## a WEEKLY JOURNAL 0F PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES,

 Vol. XXIX.--No. 23.]RECENT PROGRESS IN ELECTROMAGNETISM
Much ingenuity has been wasted upon the problem of converting electricity into mechanical force; or, in other words, of constructing electromagnetic engines destined to drive machinery, to raise weights or to draw loads. Hundreds of problem as incapable of a practi cal solution. It is not difficult, indeed, to show by a very simple by a very simple calculation that in the presen state of science the electromag netic machine can never compete with the steam engine, be cause of its far greater cost. The force in the former is derived from the oxidation of zinc in the battery, while that of the latte is due to the oxi is due to the oxi dation of the car bon in the coa burned under th boiler. Now, 1 gramme of carbon burned will raise the temperature of 8,080 grammes of water $1^{\circ}$ centigrade, while 1 gramme of zinc will only raise 1,300 gram mes to the same extent. Thus carbor would carborr would seem to be 6.2
times as effective times as effective as zinc. After
the oxidation of the oxidation of
the zinc in the the zinc in the
battery, the solu tion of the oxid in the sulphuric acid produces an additional quan tity of force (or heat) capable of


GRAMME'S NEW ELECTRIC LIGHT MACHINE
extensively used to produce the electric light and in electroplating.
In December, 1858, the electric light was employed for the first time in the illumination of lighthouses, at the South Foreland, England. The magneto-electric machine used was constructed by Professor Frederick H. Holmes. The following April a favorable report was made on the invention by Fara-
tric light was not established, however, until June 6, 1862, at Dungeness. Holmes' machine consisted of 120 permanent magnets, each weighing 50 pounds, arranged on the periphery of two large wheels. A three horse power steam en gine revolved 160 soft iron cores surrounded by coils of wire
raising 335 gram
mes more, which must be added to the 1,300 grammes ; from this, however, must be deducted the force wasted in decomposing the water in the battery, a force capable of raising $1,060 \mathrm{gramm}$ es of water $1^{\circ}$ centigrade. The balance, $5^{\prime 7} 75$, is 14 times less than the effective force of coal, and yet even this comparatively small amount of force is only attainable in the theoretically perfect battery. Taking into account that coal is about 40 times cheaper than zinc, the odds are 40 times 14 , or 560 , to 1 against the electromagnetic machine.

While thus any effort to convert electricity into the grosse form of mechanical force must fail, until zinc can be manu factured about 600 times more cheaply than coal can be mined (which it probably never will be) or until some other source of electricity be discovered, physicists have been eminently successful in reversing the problem: that is to say converting mechanical force into electricity, and they have utilized the electricity so obtained in the production of the most intense artificial light known. Before describing the immense improvements made very recently in this depart ment of science, it may be well to study the apparatus hitherto employed.
When a piece of soft fron surrounded by insulated copper wire is presented to the poles of a magnet, a momentary elec trical current is formed in the wire; and on removing the soft iron from the magnet, another current is formed in the oppositedirection. Now, these currents may be made to succeed each other with extreme rapidity by revolving the insulated iron bar before the poles of the magnet, and they may also be made to flow in one direction. The former may be done by steam, and the latter is accomplished by a device called a commutator. Thus a powerful current is produced, capable of showing all the phenomena of the battery in an exalted degree. Machines constructed on these principles have been by means of a commutator, and then conducted through thick wires into the ighthouse tower where they ter minated in car-
bon points, bebon points, be tween which the electric arch The intensity he intensity of he electric light, Fizeau \& Fou cault, is only $2 \frac{1}{2}$ times less than that of the sun that of the sun while its cost a compared with the Frespel lamp then in use wa computed to b as 400 to 290 .
A considerable improvemen was made by Wilde, who con ceived the idea of causing the cur rent induced in a coil of wire by a permanent magnet to produce more powerful more powerfu which in was to in turn was to induce a new and greatly increased cur rent. Thecur rent thus genera ted could be passed around a third magnet and so on indefin itely, as far as theory was con cerned. In prac tice, however h found it most
productive of good to mankind. The first permanent elec
Fia.

vantageous to limit himself to three maund it most ad three armatures of these magnets were driven with a velocity of 1,500 revolutions a minute, it melted a cylindrical iron rod 15 inches long and $\frac{1}{4}$ of an inch in diameter, which was placed between its poles. With gas carbon pointshalf an inch square the light generated was equal to 4,000 wax candles. Thi machine weighed about 3 tuns, and required a seven hors power engine to drive it
In his latest and most perfect form of machine, completed last June, Wilde employs two wheels of 16 electromagnet each, between which are situated two series, each of 16 sof iron armatures secured to a heavy cast iron disk. The end of the cores are terminated with iron plates of circular form which retain the helices in place and somewhat overlap the distance between the poles of the electromagnets. By hav ing the magnetic circuits of the electromagnets and arma tures closed for a short distance, and by likewise having the electric circuits closed for a brief interval at the point of no current, the magnetic intensity of the electromagnets is maintained during the rise and fall of the magneto-electric waves transmitted through the helices. These helices are divided into 8 groups of 4 each; one of these groups produce the minor current for the circle of electromagnets, and the rest are joined together for a quantity of 7 and an intensity of 4, to produce the major current of the machine.
This machine weighs only about one tun, while its powe is double that of the 4 tun machine described. It may be run at a speed of 300 to 1,000 revolutions per minute.
The Wilde machine is in operation in this city for plating purposes, at Frank Leslie's printing establishment. The machine runs with a velocity of 1,800 revolutions a minute, and will electrotypea number of plates as large as the Illustrated Newspaper in 20 minutes. Wires are also connected with the
machine, which lead to the photographic establishment across the street, and on cloudy days they print photographs by means of the electric light produced by the Wilde machine. The results obtained by these machines and by subsequent modifications certainly leave little to be desired; but the machines themsel ves, unfortunately, have inherent defects. The currents produced are intermittent; at each revolution, two electrical pulses proceed in one, and two in another, direction To collect these, a friction commutator is necessary, which wears away very fast. In Holmes' original marhine it only lasted from 10 to 20 minutes; and in the later machines, in which over 1,800 revolutions per minute are obtained, there must necessarily be considerable wear and tear wherever there is a metallic contact of moving parts.
These difficulties have been overcome in a machine invent ed by M. Gramme, of Paris, and recently exhibited before the French Academy of Sciences by M. Jamin. Our engravings illustrate the invention. The principle is as follows: If the north pole of a permanent bar magnet be moved along a soft iron bar surrounded by an insulated wire, it will produce a south pole in the iron bar, which will gradually be displaced from one end of it to the other, following the motion of the bar magnet. The result is a continuous induced current in the surrounding wire. If, now, the soft iron bar be made into a ring, A, and placed between the poles of a horse shoe magnet, D , these poles will of course induce currents in opposite directions, neutralizing each other at two points of the ring, midway between the p.les, exactly (accord ing to Mr . Crookes) as if we had two batteries connected in opposition by joining theirsimilar poles. On revolving the iron ring on the journals, E , a continuous current is developed, as in the case of a straight bar, but in opposite directions, because here we have to do with both poles of the exciting magnet. Both these currents will continually neutralize each other at the two mean points. To utilize them, all that is necessary is to connect conducting wires to the insulated wire at the mean points, and they will flow along these wires instead of neutralizing each other; just as in the two batter ies above, connecting a disk, F , with each point of contact of the similar poles, will cause the force of the batteries to flow through the conducting wires "quantity-wise." M. Gramme accomplishes this in the following manner:
If the wire wound upon the ring is very thick and there is but a single layer of it, it is sufficient to remove the insulating covering at some po:nt which, in its revolution, is made to touch fixed metallic conductors, F, situated at the neutral points. If, however, many layers of fine wire are used, the following device is adopted: The wire is divided into sec tions of, say, 300 turns each, there being no break, however, in the wire on passing from one section to another. Each sec tion has its wire exposed at one point, and to this point is
soldered a solid bar of brass, B, capable of considerable wear soldered a solid bar of brass, B, capable of considerable wear and tear. The bars thus attached to the sections are ar ranged radially; and when the ring, A, is revolved, several of thera simultaneously touch two solid metallic rubbers, F, at the neutral points. More than one bar is made to touch at a time to prevent any break in the current.
The machine exhibited before the French Academy of Sciences derived its magnetism from an electromagnet instead of a permanent one. It was provided with four metallic rub bers, two of which supplied the electromagnet with a part of the current generated. The machine started with the fidy gained in strength as the velocity increased, A machin idy this kind, having 15.4 lbs of 0.118 A of this kind, having 15.4 lbs . of copper wire 0.118 inch thick, decomposes water and fuses 1.04 inches of iron wire 0.036
inch thick when worked by hand. A large machine, driven by a $2 \frac{1}{2}$ horse power engine, which was exhibited in London, produced a light equal to about 8,000 candles ; and still larger machines are being made, which Mr. Crookes expects to give a light equal to 25,000 candles. Besides the purposes of il lumination, such machines, of the smaller sizes, will be of service in telegraphing, electroplating, gilding, medicine, military operations, and chemical decompositions. They are of especial value in electroplating, on account of the con stancy of the current. In the galvanoplastic works of $M$ Christofle, of Paris, it is found that the best machine hitherto known, when moved with a velocity of 2,400 revolutions pe minute, only deposits $5 \cdot 465$ ounces troy of silver per hour, while a smaller Gramme machine deposits $9 \cdot 645$
There will be two of these machines in this country before long, Professor Barker having ordered one for the Stevens Institute of Technology, and one for the University of Penn sylvania. At present electroplating is done in this city in several places by the Wilde machine.
It would be difficult indeed to foresee what further increase in power may yet be obtained in these machines; for inves tigators are constantly studying the properties of magnet and the means of augmenting their strength.
M. Ruhmkorff, to whom science already owes so much, still continues his experiments in electricity and magnetism He has presented the following facts to the French Acadomy of Sciences

If a bundle of iron wires, covered with thick copper wir giving passage to an intermittent current from a battery, is then wrapped with fine wire for the purpose of obtaining an induced current, that current will have more than double the usual intensity if we wrap the fine wire around the mid dle of the bundle, where there is no magnetization, instead of wrapping it near one of the poles. He concluded from these premises that he could get still more powerful effects by making a continuous ring of his iron wires, which would then present no poles; but in this he was disappointed, for cutting the ring, the spark at once increased to 0.2 inch
although the cut ends came together the moment they be ame magnetic.
On keeping the ends apart with a plug of wood 0.2 inch in hickness, the spark reached the length of 0.6 inch . With thicker plugs of wood, no further change was produced. It still remains to be seen what practical application can be made of this fact.
Jamin, in studying the magnetism of thin steel plates, found, by magnetizing plates of various dimensions and superposing a number of similarly magnetized ones, that he could construct magnets carrying twenty times their own weight. The thinner the superposed magnetized plates, the more powerful the resulting magnet. His researches will probably reveal the law according to which magnets, having a minimum weight and a maximum carrying force, may b constructed.
It seems, too. as if we were rapidly approaching the solution of the problem of an electrical illumination for our streets and houses. The difficulties hitherto have been that it is impossible to regulate the intense brilliancy of the electric light, which would be blinding on the street, and of course utterly unfit for lighting our houses; that it is not continuous, but requires the frequent renewal and adjustment of the carbor points, involving expense and compli cated apparatus for each lantern; and finally that a separ ate source of electricity is required for each lamp. All these difficulties are said to have been obviated by the invention of Mr. A. Ladiguin, of St. Petersburgh, which was recently exhibited by Kosloff \& Co., the proprietors of his patent, in the Admiralty House of that city. His invention is as follows: Only one piece of carbon, or other bad conductor connected with the magneto electric machine is placed in a glsss tube exhausted of air, filled with some gas which will not combine with carbon at a high temperature and hermet ically sealed. The carbon becomes gradually and equally heat-

ed, and emits a soft, steady, and continuous light. One machine, driven by a small three horse power engine, is said to be capable of lighting many hundreds of such lanterns, which will burn under water and in mines as well as in a room They are free from any danger of explosion, and have the additionaladvantage, over gas, that they emit no poisonous evaporations detrimental to the health. The inventor calcu lates that these lamps can be iighted at one fifth the expense of coal gas. If this invention should prove a success, few consumers will mourn the disappearance of gas compa | nies. |
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## Srinutitir Ammitan

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NEW YORK AND THE CENTENNIAL.
For several months past extended advertisements have appeared in the journals of this city, announcing a projected scheme of a grand national exposition, to be permanently lo cated in elaborate buildings, in a prominent locality near the Central Park. The originators, last year, obtained the passage of a bill in the State legislature, authorizing them to ask a subsidy of two and a half millions of doliars from the municipal government. After hearing men have refused the appropriation; and as a consequider the scheme may be considered as indefinitely postponed We have remarked, however, that during its existence portion of the press have sought to engender a kind of rivalry between this plan and the coming National Centen ial at Philadelphia. In view of the present state of affairs it is to be hoped that any feeling of jealousy which may
have become prevalent will speedily die out, and that the have become prevalent will speedily die out, and that the
people of New York will render that support to the Centen nial which the enterprise justly deserves. The quota of thi State is $\$ 1,036,600$, which it is proposed to raise by issuing stock in shares of $\$ 10$ each, paying six per cent interest, and secured by sale of tickets, concessions for advertising, etc. can be predicted, a safe and, probably, profitable one.

An immense amount of labor has been accomplished by the Centennial committee, and, from all accounts, the work is progressing rapidly and well. The people of the southern nd western States are manifesting no small amount of inter in the scheme, and State and county associations ar forming for the purpose not only of raising funds but of se curing the most complete possible exhibit of resources and products. A very liberal appropriation has been made by Pennsylvania and the city of Philadelphia, and we under tand that still further assistance is contemplated in order to add improvements to Fairmount Park, the site of the expo ition buildings. In fact the country has abundant cause to congratulate itself on the favor with which the plan has been received abroad, and the enterprise with which it has thus far been conducted at home. Uniform and flattering success, we might say, has been encountered, were it not that several of the States have manifested a dilatoriness in affording sup port, which cannot but prejudice the general progress of the undertaking.
The citizens of New York should remember that the selec ion of the plan of buildings from drawings submitted by Messrs. Vaux \& Bedford, a prominent architectural firm of the metropolis, is quite a compliment to the city, yet to be returned; and moreover that their local interests cannot but be furthered by the attraction of immense crowds to a poin only four hours distant by rail. The matter is, besides, one of national pride, and hence we trust the patriotism of the people may be relied upon not to allow the Centennial, in point of magnitude and grandeur, to fall below previous ex hibitions in Europe, or to prove so unfortunate a financia failure as the recently closed Vienna show.

## THE SIGNAL SERVICE REPORT

The Chief Signal Officer of the Army has recently sub mitted a very gratifying exhibit of the labors of his bureau during the past year. Thirteen new stations have been added, so that at the present time there are seventy eight points of observation in the United States, eleven i Canada, and three in the West Indies, the latter being lo cated at Havana, Kingston, and Santiago de Cuba. Three other stations, on the islands of Porto Rico, Guadaloupe and Barbadoes, will also shortly be equipped.
Some very excellent arrangements have been completed for securing to farmers and others, in communities not reached by telegraph, information as regards probable weather earlier than would be afforded were the reports delayed by publication in newspapers. The plan adopted has been to divide the territory of the United States into districts, each district having a distributing point, at or near the center from which two printed copies of the synopsis and proba bilities are forwarded by mail to all post otfices within th districts, or which can be reached by sail, steamer, o mail coach by 4 P . M. of the same day. The bulletins ar then conspicuously posted in the receiving offices, and 8,988 printed copies of the weather report are thus daily dis tributed to 4,491 post offices; and the plan thus far has worked admirably
There are nineteen special river stations from which re ports of the depth of water in the principal rivers of the United States are daily made by telegraph, at particular sea sons during which danger from freshets may be antici pated. Twenty of the regular stations also furnish river reports, which are of great value as giving constant and ac curate knowledge of the condition of channels, and thus adding to the safety and convenience of our river com nerce
For the purpose of studying the phenomena of the uppe portions of the atmosphere, stations have been establishe on Mount Washington, N. H., on Mount Mitchell, N. C. and quite recently a third one on the summit of Pike' Peak, at an elevation of 14,216 feet above sea level
One of the most valuable additions to the system, which has been made during the past year, is the establishment o a chain of life-saving stations along the Atlantic coast Signals visible for some distance at sea, serving to warn ves sels of probable bad weather, are to be displayed from points twenty five miles apart from Sandy Hook to Cape May, and it is intended to continue the construction of suitable tele graphic communication along the dangerous coast of Virginia and North Carolina. Without doubt, these points of obser vation will be of great benefit. They will serve as meteoro ogical stations from which information of the condition of he weather at the sea level can be transmited, as sites fo lighthouses and life boat deposits; as videttes in time of
war, to give warning of the approach of an enemy's fleet; war, to give warning of the approach of an enemy's fleet the coast; and as positions of display of cautionary signals as already noted.
With reference to international exchanges of meteoro ogical information, General Myer refers to the proceedings of the recent Weather Congress at Vienna. The proposition was adopted, by a unanimous vote of that body, that at least one uniform observation of such character as to be suitable for the preparation of synoptic charts should be taken, and recorded daily and simultaneously at as many stations as practicablethroughout the world. It is also stated that ar rangements have already been made with Prussia and Tur ey to commence, on January, 1874, the exchange of on daily report, taken simultaneously throughout those coun ries and the United States; and the coöperation of othe nations in the system is expected.

The Chinese coal fields occupy an area of 400,000 square miles. Both bituminous and anthracite coal are found of good quality. In immediate proximity to the coal,large de posits of ircn ore occur

RECENT EXPERIMENTS WITH DIAMONDS.
Diamonds are rather costly objects to subject to destructive experiments on any extended scale, and not many investigators have been favored with the privilege of doing it. Thanks, however, to the liberality of the proprietor of a large diamond-cutting establishrnent in Amsterdam, a certain M. von Baumhauer has been permitted to make numercus studies of the behavior of these interesting gems when subjected to high temperature under various conditions, thus adding largely to our knowledge of the diamond's nature and properties.
The combustibility of the diamond in oxygen was demonstrated long ago; what the effect of pure heat upon it was remained a matter of doubt. Some experiments seemed to show that at extremely high temperatures the diamond is slowly converted into coke or graphite, an effect observed especially when the gem is subjected to the energetic action of a powerful galvanic battery. In certain experiments, in which Moren and Schrötter raised diamonds to the highest heat of a porcelain furnace, care being taken to prevent contact with air, a slight discoloration of the surface was observed, whether due to heat or imperfect protection against oxygen could not be decided positively. Inclosed in a bit of hard coke, and placed in a plumbago crucible packed with charcoal powder, diamonds operated on by Siemens and Rose withstood, without the least change, the temperature at which cast iron melts. A cut diamond, under similar conditions, subjected to the heat of molten wrought iron for a considerable period of time, was superficially klackened, but otherwise unaffected. By some this experiment has bee $\%$ interpreted as implying the slow conversion of the diamond to graphite at the temperature at which wrought iron melts. It is possible, on the other hand, that the change was due to air in the crucible: indeed probable, in view of the experiments more recently made by M. von in view of the
Baumhauer.
By an ingenious device, the last named experimenter was ıble to subject diamonds, surrounded by an atmosphere of Iry hydrogen, to a temperature at which both diamond and latinum holder became invisible; but with uncolored dianonds, their transparency and brilliancy were not in the least ffected. Heated in contact with air, diamonds were not nly blackened, but reduced in weight, showing positive ombustion. In oxygen they burned with a vivid incanescence at a temperature below white heat. In a crucible rhich allowed the combustion to bs observed through a reet of mica, the burning diamond was seen to be surunded by a white flame, less bright without and tinged ith violet on the outer edge. Pure diamonds burned tranilly, retaining their sharp edges even when so reduced as be vi
Burned in an oxyhydrogen flame, capable of melting atinum, diamonds emitted a brilliant light and wasted pidly, but did not blacken. Heated to a high temperature an atmosphere of carbonic acid, they were slowly conmed, decomposing the carbonic acid, and combining with oxygen with loss of weight. Similarly treated in superated steam, no effect was produced, showing that at white it the diamond does not decompose water, as might be exted from its affinity for oxygen. In regard to the supsed transformation of the diamond into coke or graphite means of pure beat, especially by that of a battery of Bunsen elements, M. von Baumhauer is very doubtful. hould not be admitted, he holds, until the effects obved are proved to be not the result of chemical action, duced by foreign matter, or by the transmission of par3s of carbon from the charcoal poles to the surface of the nond.
he effect of heat on colored diamonds is more pronced, with the exception, perhaps, of gray and yellow a, which appear to resist such action, the sume as the rless ones. Green diamonds are variously affected. One dirty green tint was changed to pale yellow, with a at increase of its transparency; but its brightness re-
sed the same. Another, so green as to be almost black, yed the same. Another, so green as to be almost black,
wise retained its brilliancy, but gained in clearness, while vise retained its brilliancy, but gained in clearness, while
olor was changed to violet. A light green gem lost its olor was changed to violet. A light green gem lost its

- entirely, but was otherwise unaffected. Brown diads lost most of their color, showing under the microз a limpid field, scattered with black spots. A diamond st colorless assumed, under the influence of heat (out intact with air), a deep rose color, which it retained time when kept in the dark. In the light its color l , but always returned again with heacing. A naturally colored diamond reversed the phenomena, losing its
with heating, and afterwards gradually regaining it.'


