

A WEEKLY JOURNAL 0F PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

| [ NEW YORK, OCTOBER 23, 1875.0 |  |  |  |
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## MODERN SUSPENSION BRIDGES.

At Kiev, one of the most ancient towns in European RusAt Kiev, one of the most ancient towns in European Rus-
sia, and for centuries the recognized capital of the whole empire, is one of the most graceful and solid bridges ever erected. The roadway is perfectly level, being suspended from catenary chains of great strength which hang between the piers, of which latter there are five. Although the dimensions of these spans have been far exceeded in many bridges in the country, it will be admitted that the architect of the Kiev bridge has united, to a form of construction exceedingly difficult to treat with any artistic effect, a picturesque and imposing appearance.
Although we are accustomed to consider the suspension bridge as one of the triumphs of modern engineering skill, it is really one of the oldest forms of bridge construction in it is really one of the oldest forms of bridge construction in
existence. In the year A.D. 65, Ming, the Emperor of China, existence. In the year A.D. 65, Ming, the Emperor of China,
built one in the province of Yun-nan; it was 330 feet long, built one in the province of Yun-nan; it was 330 feet long,
and the road bed was laid directly on chainssuspended across and the road bed was laid directly on chains suspended across the river and drawn comparatively taut. In the time of the
Incas of Peru, suspension bridges across the defiles of the Andes were made of ropes of the bark of trees; a roadway was in some places constructed, and in others a basket was drawn to and fro. The latter plan is in use in that country in this day. The iron suspension bridge was not brought into use till the year 1819, the first being the bridge at Ber-wick-on-Tweed, England. The roadway was hung to 12 cables, and the span was 449 feet, a considerable distance for a first attempt. Telford's bridge over the Menai Strait has a span of 580 feet. The Conway bridge by the same engineer, 327 feet, and Tierney Clark's bridge over the Thames at Hammersmith, London, 422 feet, were considered marvels at Hammersmith, London, 422 feet, were considered marvels
of engineering in their day; but the wire bridge at Fribourg, of engineering in their day ; but the wire bridge at Fribourg,
Switzerland, with a span of 870 feet, eclipsed all previous achievements. But of late years, suspension bridges have been numerously constructed, and we have ceased to marvel at the dimensions they assume. The Cincinnati bridge has a clear span of 1,057 feet; and the most remarkable of all the suspension bridges yet designed, the New York and Brook. lyn, is to have a span of 1,595 feet, the whole bridge being 3,475 feet long.

It must be considered that the bridges of the future, for ong spans, will be constructed on the suspension plan. The great superiority of the iron and steel of the present day, and the improved facilities for turning out large masses of these metals, make it impossible to limit the capability of bridge constructors to defy the difficulties which Nature has placed in their way; and every year shows us fresh achievements in the art of engineering the way over crevasse, canons, and defiles.
J. AND J. A. CROOK'S SAW SHARPENER.

The annexed illustration represents a new saw sharpener, consisting of emery wheels adapted for dressing both sides
of the teeth and gumming the saw. It is claimed that by the use of the device the saw is kept perfectly circular, and the teeth equidistant and of similar shape. The saw, it is further stated, will last longer, since no more metal is used than is necessary (see dotted lines in the engraving). The than is necessary (see dotted lines in the engraving). The
employment of files is obviated, the teeth are cut square
across, and the work is done in one half the time usually required.
The radius bar, $A$, is provided with adjustable bearing pieces, B, which fit on the saw collar. At the outer end of the bar, a frame is pivoted which carries the grinding disk, C, and also, on the same mandrel, not shown, a smaller disk. These are turned by the belt from the pulley, D , which is actuated by the driving pulley on the radius bar. The pivoted frame swings toward and from the teeth, and has a spring which tends to keep it away from the latter. It has also a gage screw, E, which touches a stop when the teeth are dressed off sufficiently, and thus gages them to uniform sizes. Another gage, $F$, regulates the depth of the notches when gummed out by the small grinder. Both of these gages are adjustable to adapt the machine to different saws.
The large emery wheel, C, serves for dressing the teeth on The large emery wheel, C, serves for dressing the teeth on
the top, and the small one dresses the under or concave side the top, and the small one dresses the under or concave side
of the teeth and gums the saw plate. Said wheels are adjustable lengthwise on their axis to adapt each for being located in the desired position relative to the saw. They are clamped in place by means of collars which are screwed along the mandrel. When the small wheel is used, the gage screw, E, is screwed back sufficiently to let the wheel drop into the notches, to the required extent. The stop for the gage screw is contrived so that the frame may be shifted over to the opposite side of the axis, as may be sometimes required for saws having the teeth arranged reversely to the direction of the same shown in the engraving. The driving whee gage, $F$, and a spring cam lever-which swings down on the gage, $F$, opposite sine of the saw and over a cam to hold the radius bar to ti de and on the collar-aren ?., arranged to shif in the al sve manner and for like $p$ stoses. The grinders are pressed on the teeth, and the radiu thbar is moved formand and backward along the teeth by one hand, while the crank is turned by the other hand.
Patented through the Scientific American Patent Agency, January 5, 1875. For further particulars regarding sule of State rights, etc., address the inventors, Messrs. J. and J. A Crook, Augusta, Carroll county, Ohio.

