in feet per minute, the quotient will be the required weight.
(105) H. E. W. asks: 1. Why do nearly all nanufacturers of electric annunciators and ind of No. 28, and finer? Why not use No. 20 to 268 A In many cases, Nos. 20 or 26 wire would be preferable but with finer wire the battery does not require so much attention as might be necessary if coarser wire were used. 2. Will cotton covered answer as well as silk is beted A. Any kind of insulation will answer. Silk is better than cotton, as ordinarily put on, as it takes up
less room. 3. What size of cores, and how many feet of wire on each core will give the best results? A. Cores are usually made about $11 / 4$ inches long and $3 / 8$ inch thick for annunciators; 250 feet of wire will answer for both cores. 4. Will an electro-magnet ever lose its power o
become useless? A. Not with proper care, except that become useless? A. Not with pron
everything wears out with age.

Minerals, etc.-Specimens have been re eived from the following correspondents, and examined, with the result stated:
G. M. P.-No. 1 is hauerite, sulphide of manganese No. 3 is tremolite, a silicate of lime and magnesia. $-D$ A. C.-S is a clay ironstone, containing mnch sulphide of iron (pyrites). Gis graphite mixed with much clay.
D appears tocontain a small amount of sulphide of lead in a granite matrix. Your letters were insufficiently n a granite matrix. Your letters.
stamped to the amount of 24 cents.
R. K. says: A friend tells me that a single a double, a triple, and quadruple thread, either right o left hand, can be cut by one and the same pair of ordi-
nary stocks and dies. Can this possibly be true?-G.
. W . asks: Is there any rule for dividing a circle into 3 , 4, or more equal parts by parallel lines?-G. E. C. asks:
How can I bend the sides of a guitar? Should they be steamed?-W. H. B. asks Can you tell me how to bisec a triangle by a straight line passing through any given
point within the triangle? oint within the triangle?

## COMMUNICATIONS RECEIVED.

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and
On Friction of Slide Valves. By F. G.
On Force. By -.
On Cleoparra's Needie. By J. W.
On an Old Problem. By B. B

## Also inquiries and answers from the following

J. P. B.-T. H. C.-W. C. Y.-R. F.-E. P.-T. S.P.-

HINTS TO CORRESPONDENTS.
Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude
that, for good reasons, the Editor declines them. The that, for good reasons, the Editor declines th
address of the writer should always be given. Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given,
are thrown into the waste basket, as it would flll half of are thrown into the waste basket, as it would fill half of
our paper to print them all; but we generally take pleaour paper to print them all; but we generally take plea-
sure in answering briefly by mail, if the writer's address sure in an
is given.
Hundreds of inquiries analogous to the following are sent: "Who sells blue glass lamp chimneys? Who sells
machines for stitching magazines, etc., with wire? Who machines for stitching magazines, etc., with wire?
sells working models of steam engines 9 Who makes iron chain? Who makes the best medical electric apparatus?"
All such personal inquiries are printed, as will be ob-
served, in the column of "Business and Persuual," which
is specially set apart for that parpose, subject to the
charge mentioned at the head of that column. Almost
any desired information can in this way be expeditiouscharge mentioned at the head of that column. Almos
any desired information can in this way be expeditious ly obtained.

## official

## INDEX OF INVENTIONS

## por whicr

Letters Patent of the United States were

## February 13, 1877,

## AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]
A complete copy of any patent in the annexed list,
including both the specifcations and drawings, will be furrished from this offlce for one dollar. In ordering please state the number and date of the patent desired,
and remit to Munn \& Co., 37 Park Row, New York city. Addressing machine, J. H. Willist
Advertising device, W. A. Brice..
Air and steam blower, B. Hershey Air and steam blower, B. Her
Bag holder, B. J. . . Howe...
Bale hook, H. Hauschildt.
Bale tie, G. F. Jones.......
Barbed wire, twisting, E. P. Peac
Bed, air Macintosh \& Boggett...
Bed bottom, spring, A. W. Kendr Bed bottom, spring, A. W. Kendric Beer cooler, L. M. Davis.................
Bessemer steel, making, Hunt \& Wen
Binder, temporary, G. W. Emerson Blacking box, s. W. Valentine Bolt heading machine, G. R. Moore. Boots, etc., making, D. A. Sutherland (
Bracket, adjustable, G. P. Davis...... Breech-loading fre arm, A. J. Hudso Breech-loadng fre arm,
Brick kiln, e. W. Bingham
Brick kiln, w. S. Colwell.. Brick kiln, W. S. Co
Brick machine, T. J.


Buckle, F. W. Schafer........
Burglar alarm, W. D. Wright
Butter mould, F. First
utton, s. W. Shorey.
Batton or stud, H. S. Wing....
Can, sheet metal, G. H. Chinn
Can, sheet metal, J. S. Field..
Capstan, reverse power, T. W. Hyde
Car axle box, C. E. Candee.
Car starter, R. R. Carpenter..
Car, steam street, L. Ransom...
Carbureting air, apparatus for, A. C. Rand
Carpet stretcher, G. C. Banta
Carpet sweeper, W. s. Hall..
Carriage seat, turn over, C. W. P. Patten
auterizing apparatus, C. Paquelln.
Churc, , J. H. H. Werestcott.
Churn, G. W. Knapp.
hider press, R. C. Quapp....

losp for suspenders, G. B. Gurley..
Cloth cuting machine, M. L. Hodso
Clothes ping, W. N. Lockwood.
Coal scuttle, W. Richards
Coal seuttle, W. Richards.
Coffee fllter, M. O'Connor..
Corn harrow, E. Martin.....
Corn harrow, E. Martin.......
Corn stalk cutter, W. Gans.
Corset clasp, W. s. Phyfe....
Cradet dumny, C. O. Jobinski...............
Crank, compensating, R. D. Milne
Croquet stand, A. Errebach
Cultivator, R. B. Robbins.
Cultivator, R. B. Robbins......
Cutitivator, hand, J. W. Dowle
Curtain filure,
Curtain fixture, J. Seenausen..............
Desk and chest of drawers,
Deodorizing closets, A. Hanel...
Dor sill, A. Saur..............
Draft attachment, Otto \& Sim
Draft equalizer, s. H. Pierce.
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