## PHOTOGRAPHY OF THE INVISIBLE.

3 grand moral idea which science continually seeks to imupon her votaries is, humility of mind ; that inestimable 3 whence spring the noblest pleasures of the soul. But are it is to find this beautiful quality, even in persons
lture and learning! The great doctors looked upon lture and learning! The great doctors looked upon
o with contempt, confined him in prison as a dangerous and subjected him to the most ignominious treatment, y because he presented, for their acceptance, the light a new idea, which their dull perceptions were unable
reciate. He affirmed that the sun'did not really rise or reciate. He affirmed that the sundid not really rise or
atit was the rotation of the earth that brought day and alternately upon the earth. But the doctors, like many day, proud in their own conceit of knowledge, knew
"The scriptures tell us," they said, "of the rising e setting sun ; therefore it moves; our own eyes assure the fact; the diurnal experience of mankind confirms th. Your doctrine, Galileo, is false and dangerous.'

It is in this style that some persons, very knowing in their wn esteem, reason upon certain subjects. Take "spirit photography" for an example. They allege that spirits are $n$ visible; that an invisible thing cannot be photographed; therefore the so-called spirit photographs are base imposures.
It is not our purpose to dissent from the conclusion here assumed; but we take exception to the premises, which are not in agreement with science. Photographs of some objects that are invisible to the human eye may undoubtedly be produced. The spectrum of solar light is an example, portions of which, totally invisible to the eye, are brought out upon the photographer's plate; and
The mental effect which we term light is supposed to be produced by the beating of waves of ether against the retina of the eye. These waves enter the eye with an average velocity of about 186,000 miles in a second, the length of the waves being variable, from the one twenty-seven thousandth part of an inch, to one seventy-five thousandth part of an inch. The retina therefore receives many billions of impressions in a second, and it is supposed that it is the dif-
ference in the number and velocity of these impressions ference in the number and velocity of these impressions
that produces in the mind the sensations of the colors. If the waves which enter the eye have a much greater or a nuch less velocity than the limits above stated, they do not, it is supposed, produce the sensation of light; and the objects from which such rays come, although they may really stand before the eye, are, as we say, invisible. But although they do not effect the eye, they may impress the photographic plate, which has no such constitution as the eye.
One of the most successful methods of producing " spirit" photographs is to place, in front of the sensitive plate, within the plate shield, a clear sheet of glass having nothing upon the plate shield, a clear sheet of glass having nothing upon
it except a thin positive of the "spirit" that is to be produced on the negative. The portrait of the sitter is taken in the usual manner. The light which enters the camera lens prints the sitter and also the "spirit" which is on the thin positive upon the negative. This is a very convenient method, as it requires no manipulations likely to be detected; and is, we think, the favorite plan practiced by the best spirit photographers. Prints made in this manner pass current among the believers for genuine ghosts of the departed, directly descended from heaven.
But a more new, interesting, and scientific method of produ cing 'spirit" photographs, is as follows : the plain background screen, before which the sitter is placed in order to have his portrait taken, is to be painted beforehand with the form of the desired "spirit," the paint being composed of some fluorescent substance, such as a solution of sulphate of quinine. When this painting dries on the screen, it is invisible to the eye; but it sends out rays that have power to impress the photo plate; and thus the image of the person together with the quinine ghost are simultaneously developed upon
the negative. This is a very beautiful and remarkable the nega
method.

## SCIENCE IN THE KITCHEN.

The student of the social economy of this country will encounter no more remarkable anomaly in the habits of our people than that, while we exhaust every possibility achieved by the progress of modern science toward the
augmenting of our pecuniary welfare, we as sedulously neglect the teachingsj derived from the same source and pointing to one of the most important causes of physical health and comfort. When a man undertakes to build himself a house, it is the general rule that he exercises the closest care
that every portion of the structure shall be, in design and material, the best. He employs a shable architect, a thorougb builder, selects stone, brick, mortar and other components of his fabric with a rigid scrutiny which leaves no doubt in his mind but that his dwelling will be a strong and lasting shelter. Then he decorates, furnishes, searches for ingenious devices of household convenience, and finally enters his new habitation secure in his belief of its excel lence. Is it not strange that all his labor is done for a roof which may cover its owner but until to-morrow: for a home
which the vicissitudes of fortune may wrest from him in a day, or which of his own choice he may abandon before the mortar is perfectly dry: while to the structure in which
Providence has ordained he shall exist for a lifetime, but Providence has ordained he shall
secondary consideration is given?
Our food has been compared to the fuel which heats a boiler, makes steam, and so drives the machinery. The simile is not only trite but unjust. The substances that we eat play even a greater part. It is as if the fuel, besides istence the water, contributed by its combustion to the ex materials we consume. Clearly then, although we may subsist for a time on substances unsuitable and comparatively non-nutritious, in the end our physical system will suffer, if not break down, from the improper nature of the compo ents with which it is supplied
Cooking is the proper preparation of food for human con
sumption. We do not consider that the term means ap sumption. We do not consider that the term means ap
plying heat until the substance assumes any form which is edible, but the causing of the material to undergo certain changes, chemical or otherwise, in its condition, which render it in the most suitable state for the nourishment of the oody. Articles for the table, then, are either cooked or
ruined-necessarily one or the other. Bad cooking, like bad grammar, is non-existent ex vi termini; but as to where the dividing line happens to be between these very opposite conmay be safely drawn from the sanitary point of view, as above noted ; for a single material, like the common potato,
or example, may be nutritious and healthy when properly cooked; while if it be boiled until it be waterlogged and waxlike, its beneficial nature is lost. Theoretically, then, the gage of cookery should be the healthfulness of its results; practically, however, the standard is simply and purely one of individual taste; and that in this country, where the majority are educated to relish compounds indigestible and worthless as brain and muscle producers, is fallible in the extreme. Hence, while this sense is gratified, we give no thought to the means; in other words, so long as the builder of the fabric is satisfied with the exterior appearance of his stone, mortar, or brick, no matter, if when they are made into a wall, they prove bad within, and weak and insufficient as supports.
Dr. James, in an excellent paper recently read before the American Health Association, upon a topic kindred to that to which we are referring, points out with much clearness many of the abuses into which the preparation of our food has fallen, and inveighs with special vigor against the general assumption that women are natural cooks. Perhaps it is to the invariable inaccuracy which (our feminine readers will pardon us) is inherent to the gentler sex, more than to any other cause, that the science of cookery has descended to the level of a rule of thumb pursuit. Do we ever need a medicine, we watch the druggist, that he compounds it with scrupulous exactitude. Do we build a machine, we hire talent that will execute the work to hair breadth ac curacy ; in fact, we employ skilled labor to supply us with knowledge, to house us, to dress us, and even to shave us, everything but to feed us. It takes an artist to make our coats but the most foolish of Hibernian virgins may be installed in our kitchen to prepare the food that makes our body.
If cookery were reduced down to rule, so that a person could follow recipes with the same certainty of success, due to accuracy, with which the student pursues the instructions laid down in his text book of chemical analysis, it is presumable that any individual could produce eatable and healthy dishes ; but nothing is further from the truth. Let the reader ask any successful cook how he or she made such or such a com pound, the chances are strongly that no satisfactory ex planation can be given. "Practice" is probably stated as the reason, or "experience," or " luck." Let him turn to any so-called cookerybook, and we would be willing to wager that in nine cases out of ten the recipes for the most delicate cake and pastry contain greater margins of inaccuracy than any formula extant for mixing mud concrete. What does a teaspoonful mean, heaped up or level with the rim? Or a teacupful? What size of teacup? How much is a pinch, or a handful, or a pennyworth? There is absolutely no standard system of measures conscientiously followed; and hence a woman will gage her ingredients by the grab with the same unquestioning faith in the accuracy of the com bination that she reposes in the fact that the distance from the tip of her nose to the end of her fingers is precisely and infallibly one yard.

The practical solution of the important question, whether the masses can be educated properly to prepare their food, is yet to be determined. It is surely possible that cookery can be taught as a science, as other necessary branches of knowledge, not after the fashion of child's play, as have been most of the previous attempts in this direction, but as a serious study. We do not expect every man's wife to be would not disgrace Delmonico; but we do believe that means might be found of imparting information sufficient to relieve the people of many of the nightmare-breeding comlieve the people of many of the nightmare-breeding com-
pounds of daily consumption. Make practical cookery a part of every woman's education, and the principles of the same a portion of that of every man. Let us, for recipes, have formulæ and instructions, clearly couched but as ac curate as the physician's prescription, and deduc $\in d$ by scientific investigation. Then with the materials and means which we now have, better than which the world cannot be food destructive to our health as individuals and as a people.

## SCLENTIFIC AND PRACTICAL INFORMATION

## swedish iron

The superior quality of Swedish iron is still maintained. The price for charcoal pig, in 1873, has been about $\$ 45$ a tun Ten years ago the same article sold at $\$ 19$ per tun. It is supposed that the excellence of Swedish iron is due to the presence of tephrite, a silicate of manganese and iron. This is a discovery by M. Ingelstroem.

## an imperial thermometer.

Professor Palmieri, of Naples, has recently completed a very ingenious and elaborate registering thermometer for he private use of the Empress of Russia. The instrumen is of metal and is provided with bells, which give a signa whenever any considerable change of the surrounding temperature occurs. It is said to be so sensitive that the indicator is in a state of almost perpetual motion. Suitable devices show the extreme range of temperature during given periods of time. The apparatus is placed in the imperial traveling carriage.
the corinth ship canal.
The Italian Consul at the Piræus, Greece, communicates to this government the news that the contract for opening a canal through the Isthmus of Corinth has bsen awarded Mre Turini, an Athenian banker. The conditions of the $f 28$ fet and a docks, with storehouses, etc., covering an area of 71 acres,
are to be constructed, at half the distance, and the basin is to have a sufficient depth of water to float the largest vessels.
The work is to be completed in 6 years under a penalty of $\$ 60,000$, and M . Tuvini has obtained the entire grant for 99 years. It is estimated that the expense of the underta. king will reach about $\$ 4,000,000$. The advantage to be gained are the avoidance of the détour of the Morea and the doubling of Cape Matapan, a dangerous coast in stormy weather, thus materially lessening the journey between Greece and the western countries of Europe.
bisulphide of potash a revealing agent for galena.
M. Jannettoz, in Les Mondes, says that, on throwing a fragment or a crystal of bisulphate of potash, HO$\} \quad 2 \mathrm{SO}_{3}$, on roughly ground galena, a very sensible disengagement of sulphuretted hydrogen ensues. If the two substances be ground together, the odor becomes almost unsupportable. It is well known that sulphuric acid, mixed or even warmed with galena, does not give any sensible disengagement of sulphuretted hydrogen, nor do the sulphurets of antimony, of iron, of mercury, of silver, or even those in which the lead and sulphur do not form an isolated combination, give such results with the bisulphate. But if, to any mixture whatever, a fragment of pure sulphuret of lead be added, at the moment when the rubbing or grinding of the whole with bisulphate of potash takes place, sulphydric acid is given off.
direct determination of the elements of organic substances by a single combustion.
Mitscherlich has recently discovered a new mode by which, by direct analysis, not only the carbon, oxygen, and hydrogen in an organic substance can be determined, but also the chlorine,bromine, sulphur,iodine, phosphorus, and probably also the nitrogen therein contained. The organic material is brought to combustion with oxide of mercury, the results of which process are water, carbonic acid, and mercury. The two former are weighed in the ordinary manner. The weight of the mercury formed serves to determine the quantity of oxygen due to combustion, by subtracting which from that contained in the carbonic acid and the water, the total amount of oxygen existing in the substance submitted to elementary analysis is found. If, however, the body under examination contains chlorine, bromine, or iodine, these elements combine with the mercury set free, and are determined by weighing. Sulphur and phosphorus combine in the state of sulphate and of phosphate of oxide of mercury.
preparing ammonia salts.
Bobrownicki, of Paris, proposes to prepare ammonia salts from the ammonia liquor of gas works by acidifying and then treating it with fluoride of silicon, chloride of silicon, hydro-fluor-silicic acid, or an alkaline silicate. The silicon compounds carry down the suspended bodies, and those in solution, and hold them in a solid or half solid form. Bobrownicki calls the precipitate a silicoid. It furnishes the crude material for preparing ammonia salts in the usual manner.

NEW REMEDIES FOR CHOLERA
French physicians, as a rule, hold to the fungoid theory of cholera, and one of their number has been experimenting with the carbolate of ammonia in cases of cholera, so far, we learn, with encouraging success. One physician (Dr. Déclat) looks upon carbolic acid as a prophylactic, to be used in the ordinary way of diet during epidemics. It is taken in the form of sirup. When a patient is attacked with cholera, the sirup should be administered, and a dilute solution of the acid injected. In severe caces, the doctor employs a sirup of carbolate of ammonia, with subcutaneous injections of the same; and he is so confident as to the efficacy of his remedy that, in cases where dissolution is impending, he injects a solution of the carbolate of ammonia directly into the veins.

## A Phenomenon of Capillarity.

A curious experiment, due to capillary attraction, wa described at a recent session of the French Academy of Sciences. It consists in placing in a flask a small quantity of bisulphide of carbon, and inserting into the liquid a small tight roll of filtering paper, which passes up through a hols in the cork. Owing to the porosity of the paper, the bisulphide ascends; and on coming in contact with the atmos phere, evaporates very rapidly. A temperature is thus produced of very nearly $0^{\circ}$ Fah, under ordinary circumstances The water held in a vaporous condition in the airstances, quently condensed and precipitated in the state of hoar frost which, with the bisulphide, forms, it is said, a peculiar hy drate, which is deposited on paper in a white layer. As new quantities of the bisulphide are continually supplied, the phenomenon continues until a mushroom-shaped excrescence perhaps an inch in hight and broad in proportion, surmounts the flask.
MM. Dumas and Chevreul suggest that this may point to the explanation of certain geological phenomena,such as ferruginous and calcareous concretions, of which the forms are identical with that of the artificial stalagmite described.

For the convenience of those dandies who are unequal to the effort required to carry a cane and an eye glass at the same time, C. K. Pevey, of Worcester, Mass., has combined these two articles in one, the glass being set in a bow formed in the handie.

A MODEL of a safety watch pocket in the Patent Office ha the following inscription:
"He that hath a watch, two things must do,
Pocket his watch, and watch his pocket, too,"

## THE TOM THUMB TELEGRAPH.

There is nothing equal to experiment in impressing the facts of science upon the mind. Faraday used to say, with emphasis, to his pupils, that it was not sufficient to read about magnets and electricity. He advised them to make the magnets, use the electrical machines, and thus become, step by step, positively acquainted with the whole subject. As a means to such ends, we take especial pleasure in calling the attention of our readers to the Tom Thumb Telegraph. It affords the means of illustrating the phenomena of electricity, at a
erybody.
The Tom Thumb Telegraph consists of an electro-magnet sounding armature, a galvanic kattery, telegraph key, connecting wires, and chemicals, all complete for working, which, with excellent directions for use, are furnished for $\$ 3$ : neat ly packed, and sent to all parts of the world, on receipt of the price, by the makers, F. C. Beach \& Co., 260 Broadway, corner Warren street, New York
One of these little instruments is now in operation upon our table as we write. We had some curiosity to see what could be done with it, and will here give some of the results: First, as to the battery. It is composed of two small plates, one of lead, one of zinc, the latter covered with paper as a septum, both plates set in a common saucer, in water in which a few grains of sulphate of copper are dissolved. This little battery we found, on trial, to run for two days and a half. The water solution needs to be then renewed, which requires, perhaps, a couple of minutes to do.


THE TOM THUMB TELEGRAPH. FIG. 1.
Next, as to the instrument. It makes a first rate click ignal, and is, we think, just as useful for learning the ma nipulation of the Morse alphabet, and for sending and re ceiving messages by sound, as any of the larger and more ex pensive instruments.
In addition to its office as a signal telegraph, this little device may be used for experimenting in many ways, and with it all the principal phenomena connected with electricity and magnetism may be exhibited. Its employment for telegraph ing is illustrated in Fig. 1. In Fig. 2 the armature is re moved and a slip of glass, with iron filings, placed on the poles of the magnet, K. When the key is pressed, and the glass gently tapped, the filings assume the beautiful posi tions of the magnetic curves. Removing the glass, needles


THE TOM THUMB TELEGRAPH.-SHOWING THE MAGNETI CURVES. FIG. 2.
may be magnetized by rubbing on the poles, permanent mag net smade, weights lifted, etc. By connecting one wire with a file and drawing the other wire over the teeth,the electric light in the form of a sparkling luminosity, may be produced. This is a pretty evening experiment. The electrolysis or decomposition of water into oxygen and hydrogen may be done with the battery, and it may also be used for electro-plating. For these, and other interesting experiments, printed directions are given by the makers. For schools, large or small, the device will be found very useful in the hands of the intelligent teacher, as a means of interesting instruction.
We should find it difficult to select an article of more in terest and usefulness for a Christmas gift for young per sons than this Tom Thumb Telegraph. It supplies the mean
for easy self-instruction in one of the most interesting branches of science, with which everybody, old or young ought to make themselves familiar. These little device may also be used for office telegraphing as well as for home use and amusement. Any intelligent lad may put up the lines and set them in operation. For further information and free illustrated catalogues, address the makers a above.

## THE MINIATURE TELEGRAPH.

For about a year past we have had in use here, in the office of the Scientific American, a very simple and conoffce of the Scientric American, a very simple and con-
venient little electrical device, termed as above, the Minia ture Telegraph, the invention of Mr. Lawrence Duerden telegraph engineer of the Broadway Underground Railway, in this city. It consists of a pretty little electric bell, shown in its full size in the accompanying engraving, Fig. 1.


As used in our office, these instruments are placed upon the desks in the various departments of our establishment, and from them wires extend to the desks of the managers, on which buttons are fixed, which connect with the wires When the manager wishes to communicate with any parti cular person on the premises, he touches the button corresponding to the wire leading to the bell where the individual is at work. The touch sounds the bell, and, as a variety of signals may be sent, one bell may serve to signalize differen persons who are within its hearing. It is surprising how many steps the use of this little contrivance saves, and how many stion it facilitates the tran office business greatly it facilitates the transaction of our office business Previous to its introduction, it was necessary for us to em-
ploy messengers, who did little else than run from one part ploy messengers, who did little else than run from one part
of the premises to another, consuming time and making of the premises to another, consuming time and making
mistakes. This miniature telegraph saves all such


THE MINIATURE TELEGRAPH. FIG. 2.
troubles, and enables the manager, without leaving his seat to communicate instantly with all the principal persons em ployed in the concern. (See Fig. 2.) We have seven o these little instruments in use in our office, which serve u in signalizing a large number of persons. For factories stores, shops and offices, for dwellings, in lieu of th ordinary bells, for signaling from house to barn, and fo all the thousand and one purposes of business and domes all the thousand and one purposes of business and domes
tic communication, this improvement is very useful. Th. makers fit up offices and buildings with them when de sired. The device is so simple that any person of ordinar: intelligence may put up the wire and set into use. It is s made that by shifting a wire from one screw into another may be used as a telegraph, giving single signals, or as burglar alarm, making a continuous ringing. The cost i only $\$ 5$. For this sum, the manufacturers supply one of th bells, like those we use in our office, pictured above, togethe with connecting wires, chemicals, and a small battery, a complete for working the instrument, with directions fc use: neatly put up and sent on receipt of price to all part of the world by the manufactuvers, F. C. Beach \& Co., N $r$ 260 Broadway, corner Warren street, New York. At a sligl additional cost, the makers supply a larger battery, such \& we use in our office, which runs six or eight months withol renewal.