Preventing Suffocation in the Earth.-M. A. G. suggests that, in cases of men being accidentally buried in the earth, who frequently survive some time before completely suffocated, iron pipes, of the sort used for drive wells, suffocated, iron pipes, of the sort used for drive wells,
should be driven down just at the edge of the soft earth until the proper depth is reached: when, by the application of a pump at the top, an abundance of fresh air could be forced down to sustain life until the men could be rescued by digging.


SUSPENSION BRIDGE OVER THE DNIEPER AT KIEV RUSSIA

## §rieutific Gmxican.

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## the geological importance of our western

 EXPLORATIONSIn no period of the world's history has there been a greater activity displayed in enterprises to increase the knowledge of our globe and its history than at the present day: as in stances of which may be cited the explorations in Centra Africa, those of the ruins of the cities of antiquity, such a Nineveh, the expeditions to the north pole, intended for set tling the mystery of an open polar sea, the deep sea sound ings in the Pacific Ocean, proving the existence of a sunke continent, and, last but not least, American explorations in the Great West, now in progress, which have already con tributed to our knowledge of geology facts of greater im portance than any obtained during the previous half century. It is especially in the region of the Yellowstone River, abounding as it does with hot springs and geysers, and in the valley of the Colorado, that the mostinstructive features have been discovered. While, in the last few decades, the importance and universality of slow upheavals have been demonstrated, the explorations have shown that a second agent, namely, erosion, is of the utmost importance, and re sults in a variety of features, varying with the nature of the soil, the climate (w

## inter frosts, et

In Colorado, the erosion by the rivers produces cañons in the comparatively easily worn-out rock of thousands of feet in depth; while the aridity of the climate prevents the rain from destroying the results of the erosion, as is the case in coun-
tries where rainfall is of ordinary occurrence. If is evident, therefore, that the arid regions around the Colorado river give specially favorable opportunities for studying the effects of erosion, and the recent researches in that country have re sulted in classification of these effects, as 1, the erosion of water gaps, 2 , the cliff erosion of cañons, 3 , hogback erosion, and 4 , hill and mountain erosion. The second and third classes are due to the undermining action of water in arid climates; while in the first and last, this action is modified by surface washings in rainy or moist climates.
When another topographical feature is added, namely, the eruption and outpouring of molten matter from below, its overflow covering the eroded lands, and its subsequent ero sion in its turn, a new field of investigation is opened, especially instructive in arid climates, where surface washings do not destroy the prominent points of interest. This makes the region of the Colorado particularly rich in peculiar features, such as cañons and cañon valleys, volcanic caves and volcanic mountains, cliffs and hogbacks, buttes and plateaux, aaked rocks and drifting sand, bluffs, valleys, etc. All the mountain forms of this region are due to erosion, being
carved out by the running waters; but notwithstanding th aridity of the climate in many localities, beds lundreds of feet in thickness and hundreds of thousands of square miles in extent, beds of schist, granite, limestone, sandstone, scale and lava, have slowly yielded to the unseen powers of the air, and lava, have slowly yielded to the unseen powers of the air,
crumbled away into dust, and been washed away by the crumbled away into dust, and been washed away by the
rivers. It is an illustration on a gigantic scale of the return of the lands to the ocean depths from which they once arose. It appears, however, that the climate there has not alway been so arid as it is now ; so the basin of the Great Salt Lake, which is now so depressed that its waters have no outlet to the sea and are entirely disposed of by evaporation, leaving all dissolved matter behind, had once a moist climate and so much rain that the valley was filled with water to its brim forming a large and deep fresh water lake, which had its outlet into the Columbia River. Mr. G. K. Gilbert, wh studied the features of this outlet, considers its epcch iden tical with the glacial period; and from a further study of the deposited soils, he has proved that, before the glacial epoch, deposited soils, he has proved that, before the glacial epoch,
an arid climate prevailed there of many times longer dura an arid climate prevailed there of many times longer dura
tion than the present epoch of 100,000 years, which foltion than
The period of time required to form successive deposits of housands of feet in thickness, which the erosion of the Col orado River has brought to light, in its deep cañons, are enormous, and we cannot suppose that here the erosion was less than that of other rivers, although in moist climates the evidences of this erosion have been destroyed; while in th rid climates of our West, they were preserved.
The evidences are that that region was lifted up from the cean's bosom three times; that three times the rocks wer ractured, that three times the lava poured out of the crev asses, and that three times the water carved out valleys in the formation of the granite rocks. the second succeeded the red sandstone formation; the third period is the present. red sandstone formation; the third period is the present.
The remnants of the first and second periods are buried; but ve know that, unnumbered centuries ago in the past, th granites and schists, now on the bottom of the grand cañon,
were formed as a sedimentary bed beneath the sea, that then were formed as a sedimentary bed beneath the sea, that the an upheaval took place, after which thousands of feet of beds were washed away in the sea by rains; then a depre beneath place, siph's surface, and allowing the formation of sandstone, at least 10,000 feet in thickness, as a sediment then a second upheaval came, changing it again into dry land then the rains washed away channels in the sandstone 10,000 feet deep, requiring countless years of gentle but unrelenting nergy. Again the sea rolled over the land, which becam its bottom, and received a new deposit of more than 10,000 eet of rocky bed; and lastly, this ocean bed was again up heaved, and for 100,000 years the atmospheric influences and
the running streams, gathered from the clouds in the high the running streams, gathered from the clouds in the high
est mountain tops, have been making gorges, cañons, and est maountain tops, have been making gorges, cañons, and
valleys, and carrying the débris back to the sea, from whose valleys, and carrying the déb
bottom the material all came
We ask: Will the sea, at some future period, invad that land, by the sinking down of the latter, and will cora reefs be formed, and serve perhaps for the burial of the bones of the beings which shall then exist? Will the sur rounding continents or islands be washed into that sea and form new beds of rock, which, when again upheaved, will orm a new land, and cañons again be formed, and reveal features of the time in which we live at present?