THE CHALLENGE REVERSIBLE ROTARY HOISTING MACHINE.
A novel application of the rotary engine to purposes of hoisting or elevating has recently been brought to our notice, which in some particulars appears to be, in point of simplicity, compactness, portability, and usefulness, an improvement of considerable merit. It is claimed that the engineruns the same number of piston feet per minute as a reciprocating, and, from its construction, at a higher speed than the latter. Hence, and for other reasons to be noted as we proceed, it is believed that the ground of the objection generally true to rotary engines as a class, namely, lack of economy, is here materially decreased, and in some forms of the machine perhaps obviated altogether.
in justice to the apparatus it may be stated that, so far as our investigation has extended, it has given general satisfaction; and although from our individual knowledge we are of course unable to make confident assertions as to its merits as compared with devices of like nature, we nevertheless have been informed by credible engineers, and others by whom it has been actually employed over a sufficient period for reasonable tests, that it is, in point of relative advantage, superior to many other well known machines with which they are familiar.
In order clearly to comprehend the operation of the apparatus, an explanation of the interior working mechanism of the engine is necessary, and this will be rendered plain by a reference to the sectional view represented in Fig. 1. Bis the spider which is keyed fast to the shaft, C, and set ec centrically to the outer cylinder, A, forming an abutment at the top and leaving a steam space, D , which is traversed by the three pistons, E. The latter are held out by a loose interior ring and a spring ring, and can move with the inner cylinder or remain at rest. A regular and steady power, it is claimed, is gained at all points from the fact that each piston acts for one third of the circumference of the outer cylinder, and the steam expands by increase of area until cut off by another piston. The point, however, to which we desire to call more directattention, is the valve, which, of the usual D shape, slides over the steam ports of the engine and by its position allows the entrance of steam into one or the other side. At the

Fig. 2.

paropi it it it í

tional Line, the apparatus is used for hoisting in and out cargo, coal and freight. An apparatus rated at fifteen horse power by the manufacturers, we were told, under a pressure of 60 lb . of steam, easily lifted $4,800 \mathrm{lbs} .200$ feet per min te, raising, lowering, or holding its load at any point with equal facility. The same machine also elevated 460 tuns of coal to a hight of 20 feet in eleven hours. At a warehouse in Washington treet in this city, where the andling of heavy goods is often necessitated, an engine rated at

## THE CHALLENGE REVERSIBLE HOISTING ENGINE AS APPLIED TO MINING PURPOSES

of a segment pinion, which is vibrated by means of a hand lever extending upward. It is clear that by this mechanism the valve can be readily moved so as to admit steam as above noted, causing the engine to travel in either direction or

Fig. 3.

stop. The motor thus constructed is, by a simple arrangeent of cog gearing, connected with a large spur wheel on e hoisting drum, so that the movement imparted to the tter may be either rapid or slow
We were quite recently afforded an opportunity of inspectIg several of these machines in actual employment, and om conversations with engineers the following informaon was obtained. At the pier of the steamers of the Na-
even horse power, we were informed, wouldhoist one tun $150 \mid$ value in lifting blocks from quarries. Its arrangement is ameter was 34 inches. We under of coal lasted on an that of coal lasted on an average three months, using the machine almost continuously.

Various other illustrations of the capabilities of the apparatus were submitted to us, but the above are sufficient to give a general idea of its working. The smaller forms may be mounted on trucks and thus readily transported from point to point wherever any hoisting is to be done, it being merely necessary to secure the machine to the ground, attach a hose conducting steam from the boiler, and it is ready to operate. The lever is easily governed by the hand of the engineer, or may be arranged with cords to be regulated from a distance.
One of the most important applications of the apparatus is in connection with mines, and its arrange ment for such purpose is represented in the engravings hereto annexed. The first operations in the excavation are designed to be accomplished by the machine shown in elevation and plan in Figs. 2 and 3. This is a single powerful engine geared to a drum so as to lift heavy weights at a low speed. The dimensions of the various parts may be judged from the scale of feet and inches accompanying. Fioss. 3 and 4 are simila views of an arrangement of two engines of equal capacity in connection with a single drum geared for more rapid
feet per minute. The boiler in this case was of the type such, it is claimed, as especially to fit it for outdoor labor, as supplied with the machine, and of the upright tubular pat- its working parts are all within the cylinder, and hence protern, containing 56 two inch tubes, each 4 feet long. The di- tected. We are informed that it is made of but ten pieces, such, it is claimed, as especially to fit it for outdoor labor, as

exclusive of bolts; and finally that it rarely requires re pairs, and then but such as are easily and inexpensively effected. For further particulars, address the Lidgerwood Manufacturing Company, No. 165 Pearl street, New York city.
Coal has been discovered in the diamond fields of Soutl Africa, and is sold there at $\$ 11$ per bag of 200 lbs :
hoisting, and intended for use in the regular removal of coa from the mines. One or both engines may be employed, the valves being so arranged that a single lever governs both. From the engravings a general idea may be gained of the mechanism of the hoisting engines above referred to.
Not the smallest merit in the invention is its freedom from clutches, brakes, complicated reversing gear, etc., necessitating the frequent stoppage of the machine, and the constant supervision of the engineer. The load is held suspended at any point, by shutting off steam entirely, excepting from a very minute hair space, so thatjust sufficient is admitted to maintain the necessary opposing pressure. This is quickly and easily accomplished without jarring or racking. A natural inference, from the facility with which the motion of the device is controlled, is that it may be advantageously applied to steering gear on vessels. This we find has already been done, and the steamboat Rhode Island, of the Stonington line, is now thus fitted. A simple device throws the nain steering wheel out of action. The rudder is then governed by a small hand wheel in the pilot house, which, by a simple rack and pinion, communicates with the governing lever of the engine. We were assured that the helm is easily managed by a single pilot, even in the roughest weather, and that there is no wrenching of the mechanism due to heavy seas striking the rudder. We may add that this application of the device appears one of much value and to be superior to the more complicated arrangements usually employed.
Many other uses to which the apparatus is applicable will at once suggest themselves. Its portability and compactness render it a convenient device for elevating stone and other material in the construction of buildings. It can be permanently placed on the decks of steam vessels as a substitute for the ordinary form of winch, and will doubtless prove of


## Cimetaymudente.

## The Vienna Patent Congress

## To the Editor of the Scientific American:

Upon my return from Vienna, I have been shown an article in your paper, of September 27,1873 , in regard to the Patent Congress in that city, stating that "it adopted as its final resolution the absurd proposition that inventors ought not to be allowed to sell their patent rights, except at such rates as government officers might dictate."

Accepting this extraordinary statement at second hand as a fact, you naturally characterize those who are said to have supported it as "incompetent." As you have taken the liberty of using my name as one of these, I beg the opportunity of making a brief statement of the objects and course of the Patent Congress, whose work, moreover, cannot fail to be a matter of interest to your readers; and if my action there seems objectionable, you will then, at least, have the facts at first hand, on which to make criticom
No one knows better than you that the condition of patthe present practice is wholly opposed to the interest of in ventors. To bring about a better condition of things was the great object of those who devised the Patent Congress. It was felt that the first thing to be done was to get together experts, so to speak, from different countries, leading manufacturers, scientific men, and patent authorities, who should produce a concise and forcible argument in favor of patent protection, and should also prepare a brief statement of the fundamental principles upon which such protection should be founded; so that in asking of the continental governments a change in the patent laws, those applying should be able to say precisely what they desired. In the Patent Con gress such a set of men were brought together. It included leading authorities from various parts of the world; and in spite of the determination of the Austrian government not to recognize it officially, it comprised unaccredited, but regularly appointed, delegates from nearly all the leading nations. In this way, the United States, England, Belgium, Bavaria, Sweden, Prussia, Switzerland, 'Greece, Hungary, Italy, Roumania, and even Austria herself, were represented Italy, Roumania, and even Austria herself, were represented
by regular delegates sent for the purpose. A declaration and by regular delegates sent for the purpose. A declaration and
argument of the strongest kind, was presented by Mr. Barargument of the strongest kind, was presented by Mr. Bar-
nard Siemens, and adopted loy the convention in favor of nard Siemens, and adopted by the convention in favor of
patent protection as a stimulus to invention and to manupatent protection as a stimulus to invention and to manu-
facturing industry; and the Congress then proceeded to the preparation of a statement of the fundamental principles upon which such patent protection should rest. This work proceeded most harmoniously till a clause was reached, which, as nearly as it can be translated, reads thus:
${ }^{4}$ It is desirable to devise regulations under which a patentee shall be held to grant licenses to responsibleapplicants in consideration of adequate compensation."
Upon this a great discussion arose; the Germans reprasented that it was vital to their prospects that something like this should be passed, that the great argument of the conservatives, who were opposed to patents, was that they were monopolists, giving power to individuals to shut up inventions which should be made public. The English, with Mr. Webster, the distinguished patent lawyer, at the head, took the same ground, representing that they were laboring for a reform in patent law in England, and that a cardinal point in any reformed code must be something which would protect the public against the growing tendency of rich and powerful combinations to control valuable patents in an unreasonable oppressive manner. The Americans, on the other hand, took strong ground in favor of the free control by inventors of their own inventions, and the undersigned stood with these. The matter was debated for a day and a half. At last it became evident that some mean must be found on which differing interests could combine, and the writer proposed that, as the conditions varied in different countries, proposed that, as the conditions in question shonld be replaced by one which dethe clause in question shonld be replaced by one which de-
clared that the matter should be left to the different States clared that the matter should be left to the different States
to decide for themselves. This was rejected by the Germans to decide for themselves. This was rejected by the Germans
and English. However, on the morning of the next day, and English. However, on the morning of the next day
they proposed that the objectionable clause should be amend ed so that it should declare that it would be desirable that patentees should be held to grant licenses for an adequate consideration when the public interest demand.s it.
The Congress was tired of the question. Those who sustained the original proposition had a large majority, and nothing but their feeling that they needed the moral support of the Americans had prevented them from passing the clause long before. It seemed to me that (as in practice it must rest with each nation to determine when, if at all, the public interest demanded interference between the in ventor and the public) it came to the same point as the proposition made by me the day before; and I stated to the convention that this was my view, and, with this understand ing, I would agree to the clause as modified. No objection was made to this, and the clause was passed with this understanding by a nearly unanimous vote, including many Americans. The convention went on to a harmonious con clusion, and, at its end, there was a general feeling expressed that it had done all, and more than all, that could be expected of it.
In conclusion, the writer was in a position to know the sentiments of our official representatives, and of the liberal members of the Austrian Government, and also of prominent persons among the German liberal party; and in their opinion the harmonious and united action of the Patent Congress was worth a thousandfold to the interest of Americans beyond anything which cauld have been gained by
carrying the dispute further upon a point which, as modified, had ceased to be vital.
I beligve the judgment of all sober and reasonable men will bear out this opinion.
Boston, Mass.
Hamilton A. Hill.
Remarks:-We give place to the foregoing with pleasure, since it is only fair that both sides should be heard. The unprejudiced reader will, we think, conclude with us that the statement published in the Scientific American, to which Mr. Hill takes exception, is substantially confirmed by his own showing.

## Echoes in Buildings.

## To the Editor of the Scientific American:

The Presbyterian church building of Tiffin, Ohio, eshoes, The dimensions of the audience room are $63 \times 50$ feet; from the floor to the ceiling is $27 \frac{1}{2}$ feet. The minister's desk or stand is 12 feet from the wall. The floor is carpeted, with exception of the space beneath the pews, which is not cov ered, nor are the pews upholstered. The ceiling and side walls are flat and without interruption. There are no gal leries in the church. The floor of the pulpit is 20 inches above the floor of church, and the speaker is 5 feet 7 inches tall. There is a great modification of the echo when the room is full: indeed when the room is filled to its capacity there is scarcely any echo. The angle of the ceiling to the sides is a right angle, without any cove.

## Tiffin, 0 .

J. T. Pollock.

Remarks by tee Editor.-The echo is probably caused by the rebound of the waves of sound from the front wall, as shown in the sketch. All the vibrations of air that strike on said wall above the line, $g d$, are reflected to the ceiling

nd to the rear wall above the speaker's head. Those tha trike between the points, $a \quad b$, are reflected to the ceiling, thence to the rear wall, and then back into the ears of the auditors, arriving a moment later than the direct sound and thus producing confusion. The erection of a front gal lery would have a tendency to prevent the echo. In some ate experiments in England, it has been found that wires stretched across the space, at about 6 inches apart, have broken the vibrations. This might be tried in this case by running them horizontally, at that distance apart, in a series extending from $a$ to $b$. Painting them the color of the wall would conceal them.-EDs.

## SUBJECTS FOR ENGINEERING PAPERS

The Cuuncil of the Institution of Civil Engineers, London, nvite communications dealing in a complete and compre hensive manner with any of the subjects included in the following list, and other papers treating on analogous quesions:
$a$. Account of the progress of any work in civil engineer ng, as far as absolutely executed (Smeaton's narrative o he building of the Eddystone Lighthouse may be taken as an example).
b. Descriptions of distinct classes of engines and machines of various kinds.
c. Practical essays on subjects allied to engineering, as for instance, metallurgy ; and
d. Particulars of experiments and observations connected with engine ring science and practice.

List.

1. On the application of graphic methods in the solution of engineering problems, and in the reduction of experimental bservations.
2. On the elasticity, or resistance to deflection, of masonry, brickwork and concrete, with observations on the deflection of bridge piers, caused by the unequal loading of the arches abutting on them.
3. On the use of concrete, or béton, in large masses, for harbour works and for monolithic structures.
4. On the manufacture of iron and steel as now practised on the effect on the strength and tenacity of the metal by he admixture of substances with the ore; on the various experimental tests by which the quality may be ascertained and on the effects of low temperature on metals.
5. On the results of experience in the recently extended use of steel in mechanism and in works of engineering.
6. On the theory and practical design of retaining walls for sustaining earth or water, and on experimental tests of the accuracy of the various theories.
7. On modern methods of constructing the foundations of bridges, and on bridges of large span, considered with reference to examples; including an account of the testing, and of the effects produced by variations of temperature.
8. On the different systems of swing, lifting and other opening bridges, with existing examples; and on the application of machinery in working them.
9. On the proportions and details of construction of lock gates, and on the application of machinery for moving hem
10. On the appliances and metheds for rock-boring an
blasting in this country and abroad, and on the results ob tained.
11. On the systems of signaling on railways, and on the comparative advantages of the absolute or permissive use of the block system.
12. On the constant use of water supply, with special reference to its introduction into the metropolis in substitution for the intermittent system; and on the waste of water and the best apparatus for its prevention.
13. On the various modes of dealing with sewage, either for its disposal or its utilization.
14. On the separate system of sewering towns, with a de tailed description of the works in a town to which this systailed description of the works in a town to which this sys-
tem has been wholly or partially applied, and particulars as tem has been
to its results.
15. On the ventilation of sewers, with a résumé of the
experiments as to the motion, pressure, etc., of gas in the sewers.
16. On the relative value of upland and of tidal waters in maintaining rivers, estuaries, and harbors.
17. On the construction of sluices for the expeditious filling and emptying of locks of large size on navigable 18.
18. On the maintenance by sluices of the harbors on the oasts of France, Belgium and Holland.
19. On the sea works at the mouths of the rivers Adour and Maas, and on the effects produced thereby.
20. On recent improvements in the construction of steam boilers adapted for very high pressures.
21. On the best practical use of steam in steam engines, and on the effects of the various modes of producing condensation.
22. On the modern construction of marine engines, havng reference to economy of the working expenses, by superheating, surface condensing, high pressure, great expansion, etc.
23. On modern locomotive engines, designed with a view to economy, durability, and facility of repair, including particulars of the duty performed, of the cost of repairs, etc. 24. On the application of steam as a motive power for pumping water or sewage, with a comparison of the adpumping water or sewage, with a comparison of the
vantages of the different classes of engines, and details of vantages of the different classes of
the cost of working for long periods.
he cost of whion
24. On the various descriptions of pumps employed for raising water or sewage, and their relative efficiency; and on the employment of water as a motive power for pumping by means of water wheels, turbines, water pressure engines, or ther machines.
25. On the employment of steam power in agriculture.

27 . On the methods of transmitting force to distant points ; and on the details of the existing system of rope transmisand on
sion.
28.
28. On the present state of science in regard to the manu facture of gas for illumination; and on the materials most suited for the purpose.
29. On the manufacture of mineral oils and the lamps best adapted for their consumption in dwellings and lighthouses.
30. On the out put of coal in the United Kingdom, as compared with that of other countries, illustrated by statistical tables, plans, diagrams, showing where coal is produced, and where and how it is consumed.
31. On mechanical apparatus at present in use in getting coal.
32. On modifications necessary in future coal-mining operations, suggested (or indicated) by the working of deep coal fields.
33. On turf (or peat) cutting, macerating, and pressing machinery, with experiments as to its heating power and expense as a fuel, as compared with coal.
34. On the various methods of draining distant isolated ections of mines.
35. On compressed air as a motive power for machinery in mines, with some account of its application on the continent.
36. On the use of diving apparatus in mines, especially in Westphalia and in Germany.
For approved original communications, the Council will be prepared to award the premiums arising out of special funds devoted for the purpose. They will not, however, consider themselves bound to make any award should there not be any communication of adequate merit; but, on the other hand, more than one premium will be given, if there are several deserving memoirs on the same subject. It is to be understood that, in this matter, no distinction will be made between essays received from a member or an associate of the Institution, or from any other person, whether a native or a foreigner.
The communication should be written in the impersonal pronoun, and be legibly transcribed on foolscap paper, on the one side only, having a sufficient margin on the left sid in order that the sheets may be bound. A concise abstract must accompany every paper.
The drawings should be on
The drawings should be on mounted paper, and with as many details as may be necessary to illustrate the subject Enlarged diagrams, to such a scale that they may be clearly visible when suspended in the theater of the Institution hould be sent for the illustration of particular portions.
Papers which have been read at the meetings of othe ocieties, or have been published in any form, cannot be real at a meeting of the Institution, nor be admitted to competi tion for the premiums.
The communications must be forwarded on or before th 31st of January, 1874, to the house of the Institution, 2 Great George street, Westminster, S. W., London, wher Great George street, W estminster, S. W.

THE GERM THEORY AND ITS RELATIONS TO HYGIENE.

The following very interesting paper, by F. A. P. Barnard, LL.D., President of Columbia College, on the germ theory of disease in its relations to hygiene, was read before the American Public Health Association, on November 13. After a few excellent remarks on the general recognition, among educated men, of the universal reign of law and order, Professor Barnard said
The germ theory of disease is not, as is commonly sup posed, a theory which has originated in very recent years. More than 200 years ago it was brought forward, at least as a hypothesis, by the celebrated Father Kircher, in his Scrutinium physico-medicum contagiosse luis quce pestis dicitur, to account for the infectious propagation of the plague. However plausible this theory might at the time have seemed, it could then, nevertheless, claim no higher rank than that of a bare hypothesis; aud it has only been in times comparatively recent that observation has brought to light a sufficieat number of facts apparently favoring it to justify our advancing it in the arena of scientific discussion to the higher dignity of a theory.
dignity of a theory.
Before proceeding to consider the evidence bearing on the
truth of this theory, for or a gainst, a few truth of this theory, for or against, a few observations of a general nature may properly here find place. No living organism enjoys an existence of unlimited duration. Every such organism, under favorable circumstances, passes through three distinct stages, which are those of growth, vigorous maturity. and decline. The organism commences as a germ, and ends in dissclution and disintegration. Since the laws of life, as well as those of physics, are fixed and definite, there is reason to believe that all organisms of the same species, if placed in conditions equally favorable to their development, would be equally long-lived; yet, in point of fact, those which pass through the regular stages constituting their normal life are comparatively few. In the large majority, the vital functions are, earlier or later,
more or less disturbed, if not arrested, by an endless variety more or less disturbed, if not arrested, by an endless variety of causes tending to produce disease and premature death.
In the human race, life is often shortened by ignorant or In the human race, life is often shortened by ignorant or
wilful disregard of the conditions necessary to the preservation of health. Accident, also, often exposes individuals to deleterious influences. Thus, in many cases, diseases arise from exposure to extremes of temperature or from excesses in eating and drinking, persisted in until the organs of digestion become debilitated and fail to fulfil their proper functions. But beside these causes of disease, which may be classed under the head of "injurious conditions," there are other influences directly morbific, which, whenever they come into play, cut short the duration of life. Poisons belong to this class, but the effects of these are felt only in occasional and accidental instances. Other noxious influ ences, of which the pernicious consequences are more widely spread, are those which produce the diseases called zymotic.
Such are malaria, contagion, and infection, instrumentalities Such are malaria, contagion, and infection, instrumentalitice
to which are owing the widespread ravages of epidemic.
It may be remarked that there are many cases of disease in which the cause is not traceable directly to any of the sources above mentioned, but in which the disease has been transmitted by inheritance from a parent similarly affected. In such cases there is nevertheless every reason to believe that the disease in its first appearance was produced in a healthy organism by causes belonging to one or the other of the classes above named.

The diseases which it is the object of the present paper to consider are only those which belong to the epidemic or contagious class.
the epidemic or contagious class of diseases.
No subject has occupied more the carefulattention of physicians, or has been a subject of more elaborate observation and experiment, or has led to more marked difference of opinion or more animated controversy, than that of the nature
of the influences by which these diseases are transmitted from of the influences by which these diseases are transmitted from
individual to individual. That many epidemics arise from peculiar conditions of the atmosphere, not in the least as yet understood, can hardly be doubted; and in this case the influence which excites disease simultaneously in many is not dissimilar to that by which contagious diseases are transmitted fromindividual to individuals. Two theories, distinctly opposed to each other, have long been held on the subject. These may be distinguished as the chemical theory of infection and the germ theory. The chemical theory is founded on a presumed analogy between the propagation of disease
in living organisms and the process of fermentation in certain forms of organic matter without life. This theory assumes a ferment to be an organized substance in a certain state of decay, which possesses the property of exciting the same decay in other organic substance with which it is in
contact. Applying this theory to disease, it supposes that contact. Applying this theory to disease, it supposes that
infection is communicated by the instrumentality of particles thrown from the person, or from substances proceeding from the person diseased, and borne by the air to other persons in full health, in whom they excite, probably by contact with the membranous linings of the lungs, the same diseased condition which exists in the patient. The opposing theory presumes that the diseased person is suffering from an invasion of his system by microscopic algoid or fun-
goid vegetative forms having the property of rapid selfgoid vegetative forms having the property of rapid self-
multiplication, and that the spores which proceed from these multiplication, and that the spores which proceed from these
fungi or the calls of the algæ are wafted in like manner fungi or the calls of the algæ are wafted in like manner
by the air from person to person, penetrating the systems of by the air from person to person, penetrating the systems of
the bealthy, and establishing new colonies to generate disease in them.
A prima facie exidence, which so far as it goes is favora
ble to the germ theory, is found in the well known fact that all the forms of cryptogamic vegetation are propagated by spores, which they shed freely abroad in all directions, and that these are borne in infinite numbers through the atmosphere, which they pervade near the surface of the earth in all places. The fact of their universal presence is made manifest by the promptitude with which fungoid growths spring up in all circumstances in which the conditions favor their development. We know that the numbers of spores which all fungi produce are incalculable. The larger fungi give us evidence of this. The spores of a single puff ball have been estimated to be more numerous than the entire human population of the globe. It is true that to ordinary observation the presence of foreign matters in the atmosphere is not perceptible, except when such foreign matters take the gross form of clouds of smoke or dust; but particles of smoke or dust, and in general of all inor ganic substances, are so heavy that they soon subside; y when the air is thus left apparently free from all foreign
admixture, it is demonstrably full of organic particles so extremely light as not to subside for many hours or even extremely light as not to subside for many hours or even
days of perfect rest. The chemist, it is true, is unable to days of perfect rest. The chemist, it is true, is unable to
detect them by his tests, delicate as they are; for being detect them by his tests, delicate as they are; for being
organic, and composed in general of but two or three ele-ments-which elements are in great part those of the at mosphere itself-they produce no distinctivereactions under the ordinary processes of analysis. But there is a mode of analysis much more delicate than even that of the chemist. It is tnat which has been applied incidently to this question by Professor Tyndall, in his interesting investigation in to the chemicai effects of light upon vapors. Professor Tyndall discovered that there are many substances of great volatility which, when in the state of vapor, are easily decomposed by light. He found that a perfectly transparent vapor-like light. He found that a perfectly transparent vapor-like
steam, when traversed by a luminous beam, is absolutely invisible; while we all know that if we admit a beam of sunlight into a darkened room, through an aperture in the shutter, the path of the beam through the apartment is as distinctly marked as if it were a solid bar. That this visibility of a beam of light in the air is not owing to the power of the aerial particles themselves to reflect light, is demonstrated by him by proofs entirely conclusive A beam of light from an electric lamp was made in his experiments to pass through a large glass tube closed at both ends by plates of glass, ground on. No light was permitted to escape into the room; and, accordingly, when the tube was exhausted of air altogether, and no light from its interior was reflected to the eye, it was perfectly invisible. But if the air of the room were allowed to re-enter it, it immediately became brilliantly luminous, as in the case of a sunbeam admitted through a window shutter. He showed, however, that a filter of rather closely compacted cotton will shut off
entirely, or almost entirely, the organic matters which the air contains; and he showed, finally, that absolute rest for a long period of time will cause these particles completely to subside. He constructed a closed space, cubical in form and several feet in linear dimensions, glazed so as to permit him to pass through it a beam of light, and to observe the path of the beam. This small apartment was made abso the brilliancy of the transmitted beam grew less and less and at length, at the end of a week, it could no longer be perceived at all. The apartment was optically empty.
the air filled with organic matter.
It is not necessary to suppose that all particles of organic matter are living germs of vegetable or animal organisms but when we see how constantly such organisms spring up wherever the conditions favor germination, it is impossible to doubt that a vast many of them have this character; and that these are the source of those growths of minute cryp
togams which thus seem to spring up spontaneously. There togams which thus seem to spring up spontaneously. There
is no mode of accounting for such growths, except to sup pose that they are actually spontaneous; and accordingly the view has been taken by some physiologists, perhaps I should say many, that the true mode of accounting for the appearance of microscopic forms of life is to suppose that they originate without organic antecedents, or as they ex
pressed it, de novo. No question at the present day is mor sharply debated than that which relates to the origin of life There is no subject which has been pursued experimentally with more zeal, more earnest solicitude to reach the truth, and with more singularly discordant results than this. The notion of spontaneous generation, is not, by any means, of modern origin. It has been entertained by naturalists in every age since the dawn of scientific history. But the
earlier naturalists, Aristotle and Lucretius, for instance, conearlier naturalists, Aristotle and Lucretius, for instance, con-
ceived that organisms of a high order of complexity, such as insects, or fishes, or reptiles, might be directly produced out of the moist earth softened by showers, or out of the slime and mud of rivers; whereas those of our time have long since abandoned any such extravagant notions, and
confine themselves to the assertion that life in its sponconfine themselves to the assertion that life in its spon
taneous origin is manifested only under the simplest forms
Less than three centuries ago the belief that living thing may originate without eggs, or germs, or living parents from which to proceed, may be said to have been universal in Europe. Of the truth of this belief there was supposed to e visible evidence in the invariable occurrence of maggot in putrefying flesh. The doctrine was held as matter of
faith, and those who first assailed it were naturally accused fimpiety and irreverence. Prominent and perhaps first among these was Francis Redi, an Italian philosopher scholar and poet, born in 1626. He presented a conclusive
disproof of the spontaneous generation of maggots in putre fying flesh, by simply inclosing, in an open mouthed jar cer
red with gauze, pieces of flesh still ssund, and leaving them the sun to putrefy. Putrefaction occurred as before, but maggots made their appearance. The maggots, nevermeless, did appear on the gauze, and a little observation
made origin manifest. The flies, of which they are the progeny in the larval state, being attracted by the odor of the flesh, but unable to reach it, laid their eggs upon the the flesh, but unable to reach it, laid their eggs upon the
covering of the jar, and out of these the larvæ were precovering of the jar, and out of these the larvæ were pre-
sently developed. Having demonstrated the falsity of the sently developed. Having demonstrated the falsity of the
popular belief on this subject in a case so conspicuous, Redi popular belief on this subject in a case so conspicuous, Redi
naturally generalized his conclusion, and took the ground that no living thing comes into existence without deriving its life from something previously living. He did not say, as it has been said later, " omne vivum ex ovo," but "omne vivum ex vivo." He still believed that out of a living plant may arise a living animal, as the insect within the gall of the oak, or the worm within the fruit which presents no ex ternal puncture. His doctrine was, therefore, that which Huxley has named biogenesis, in contradiction to spontaneous generation, called by him abiogenesis, and by Bastian archegenesis. But archegenesis had been put aside only to return again under a new form. Among the earliest revela tions of the microscope was the remarkable fact that, when ever a dead organic substance is infused in water, myriads of minute creatures presently make their appearance in the in fusion, all possessing most extraordinary and many of them very varied powers of reproduction. They multiply by means of ova, by means of buds, or gemmation, and by means of self-division, or fissuration. All this was strongly favorable to the doctrine of biogenesis. Where so many means of reproduction existed, every one of them so effectua and sufficient, to provide that the same forms of life should be produced without any organic antecedents, seemed "wasteful and ridiculous excess," This view, however, me here and there with a dissentient. About a century and a quarter ago, John Thurberville Needham, an English natur alist, resorted to an experiment which, with various modifi cations, has been since repeated many hundreds, possibly many thousands, of times, with the view thoroughly t test the question whether, in its application to infusorial life, the doctrine of biogenesis is universally true. He pre pared an infusion, thoroughly boiled it in a flask, corked i tight, sealed the cork with mastic, and covered the whole with hot ashes, designing to destroy by heat any germ which might be in the infusion, in the substance infused, or in the air above the liquid in the flask. After some days or weeks, he found that, notwithstanding all these precautions, living organisms did make their appearance in the flask, pre cisely such as, in freely exposed infusions, habitually ap peared earlier. This experiment was immediately repeated by Spallanzani, an Italian ecclesiastic and naturalist; but Spallanzani, instead of corking his flask and cementing hi corks, sealed the vessels by fusing the glass; and having thus completely cut off communication with the outward air kept them at the boiling temperature for three quarters o an hour. No life appeared in the infusions of Spallanzani, and the doctrine of biogenesis was again apparently tri umphant.

## Marbled Paper.

This, much used by bookbinders, is produced in a very curious way. The name is not exactly suitable, seeing tha few of the specimens are imitations of real marble; but it has gradually become applied to sheets of paper of which one surface is made to imitate any kind of stone or wood. Small brown spots on a light ground, marble veining on a shaded ground, curled patterns and wavy patterns, all are produced in greatdiversity. The colors are of the usual kind, such as Naples yellow, yellow ocher, yellow lake, or piment, verdigris, rose pink, red lead, carmine, terra di Sienna, Dutch pink, indigo, Prussian blue, verditer, umber ivory black, etc.; they are ground up very fine. with pre pared wax and water and a few drops of alcohol. A solu
tion of gum is made of gum tragacanth, alum, gall, and tion of gum is made of gum tragacanth, alum, gall, and water, and placed in a trough or shallow flat vessel. Colo is thrown on the surface of this gum water, usually by striking a brush against a stick, so as to produce a shower of sprinkles. Pigments of different tints and different thick nesses or degrees of consistency are thrown on; some spread more than others, and thus a diversity of patterns is pro duced. Sometimes the color is thrown on by means of a pencil of very long bristles; it is diversified by means of a rod, held upright and carried along amongst the colors in a wavy or spiral course, and it is further cut up into tortuou lines by passing a kind of comb along it. All this take lace on the surface of the gum solution in the vat. Whe he vat is prepared, a sheet of paper is laid down flat on the solution, care being taken that every part of the surfac shall be wetted; the paper takes up a layer of paint, fanci fully disposed in a pattern or device, and is hung up to dry in order that one color may not be blended or confused with nother, they are ground up with different liquids, some watery, some gummy, some oily. The imitations of marble, gray and red granite, and fancy woods, are certainly not very faithful ; but the paper is lively in appearance, and re mains clean and bright a long time when polished. Thi polishing is effected by moistening the colored surface of the paper with a little soap, and rubbing it with a piece of mooth marble, an ivory knob, a glass ball, or an agate bur isher. Beautiful products have been produced within the last few years under the names of iridescent and opalescen paper. Like the commoner kinds, these receive colored de ices on one surface; but great delicacy and care are called for in the processes to produce the exquisite play of light and shade which suggests the names given to these varieties.Practical Magazine.

## IMPROVED BOX CORNER GROOVING MACHINE.

 We illustrate in the accompanying engraving an improve machine for box makers' use, the object of which is to cut, in an expeditious and accurate manner, the tenons or grooves by which the corners of wooden boxes are matched together. This operation is effected by bringing the edge of the slab in contact with a set of circular toothed blades arranged in cylindrical form, and rotated at a speed of some 3,000 revo lutions per minute. The principal points of advantage claimed are the simplicity and fewness of parts, compac form, adjustability of table and blades, besides others o more detailed nature, which will be found referred to below.A is the set of cutters arranged in succession upon a horizontal shaft, the pulley of which is rotated by a belt communicating with the driving pulley, as shown. Between each blade is placed a collar, so that a space between the cutting portions is left, which forms the tenons between the grooves of the board operated upon. As the cutters are easily removable for adjustment, it is eviden that all may be made of a gage equal to the narrowest groove which might be required because, in case a wider cut is required, blade may be placed in groups of two or even three directly side by side, so as to form a less num ber of cutters, but of greater thickness. Iu front of the cutting cylinder is placed the table, B, which is arranged with suitable arms so as to vibrate on a pivot at C , and to be swung nearer or further from the cylinder by a pressure of the foot upon the spring treadle beneath the machine. To this table there are three adjustments; first, by a screw at $D$, by means of which its angle of inclina tion to the horizontal is altered. Second, by set screws at E , which are inclosed in spiral springs, and the object of which is to regulate the distance of the inner edge of the table from the cutting cylinder, so that, as the latter wears away, said edge may be brought in the closest possible proximity to the teeth. Third, by another pair of screws at $F$, which regulate the outward swing of the table or its move ment in a direction away from the cutters. On the inner edge of the table and placed at an angle, cutting edgeup, is a blade, H , and near the same will be noticed two projections, G, resembling teeth. The latter are attached to carriers which project from and are secured under the table, and, besides, connect with adjusting screws, one of which is shown at I. By means of these screws the distance of the teeth, H , from the edge of the table may be increased or diminished, so that they may enter more or less into the space left between the cutting blades. Lastly, the table is provided with suitable detachable guiding pieces, and there is a swinging cover, which fits over the top of the cutting cylinder.
The mechanism thus far understood, the operation of the device is readily followed. For rough work, the slab is simply laid upon the table, the latter being previously brought as close as possible to (without touching) the cutting cylinder. The board is then fed by hand against the blades which, rotating from left to right, rapidly cut the grooves into the wood, until the motion of the latter is arrested by its coming into contact with the projections, G. These projections, as before remarked, enter between the blades when the table is close to the cylinder, consequently their distance from the periphery of the cutters inward governs the depth to which the latter are enabled to penetrate. This depth, depending on the position of the projections, is consequently easily regulated by moving the latter in or out by the screws, I.
It is a common defect, of rotary blades acting as above noted, that, although the upper side of the groove in the board is cleanly cut, the under portion is apt to be ragged or to have small fragments split off inward from the edge. To obviate this difficulty the inventor employs the fixed blade, H , which, bearing directly against the under surface of the slab, ensures the smooth division of the wood, as the portions which are to be cut away to form the groove are forced directly against its edge by the teeth of the revolving cutters. This is a point claimed as of especial advantage and s work
In case greater care is necessitated in cutting the grooves, in thin or short boards, for instance, the stuff is not fed by hand to the cutters, but by the motion of the table. It is laid upon the table and there firmly held by the operator, while the latter with his foot presses down the treadle, bringing the table slowly toward the cylinder. The slab is thus carefully brought to the cutters, which gradually form the grooves, thus avoiding the sudden impact and probable tilting of the delicate work, as might be the case were hand guidance alone relied upon. It will be noticed that no bolting in forms is required, nor indeed is there any operation needed for securing the board, at expense of considerable time and trouble. Another merit claimed lies in the fact that boards of any width may be grooved. This is done by removing one of the guides from the table, leaving one by removing one of the guides from the table, leaving號 laid and in this pois of course, groove the board for the length of the cylinder The fixed guide is next removed and the opposite one returned o place. Against this the other edge of the slab is adjusted, nd the grooves on that extremity cut, thus completing the
width of the board, care being previously taken to have th second set of indentations follow those first made in proper uccession.
The apparatus is the invention of Mr. Asahel Davis, of Lowell, Mass. The same inventor has also devised some novel machines of equally compact form for planing and dovetailing purposes, so that the present apparatus com letes a very usesul so the present apparatus com ection of which much time and care has been devoted. Fur ther particulars may be had by addressing the patentee a above, and the devices themselves may be seen at the war


DAVIS' BOX CORNERING AND GROOVING MACHINE.
mall roots will seek the water; a straight and tapering tem, with beautiful glossy green leaves, will shoot upward and present a very pleasing appearance. Chestnut trees may be grown in the same manner, but their leaves are not o beautiful as those of the oak. The water should be changed once a month, taking care to supply water of the ame warmth; bits of charcoal added to it will prevent the water from souring. If the little leaves turn yellow, add one drop of ammonia into the utensil which holds the water, and hey will renew their luxuriance.
Another pretty ornament is made by wetting a sponge and sprinkling it with canary, hemp, grass and other seeds. The sponge should be refreshed with water daily so as to be kept moist. In a few days the seeds will germinate, and the sponge will soon be covered with a mass of green foliage.

## Temperature Indicator for Petroleum

 oils.Petroleum oils, as is well known, contain va rious volatile oils, which, in being disengaged in a state of vapor and mixed with atmospheri air, form an explosive mixture that has been the cause of numerous accidents. It is consequent ly important to ascertain, by a simple method, as quick and exact as possible, the temperatur of ignition. M. Granier has arranged an ap paratus for the purpose which he has exhibited before the Société d'Encouragement.
A small receptacle, of a cylindrical form and made of metal, is closed by a movable cover, furnished, in the center, with a circular opening This vessel is about two thirds filled with the oil that has to be tested, so that there may be chamber of air between the surface of the oil and the top of the cover, in which may be re ceived the inflammable gases disengaged by the oil. A tube, soldered to the bottom of the ves sel, holds a wick, the extremity of which ends in the middle of the opening of the cover. A thermometer is inserted in the oil to indicate successive and minute changes of temperature. For the purpose of testing any oil, it is poured into the vessel to the hight already stated The wick absorbing the oil is then lighted and rooms of John B. Schenck's Sons, No. 118 Liberty street, |thus gradually heats that in the vessel. This is hastened by New York city.

## THE YUCCA PENDULA.

This is one of the very best species of a beautiful genus and its graceful and noble habit makes it simply invaluable every garden. It grows about six and a half feet high, the leaves being at first erect, and of sea green color, after

wards becoming reflexed, and changing to a deep green. Old and well established plants of it, standing alone on the grass, are pictures of grace and symmetry, from the lower leaves which sweep the ground to the central ones that point up as straight as a needle. It is amusing to think of people putting tender plants in the open air, and running with sheets to protect them from the cold and rain of early summer and autumn, while perhaps not a good specimen of this fine plant is to be seen in the place. There is nothing more suited for planting between and associating with flower beds, for isolation and small groups, on the turf of the pleasure ground, for large vases, and for bold rocky banks. - The Garden.

## Simple Ornaments.

A pretty mantlepiece ornament may be obtained by suspending an acorn, by a piece of thread tied around it, within half an inch of the surface of some water contained in a vase, tumbler, or saucer, and allowing it to remain undisturbed for several weeks It will soon burst open, and
thus gradually heats that in the vessel. This is hastened by
the presence of some fine copper wire, which extends from the burning wick into the oil, thus spreading the heat through it When the temperature is sufficiently elevated the va pors are disengaged, and an explosive mixture is produced, which, on catching fire, causes a slight explosion. The temperature is noted at this moment, and the point of igni tion thus ascertained

## Necessity the Mother of Invention,

Young men are retrenching in these dull times, and making strong efforts to appear well dressed and at the same time save their money. Two young gentlemen of Oil City, says the Derrick, have invented a novel plan to attain these says the Derrick, have invented a novel plan to attain these
two points. The two are nearly of the same size and build, and what one wears fits the other. By putting their money and what one wears fits the other. By putting their money
together, they were able to buy one good suit, and now take turns in wearing it, changing about, one week off and one on. Of course the man who has a week off is unable to ac cept invitations out to tea, hops, and balls; but then his sui or his half of the suit will be there as a representative.

## A Mammoth Cheese.

The Painesville (0.)'Telegraph describes a mammoth cheese which lately passed through that town on its way East It was mounted on a substantial platform to which were attached small cast iron wheels, so that it easily moved, and the platform in turn was mounted on a heavy lumber wagon, drawn by two span of horses. The cheese was cased in a tight fitting cheese box which was firmly secured to the plat form to prevent sliding. Its measurement is: Hight, 3 feet 2 inches; diameter, 5 feet 4 inches, and circumference 16 feet. Its net weight is four thousand and fifty pounds. In quality, itis said to be fully equalto any of the Carter cheese, which stands so prominent in every market. It was manufactured for Messrs. Gass, Doe \& Chapin, of Boston, and will be cut for the holidays.

Fish Way in the Connecticut River
The Holyoke (Mass.) Water Power Company have just built, under the mandate of the Supreme Court at Washington, a fish way on their big dam, against which they had long held out. It is described as a sort of covered ladder. 450 feet long, and divided by short zigzag "' locks" or checks, to break the force of the cataract, and permit shad and salmon to get over the big fall at the dam. It has cost about $\$ 25,000$. The State of Massachusetts, four years ago, appropriated half that amount, but the company declined to touch it; and now the latter must bear all the expense, as the courts have so decided. The Fish Commissioners of Connecticut, Massachusetts, and other New England States will meet this month to examine this work.

The Fireless Locomotive in New York Streeis.-The Fireless Engine Company, whose locomotive we illustrated and described some time ago, have obtained the permission of the Board of Aldermen to run their machines on any of the city railroads above 14 th street. This is a most important concession, and must be taken as an admission by the city authorities that the system can safely be worked without danger on our street rails. The want of some better mode of propulsion than that of horses is painfully obvious.