## CARNIVOROUS PLANTS

Mr. Darwin has recently added to the literature of modern otanical discovery a valuable work on "Insectivorous Plants." Without reciting the history of the researches int

this interesting subject, which has already been fully treated in our columns, we will simply state the author's broad proposition, which, coming from such an undoubted authority, must be considered as a final settlement of theo ies which were, till recently, still undergoing investigation This proposition is that certain plants, chiefly the drosera cece or sundews, devour insects in the ordinary acceptation

of the term, that is, they kill, swallow, digest them, and ab sorb and assimilate their juices. Some (such as the droso phylla) secrete and exude a viscid fluid, to which insects adhere as they do to the buds of the horse chestnut and the corollas of the Caps heaths; but these are not in jec tivorous.

But the drosera rotundifolia shows a higher organization, being endowed with sensitive tentacles, of which we give a representation in Fig. 1 Each of these tentacles terminates in a knob, from which issues a glittering secretion, on a ccount of which the plant has been called the sundew; and each entacle can bend over towardsits prey, either independently of or conjointly with the adjacent tentacles. Fig. 2 shows one half of the tentacles bent over and the other half erect. Almost any kind of interference with the tentacles, such as lightly touching them, placing inorganic substances upon hem, or especially putting organic matters (particularly such as are nitrogenous) on them, will set the sundew in motion and the more soluble the matter enfolded by the tentacles, the longer do they remain inflected over it.
In our third engraving are shown the magnified cells of the tentacles, exhibiting the various forms assumed by the Fig. 3.

protasm. Mr. Darwin says: "If a tentacle is examined ome hours after the gland has been excited by repeated touches or by inorganic or organic particles placed on it, or y the absorption of certain fluids, it presents a wholly changed appearance. The cells, instead of being filled with omogeneous purple fluid, now contain various shaped mass s of purple matter, suspended in a colorless or almost co orless fluid; and shortly after the tentacles have re-expan ded, the little masses of protoplasm are all re-dissolved, and he purple fluid within the cells becomes as homogeneou nd transparent as it was at first."
Mr. Darwin's investigation also comprised an elaborat study of the digestive apparatus of the plants, and of the ecreted fluids, which, beyond any doubt, perform the func ions of the gastric juice and of a kind of pepsin, the latte being necessary to the complete direct assimilation of anima matter to a vegetable body

## THE FAIR OF THE AMERICAN INSTITUTE.

There is an ingenious device in a rather out-of the way corner of the fair, which will prove interesting to owners of orses, inasmuch as its object is to benefit the animals in variety of ways, and principally by protecting them from egligence on the part of stable men. It is

AUOMATIC HORSE FEEDER,
consisting of a simple clock, the works of which are con nected by a cord with the hinged bottom of a grain hopper or water receptacle. At certain bours to which the clock mechanism is adjusted, the cord is slackened, and the bottom of the hopper or water vessel falls, allowing of the escape of he contents into the manger, This escape takes place for a certain time, regulated by suitable mechanism. so that a cer tain quantity of material is measured out, and then the bot om shuts, preventing a further supply. The horse is thus ed at exact hours and given a previously determined amoun of food and water, without the intervention of the stabl people, or requiring any other care than the timely winding of the clock.
burglar alarms
n great variety are exhibited. The simplest is one which travelers can carry in their trunks or even pockets, and which will be found an excellent protection against the entry of thieves into an hotel room. It is a small wedge-sbaped ase of metal, containing a gong, the hammer of which is ctuated by clockwork. The latter is wound, and the device is placed on the floor with the edge of the wedge just in ront of the door. When the door is opened, however gently from the outside, it strikes against the wedge, and suitable mechanism therein frees the spring of the clock train so that the gong is loudly and continuously sounded. The noise is sufficient to arouse the soundest sleeper. The inventio might easily be adapted for windows as well as doors.

## A NEW INDUSTR

bids fair to be set on foot, through the utilization of the fir and pine tree leaves. Mr. Charles Fulton has devised a pro cess by which the coherent parts, such as resin, wood, tannin tc., from the fibers of the needles or acicular leave, are dissolved and removed by boiling in suitable chem cals. The result is a substance resembling cotton, or pe haps more nearly wool, of a dark greenish brown color It is prepared in four qualities, adapted for stuffing mattresses, pillows, etc., and for weaving. For the latter purpose, the fibers of the material are separated and treated in machines similar to fulling mills. Other processes follow, which re sultin the production of an excellent thread, which can be woven alone or mixed with wool, cotton, silk, or other fibers Cloth of very close and fine texture is exhibited, made of the thread. It is soft and pliable,and resembles a fair quality of flannel. There is an enormous amount of raw material for his manufacture in the country, which now is of no value and which can be obtained at simply the cost of transporta ion. By the process above described, it is rendered availa ble both for textile and for paper industries, and hence may form a new and valuable supply.
'The needs of dwellers in the narrow quarters of our city flats must be uppermost in the minds of inventors, if we may judge from the quantity of

## combination furniture

hat is displayed. We spent an amused half hour in watch ng agile exhibitors put bedsteads and couches through as onishing transmutations, and departed as much entertained
as if we had witnessed the wonderful performances of the mpossible furniture of the average pantomime. At one in stant, we observed an individual stretched upon a bed; we looked again, and the bed had vanished and its occupant was calmly sitting by a table. Another person launched himself at an inoffensive couch and dragged fiercely on handles and pulled on strings, and behold, a bookcase developed itself. Then there are pieces of furniture whichare riddles in themselves; one never knows when he is through finding things in them. For instance, there is an affair which looks like an overgrown book case. On each side you discover a swing ing rack of paper files; then you lift up a flap and pull out some legs, and there is a writing desk with a pivoted ink stand swung in it. You pull aside the flaps, and a series of closets and drawers appear. At the ends you discover more writing desks, with sunken inkstands and receptacles for pen cils, more doors and pigeon holes, more cupboards under neath, until you depart,lost in admiration at ingenuity which leaves such simple affairs as Chinese puzzles far in the shade.

## a puffing machine

is something new for the ladies. There is a corrugated bed piece, and a kind of hand irnn having a bottom similarly corrugated to fit into the indentations of the bed. The bot tom of the iron is,however, V -shaped in section, the apex of the $V$ being in line parallel with the direction of the handle which resembles that of the common flat iron. Both bed piece and iron are heated, and the gathered material is damp ened and pressed between the two until dry. The work is very neatly accomplished. The same machine may also be used, for fluting, in which case a corrugated comb not heated is substituted for the iron.
new fire escape
is exhibited, which seems to us one of the best of the many similar inventions which have appeared. It consists of a swing ladder, with hickory rounds and wrought iron links. Between each pair of rounds is a light frame of iron which keeps the ladder out from the building. A hook on the upper end sustains the whole, when in use. It can be folded into a very small parcel, and weighs about one pound to the foot.

## We defer reference to the

MACHINERY DEPARTMENT
for a time, until further novelties appear; as the present con tents, though numerous, are almost entirely composed o machines already well known to our readers.

## SCIENTIFIC AND PRACTICAL IN FORMATION.

ROGRESS OF RHE MILLION DOLLAR TELESCOPE.
Mr. Lick has fixed on Mount Hamilton, in Santa Clara county, Cal., as the most eligible site for the establishment of the observatory in which the great telescope is to be located, and he has notified the county supervisors that he will begin the erection at once, if they will construct a road to the summit of the mountain. As Mr. Lick offers to advance the necessary money to begin work on the road, and accept its bonds in payment, it is probable that his proposals will be adopted, and hence there is an excellent prospect of the much-talked-of telescope becoming ere long an accomplished fact.
Mount Hamilton is 4,448 feet high. The summit is higher than any land within 50 miles, and consequently below the level of the plane of the observatory; which, in an astro nomical point of view, is the desideratum sought. The beau tiful valley of San José, the snowy ridge of the Sierra Neva da, and a boundless area of mountain scenery are in the scope of vision, and the elevation is so high as to be above the fogs of summer, and is not so high as to be much disturbed by the storms of winter.
about bitters.
The Board of Health of the city of Boston, Mass., not long ago appointed Professor W. R. Nichols, a celebrated chemist of that city, to examine into the various concoctions enormously advertised and sold to an unsuspecting public under the mild name of " bitters." Mr. Nichols is continuing his investiga tions, and up the present time has elicited enough to warrant a wholesale condemnation, certainly, of the most popular of these disguised drinks. He says that, out of twenty samples, only one did not contain alcohol, and that had the least sale. mproved sugar machinery
Messrs. Morris, Tasker \& Co., of Philadelphia, are now ship ping a large amount of machinery to be used in Louisiana in a new process of manufacturing cane sugar. The method is what is known as the diffusion process, as distinguished from the maceration process, which is that of all previously constructed sugar machinery. The cane is passed betwee rollers by the old method and the juice squeezed out. In the new, the
out of it.