## How to Make Money Honestly

Professor R. W. Raymond, in his recent address at the dedication of Pardee Scientific Hall, Easton, Pa., said Lesoinne, a distinguished French writer, defines metallurgy as "the art of making money in the treatment of metals." This definition may be applied to almost all occupations of life. The practical art of each is not only to achieve certain results, but to do so profitably, to make money in doing so; that is to say, to increase the value of the raw materials, whether wood, or cotton, or ores, or time, or ideas, by the use we make of them and the transformation to which we submit them, so as thereby to really elevate the condition of humanity: to leave the world better than we found it. This is, in its last analysis, the meaning of honestly making money. Men are put into this world with limited powers and with limited time to provide for their own sustenance and comfort, and to improve thei condition. A certain portion of these powers and this time is required for the support of life in a greater or less degree of comfort, and more or less multiplied means and avenues of enjoyment, activity, and influence. Whatever their labor produces more than this is represented by wealth, and, for purposes of exchange, by money. To make money honestly is to do something for other men better or cheaper than they can do it for themselves; to save time and labor for them in a word, to elevate their condition. It is in this sense greatly as we Americans are supposed to be devoted to making money, that we need to learn how to make more money how to make our labor fruitful; how to assail more success fully with our few hands the natural obstacles and the natural resources of a mighty continent; how to build up on the area of that continent a prosperous nation, united in varied, fruifful, and harmonious industries, glowing with patriotism and inspired by religion.
In this work we need specially the basis of a more thorough technical education, applying principles of science to the material and economical problems involved. This education is necessary to supply the directing forces for the great agricultural, manufacturing, and engineering improvements of the country. It is also needed as a solvent and remedy for the antagonism between labor and capital. The true protection of labor will be found in its higher education, and in opening to the individual laborer, for himself and for his children, by means of that education, a prospect of indefinite improvement and advancement.
In the realm of metallurgical and engineering operations the difference between theoretical and practical training is, perhaps, still more striking. The student of chemistry in the laboratory cannot be made acquainted with many of the conditions which obtain in chemical and metallurgical operations upon a larger scale. All the chemists of the world failed to comprehend or describe correctly the apparently simple reactions involved in the manufacture of pig iron until, by the genius and enterprise of such men as Bell, Tanner and Akerman, the blast furnace itself, in the condi tions of actual practice, was penetrated and minutely
studied. Moreover, in all the experimental inquiries of the laboratory, the question of economy plays no part. It is the art of separating and combining substances which the student follows there, not the art of making money. That
education of judgment and decision, of choice of means for ends which the exigencies of daily practice give, cannot be imparted in the school
In mechanical engineering the same principle is illustrated. The highest department in this art is that of construction, and in this department the highest function is the designing of machinery. Now, the most perfect knowledge of the theory f a machine and its mathematical relations, of the strength f materials, or the economical use of power, will not suffice qualify a man to design a machine or a system of machines, for the reason that in this work an element must be considered not at all included in theoretical knowledge, namely the element of economy in the manufacture, as well as in the operation of the machine. A machine, any part of which requires for its manufacture a tool(such, for instance, as a peculiar lathe) which is not already possessed by the manufacturer, and which, after the construction of this one part, would not be necessary or useful for other work-such a machine could not be profitably built. In other words machines must be so designed, in a large majority of cases as not to necessitate the construction of other machines to make them ; and the planning of machinery, so that it shall be at once economical and durable in operation and simple and cheap in construction, is not merely an important in cidental duty; it is absolutely the chief and most difficult duty of the mechanical engineer.

## the Pashiuba palm of brazil

Among the many wonders of the region of the Amazon river (now being traversed by Professor James Orton, and described by him in the series of letters in the course of publication in our pages), there is none more marvelous than the vegetation, "of which the singularity of the species is as remarkable as their prodigous fecundity
We present herewith an engraving of the pashiúba or paxiúba palm tree of Brazil (iriartea exorrhiza), which certainly "bears off the palm" for eccentricity of growth. The frst sight of this tree, says The Garden, suggests the idea hat some careful hand has been at the trouble of placing round its base a tree guard to protect the stem, somewhat after the manner in which the trees in our parks are railed and fenced in from cattle. A nearer approach, however, discloses the fact that the supposed tree guard is neither more nor less than the roots of the tree itself, which are disposed in this strange fashion. These roots are of the kind known as aerial, and spring from the trunk above the ground, new ones being successively produced from a higher point than the last. They take an oblique or diagonal direction unttly they reach the ground, into which they descend and root themselves. As fresh ones appear, those underneath decay and die off, leaving the tree supported by a hollow cone of roots, which is sometimes so high that a man may stand in the center, with the stem of the tree, 60 or 70 feet
in length, immediately over his head. These roots are densely covered with small, hard, tubercular prickles, and are used by the natives as graters for reducing tho inside of the cocoa nut to a pulpy mass, to be boiled with rice and water. The same peculiar mode of growth is exhibited by iriartea ventricosa, and several allee species.

## A Quick Change of Gage

The Grand Trunk Railway Company of Canada have late y been changing the gage of a considerable portion of thei ines from 5 feet 6 inches to the standard of 4 feet 8 nches.
On the main line from Stratford, Ontario, to Montreal, distance of 421 miles-or, including sidings, 500 miles- 1510 men were employed to do the work, the staff thus averag rand Tru per mile of main line. The engineer of the personally by going over the road by hand car, arrenging each gang in position, and laying out the details of working To each 15 miles of main line an overseer was appointed, To each 15 miles of main line an overseer was appointed,
and these overseers reported progress to the engineer. Each gang of men had their allotted work, and, when they had ompleted it, reported to their overseer.
After the passing of the last train, it took each oversee rom $3 \frac{1}{2}$ to 5 hours to narrow his district of 15 miles; so tha had the main line been cleared of cars so that all these verseers could have commenced at the same time, a maxi mum of 6 hours would have completed the work of 500 miles of main line and sidinge. As it was, some of the main line was taken possession of on a Friday noon, and the balance, on Saturday at daybreak. The whole was completed and trains running on the afternoon of the second day from commencement.

## A Novel and Simple Electric Light

Dr. Geissler, of Bonn, Germany, whose name is inseparably associated with some of the most bequtiful experiments that can be performed by the agency of electricity, makes an electrical vacuum tube that may be lighted withou either induction coil or frictional machine. It consists of tube an inch or so in diameter, filled with air as dry as can be obtained, and hermetically sealed after the introduction of a smaller exhausted tube. If this outward tube be rubbed with a piece of flannel, or any of the furs generally used in exciting the electrophorus, the inner tube will be illu mined with flashes of mellow light. The light is faint a first, bat gradually becomes brighter and softer. It is mo mentary in duration: but if the tube be rapidly frictioned, an optical delusion will render it continuous. If the opera tor have at his disposal a piece of vulcanite, previously ex cited, he may, after educing signs of electrical excitement within the tube, entirely dispense, with the use of his flan hel or fur. This will be found to minister very much to his personal ease and comfort. He may continue the experi ments, and with enhanced effect, by moving the sheet of vulcanite rapidly up and down at a slight distance from the tube. This beautiful phenomenon is an effect of induction


THE PASHIUBA PALM OFO

ASTRONOMICAL NOTES.
Observatory of Vassar College.
For the computations (which are approximate only) and most of the observations contained in the following notes, I am indebted to students.

Positions of Planets for December, 1873. Mercury.
Mercury rises on the 1 st at 6 h .57 m . A. M., and sets at 4 h . 25 m. P. M. On the 31 st it rises at 6 h .8 m . A. M., and sets at 3 h .14 m . P. M.
On the 10th, Mercury and Venus will be in conjunction, the latter being two degrees south of Mercury. They should be looked for in the morning before sunrise.
venus.
At this time (November 15) Venus is very brilliant be ore sunrise. On the 10th Mercury will be near it, and Jufore sunrise. On the 10th Mercury will be near it, and Jupiter will precede them and come to the meridian four hours
in advance of them; all three should be observed in the early morning.
Deceraber 1, Venus rises at 5 h .28 m . A. M., and sets at 3 h .26 m . P. M. December 31, Venus rises at 6 h .37 m . A. M. and sets at 3 h .37 m . P. M.

## Mars.

Mars is at this time (November 15) approaching Saturn, Saturn's apparent motion being much slower than that of Mars, and both being eastward. They can be seen well only in the early evening hours. After the 20th of November Mars will be east of Saturn, and will steadily diminish in its apparent diameter.
Mars rises December 1 at 11 h .10 m . A. M., and sets at 8 h .39 m . P. M. On the 31st, Mars rises at 10 h .13 m . A. M., and sets at 8 h .42 m . P. M.

## Jupiter.

Jupiter rises December 1 at 1h. 9 m . A. M., and sets at 1 h . 21 m. P. M. Jupiter rises December 31 at 11h. 22m. P. M., and sets at 11 h .30 m . A. M., its diurnal path being for the whole month nearly in the celestial equator. This planet is becoming more and more favorably situated for observation, and its apparent diameter steadily increases until the last of March.

## Saturn.

Although Saturn is not in a good position for observation, being far south in declination, and therefore low in altitude, yet with a telescope of moderate power its ring can be seen and perhaps one of its moons. With a large telescope, the ring can be seen to be divided, belts are observed on the body of the planet, and five or more moons circling around. December 1 Saturn rises at 10 h .41 m . A. M., and sets at 8 h .4 m . P. M. December 31 Saturn rises at 8 h .54 m . A. M., and sets at 6 h .21 m . P. M.

Uranus having set on the 1st of December at 11 h .20 m . in the morning, rises again at 8 h .59 m . in the evening. On the 31 st it sets at 9 h .19 m . in the morning, and rises at 6 h .37 m . in the evening. It is among the small stars of the constellation Cancer.

Neptune.

Neptune rises December 1 at 2 h .25 m . P. M., and sets at 3 h .30 m . A. M. On the 31 st it rises 27 m . after noon, and sets at 1 h .29 m . after midnight. It is very near the star o Piscium.

## Meteors.

A lookout for meteors was kept up on the morning of Nuvember 14 from midnight until 6 h .30 m ., eight students being employed, who divided into sets of two, each set being relieved after half an hour's watch. The night was remarkably fine, but not more than 200 meteors were seen, and of these not more than three fourths seemed co radiate from $L e o$, the point of departure for the meteors of the 13 th and 14th of November.

Sun Spots.
Daily photography of the sun at noon, the record extending from October 22 to November 14, shows that the disturbances of spots and faculæ have been comparatively slight. From the 23d the spots, then being very few and mall, increased slightly in number, but on November 1 here was only one exceedingly small spot near the center of any of those which appeared on the 30th (the 31st being cloudy). From November 4 to November 5, there was a marked change, a pair of spots of equal size uniting, while the resultant spot was larger than the sum of the original two. On the 10th, a group of fourteen small spots was scatlered over an area a third of the diameter breadth about one half its own length length, and in breadth about one half its own length. On
the 11th this group had begun to pass from view, owing to the 11th this group had begun to pass from view, owing to
the revolution of the sun on its axis; and by the 14th, cloudy days intervening, it had disappeared entirely. Faculæ have been visible nearly every day, and were of considerable ex tent on October 28th and 29th.

## Barometer and Thermometer.

The meteorological journal from October 15 to November 15 gives the highest barometer, October 15 and November 7, $30 \cdot 5$ : the lowest barometer, October $30,29 \cdot 43$; the highest thermometer, October 19, at 2 o'clock P. M., $71^{\circ}$; the lowest thermometer, October 19, at 2 o'clock P. M., 71
thermometer, November 7, at 7 o'clock A. M., $20^{\circ}$.

Amount of Rain.
The rain which fell between the night of October 26 and the afternoon of October 27 amounted to 0.91 inch.
The rain which fell between the evening of November 7 and the evening of November 8 amounted to 0.65 inch.
Dr. Hugarns has discovered, by the movement of the lines in the spectrum, that the star Arcturus is approaching he earth at the rate of about 50 miles per second.

## the nebule.

by professor c. A. young.
/Scattered here and there through the sky are thousands of little luminous clouds, for the most part so faint as to be visible only with powerful telescopes. These are the nebulæ, which to the modern astronomer are objects of great and in which to the modern astronomer are objects of great and in-
creasing interest. A few of them, perhaps a dozen, can be creasing interest. A few of them, perhaps a dozen, can be
discerned by the naked eye; of those visible in our northern hemisphere, the brightest, situated in the girdle of Andromeda, is favorably placed for observation in the autumna months; while the second in order adorns the winter sky as the most beautiful, if not the most conspicuous, of the celestial gems which form the wonderful constellation of Orion. The total number at present known is not quite 8.000, but every new investigation increases the catalogue./ Many of
them consist of separate stars divided by dark spaces, and are known as clusters; others exhibit starry points on a bright back ground; these are said to be resolvable; the majority, however, show no structure, but even under the highest telescopic power remain mere blotches of hazy light; and among those which thus defy all attempts to resolve them are some of the brightest. In form they are most commonly oval, and somewhat brighter in the middle. Sometimes the condensation is so great that the central point appears like a star surrounded by a nebulous atmosphere. In
many instances, they are nearly circular and of uniform many instances, they are nearly circular and of uniform
brightness throughout, and these are called planetary nebulæ. There are also a few annular nebulæ, which are darker at the center, and seem to be rings of the shining mist; and there are double nebulæ, which, like the double stars, probably revolve around each other in elliptic orbits; and spiral nebulæ, whose filaments are so arranged as to suggest almost irresistibly the idea of a whirlpool-like movement of the whole mass. Besides these, there are a multitude in which the nebulous matter is distributed in streaks and patches of most fantastic and unaccountable formation. To this class belongs the nebula of Orion.
Unless nearer to us than the stars (which there is no rea son to suppose), even the smallest of these objects must greatly exceed the dimensions of our whole solar system; and yet our outside planet Neptune is so distant from the sun that the swiftest express train would require nearly 8,000 years to make the journey. And the great nebulæ exceed the small by many thousand times in bulk.
But/what are they? The elder Herschel, who was the first to make a careful study of the subject, concluded that many of them at least are masses of a peculiar cloud-like substance, mainly gaseous,-the material out of which worlds are formed,-and falling in with Laplace's theory, he thought that in these objects we have instances of stars a-making. But when some thirty years ago it appeared that every increase of telescopic power resolved more and more of them into stars, a different theory prevailed, urged especially by certain astronomers who considered the hypothesis of Laplace to be hostile to revealed religion. They jumped to the con clusion that all the nebulæ are merely clusters of stars, the
component stars themselves being as large as the uther suns which constitute our stellar system, and separated from each other by intervals as vast, but so remote from us that even such suns and such abysses are confounded into these little whiffs of haziness.
This is the view of the matter presented by many of the popular astronomical works still current, and even in some of our text books; but fascinating as it is, it is demonstrably incorrect, and Herschel's original doctrine is much nearer to the truth. Time would fail to indicate the many facts which prove that the nebulæ (and star clusters too) really belong to our stellar system, and are no farther from us than the stars, but are scattered through the star depths,and that not without pretty well marked laws of distribution. For this we must refer to the works of Struve, Abbe, Proctor, and others who
have discussed the subject.
But though such evidences are really conclusive, they would probably have produced but slow conviction had not the spectroscope intervened, and by a single observation so settled the main fact of the gaseous nature of certain nebulæ Huggins first applied the new instrument to the study of these objects, and the very first he examined gave him a spectrum of three bright lines. This of course is absolute demonstration that the nebula in question is mainly a gaseous mass of no great density; and could the lines be identified with those of terrestrial substances, its chemical consti tution would be known. In fact, one of the lines apparently coincides with the so called F line in the spectrum of hydro-
gen, and a fourth, since observed in some of the brighter gen, and a fourth, since observed in some of the brighter
nebulæ, also coincides with another line in the spectrum of the same gas. The brightest line of the whole is in the green, and very hear the principal double line of nitrogen; so near indeed that at first Mr. Huggins supposed it to indicate the presence of that gas. At present, however, he thinks it certain that the coincidence is only approximate and accidental, and that the line is due to some other element, as ye origin
Not all the nebulæ give a bright line spectrum. Those which the telescope resolves into stars present a continuous spectrum like that of the sun; those which are classed as resolvable usually show bright lines upon a faint continuous background; and some of the brighter iresolvable nebulæ (notably the great nebula in Andromeda) give a simple continuous spectrum like the clusters. It must be remembered, however, that such a spectrum may come from gas under strong compression, as well as from incandescent solids or
spectrum of bright 'lines show the same lines, so far as yet observed, and that the appearance of the lines indicates that the gaseous matter is but slightly compressed, and at a tem perature much lower than that of the sun and stars.
It would seem, therefore, that we are to consider the nebulæ as great clouds of gas, probably sprinkled throughout with minute solid and liquid particles. Whether they are luminous from simple elevation of temperature, as ordinarily understood, or in some other way more analogous to phosphorescence, is not certain. They are in various stages of lecting themselvesaround a single center to form a single sun. ondensation; some granulating into stardust, and some col The distance and dimensions of a nebula have never yet been determined. A year or two ago, indeed, it was an nounced by an English observer that he had detected a par allax of nearly two seconds of arc in a nebula situated in the constellation of Ursa Major. This would correspond to a distance about one half as great as that of $\alpha$ Centauri, our nearest neighbor among the stars. But the observation has not been confirmed, and deserves but little confidence.
Of course, if the nebulæ are such bodies as have been de scribed, they ought continually to change in form and apscribed, they ought continually to change in form and ap-
pearance; and in fact the best observations upon those in Orion's sword and near $\eta$ Argus seem to indicate actual alterations within the last fifty years. Yet the observations are so difficult, and what is seen depends so much on the ob server, his instrument, and the purity of his atmosphere that great caution must be used in coming to any conclusion. From what has been said it is easy to understand the in terest with which astronomers regard these objects. It almost seems as if in studying them we might come to witness for ourselves the building of suns and systems. -Boston Journal of Chemistry.

## A Whale Caught by a Telegraph Cable

We published some time ago a drawing of a portion of the Singapore ocean telegraph cable, which had been pierced and injured by the lance of a saw fish. We have here to chronicle an accident of a still more extraordinary nature, by which the Persian Gulf cable was broken. The particulars are given in Engineering:

The cable between Kurrachee and Gwadur (a distance of about 300 miles) suddenly failed on the evening of the 4th of October. The telegraph steamer, Amber Witch, under the command of Captain Bishop, with the electrical and engineering staff under Mr. Henry Mance, proceeded on the following day to repair the damage, which, by tests taken at either end, appeared to be 118 miles from Kur rachee. The cable was successfully grappled within a quarter of a mile of the fault.
"The soundings at the fault were very irregular, with overfalls from 30 to 70 fathoms. On winding in the cable unusual resistance was experienced, as if it were foul of rocks; but after persevering for some time, the body of an immense whale, entangled in the cable, was brought to the surface, where it was found to be firmly secured by two and a half turns of the cable immediately above the tail. Sharks and other fish had partially eaten the body, which was rapidly decomposing, the jaws falling away on reaching the surface. The tail, which measured fully 12 feet across, wa perfect, and covered with barnacles at the extremities.
"Apparently the whale was, at the time of entanglement, using the cable to free himself from parasites, such as barnacles, whichannoy whales very much; and the cable hanging in a deep loop over a submarine precipice, his probably, with a fillip of his tail, twisted it round him, and then came to an untimely end.'
This is, without exception, the most extraordinary accident that has happened to any submarine cable which has come within our knowledge, although many strange accidents have arisen. In one case the cable across the river Yar, in the Isle of Wight, was broken by a bullock, which falling overboard, got entangled in the cable, finally breaking it.

## A Novel Contest between Horseshoers,

The horseshoers of New York and Brooklyn have been excited for a month past over a wager made between John Burns and George Boyle as to which of them could make a greater number of shoes in a specified time. Both men work in Brooklyn. Burns bet Boyle $\$ 50$ that the latte could not turn out as many shoes as he could in eight hours. A day was assigned for the contest. Several hundred horse shoers from New York and New Jersey were attracted to Brooklyn to witness the contest, and considerable money was staked in outside bets on the result. Work was begun at eight o'clock, Burns being at Slavin's shop in Atlantic avenue, and Boyle at his brother's shop in Livingston street. Burns was watched by Pat. Boyle, and his opponent by Slavin. Each of the contestants had a "helper" and used the following described material: Two dozen and a half pieces of iron, an inch and an eighth wide by nine sixteenths of an inch thick; two dozen and a half, an inch by nine sixteenths; two dozen and a half, an inch by half an inch; two dozen and a half, an inch by seven eighths. Each piece of iron was 13 inches in length.
Both shops were crowded throughout the day, the spectators going from one to the other to watch the progress of
the work. In seven hours Boyle made 10 dozen shoes, and at theexpiration of the eighth hour he had turned out just 11 dozen and 10 shoes to his opponent's 11 dozen. Boyle was accordingly declared the winner. His was the fastest work that has ever been performed.

The largest bar of gold ever produced was lately made up for exhibition at Helena, Montana. Its value was $\$ 50,000$; weigh i, about 172 pounds; fíqness $\mathbb{C O} 0$.

DECISIONS OF THE COURTS.

## United States Circuit Court--District of Massach


#### Abstract

   


## 


 a longer handele when the pencil is extended than when onstracted in the
ordinary maner, and a still longer handele when the enencil 1 s d drawn in and
 part paraliel to bo tot not tin Ine with tits orvarart part.

## Improved Harness Mounting.

Thomas Fawcett, New York city.-This invention consists in the improve-
ment of terret rings which are covered with leather, the edges of the leathment of terret rings which are covered with leather, the edges of the leath
er being sewed together on the inner side of the ring. A metallic band then slipped into the ring to cover the sewing and receive the wear. In
putting the coveringson the mountings, the edges of the leather are received putting the coverings on the mountings, the edges of the leather are received
into grooves or rabbets in the ring, which hold the edges in place when an into grooves or rabbets in the ring, which hold the edges in place when an
inner ring is introduced. By this improvement these mountings, it is stated are greatly improved in appearance, rendered more durable, and
duced at less expense than by the old method of manufacture.

Improved Ferry Boat for Trains of Cars. rail way car ferry boat, mounted on a series of screws on each side and ar rall way car ferry boat, mounted on a series of screws on each side and ar
ranged with vertical guide posts. The screws of each side are geared to
line shaft running the whole length of the truck. At one end, the $t w o$ line shafts are geared toget her and connected with a power mechanism, so
that the railway track can at any time be adjusted up or down to coincide with the shore tracks, so that the rising and falling of the
terfere with the running of the cars on and off the boat

$$
\begin{aligned}
& \text { Improved Lightning Rod. Red. } \\
& \text { Juliustown, N. J.-The object of }
\end{aligned}
$$

Joseph J. White, Juliustown, N. J.-The object of this invention is to
improve lightning rods, by rendering them more durable and easily made and more permanently joined together; and it consists in the joint, and in such a construction of the rod that the pieces slip together, and the ends
lap past each other and form the joint. Two rivets pass through the joint at right angles to each other, thus securely bind
making the joint the strongest part of the rod.