## parlor magic

The following beautiful experiment in instantaneous crys tallization is given by Péligot in La Nature: Dissolve 150 parts, by weight, of hyposulphite of soda in 15 parts boiling water, and gently pour it into a tall test glass so as to half fill it, keeping the solution warm by placing the glass in hot water. Dissolve 100 parts by weight sodic acetate in 15 parts hot water, and carefully pour it into the same glass; the lat ter will form an overlying layer on the surface of the former and will not mix with it. When cool there will be two supersaturated solutions. If a crystal of sodic huposulphite persatached to a thread and carefully passed into the glass, it will traverse the acetate solution without disturbing it it will traverse the acetate solution without disturbing it,
but, on reaching the hyposulphite solution, will cause the latbut, on reaching the hyposulphite solution, will cause the lat-
ter to crystallize instantaneously in large rhomboidal prisms
with oblique terminal faces. When the lower solution is completely crystallized, a crystal of sodic acetate, similarly lowered into the upper solution, will cause it to crystallize in oblique rhombic prisms. The appearance of the two differ ent kinds of crystals will not fail to astonish those not ac quainted with this class of experiments.

## FLAT SURFACES.

The following rules, for determining the thickness of boil r heads, cylinder covers, and other flat surfaces, are take rom Des Ingenieur's Taschenbuch, being adapted to English measures, and the constants being chosen so that the work ing pressure is one eighth as much as the breaking strain These rules have never before been published in English, so far as we know, and we judge that they will be of interes to the engineering profession. They were deducel by Dr R. Grashof, and the reasoning on which they are based will be found in Die Festigkeitslehre, von Dr. F. Grashof, Ber lin, 1866. Being purely theoretical deductions, which have not, we believe, been verified by experiment, it is possible not, we believe, been verified by experiment, it is possible
that they may be somewhat incomplete; but we are confident hat, with the constants we have chosen, they will give pro portions that are at least as safe as those determined by the mpirical methods in common use. It is worthy of notice in this connection, that so high an authority as Professor D olson Wood remarks in a recent publication (as we under tand him) that, in the present state of our knowledge of the strength of materials, it is impossible to solve the problems under consideration without additional experimental data We believe, however, that the results of Dr. Grashof's in vestigations are generally accepted by German engineerscertainly they are by the distinguished editors of Des Ingen ieur's Taschenbuch.
A. To find the necessary thickness for a flat plate exposed o a given pressure in lbs. per square inch (all dimensions in nches)

1. A circular plate, supported at the edges: Multiply the product of the square root of the pressure, and radius of the plate, by 0.018257 , for a cast iron plate; by 0.11785 , for wrought iron plate; and by C.0091287, for a steel plate.
2. A circular plate, secured at the edges, such as a boiler head, or cylinder cover: Multiply the product of the square root of the pressure, and radius of the plate, by 0.01633 , for a cast iron plate; by 0.010541 , for a wrought iron plate; and by 0.0081649 , for a steel plate.
3. A flat plate, supported by stays, at a given distance from center to center: Multiply the product of the square root of the pressure, and distance between stays, by 0.0094281 , for a cast iron plate: by 0.0060858 , for a wrought iron plate and by 00047141 , for a steel plate
4. A rectangular plate, secured at the edges:
(1) Divide the pressure by the sum of the fourth powers f the two adjacent sides of the rectangle.
(2) Take the square root of the quantity obtained by (1). (3) Multiply the product of the square of the long side of he rectangle, the short side, and the quantity obtained by 2), by 0.014142 , for a cast iron plate; by 0.0091287 , for a wrought iron plate ; and by 00070711 , for a steel plate.
5. A square plate, secured at the edges: Multiply the pro uct of the square root of the pressure, and the side of the quare, by 0.01 , for a cast iron plate; by 0006455 , for a wrought iron plate; and by 0.005 , for a steel plate.
B. To find the working pressure, in lbs. per square inch, or a flat plate of given thickness (all dimensions in inches) 1. A circular plate, supported at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,000 for a cast iron plate; by 7,200 , for a wrought iron plate; and by 12,000 , for a steel plate.
6. A circular plate, secured at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,750 , for a cast iron plate; by 9,000 for a wrought iron plate; and by 15,000 , for a steel plate.
7. A flat plate, supported by stays: Divide the square of the thickness of the plate by the square of the distance beween centers of stays, and multiply the quotient by 11,250 for a cast iron plate; by 27,000 , for a wrought iron plate nd by 45,000 , for a steel plate.
8. A rectangular plate, secured at the edges
(1) Take the sum of the fourth powers of the adjacent sides of the rectangle
(2) Multiply the quantity obtained by (1) by the square of he thickness of the plate.
(3) Multiply the fourth power of the long side of the rec angle by the square of the short side.
(4) Divide the quantity obtained by (2) by the quantity ob ained by (3), and multiply the quotient by 5,000 , for a cast ron plate ; by 12,000 , for a wrought iron plate ; and by 20,000 or a steel plate.
9. A square plate, secured at the edges: Divide the squar of the thickness of the plate by the square of the side of the plate, and multiply the quotient by 10,000 , for a cast iron plate; by 24,000 , for a wrought iron plate; and by 40,000 or a steel plate.
A few examplesare added, to illustrate the foregoing rules 1. What is the proper thickness for a steel boiler head the pressure of the steam being 60 lbs . per square inch, and he diameter of the boiler 24 inches?
The product of $7 \cdot 746$ (the square root of 60 ), 12 , and .0081649 is $0 \cdot 78$, or $\frac{25}{3} \frac{5}{2}$ of an inch, nearly, the thickness re quired.
10. Required the thickness for the sides of a cast iron box 20 inches long, 15 inches high, exposed to a pressure of 20 bs. per square inch
Dividing 20 by 210,625 (the sum of the fourth power of 20 and 15), and extracting the square root of the quotient, w obtain 0.0097445 . The product of 400,15 , and 0.0097445 is $\cdot 83$, or about $\frac{5}{6}$ of an inch.
11. What is the safe pressure for a flat plate, supported by tays, 10 inches from center to center, the plate being of rought iron, $\frac{8}{8}$ of an inch in thickness?
Dividing $0 \cdot 140625$ (the square of $\frac{8}{8}$ ) by 100 , and multiply ing the quotient by 27,000 , we obtain the pressure, about 38 bs. per square inch.
12. The side of a rectangular box, 25 inches long, 20 inches high, is of steel, $\frac{1}{4}$ of an inch thick. What is the working pressure?
The sum of the fourth powers of 25 and 20 is 550,625 . The product of 550,625 and 0.0625 (the square of $\frac{4}{4}$ ) is 6882 , 812,700 . The product of 390,625 (the fourth power of 25 ) and 400 is $156,250,000$. Dividing $6,882,812,700$ by 156,250 , 000 , we obtain the working pressure, 44 lbs . per square inch. Below will be found the analytical expressions for the rules given in this article.

Thickness ( $\mathbf{T}$ ) in inches for a plate exposed to a uniform pressure ( $p$ ) per square inch.

|  | Thickness ( $\mathbf{T}$ ) in inches. |  |  |
| :---: | :---: | :---: | :---: |
|  | Cast iron. | Wrought iron. | Steel. |
| Circular plate, of radius R , supported at the edges. | $0.018257 \mathrm{R} \times \vee$ | $0 \cdot 011785 \mathrm{R} \times 1 / p$ | $00091287 \mathrm{R} \times \sqrt{p}$ |
| Circular plate, of radius $R$, secured at the edges. | $0.01633 \mathrm{R} \times \sqrt{\bar{p}}$ | $0.010541 \mathrm{R} \times$ V $\bar{p}$ | $0 \cdot 0081649 \mathrm{R} \times \sqrt{\bar{p}}$ |
| Plate strengthened by stays, $a$ inches from center to center. | $0 \cdot 0094781 a \times \vee p$ | $0.0060858 a \times \sqrt{p}$ | $0 \cdot 0047141 a \times v p$ |
| Rectangular plate, sides $a$ and $b$, ( $a^{\triangleright} b$ ), secured at the edges. | $0.014142 a^{2} \times b \times \sqrt{\frac{p}{\mathrm{a}^{4}+b^{4}}}$ | $0.0091287 a^{2} \times b \times \sqrt{\frac{p}{\sqrt{a^{4}+b^{4}}}}$ | $0.0070711 a^{2} \times b \times \sqrt{\frac{p}{\sqrt{a^{4}+b^{4}}}}$ |
| Square plate, side $a$ secured at the edges. | $0 \cdot 01 a \times \vee p$ | $0.006455 a \times \vee \bar{p}$ | $0005 a \times \mathscr{V} p$ |

Safe pressure ( $p$ ) in pounds per square inch for a plate of given thickness ( $\mathbf{T}$ ) in inches.

| Form of the <br> - (Dimensions in inches). | Safe pressure ( $\bar{p}$ ) in pounds per square inch. |  |  |
| :---: | :---: | :---: | :---: |
|  | Cast iron. | Wrought tron. | Steel. |
| Circular plate of radius $R$, supported at the edges. | $3,000 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ | $7,200 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ | $12,000 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ |
| Circular plate, of radius $R$, secured at the edges. | $3,750 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ | $9,000 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ | $15,000 \times \frac{\mathrm{T}^{2}}{\mathrm{R}^{2}}$ |
| Plate strengthened by stays, $a$ inches from center to center. | $11,250 \times \frac{\mathrm{T}^{2}}{a^{2}}$ | $27,000 \times \frac{\mathrm{T}^{2}}{a^{2}}$ | $45,000 \times \frac{\mathrm{T}^{2}}{a^{2}}$ |
| Rectangular plate, sides $a$ and $b(a \triangleright b)$, secured at the edges. | $5,000 \times \frac{\mathrm{T}^{2} \times\left(a^{4}+b^{4}\right)}{a^{4} \times b^{2}}$ | $12,000 \times \frac{T^{2} \times\left(a^{4}+b^{4}\right)}{a^{4} \times b^{2}}$ | $20,000 \times \frac{\mathrm{T}^{2} \times\left(a^{4}+b^{4}\right)}{a^{4} \times b^{2}}$ |
| Square plate, side $a$, secured at the edges. | $10,000 \times \frac{\mathrm{T}^{2}}{a^{2}}$ | $24,000 \times \frac{\mathrm{T}^{2}}{a^{2}}$ | $40,000 \times \frac{\mathrm{T}^{2}}{a^{2}}$ |