Improved Measuring Faucet.
Jacob Schalk, Jr., Gutten berg, N. J. J.This self-measuring faucet consists
of two faucets combined and a measuring cup. When a hollow plug is
turned so that two orificescorrespond in position, in whole or on turned so that two orificescorrespond in position, in whole or in part, the
liquid in the can will run down into and fill the cup. When the orifice is liquid in the can will run down into and fill the cup. When the orifice is
closed, the orifice in the plug is brought in communication with an air tube closed, the orifice in the plug is brought in communication with an air tube,
which subjects the contents of the cup to atmospheric pressure, and allows a free discharge thereof. The plugs of the faucets are connected by means
of a gear wheel on each. The receptacle is placed beneath the discharge tube and the plug turned, which, by virtue of the gear wheel, trins the in ner plug and closes an aperture. The liquid in the cup (and no more) is
consequently discharged. When that quantity is drawn off, the faucet is consequently discharged. When that quantity is drawn off, the faucet is
turned back and the cup immediately fills, and it is ready to be again dis-
charget. Improved Children's Carriage.
a cuild's perambulator mounted on the frame with rockers, so the body of be used as a cradle as well as a perambulator when it may be required to do so. Hooks are attached to fasten the body, so that it will not rock when it Is not desired. Improved Evaporating Pan.
David Watson, of Mexico, Mexico.--The inventioncons evaporating par vel chan surround or canding the evaporating pan or vessel with a channel or canal surrounding the same at
the top, and leading at the ends into a filter, which is in communication and filter or strain the same before it again enters the vessel.

Improved Street Sweeping Machine.
Connor, of Chicago, Ill. -This invention is an
Lesile $J$. O'Connor, of Chicago, M1.-This invention is an improvement
in street sweeping machines of the class in which a fan is employed to draw the dust away from the rotary brush and into a suitable re-
ceptacle. The improvement relates to the arrangement of a train of to the brush, in combination with vertically adjustable supports for said brush, whereby the raising and lowering of the same does not in
any way obstruct or interfere with the train. The invention also reany way obstruct or interfere with the train. The invention also re-
lates to the arrangement of a curved sheet metal hood drectly over the
front upper portion of the rotary brush, and front upper portion of the rotary brush, and having a pipe leading from the
center thereof to carry off the dust. The machine is designed for removing center thereof to carry off the dust. The machine is designed for removing
snow from street rail ways as well as dust, and the broom is extended each
side beyond the truck wheels as much as it is desired to remove the snow side beyond the truck wheels
from each side of the track.

Improved Car Starter.
Benjamin F. Oakes, of Milford, Me.-The object of this invention is to provide means for moving railroad cars by hand and by one man power and it consists in a lever having a head adapted to be pivoted directly or
indirectly to the drawhead of a car at its middle, and provided at each end with an arm, having a gripe so that the levermay be vibrated horizontally to each clamp a
the operator.
Willian G. Cowell, of Wallingford, Conn.
Willian G. Cowell, of Wallingford, Conn..The invention consists in
using a can to hold oil, a heater pipe to keep it in a melted state, and a pump using a can to hold oil, a heater pipe to keep it in a melted sta te, and a pump
iodischarge it from the can, all being combined to operate together. The pidschargeit from the can, all being combined to operate together. The
pipe may connect at the upper end withthe exhaust pipe of a steam engine,
or with the hot feed water pipe of a hot air reservoir, so that 1 t can be readily attached at any time to be heated. It may be coiled within around outside of the can, or a jaeket may surround the can wholly or in
part, with pipe connections to conduct the heating medium into and out of part, with pipe connections to conduct the heating medium into and out
it. This plan is preferable to the ordinary method of setting the can on stove to heat the oll.

Improved Seed Planter and Fertilizer Distributer. Richardson Montfort, of Butler, Ga.-This invention relates to an ar
rangement of vertically adjustable shoes or supplementary seed distribut ing hoppers with stationary receiving hoppers, whereby the delivery of
seed from the latter to the former may be conveniently and perfectly con-
trolled or stopped altogetaer, as required.

William Goshorn, of Waterloo, Pa.-The object. mprove the old reel bolt in such a manner that the flour is ing, so as to be fit for immediate packing; that ti bolts faster and cleaner and requires less cloth, wh ich lasts longer time, as no middlings or bran re mains in the bolt, offering thereby less opportunity for injury or destruc
tion by insects. The invention consists in arranging the flour bolt in upright positio
partitions.
Improved Stove Pipe Thimble.
Thomas D. Slauson, of Havana, N. Y.-The object of the invention is to furnish an improvedc casing for conducting stove pipes through wooden against any danger by fire, and leaves no communicating holes between the rooms, being fully covered by the plastering. It consists in a double casing,
which is attached sultabiy to the wooden partition, being provided with bentup face pieces and side perforations, through which the circulation of the air around the inner casing is kept up.

Improved Automatic Gate.
George W. Olbert and William Young, of Barr's Store, Ill.-The improvement consists in a pendent swinging gate, connected by means of cranks
and rods with pivoted levers, which are arranged horizontally and parallel to the roadway, so that, when a vehicle wheel is run on to one of said levers,
the gate will be thrown by the superior weight of the vehicle into a nearly vertical position, leaving the passa-e way unobstructed.
Improved Children's Carriage.
Albert F. R. Arndt, of Detroit, Mich., assignor to himself and W. Doeltz, Albert F. R. Arndt, of Detroit, Mich., assignor to himself and W. Doeltz،
of same place. - The object of the invention is to so improve the child's carriage in common use that the handle part may be detached and applied
at pleasure either to the front or rear of the body. For storage during the winter months, space is saved by the disconnection of the handle, which is, to the front and rear ends of the carriage, sockets for the handle ends, in to which the latter lock by means of suitable spring catches.

Improved Check Rein.
George J. Townley, of Parma, Mich.-This invention consists in a check
rein attached to the head stall on each side of the horse's head. A pulley is fastened by a frame to this rein. One end of a strap is passed around the pulley coupled with the ordinary check refn, and extends back within reach
of the driver. This rein gives the driver ccmplete control of the horse, as, by the purchase which he obtains by means of the pulley, he can draw the check just as tight as he pleases, and stop him or check his speed if he is
disposed to be unruly, or attempts to run away

Improved MiNode of Securing Wheel Hubs to Shafts.
Edwin Sanford, of Hartford, Conn.-For fastening pulleys. cog wheels,
etc., on the shafts in a way to save the expense of boring the hubs, turning the shafts, and fitting the wheels to the shafts, it is proposed to cast the wheels with their holes a little larger than the shafts, and with three or
more grooves in said holes, in which gibs or keys are fitted. On the latter the wheels are secured and trued to the shafts by set
through the hubs and clamping the gibs on the shafts.
$\underset{\text { J. P. Florimond Datichy, Brooklyn, N. Y.-The object of this invention is }}{\text { Imprond }}$ improve the machines for emptyng and cleaning sinks, privies, cesspools, sewers, marshy lands, etc., in a perfectly odorless manner, so that
the work can be done in the day time without the least discomfort and annoyance to the occupants of the dwellings, and without the use of sepannoyance to the occupants of the dwellings, and without the use of sep-
arate machines by which the vacuum in the tank is created. The Invention
consists of a tank of suitable capacity, which is provided with double act. ing pneumatic pumps and all necessary appurtenances to insure the efficient working of all the parts. The tank is carried on a four wheeled truck
of suitable strength, and the vacuum is created by the hind wheels working the air pumps by eccentrics, said action to be discontinued by the application of a regulating gear, which frees. the piston from its shaft, according to a gage placed on a cupola connected with the tank, which assists, also,
the perfect working of the machine.

Improved Toy Device for Making Soap Bubbles. nish, for the amusement of children, a toy instrument by which soap bubles may be easily and quickly produced, witheut the spilling of soap water ment of a double tubular casing for soap and soap water, with an air pipe and exit tube, in which latter the quantity required is regulated by a suit-
Improved Internal Spring Coupling and Brake. Léandre Mégy, José De Echeverria and Felix Bazan, Paris, France.-This coupling system is based on the use of one or several blade springs suitably
curved, inclosed within a hollow drum or pulley, and working by their own xpansive force, which keeps them pressing more or less closely against the independent of any exterior action, causes a close adhesion of the satid pring to the hollow pulley, which makes them, as it were, a single piece by preventing their sliding on one another, and this adhesion can only be de-
stroyed by an impulsion from the exterior. It follows, therefore, that, if one of the two mentioned pieces, either the spring or the pulley, is set in motion, it naturally carries along the other one, so long as the resistance
which the latter has to overcome are insufficient to produce the sliding of the said pieces on each other, or so long as the adhesion bet ween the spring and drum is not destroyed, either completely or partially, by any exterior action. The self-acting brake is claimed to afford security for the handling
of the heaviest loads. The ascending movement being caused by the effect of the adhesion of the spring to the pulley, then if this adhesive force was able to raise the load it will, of course, be able to maintain it in suspension at any period of its ascent. The workman has no ratchet toliftup, no kind
f operation to perform in which he could make a mistake; he has only to of operation to perform in which he could make a mistake; he has only to
turn the crank round to cause the load to ascend, to weigh lightly on the ame crank in a contrary direction in order to cause the said load to demoment by only letting go the handle, having no effort to make, no danger o run, since the crank does not revolve when the load moves down, so that
e has nothing to preoccupy his mind. The almost instantancous stoppag which takes place when suddenly letting loose the handle cannot have an urtful effect on the chain, for the active impulse is employed only to cause
the spring to slide till that impnlse is annulled by the friction of the latter he spring to s .
on the pulley.
Improved Oscillating Gland for Flowing Oil Wells. George Finton, Mead ville, Pa.-This invention relates to an apparat as during the process of drilling oil wells; and it consists in a ball and socket gland which permits the rope from which the iron tool is suspended
o pass through the gland oil and gas tight, and to move up and downin the o pass through the gland oil and gas tight, and to move up and downin the
ct of drilling without permitting either oil or gas to escape, excep act of drilling without permitting either oil or gas to escape, except
through proper orifices. If oil escapes, it may be conveyed to an oil tank, and if gas escapes it may be conducted off to a distance, so as to avoid

Improved Method of Propelling Boats.
 water the pressure of the water will close them. These are kept from clos ng against each other by one or more stops, interposed bet ween them and
ttached to the bar, so that as the paddle begins to make the stroke the ressure of the water may open or spread the blades so as to present the greatest possible surface. The upper ends of the bar are designed to be
attached to the shafts, which are arranged so as to be operated independ ently of each other. The shafts are placed in line with each other, and pintle may be attached to the end of one shaft to enter a socket in the end of the othershaft. Levers are attached to the inner parts of the shafts,
xtending above and below said shafts, and having handles attached to extending above and below said shafts, and having handles attached to

Improved Fastening for Bedsteads. duce a simple and reliable means for connecting converging rails, boards, pieces of articles of furniture, so that such converging or joining pieces may be firmly held together, but so that they can be readily taken apart
The invention consists in the application, to such converging pieces, of weage-shaped or oblique edged blocks, of which one is attached to each piece in such position that the two blocks, when overlapping each other
with their obligue faces, hold the pieces to which they areatached proper with their o.
ly together.
Allen Lapham, Pate Improved Shears. ard of same place.-This invention consists of a compound lever arrange The handle or arm is in two sections, of which one is a part of the blade, terminating a little beyond the pivot by which the two blades are connected
together, and is pivoted at said end to the other section a short distance together, and is pivoted at said end to the other section a short distance
above its lower end. The latter is connected by a link to the handle for a fulcrum. It extends from the pivot which connects the two sections along
with the other handle to its end. A wider sweep and more power is thus given to the blades. The improvement is designed more particularly for given to the blades. The improvement is designed more particularly
the "snip "shears used by tinners and others for cutting sheet metal.
Improved Picture Frame.
Felix Reifschneider, New York city.-This invention consists of a round
or oval frame, of wood, metal, or other material, covered with velvet or or oval frame, of wood, metal, or other material, covered with velvet or
other cloth, and the cover secured at the edges by ornamet tal spun metal other cloth, and the cover secured at the edges by ornames tal spun metal
bands, in addition to being glued to the surface of the metal or wood bands, in ad
portions.

Improved Mordant for Dyeing.
Gustav A.Hageman, Copenhagen, Denmark.-This invention relates to caleined to an mically known as acetate of alumina. Acetate of soda is calcined to an anhydrous or a mon ohydrous state, and then pulverized by
means of a fine sieve. The finest powder is removed and mixed with a fresh
charge of hydrous charge of hydrous acetate to be calcined. The coarser powder of average
fneness is separated by another sieve, and forms the part prepared for use. two coarse grained powders thus obtained are then mixed witi each other, precerably by sifting both at thesame time through an open sieve, and the
mixed powder is ready for packing. The sulphate of alumina may be uscd mixed powder is ready for packing. The sulphate of alumina may be uscd

Improved Elastic Seat for Railway Rail Joints.
Lewis Scofield, Jr., Atlanta, Ga.-This invention is an improvement in
cushioning the joints of railroad rails; and relates more particularly to a cushioning the joints of railroad rails; and relates more particularly to a
socket plate for the rubber cushion, which is provided with end flanges to adapt the cushion for use with wooden sleep ers or cross ties.

## Improved Boiler Feeder.

Rafael Rafael, Havana, Cuba.- The object of this invention is to furnist an automatic water feeder for steam boilers. There is a many chambered
cylinder, the periphery of which is provided with cogs, which engage with a perpetual acrew of the driving shaft, by means of which the cylinder is slowly revolved. The cylinder is placed between two plates, which are
secured together by bolts. The cylinder revolves watertight between secured together by bolts. The cylinder revolves watertight between
these plates, the contact surfaces being ground so as to make tight joints, and still allow the cylinder to revolve. The feed water descends throush
a pipe and fills one of the chambers, the air contained in the chamber being a pipe and fills one of the chambers, the air contained in the chamber being
forced out through an upper pipe, in which the water rises to a level with forced out through an upper pipe, in which the water rises to a level with
that in the tank. Power being applied to the pulley on the worm shaft, the cylinder is slowly revolved, and the full chamber is carried round to the ischarge pipe, while other chambers are filling and bemane pipe, the water is sub.jected to boiler pressure of steam by means of the steam pipe; and if there is a deflciency of water in the boiler, the water in the chamber will fall by its own gravity, and the chamber will move along filled with steam
until it reaches orifices in the upper plate, when the steam will be dis. until it reaches orifices in the upper plate, when the steam will be dis-
charged. The cylinder thus keeps revolving, and the chambers constantly discharge water in sufficient quantity to keep the water in the boiler up

Improved Water Wheel.
Eli Overton, Utica, N. Y.-The gages for regulating the capacity of the
buckets according to the volume of aater to be used consist of horizontal plates, constructed in the form of the cross section of the space between the upper or vertical portions of the buckets. They are attached to the
lower end of the curb surrounding the upper portion of the wheel, and ex. tend above it and the upper wall of the chutes as high as the gages may require to be lowered. The gages for the chutes are a tached to the curb,
which is the gate to be raised and lowered by it, and thus be adjusted as which is the gate to be raised and lowered by it, and thus be adjusted as
readily as the gate is. The gate being connected by its sleeve with the sleeve to which the wheel gages are connected, both the wheel and the chute gages will be adjusted together and alike, and at the same time that
the gate is opened, so that the labor of adjusting the wheel gages separately to the different hights as the stream varies, or as the labor to be performed by the wheel varies, will be avoided.
Improved Ice Cream Freezer.
Miller F. Graves, Sunbury, Pa.-In the bucket is made a stationary tube
of perforated sheet metal. This is placed at the center, and extends nearly of perforated sheet metal. This is placed at the center, and extends nearly which has a non-conducting cover lined with charcoal. The ice is packed in the space between the tube and the shell of the pall, and is, by the curb, out, so from filling up the center of the pall when the cream can is taken without repacking the ice.

Improved Safety Platform for Railroad Car.
Strode, of Coatesville, Pa.-The invention is designed
Richard Strode, of Coatesville, Pa.-The invention is designed to prevent persons from falling between the platforms of cars, and fracturing their imbs, or otherwise more seriously injuring themselves. It consists in a contact, yet allows the lateral motion required in the attachment to each car of a projection which passes under the opposite one (and this prevents them from telescoping with one another), and finally in pendent s.ops which are placed on the sides of platform and outside of the
from readily upsetting and falling over embankments.

Improved Reversible Plow Point
Imlo, of Cartersville, Ga.- This invention
Robert M. Pattillo, of Cartersville, Ga.- This in vention relates to the plow iron now generally used in the cultivation of cotton upon a one horse
frame, and attached only to the foot of standard by a bolt, which passes trough the plow, and which holds it in a notch upon an inclined surface. These are known through the South as twister plows, the share and mold board being in one piece, somewhat spirally concaved. The invention con-
sists in the peculiar relative construction of the two parts of these $t$ wister sists in the peculiar relative construction of the two parts of these twister
plow irons, so that the mold board and point become interchangeable, and, wearing at different parts, enable nearly or q.
obtained out of the same quantity of metal.

Improved Bee Hive.
Joseph R. East, Fincastle, Tenn.-The hive is so constructed that honey can be removed with perfect safety, yet without injury to the bees, and the
. ity. The hive is also well ventilated, is provided with means of protection against moths, and adapted for use of a ventilating attachment in the
form of a wire gauze basket which allows admission and circulation of air, andforms practically an extension of the hive,which the bees may enter at any time whenever the heat istoo great within the hive.

Improved Car Coupling.
den. Ala.-The bumper heads
Wille D. Pope, Gadsden Ala-T ne usual hopper shape. Pivoted within at its angle, by a transverse pin, is
two armed lever-one arm of which projects toward the mouth of the bumper, and has a hook on its extremity, and the other extends up through a slot in the upper part of the drawhead. The link, entering, is guided by a
spring so as to catch under the hook. A cord may be attached to the for ard end of the upper arm of the hooks and carried up to the top of the car, so that the hook may beraised for uncoupling from that point.
ohn S. Hall, Pittsburgh, Pa. - This sinvention in a projection plate applied to the rear of the mold board, and co co ve several useful purposes; in a novel mode of splitting the beam so $t$ the landside is formed out of the same piece of metal; ; also In placing
hook which connects the mold board and beam at the rear end of an ension of the beam and enabiling it to hold by the rear end of the mold ension
rd.

Improved Artificial Teeth.
and ently and firmly secured to the various plates or bases apon which they et or mounted. It consists in a platinum lining upon the back of the h , with or without pins. When the teeth are to be applied singly, or in
ks, to a rubber or vulcanite base or plate, the platinum lining will be ks , to a rubber or vulcanite base or
red up and concealed by said plate.

## Improved Wood Fence.

bert F. Ward, Senatobia, Miss.-The stakes are used in pairs, set at an inclination toward each other that they intersect or cross, and are
ed at the usual distance apart to form a panel of fence. A rider is suped at the usual distance apart to form a panel of fence. A rider is sup-
ed in the angles formed by the intersection, and an upright is placed rally between each pair of stakes. These uprights extend to near the :section of the stakes, with a rider extending across the top ends
eot. Braces are attached to the stakes at one end, while the other end , beneath the lower angle of the latter, on the rider. The uprights are lected with the stakes by slats, and placed at an angle of fifteen degrees
the surface of the ground. Rails rest on these slats, and their ends lap each other by placing them on opposite sides of the uprights. The
3is said to be straight, and proof against unruly stock as well as high

## Improved Grave Covering.

ieph R. Abräms, Greenville, Ala.-This invention relates to mounds ed over graves, and consists in three arches of stone sunk in the
ad so that their upper faces are about level with the surface. On these ad so that their upper faces are about level with the surface. On these
:our inwardly inclined plates, whtch support another platewith an oval ing and an angular recess.
mproved Device for Changing the Speed of Machinery. red Betts, wilmington, Del.-This invention consists in a mechanical
ment by which the velocity of a drive shaft may be quickly lessened to greater power, or the reverse, a portion of the former being converte

Improved Explosive Engine
lah M. Welbourn, Caledonia, Ohio.-The object of this invention is to es. The invention consists in the introduction and explosion of powlarges into chambers, which are alternately discharged to act on piswhich turn the driving wheels, and are regulated by suitable anism. The base frame on which the engine is placed is of oblong , and contains two powder chambers arranged parallel to each other gltudinal direction at both sides. The driving wheels produce, by
ately completing one half of a revolution on each wheel, rotary mo $f$ a shaft from the reciprocating motion of the pistons. Each powder Jer is closed by an adjustable breech piece, which may be detached eaning out the chamber. The closely fitiong piston moves in the
رer, its piston rod connecting, by a cross pin, with a strong spiral ,er, its piston rod connecting, by a cross pin, with a strong spiral
i, which is also applied by cross head and pitman, to the side of a i, which is also applied by cross head and pitman, to the side of a
g wheel. The required quantity of powder is introduced, in cartridge g whee. The required quantity of powder in introduce, in cartring rails placed on the top of the chamber. A brush of casing serves to , the cartridge in recess of the sliding piece, which is carried forward ckward in guide ralls. On the forward motion of the slide the cart-
irops into a chamber, to be carried back toward the breech piece by lrops into a chamber, to be carried back toward the breech piece by
turning piston, and be discharged by the concussion against the block. The piston is, by the explosion, forced forward again, and , by its action on the pitman, the rotation of the wheel. The smoke ises escape through side apertures, admitting the immediate re
lmproved Butter Print Press.
Coates and is furnish to farmers and dairymen au.-The object of this in is, by which the butter may be quickly and evenly formed into cakes ured weight, with su'table print marks thereon, without previous
ng. Itconsists in a sliding box, into which the butter is introduced ssed on a printing block, by a follower block and lever, into suitable nd weight.
Improved Painted Cloth Cover.
am D. Richardson, Pawtucket, R. I. - The cloth or other material $r$ ornamenting, is backed before painting on with any stiff material, rrovided it is thick and strong enough to fasten permanently and
y thereon. It is cut of the exact size required, and bound with me-lges to protect the edges and prevent a disconnection of the cloth
e board. The metal edges serve also as an ornamental finish. le board. The metal edges serve also as an ornamental finish. If to be folded up, which, in the case of chess boards and other games desirable.
${ }_{3}$ Sibley, New York city.-The object of this invention is to provide :or protecting the dresses of ladies from the ruinous effects of per-
n under the arms; and it consists in a shield or protector made $\mathrm{o}^{+}$ known as chamois skin or
ent material in combination.

## Improved Life-Preserving Mattress.

Tmproved Lire-Preserving Mattress.
J. Woodifie, Hoboken, N. . -This invention is a life-preserving
s , made of cork strips or similar buoyant material, having end secnnected $w$ ith a middle section by straps that interlock, one sliding e other and both together, allowing the said end sections to turn up
rside of the middle one, so that they can swing up edge wise when tress sinks by the weight of a person. Cords are arranged on the the middle and end sections for grasping the float by one floating ater, and they are provided with the loops, also, for grasping hold
tor making temporary rowlocks, in which to use paddles for protor making temporary rowlocks, in which to use paddles for pro
he raft.
mproved Taper-Turning Attachment to Lathes.
31 Neckermann, Pittsburgh, Pa.-This invention consists of a
rack on a lathe frame, and a system of gears on the tool slide, rack on a lathe frame, and a system of gears on the tool slide,
oves lengthwise of the lathe, combined with the screw which etol slde crosswise in such manner that the tool is fed crosswise e tool side crosswise in such manner that the tool is fed crosswise
he at the same time that it is fed lengthwise, so as to turn tapers. els are graduated and the supports contrived so that, by the use of ageable wheels of different sizes and numbers of teeth, tapers of
predetermined angles can be produced, and they can be turned redetermined angles can be produced, and they can be turned
y -that is to say, from the large to the small end, or vice versa.

Improved Car Coupling.
C. D. B. Eisaman, of same place- -The enterignors to the ck in such a direction as to strike the pivoted block below it point, swinging thesameback and continuing on beneath its lower
n enlargement is formed in the upper part of the drawhead, to n enlargement is formed in the upper part of the drawhead, to
a for the pivoted block to swing in. The couplingtbar is made int in its middle part, to adapt it for use in coupling cars of unet . This joint is made with almost straight shoulders, to guard it ping down too tar. The ends of the coupling bar are rounded off, shoulders formed upon their upper sides near their ends, to
re lower ends of the pivoted blocks, and thus sustain the draft With this construction, the low of the block is free to swing uncouple the cars a key is drawn out, which anlows the block to ely in either direction.

Improved Vehicle Axle Box.
Oliver P. Rice, New York city.-This invention ha diminish the wear and friction of axle journalsand boxes particularlect to of rail car trucks; and it consists in a chambered axle box provided with a lange in which the lubricating material is contained, and from which it is discharged to the frictional surfaces, and on a perforated journal sleeve,
which is also provided with discharge orifices by means of which the axle is lubricated. There is a cap nut on the end of the axle, which incloses the ends of the box and sleeve, and comesin contact with the hub of the wheel.

Improved Wheel for Vehicles.
Peter C. Hairston, Crawfordsville, Miss.-The object of this invention is Peter C. Hairston, Craw fordswnle, Mss.-
to construct an improved metallic wheel for wagons, carriages, etc. It
consists of a hub with projecting central piece and two detachable collars, nto which the two dovetalled ends of the spokesare mortised and held by ateral screw connections. The curved spokes bear against the tyre, and
, wh thir concal outer enas, screwed thereln.
Improved Railway Switch.
ell, Shell Rock, Iowa, assignor to himself and Peter C.
Joseph $\subsetneq$. Rockwell, Shell Rock, Iowa, assignor to himself and Peter C.
wette, of same place. - This iavention consists of apparatus arranged in connection with the switch to be actuated by a shaft or wheel on the locomotive coming in contact with a lever alongside of the rail, and caused to
unlock the switch and changeit, and shift the target before the locomotive nlock the switch and change it, and shift the target before the locomotive
uns on to the switch, the said apparatus being arranged so that a locomoive approaching from either direction will shift it.
$\underset{\text { Clarington, Ohio.-This inven }}{\substack{\text { Improved Miner's Pick }}}$
Richard K. Walton, Clarington, Ohio, able bit attached to an ordinary pick, provided with two triangular points Automatic Lubricating Water and Gas Cock.
Edwin F. Brooks, Baltimore, Md.-This invention consists in a water or gas cock provided with a valve having an oil reservoir in one or both ends
and connected with the outer surface of the valve by a suitable aperture lso in a spring piston, applied in connection with the screw cap so as to expel the oill.

Hoboved Children's Carriage
Lucinius Havasy, Hoboken, N. J.-The body is constructed mainly in the form of a covered chair with inclosed sides, and suspended by arms from a
rod, which is mounted at the top standards, extending up from the lower ortion of the frame about as high as the top of the body so that it can be swung forward and back whenever it may be desired to do so to quiet the
child. For this purpose the wheels are made small and arranged wide part, to suspend the boay as low as possible, and aford a substantial sup port for the body when swinging. It is proposed to mount the frame on he middle cross bar of the wheel frame by light, flat, semi-elliptical side pieces of the frame by their turned up flanges, which are notched and fitted in notches in the frame.
Edward Burstow, Horsham, Sussex county, England.-This invention elates to the ordinary sash fastener, which prevents the window from being pened, and consists in means whereby the introduction of a blade or
instrument between the sashes in order to unlock them may be effectually revented.

Inventions Patented in England by Americans. Compiled from the Commissioners of Patents' Journal.
From October 30 to November 3, 1873, inclusive. Boiler Furnace.-L. Stevens, Washington, D. C.
Boot Lastina Machine.-G. McKay, boston, Mass. Excavator.-T. FitzRandolph, Morristown, N. J. FUrNace for Iron, etc.-S. Danks (of Cincinnati, Ohio), London, England Horseshoe Machinery.-M. E. Hawes, Somerville, Mass.
Making Cans, etc.-T. J. Powers, New York city.
Metal Tubing, etc.-S. W.W ood, Cornwall, N. Y. ails and Spiess.-B. T. Nichols, Roselle, N.
Pen Finger Guard.-S. T. Pomeroy (of New York city), London, England. Preserving Teethe-G. H. Chance, Salem, Oregon.
Pudding Furnace.-S. Danks (of Cincinnati, Ohio), London, England Railway Carriage.-W. B. Rogerson, Paterson. N. J.
Sidide Rest, etc.-S. W. Wilson (of Philadelphia, Pa.), London, England.

## Value of Patents,

 AND HOW TO OBTAIN THEII.Practied Iiilts to lurentios.
ROBABLY no investment of a small sum of money brings a reaterreturn than the expense incurred in obtaining a paten ven when the invention is but a small one. Larger inventions
re found to pay correspondingly well. The names of Blanchard are found to pay corresponingly well. The names of Blanchard
Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inven-
tions, are well known. And there are thousands of others who tions, are well known. And there are thousands of others who More than Fifty
More than Fifty Thousand inventors have availed themselve of the services of MUNN \& Co. during the TWENTY-STX year They stand the thead in this clas of business; and their of assistants, mostly selected from the ranks of the Patent Office: men ca pable of rendering the best service to the inventor, from the experience
practically obtained while examiners in the Patent Office: enables MUNN \& practically obtained while examiners in the Patent Office: enables MUNN \&
Co. to do everythtng appertaining to patents BETTER and CHEAPER than er reliable agency.
HOW TO GN $\quad \begin{gathered}\text { This is the closing inquiry in } \\ \text { nearly every letter } \text { describing }\end{gathered}$
 swer can only be had by presenting a complete application for a patent to
the Commissioner of Patents. An application consists of a Model, Draw ing. Petition, oath, and full Specification. Various official rules and for business himself are generally without successs, After great to do all this delay, he is usually glad to seek the aid of persons experienced in patent busin ess, and have all the work done over again. The best plan is to solicit
proper advice at the beginning. If the parties consulted are honorable men the inventor may safely confide his ideas to them, they will advise whether needful to protect his rights.

## How Can I Best Secure my Invention?

This is an inquiry which one inventor naturally asks another, who has had and correct :
Construct a neat model, not over a oot in any dimension-smaller if pos ible-and send by express, prepaid, addressed to MUNN \& Co.,37Park Row New York, together with a description of its operation and merits. On re
ceipt thereof, they will examine the invention carefully, and ad vise you to tts patentabllity, free of charge. Or, If you: have not time. or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect
of a patent will be received, usually, by return of mail. It is sometimes
best to have a search made at the Patent Office. Such a measure often saves
In order to have such search, mare ouc a written descrit.
tion, in your own words, and a pencil, ar written description of the inven with the fee of $\$ 5$, by mail, addressed to MUNN \& Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a writ search is made with great care, among the models and patents at Washing. ton, to ascertain whether the improvement presented is patentable.

## Rejected Cases.

Rejected cases, or defective papers, remodeled for parties whohave made
polications for themselves, or through other agents. Terms moderate

## To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if sus.
ceptible of one, although sometimes it may be dispensed with; or if the in vention be a chemical production, he must furnish samples of the ingredtents of which his composition consists. These should be securely packed the inventor's name marked on them, and sent by express, prepaid. Small
models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN \& Co. Persons who live in remote parts of the country
can usually purchase drafts from their merchants on their New York can usually pu
respondents.

## Caveats.

est time, by sending to file a caveat can have the papers prepared in the short est time, by sending a sketch and description of the invention. The Govern-
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Points and adjustable holder for working Stone, dress thg Emery Wheels, Grídstones, \&c., e4 Nassau st.,N.Y.

## 

In our answer to T. C. E., page 33, current
'volume, it is stated that elther borax or hellac will
probably dissolve the gum of the peach tree. The word probaby dy disos lve the e sum ort the peach
iether should e substituted for ether.
P. G. W. asks: Is it practicable to raise
 'be as economical as to to we a ateam pump for the work ?
Answer: The eeector will work very well under the cir-
cumstances mentioned but probably it will not be as cumstances mentioned; ; but probab.
economical as a good steam pump.
T. asks: 1. Has there ever been discovany angle save a right angle? 2. . . si there any y now
way by which a hyperbola or parabola may be trisected way by which a hyperbola or parabola may be trisected ?
Answers: 1 . An equation of the thirr degree sis invoved n the sosutition of this problem. 2 . We do not understand
what oua maan yy this guestion.
A. M. asks: How can I get iron out of dip. been dissolved in it? It It Ives the brass articles a dull
color when dipped in it. Answer : If the mixed acids are not too strong, you can precipitate the iron as prus,
sian blue by the addition of dillute solution of yellow prussiate of potach (ferrocyanide of potassium). Add the yellow prussiate solution by degrees, stirring well
untila bluecolorceases to be formed, andthenallow to until a buecolor ceases to e formed, andthen
settle. Pour off the acid from the preciptate.
C. A. asks: How can I remove and prevent
rust on a cooking stove? Answer: Remove as much of the rust as possible by scraping and brushng, and
then rub with plumbayo, ordinarly called bhack lead
The ordinary stove polish is this substan nee prepared for The ordinary
the purpose.
J. A. M. asks: What is the best material tor a bake oven? Answer: A brick oven will probably
be the most serviceable, but you can make one of mud
or chat
F. W. D. asks: If a curr sht of electricity be ow can I find the direction it takes, knowing nothing on the wire e Answer: tif the wrire runs approximatelys
north and south, you might be able to tell the direction of the current by placing a magnetic needie beneath it and observing the enfiection. If the wire runs neari
east and west, it would probably be necessary to attach a compensating magnet, so as to annul the influence of
the earths polarity. In case the intensity of the current
 cut the wire and attach the ends to the instrument. You
will find directions in regard to the use of galvanomewill ind diriaction in rearard to the use
ters in any good text book on electricty.
J. H. M. says: 1 . I have two boilers, 4 feet
diameter, 16 feet iong. with two 16 inch flues. The fre is under front end of boilers; it passes under boiler and returns through the flues and up the chimney. Wil
some one tell me how large and how high a round iro some one tell me how large and how high a round iron
chmney should be to have a good dratt? Fuel is we
and sawdust. I want to carry 9 olbs. steam and burn as muct nace and give its capacity for burning sawdust and
 ble to wood or ron, being a saving of belts? Answers 2. Itis quite common to use sawd ust for fuel, in many
ocalities. If you will write to any good builler of sta. ionarites. II you will write to any good builcer or sta
iond engraving illustrating the arrangement of furnace. Per-
haps some of our readers who have had experience with

D. T. T. asks: 1. What attractive or lift. Is there any magnet that will lift an object upward
o any distance? Answers: 1. About $3 / 2 /$ tuns. 2 . No
R. B. says: While at breakfast this morning
drop or two of coftee was by accident spit on $m y$ late, and came in contact with some sirup I had bee eating. The peculiar shate assumed by the mixture
ratised my sumppicions that all was not right with the sisup Oon furthert trial, I found that the coffee and sirup,
shen mixed, turned very dark, white coftee and molases
wit did not change color. I after wards etested the sirup
with tannin, and found, as $I$ expected, that $I$ had pret ty fair articie of ink from the mixture. I presume the
sirup was made from starch. I would be glad to have
 If so, it certainly is a very simple test, which can be made at any time, and dhould be better known. Answer
The reaction of which you speak ind ind cates the presence of fron in the sirup. Tannic acit, it is is well known, as
well as its salts, are characterized by trikikg a deen well as its salts, are eharacterized by striking a deen
black color with the persalts of ron. Ther it sumfle ent tannin in coffee to effect this reaction, and the iron in
the sirup is probably due to the iron vessels used in its manufacture.
of tea with iro
In D. A. C. asks: 1. Would rubber dissolved gum belt from which the rubber has been worn off? a gum belt from which the rubber has been worn off?
Wooll it adher well, or would the solvent inine the
coton of the belt? 2. Would this solution do or waterproonng boots and shoes? 3. We are using a locomo-
tive boiler with 6 f two inch flues; we have had great hey were no better. Then we stopped using the wate from our well, and took it from a dam on a smals streain,
since which wh have had no trouble. Now the thes are since which we have had no trouble. Now the tubes are
clean, or very nearly so. Do you think that any kind of appearances, it was the water that caused it, but we are
surprised that any water should cause it at once, and thought that they must beome coated so as too over heat irst. Answers: .1. We do not think that you can
repart the belt it the mannermentione. 2 . There 18
solution . Fresh water sometimes cuts out scale or mud at once,
S. A. T. savs: I had about $\$ 10$ worth of
postage stamps, torn apart, in a tin box onmy esk; and omebody upset ink on them, which has dissolved the
 ink. What can I do with them? I can soak them apart,
nut how about the ink? Answer: After carefully soak ne the about he inf? Answer: After carefulily soak
ng the stamp apart, you can remove the ink stain by brushing them over with a fne camel's hair brush dipped
in a dinute solution of oxalic acid. 0 oxalic acid 1 s polsonJ. T. A. asks: : . Can buckshot be fired
from aswivel boat gun, so as to kill large birds at 1,000 yards? 2. What would be the length and calliber of sucha gun, and the proper charges of powder and buckshot?
Answers: : No. 2 . Your best plan would be to copy as nearly as possible the 12 pound mountain howitzer
sed in the army. The weight of this gun is 220 pound
 obtan a range of perhaps 500 yards: but the deviation
of the balls at the end of their path would be over a pace of fully fifty feet in dameter. The proper charg
powder is lb, to the above ment
 understand the arrangement of time fuses, you can do
good execution ati,05yards range, elevatingyour piece to 5 a and dutting gour fuse a at secoconds. For or urther in
formation consult an standard work'o gunner, or the Army Ordnance Manual, whence you can obtain ful Army Ordnance Manual, whence you can or
particulars as to caliber, material, length, etc.
W. P. asks: In heating a greenhouse by
hot water, would it not do to carry the smoke alons the floor in an ordinary heating fiue, and thus utilize it ieat instead of carrying it directly up the chimney a
is usually done? Answer: A very common method o heating greenhouses is to
the floor, as you suggest.
R. asks: Which locomotive engine has the rive wheels or one with small? Answer: The engine
ith small wheels has more tractile force other the with small wheels has more tractile force, other thing
being equal, because the difference between length of crank and radus of wheel 11 less than in the case of
engine with larger drivers.
H. D. asks for a formula for bay rum. An carbonate of ammonial 1 oz, borax 1 oz., rose water
quart. Mix ana filter. Bay rum is said. to be made in quart. M
the est
bevt tre
P. asks: What is the eract differ in
 Twelve minutes, ffteen and forty-seven hundredths
seconds, (12 min. $15 \cdot 4$ sec.). S. E. asks: What is a horse power of an
engine? Answer: A horse power, when used in reference to a machine, , is a unt for expressing the amount
of work that it is capable of performingin $\boldsymbol{y}$ beng the po wer r
high in a minute.
F. $O$. W. Says: : What is the reqt isite edu
cation for entering the United States navy as enginer? Also, what experience, influence, money, etc., are need
ed? In what text books would one be examined? An
 wish to iont the engineer corps of the United States
Nayy to enter the Naval Acadey as cadet enginer.
If you will write to the chief of the Bureau of Steam Engineering, Navy Departmentat Washington, we.
you can obtain a circular gliving full particulars.
$\underset{\text { the same pressure of of atmosphere inside a room as it }}{\text { F.P. B. B. Say }}$ Che same pressire of atmosphere inside a room as it
does outside? Answer: Because the atmosphere of the tnside of an apartment communicates, through the
cracks of the doors, windows and other parts, with the outside atmosphere. If the room in which the barome
ter is placed is airtight and rigid, the barometer will not be affected by changes in the exterior atmosphere.
A. B. K. asks: 1. What is used to give imthing that will prevent the iceing of cakes from rapid 11 turning yellow? 3. What it used to preperare the sugar
for molding for ornamenting A nswers: Wash your vegetables and fruit in cold spring water, and steep for ome days in strong brine; drain, dry, and put in jars
add the spice, if required, and fill up with hot, strong pickling vinengar; cork up tight, and tite ower with ladid,
der. When the jars are cold, seal over the corks with der. When the jars are cold, seal over the corks with
sealing wax. The ordinary difficulty is with the vine-
 Beat the white of eggs to a full froth, with a ilttil rose
water ; add, gradually, as much finely po wdered sugar as will make it thick enough, beating it all the time. Use vegetable coloring matter for the ornaments. This
ought not to become rapilly discolored, if the sugar is pure.
C. S. K. asks: Why does a hair out of the
tail of a horse, thrown into warm water, become anit mated in a few days, with appare ntly some of the char
acteristics of the snake? Answer: It does not.
J. A. asks: What is the law in regard to patentable improvements on machinery? For instance,
employer, $A$, is uing new and peculiar machinery of his own device and construction; employee, B,is at work for A, for per dien wages, and he proposes changes
and improvements which, with A's advice and consent are put in at $A^{\prime}$ s expense of time, material, and risk,
someof which improvements in their details $A$ requests
s. to have tried ; the improvements operate successfully;
A proposes to have a patent, and orders a model conA proposes to have a patent, and orders a model con
structed, which B goes on and builds, employing the as sistance of other workmen of A. Now towhom be
longs the right of the patent? claim it for himself? Or does it belong to both? If
B may claim it, what becomes of A's right and interest, Be ment imprevent being devised expressly for him at his expense and under his order and knowledge? Answer:
The rule is that when an employer directs an employee to make thing, yiving him general instructions what
to make, the invention pelongs to the mployer, the other party having merely exercised his mechanica sill in acrrying out orders. But where an employee
gets up anew improvement without such instruction, gets up a new improvement without such instruction,
the invention belongs to him thoughmade while at work
the is put into use plopers have the right to oontinue the use of the speci-
flic machine thus made, atter a patent has been granted fle machine thus
to the inventor
J. P. says: I have observed the following
phenomenon which I cannot satisfactorily account for. placed a lamp in a room some twelve feet distance
from the wall, and held a planoconvex lens in the ray of light near the wall, and observed the focus to be a
sman speck $;$ t then removed the lens into cose prox.
sily times greater than in the former case. I also noticed Chat these were the only two points where $a$ lens could
he placed to form a focus orimage upon the wall. What
 the frst? 2 . Is it because the lens in the second case in
tercepts a greater number of rays and is incapable of tercepts a greater number of rays and is incapable of
converging to a small focus?
3 $\begin{aligned} & \text { speculum which has become covered with fity dirt with. } \\ & \text { out Injuring the face? }\end{aligned}$ Answers: 1 and 2 . There is only one position of the lens (with respect to the 1 light of the
wall) where a true focus can be obtained. Thisis where he diverging rays of light from the candle are refract,
it a a ocus oy the plano-convex lens. The nearer this lens is moved to the source of light, the more divergent
the incident rays become ; and consequently the less the incident rays become; and consequently the less
convergent are theraysafter refraction, and the farther the true focus is from the lens. 3. Rub gently with soap
and water, using a soott woolen cloth, and then rub with
A. H. says: We have a breast wheel 25
feet diameter by 12 feet face. The wheel gears into a pinion 3 feet in diameter; on same shaft with pinion in an intermediate gear 5 feet in diameter, which gears
into another pinion 2 g/ feet in diameter; on the shatt
wit ith last named pinion is the main drum, 8 feet in diam Recently we have added machnery so that the buckets of the wheel inlle full and a manall quantity of ateter spurts out at each side of the apron; at the same time we fall
short of our regular speed about 4 revolutions on loom which rung 7 feet per second on the rim. Can I lag the maindrum, sumficiently to gain the right speed as the
wheel now runs, or would it be better to lag apmore and run the wheel slower? Would it be any gain in power,
or effect any saving of water, to throw out the 5 feet inCermediate and the $23 /$ feet pinion gear, put a larger dermedate and che eshati, and seo get power and pateed
direct from wheel? Answer: There will probably be a litle gan if you throw out the tntermediate gear ; ;ut
lite
lagigng up the wheel will have on effect tif the water
wheel is not suftciently powerful, as we judge, from Wheel is not sufficiently po
your statement, 18 the ease.
W. E. says: 1 . It has been the practice, in
bullding up a wagon spring, to punch a slot in one lea and $a$ nib on the other, so that the nib will enterthe slot
and keep the leaves straight. Where these slots and nibs are made, about one thlrd of the strength has been
destroyed ;and the strain 1 thrown on the weakest point and they soon break. If I make a spring without these
lots and nibs, but, in the place of them, with an ear on slots and nibs, but, in the place of them, with an ear on
two Inside corners of each leaf to rest against the inside edge of the next longer leaf, and thas, in connection
隹 with the bolts in in the eenter, beep them, straight, would
t not be an improvent it not be an improvement and patentable? Answer
Probably the value of this method would depend upon Probably the value of this method would depend upon
the cost of manufacture. As to your water wheel query
J. K. W. Says: I have difficulty with my
boilers on account of want of drafl. $I$ have 2 boilers. set side by side, 12 feet long, 42 tnches in diameter, with
siflues each. Theyare conneoted with a breeching. The
 npwards 75 feet. Stack 1818 inches in dameter all the
way from boilers. Is there any way to increase the draft except by enlarging the smoke stack? If not, how large should the smoke stack be to give sufficlent draft?
very seldom have enough draft, except in very cold weather, and not allayys then, sometimes one boiler
will have a fair draft and the other none at all. I tried Will have a fair draft and the other none at all. I tried
a blower last winter, frrst in the smoke stack and after. a blower last winter, irst in the smoke stack and after.
wards under the grate bars, but failed to receive any bene fit I have sine tried a jet of steam in smoke stack
faken
fake frem $\begin{aligned} & \text { taken from another boiler, running with } 40 \text { pounds of } \\ & \text { steam, but still fail to improve the irraft. Iburn anthra. }\end{aligned}$ cite coal. Ans wer: Possibly the chimney is not proper.
ly proportioned. Youdo not send enough data to enable 1y proportioned.
us to determine.
182. A. F. says: In your issue of October 26 .
 gum catechu 5 ounds, and sal ammonnac 5 pounds, and
use one pound of the mixture to each barrel of of water
used and it will take the scale of the boller 1 W. Willthis mixture in jure a boiler in any way; and will it take the
scale off which is ormed by different kinds of water?
 that rue? 2.1 aliso wish to know how copper is depos
ted on iron wire, such a sis used for pall bails. Answers: 1. We know nothing of the merits of this mixture, and
would hardly recommend the use of sal ammoniac in a solution of sulphate of copper.
 is 14 inches by 20 , making about 110 or 120 strokes per
minute. The present lead is hardly one sixteenth of an Inch. Many years ago, I had an engine of 2 feet stroke.
The motion had to be reversed ; and in doing so, the length of lead was changed from almost nothing to a about
one ourth of an Inch. The eng ine ran much faster with the same steam. Would $t$ t mprove my engine to glve it
more than one sixteent of an case my boiler. Ought I to une anything bestdes the
planking; and if so, whatis best? Will the boardsalone do? The boiler ris on the locomotive plan. Answers: :
We think you should give the valve, if sit set cold, about three eighths of an inch lead. hitting upon the best po sition. 2. See our advertising columns for boiler coor-
siting and
ering. J. S. M. asks: 1. What is the best way to
filter the water after it has passed through a surface condenser? The steam goes in on the outside of the
tubes, and water is ispumped througg the tubes by a cir
cold culating pump. The air pump is a fresh water pump
which pumps the water overboard ; there are two plung. er pumps, which take the water from the bottom of an
air chamber on the air pump. There is a delivery on the the top of the air chamber? 3 . How do pumps draw the water when in it so hot? 4. Does this condensen rave
tube heads besides the outside eheads? 5 . If there is tubt heads besides the outside heads? 5 . If there
cut-off on an engine, is there any need of the main v do not think that it is necessary to filter the wate. Probably for convenience. 3. The pump will draw water unless the tension of the apapor is sumplient to overcome
the vacuum that would other wise be produced. Some of the vapor when it exceeds a given pressure. 4. Yes.
5. It is not absolutely necessary, but it is sometimes convenient. You might find Auchine loss on " "Link and
Valve Motions," and Molesworth's "Pocket Book," "use ful. Much of the information you want can only be acquired by practice.
C. W. D. . D asks: 1 . What is the differenct
velocity of a body, for instance iron or lead, falling through air or trinough a a vacume ; and if the rule for for
computing the velocity the same? 2 . Can air be used a fuel? 3. You say in your answer to A.M. M : "The speci
fications and drawings issued at the Patent oflce are di vided into classes, and those of any class are sent fo
ten cents," but
 1ation, the resistance of the air must be considered. We think not. 3. In our answer to A. M., we sald tha
the price of the specilications of any class was ten cent each. You must send to the Patent office at Washing
ton for them.
M. E. J. asks: 1 . What is the rule for finc
ing the number of pounds weight to hang on a safet valve lever, and the proper distance from the valve
falerum when the area of valve and number of pound
 number of pounds indicated by steam gage show tt
number of pounds per square inch in the boilier? AI
swers
 rom fulcrum to center of valve, and from fulcrum