MAKING GAS FROM PETROLEUM.
Mr. John McClarty, of Racine, Wis., treats petroleum or naphtha under the admission of steam in a preparatory re tort, and conveys the semi.fixed gas produced therein by connecting pipes to the common retorts of gas benches, from necing pipes to the common retoris of gas benches, from
which the thoroughly fixed gas is conveyed for further treat. which the thoroughly fixed
ment, in the usual manner.
In the engraving, $A$ is a small tank, to which the petroleum or naphtha is fed by a hand pump. The oil is conveyed by a pipe, $a$, to the first retort, $B$, made of cast iron, of round shape, and suitable width and length, and heated to a bright red previous to the admission of the oil. The nozzle of a steam pipe, $b$, is inserted about one and a half inches into the oil pipe, as shown in Fig. 3, for the purpose of imparting in Fig. 3, for the purpose of imparting
force to the oil. The steam is obtained force to the oil. The steam is obtained
from a boiler, C , and the inlet of oil and from a boiler, C, and the inlet of oil and
steam, in pipes $a$ and $b$, is governed by steam, in pipes $a$ and $b$, is governed by
valves, $d$. The oil and steam pass tovalves, $d$. The oil and steam pass to-
gether to the inside of the ratort, $B$, gether to the inside of the ratort, B,
through a pipe, $e$, passing to the back through a pipe, $e$, passing to the back
end of the retort, then to the front, and finally to the back end again, as shown in Fig. 2, being discharged in a highly heated spray, and forming, by the heat of the retort, a semi-fixed gas. This gas then passes through the outlet pipe, $f$, to a bench connecting pipe $g$ and $f$, to a bench-connecting pipe, $g$, and through drop pipes, $g$, to the lids of the several retorts of the gas bench. The pipes, $g^{\prime}$, enter the retorts, and extend
to a point about twenty inches from the back end of the same, discharging there the gas, and converting it, by vassing forward in the retorts to the stand pipe fixed gas. Each of the drop pipes, $g^{\prime}$, on into a thoroughly vided with a valve and union coupling, so that the flow of prepared gas into the retorts can be governed at pleasure

Fig. 2


Figy. 3
The retorts are fed subject to a pressure gage placed on the stand pipe of retort, $B$.
The in ventor claims that,should the supply of petroleum fail, by accident or otherwise, no inter ruption of the works is necessary, as they can be instantly employed for the common coal process.

NOVEL ENGINE COUNTER AND TELL-TALE
We extract from La Nature the annexed illustration of new tell-tale for counting the strokes of an engine, indica ting the speed, and also showing any variations in the work

ing or stoppages of the machine. The mechanism, contained in thte clock shown, causes the rotation of a disk placed be low he clock face, on which disk a piece of paper, divided into divisions for 24 hours and fractions, is adjusted, the nig $b$ thours being denoted by a line, drawn from 12 to 12 , and nearer the center of the circle than the other marks. Above the disk is a lever which moves a pencil holder in front of the disk, and which receives motion from an arm which is connected with a counter The latter is placed in
communication with the engine by the eccentric and rod shown. The construction is such that, when the engine has made 100 turns, a rod, extending through the upper side of the counter and connected with the pencil-moving mechanism, rises one tenth of its entire course, causing the


## McCLARTY'S METHOD OF MAKING GAS FROM PETROLEUM.

 spread in a vacuum.tensity because of the bad conducting power of the succes sive denser layers of air and of the crust of the earth. That would then only be negative, as being less positive than the air. The diffusion of electricity through planetary space would be limited by the diffusion of matter, since it cannot

That gaseous matter extends further through space than the distance which is generally assigned to the earth's atmosphere will be proved by the fact that auroras, which are due to electric discharges, are pro duced at hights of 100,000 and 200,000 yards, where some gaseous matter must exist.
M. De la Rive agrees with M. Bécquerel as to the electrical origin of the aurora, but considers that the earth is charged with negative electricity, and is the source of the positive atmospheric electricity, the atmosphere becoming charged by the aqueous vapor rising in tropical seas. The action of the sun, he considers, is an indirect action which varies with the state of the sun's surface, as shown by the coincidence in the periods of aurora and sun spots.