 sure. G. A. H. asks: Can sheet zinc be tinned
ff
shat is the T. F. de S. asks: How can I anneal lan 1. Place them in cold water, and heat it slowly to bo
ing point. Then allow tit to cool gradually. 2. Carb
ar 48 supposed to be an element. It exists in crystalliz
nd amorphous states. Soot or lampblack is a cood ample of amorphous
crystallized carbon.
F. L. G. asks: What should be the dimen
ons of apieasure boat, to use an engine and boiler
1orse power? What sizz and pitco should the whe orse power? What size and pitct shoud
ve? Answer: About 2 feet long by 5 f
veter of propeller 20 inchese, pitch 2 feet.
V. G. says: A friend says that he has a eet and upwards, perpendicularly. Is say that nosuch
np ever did or will doit. Ansyer: You hre right. W. E. says: I have a wash pipe 1 inch in g, and protected by the usuas cross bars. The pipe ouse. How can I clear it out withount taking it dhwn? uld oil of viriol do it, without destroying the pipes? W. B. G. asks: Are not conical bullets for
die and other riftes made by punching, and how fast they be made by the macines now inue? Answer, manan named Snyder, in the arsenal at waterviliet . We think it itak es a bout 40 bullets a minute, but aot quite certain. Some ofo
correct us, if we are in error.
$\stackrel{\text { L. O. Says: }}{\text { Lersing }}$ I have a 2 . horse power en$t$ pipe indicates 20 Ibs. pressure; the engine is used
for 2 hours per day. Could I use the hydrant water ad of steam in my engine? I think the amount of rased is cheaper than coal. Answer: Probably you
1 not make the change, with the present arrange. ; of valves.
L. C. asks: : What will produce a very
t permanent red color on leather, to be polished a hot tron? Answer:
yed with cochneal.
B. G. asks: 1. How can I qive a fine blue
h brown color to small articles h brown color to small articles mace from sheet onzed? Answers: 1. After the articles are tem-
, polish them, and heat to color, over a spirit lamp,
F. B. asks: What is the lifting power of
,the shape of which is an inverted isosceles trian10 feet perpendicular, surmounted by half a circle
et diameter? Answer: We published on p. 331, t volume, a table of the force of the wind, at difvelocities. Knowing the weight of the kite, an
ection which the wind has, you can calculate th
F. asks: How can I make Babbitt metal?
r: Melt 4 lbs. copper, add by degrees 12 lbs, be Js. regulus of antimony, and then 12 lbs. more tin or 5 lbs. of the last quantity of tin nave been
reduce the heat to a dull red and add the re-
. A. asks: 1. How much power will it
cut a plate of iron $1 / 2 /$ inches thick? 2. What the effect of expansion and contraction on the
at St. Louis, Mo.? Answers: 1 The resistance ight trou to shearing is about 45,000 pounds pe ise and lower the crown of the arch a little, if
,le structure is rigid. I. asks: What is the difference in cottween ordinary and midaling, or instance), and
$t$ detecte ? Answer : The classification of dif-
. of fiber, and is expert work.
when first appeaxing over the horizon seem lan when in the zenith? Is it owing to the pe
ondition of the atme odition of the atmosphere near the earth
says: Chemistry teaches that, when of hydrogen and oxygeif contains common a water tor charging boilers were drawn fro of a deep tank, the superincumbent column the square inch) and all air would be 15 osives in solution. In the tank containin ere should be arranged some flat vessels con umina or the like incombustible substance explosives would be neutralized, the wate
ified for that purpose. Answer: We believ milttee of the Franklin Institute made exper this subject in 1837, and determined that ex oilers.
R. asks: What is oil of citronella androphogon scheenanthus, which grows wild
ibundantly in Ceylon, whence this oil is chiefly

Says: In Culpepper's "Complete tanical name of that plant? Answer: You
refer to the flower of the bush known as asks: Is the ocean level? How much the city of New York than Liverpool? An
evel line is one that coincides with the evel line is one that coincides with the gene
the surface of the earth, which is that of teroud. The surface of the ocean would be
jan low tide, were it not for the wind. As it I varies in different locations. The difference
re level of New York and Liverpool, if any, is P. asks: 1. What is carbon disul e hands when bruised, so as to form a false und sulphur, made by passing the vapor of dcondensing the gaseous product. It isals ide of carbon, and sulphuret of carbon, and of carbon. 2. Collodion is used for the pur nytion. This is made by dissolving gun cot er for you to purchase the collodion alread a druggist, as its preparation involves skil pecially in making the pyroxylin, which, , asks: 1. Have the Bessemer steel e satisfaction to railroad managers antic considered, over a first class fron rall? 2.
ee silicon rail compare with the Bessemer in wers: 1. Yes. 2. So far as we know, very
de of the sillicon steel have been laid down, s not been enough time to enable a compa
$\left\lvert\, \begin{aligned} & \text { D. B. P. says: } I \text { wish to run } a \text { woven iron } \\ & \text { wire cyinder }\end{aligned}\right.$

 might overcome the difficulty by constructing the cylin-
der of wire cloth with a larger mesh than you reguire der of wire cloth with a larger mesh than you require,
so that, when it is galvanized, it will be of the proper size. Or you might have the cloth made of galvanized B. and $P$. Say: We have to use swamp
water for our boiler ; it forms a soft muddy scale, easily scraped off, but it has to be done often. What is the
best thing to hold it in solution thatit may be blown off? . Water collects in our steam heating pi pe and freezng, bursts, or cracks it. What is a good cement for the
cracks? Answers: 1. Probably your best plan will be to filter the water, before it enters the boiler. There
are feed water heaters in the market that are said emove all impurities whtch are held in solution. 2. We night try a cement made of red and white lead and fin iron borings. Put this over
piece of tin, and wrap strongly.
F. N. says, in reply to A. R.'s query in re-
gard to the locomotive, that air can be pumped in the boiler to almost any pressure where there is power suf-
ficient to draw the engine; of course the engine is reversed. I have frequently seen engineers oil their throttle valves by reversing their engines for a few seccylinders, when there was, perhaps, a pressure of 140
pounds of steam on the boiler. A. R. seems to think hat the air would escape by the way it entered. The T. B. J. says, in reply to L. W.: Brass can mixture of iron scales 1 lb ., arsenic 1 oz., murlatic he solution.
G. M. says, in reply to A. D., who asked for
remedy for snails other than sait: Put ashes with the seeds into the ground, or outside. of them, wherever the
F. V. F. says, in reply to G. W. C.'s ques-
ton as to two locomotives: If the wheels were of the same size on the two locomotives, it is evident that they
would both reach the foot of the incline at exactly the same instant; but the wheels being of different diam
ters, it is equally evident that nothing can influence $t$ te relative motions of the locomotives on the incline except the friction of the two sets of wheels, which friction $1 s$
found by experiment to be inversely proportional to
their radii heir radii. Hence, since the radii of the two sets of
wheels are to each otller as $\% / 3$ is to 1 , the friction bein inversely proportional to the radii, we have $\mathrm{S}: \mathrm{L}:: 1: 1 / 3$,
n which L and S indicate the large and small wheels r sectively. Also, in the case of the smaller wheels, in consequence of their making a greater number of revo
lutions during the descent than the larger wheels, rods, shafts, links, etc., attached to them would mo aster, and hence increase the friction. I conclude from foot wheels has a little more thin $1 / 3$ ss much friction a will arrive at the foot of the incline in a little less than \% of the time that it takes the other to arrive there. A. G. Jr. says, in reply to J. N. Q.'s query
s to coloring photographs: An exact representation o any transparent leaf or plant of any color or shade ca
easily be made by obtaining direct from the leaf carbon negative, then using tissue, of the color desire or positives. Youcan obtain, from the following so utions and their admixtures, almost any shade of blu green, yellow, and brown. Solution No. 1, to be
used as a bath: Dissolve 2 ozs. lead in nitric acid, and evaporate to dryness. Then dissolve 2 ozs. of water, in a glass or porcelain vessel. In or another, dis solve 2 ozs. of the ferricyanide of potassium (red prizus
siate of potash), mix the solutions, and fil er into ate of potash), mix the solutions, and ifl er into
uitable bath. Then float, upon this, either plain albumen paper, and dry in the dark. Then use a paper, or carbon, or ordinary photographic negatives as J. N. $Q$ describes. After finding the proper time to expose (an
afew experimental failures will soon do it), immerse in he following solution to make a dark green leaf: bichromate of potash $1 / 2 \mathrm{oz}$., perchloride of iron $1 / 2$ oz., wate bout one pint. For red: sulphate of copper 1 oz. water 1 pint. For brown: weak solution perchloride o
ron and a litule sulphate of copper. For dark brown, more iron and less copper.
E. J. O. says, in reply to J. N, N's query a apor, after death: It is a mold or fungus, and is cause by the bite or sting of the mosquito. I have watche and immediately following the death struggles of the
W. E. H. says, in answer to W.'s question s to mensuration of circles: I use rules that are no given in school arithmetic books: To find the cir
cumference of any circle: Multiply the diameter by $9 \frac{5}{10}$ and divide by 3 . To find the area of the same circle: Take of the square of the diameter. Having the circumference, to find the diameter: Divide the circumference bs 9 and multiply the quotient by
J. C.S. says: " When our belts slip, we
pour castor oil on them just in front of the pulley, and he effect is always satisfactory ; we also use tanner's o neats' foot oil on the outside of the belts. We run th
rain side of our telts next the pulley, preferring alway to use, for our own purposes, large pulleys and long
belts, keeping them soft and pliable, and having them elts, keeping the
C. H. R. says, in reply to C. C.'s question on
page $2 \overline{50}$, currenc volume: The answer is: friction, which in this case would be over $1 / 3$, and also less an ampunt in proportion to the distance the pin fo
the sheaves is placed from the ends of the lines. C. M. N. \&ays that A. M. can solder brass to dding a little silver while melted in a crucible. One ighth part of silver will do, and it will melt just as the piece to be soldered begins to flow. Two parts bras
$\underset{\text { age } 250 \text {, current volume: Disregarding triction ( }}{\text { E. }}$. says, in reply to C. C.'s question on will be about 1/3), the pressure on w will be 72,838 lbs our times the power (less friction) given by the use o he four pulleys.
Minerals, etc.-Specimens have been re eived from the following correspondents, and examined with the results stated:
R. W. H.-Your
H. S.-The black material is carbonate of iron.
J. J. T.-Galena or sulphide of J. J. T.-Galena or sulphide of lead, a valuable ore of
lead, consisting of lead 85 and sulphur 13 parts, the re mainder being oxide of iron or other impurity, with sometimes a little silver. Lead is obtained from it by
roasting in a reverberatory furnace, and smelting the residue with coal and lime
M. E. B.-Nos. 1 and 3 are trap rock, of no value.
is trap with spangles of plumbago, and perhaps some
alena, disseminated through it.
rigin. No.2. hornblende. No trap, ofigneous or eruptive rigin. No.2, hornblen
iferous at some denth.

## COMMUNICATIONS RECEIVED

The Editor of the Scientific American
acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects :
On River Navigation. By G. W.
On Sexadigitism. By W. T. R.
On Ecclesiastical Bickerings. By J. R. P.
On Insect Nests. By A. B.
On Snake Poisons. By T
On Flying Spiders. By E. F
On Water Gas. By A. A. H
On the Proposed Great Telescope. By W. M.

Also enquiries from the following
W. A. B.-S.-E. N.-S.B. H.-J. P.-B. W. W.-J.C
-T. C. C.-G. S.-C. E. B.-J. W. P.-S. N.-A. L. B.
P.L.-J.M.-F.C.D.-J.A. V.-F. D. B.-A. L. B.-

Correspondents whe write to ask the address of certain manufacturers, or where specified articles are to be had,
also those having goods for sale, or who want to find partners, should send with their communications a he head of " Business and Personal " which is speciall devoted to such enquirles.
[OFFICIAL.]

## Index of Inventions

 FOR WHICH
## Cetters Patent of the United Statc

 were granted for the week ending November 4, 1873,and each bearing that date. [Those marked (r) are reissued patents.]

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Bags, manufacture of traveling, J. W. Lieb. Bala nce, e. C. Pickering.........
Bed bottom, spring, J. S. Judson Beef,machine for slicing, A. Iske Beefsteak tenderer, J. S. Morris. Blackboard, J. Reber
Blackboard, revolving, C. B. Lyon
oiler, steam, Worswick \& Lewi
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Car brake, W. Naylo
ar brake, Warwick \& Duggan.
ar coupling, W. R.Coovert
Car coupling, w. B. Snedak
ar couping, J. M. Wells.
ar heater, Berghausen \& Kiesling
ar propeller,Steel \& Austin
Car spring, volute, P. G. Gardine
Car starter, A. H. Croze
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Harvester, C. S. Stone
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Hemp brake, J. F. Brake.
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Last block fastener, N. R S
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Leather, removing acids from, M. W. Fry........
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Nan machine, cut, J. Ru.
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Ore pulverizer, S. Gardner...........
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Pantaloon fastener, etc.,
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Paper from gran .
Paper from grain, stenlin et al....................
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Pin, tidy, G. Doolittle.
ipe, olow, McClure \& Ainsworth
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Press, meat, J. I. Danforth..
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Propelling canal boats, etc., L. Baste Pump, steam vacuum, w. Burdon, 4,278 Ra Railroad rail, M. R. M. Gerkins . Railroad snow plow, C. L. Wo
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Rake, horse hay, A. Amos... Sash molding, R. L. Andert
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Soda fountain attachment, o.
Spark arrester, $J$. Hughes.... pinning and twisting m Steering apparatus, M. R. Perkins.
Stocking supporter, A.C. Adams. tocking supporter, A. C. Adam Stone, cutting and working, H. Cottrell Sone sawing machine, H. Co
Stove, cooking, J. McMaster tove door, A. S. Shontz Stoves, retaining fire in, E. Y. Robbin sugar from molasses, J. B. Thoms sugar, etc., vacuum pan, J. B. Root... Table slide, extension, J. King...........
Teeth, artificial crown for, J. B. Beers.. Telegraph key, self-closing, W. Hock Trap, cement pipe, A. A. Lovell...
Valve, balanced slide, J. Evered.. Valve for water pipes, D. G
Valve, slide, A. W. Nelson... Vehicles, king bolt for, J. Deeble............................ 144,322
Vessel, construction of steam, T. Winans et al... 144,24 Walk edger, Brower \& Higgins...
 Watch, A. Frankfeld.


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