In the accounts of travelers in Norway, we often read of their being enveloped in the aurora, and perceiving a strong smell of sulphur, which must be attributed to the presence of ozone. M. Paul Rollier, the aeronaut, who descend $\epsilon d$ on a mountain in Norway 4,328 feet high, saw brilliant rays of aurora across a thin mist which glowed with a remarkable light. To his astonishment an incomprehensible muttering ceeding hundred turns, the disk continues its rotation, so caught his ear; when this ceased he perceived a very strong that the pencil, pressing against the paper, ieaves a circular smell of sulphur, almost suffocating him.-Manual of the line. This is again broken by a cross mark of the pencil Natural History, Geology, and Physics of Gr. enland. when the hundred turns are finished, and so on, until ten indications are made, showing that 1,000 turns have been accomplished. The rod in the counter has then completed its upward motion, and falls instantly back to its lowest position, causing the pencil to make a cross or nearly radial line ten times as long as that made to indicate the hundred turns.
It will be seen from this that the circular line, or rather that portion of it included between any two hundred turn marks, passing as it does over the time divisions inscribed on the paper, shows exactly how long a period was occupied
by the engine in making the above number of by the engine in making the above number of rotations. By
comparing these sections of the line together, the fact of all comparing these sections of the line together, the fact of all being exactly the same length shows the regularity of the machine, while the stoppage or irregularity of the same will at once be indicated by the circular line continuing unbro ken. The length of the line between the 100 turn divisions also shows the speed of the engine; and the same may, besides, be used to indicate whether or not the machine was started or stopped according to orders at any predetermined cases, so as not to be accessible to the engineer.

## a solid flame bunsen burner.

The accompanying engraving represents a new form of Bunsen's burner, described in a paper recently read by Mr. John Wallace before the Newcastle-on Tyne Chemical So ciety. Its chief peculiarity is an adjustable cap of perfora ted metallic plate, which enables it to burn a much more in

flammable mixture of air and gas than is possible with the ordinary burner. The tendency to light within is also completely prevented, whatever may be the pressure, quality, or quantity of gas passing. By raising the cap to the necessary hight a perfectly solid flame is obtained-a novel and valuable feature, since it allows any substance to be heated to be put much nearerthan usual to the center of the flame without interfering with combustion. It can be made from one inch to two inches in diameter, and is capable of burning as much as 40 cubic feet of gas per hour.

Origin of Atmospheric Electricity
According to M Becquerel, solar spots, which are some times 16,000 leagues in extent, appear to be cavities by which hydrogen and various substances escape from the sun's photosphere. But hydrogen, which appears here to be only the result of decomposition, takes with it positive electricity which spreads into planetary space even to the earth's at mosphere and to the earth itself, always diminishing in in-

## LLOYD'S FLOATING APPARATUS.

Mr. Lloyd's apparatus has claims which are worthy of far more consideration than those of the Boyton dress. First perhaps in utility is an air matiress of the ordinary shape, which is inflated in three compartments, and by the aid of which Mr. Lloyd lately crossed the Solent. This mattress, ays The Field, is available as an ordinary bed, either on board ship or under canvas. "With the middle compartment empty, Mr. Lloyd showed us that its buoyant powers are sufficient to enable him to jump into the water without sink ng below his armpits, while it affords protection from me chanical injury by wreck or rock. After entering the water in this way, he inflates the middle compartment, and it then forms a raft, which he is ah'e to propel with the paddle at the rate of between two and three miles an hour. Lmigrants may therefore, without any extra outlay, provide themselves at the above rate with a floating apparatus which may be propelled to shore from a wreck. Another useful means of flotation is his swimming waistcoat, by the aid of which a bather can float without the possibility of its shifting. is unsightly, no doubt, but this ought not to weigh against its utility in avoiding the risk of sinking when learning to swim. Its price is only $\$ 3.75$, gold."
The most noteworthy, however, of Mr. Lloyd's inventions is his canoe, which can be folded into the compass of a small

portmanteau or carpet bag when empty. It is made in two divisions, buckled firmly round the waist after inflation, and kept in position by a strap passing between the legs from the frocit to the back. A waterproof dress is first drawn on made of the ordinary twilled material used for coats, etc nd buckled over the shoulders, with the arms quite free Having first encased himself in this way, Mr. Lloyd jumped into the water, and, with his paddle in his hands, sinking only the level of his armpits, easily paddled with the tide at the rate of 3 miles an hour.

## NEW GAS REGULATOR.

The annexed illustration, extracted from the Bulletin $d u$ Musée, represents a novel gas regulator recently devised by M. Liebda. A cast iron vessel, A, is provided with circular channels, $a$ and $b$, which are filled with mercury. $c$ is a conduit for emptying them. The gas enters by tube, $d$, and escapes by tube, $e$ : and at $f$ are screw plugs which close the apertures from which the water which accumu lates in the apparatus is removed.
The entry of the gas is regulated by a valve or cover, B. the edges of which, as shown at $g$, are triangularly indented, and are plunged into the mercury in the channel, $a$. A large cover, C , is provided, the edges of which enter the mercury in channel, $b$, and at $h$ access may be had to the interior. The covers, B and C, are connected together by the three double levers, D. E is a water manometer for indicating the gas pressure, and finally, $F$ is the envelope which encloses all the working parts.
The gas, on entering $d$, passes under $B$, and through the triangular indentation in the edges of that valve. It then presses upon the larger cover, C, and, by raising or lowering the same, causes the reverse effect upon B, through the levers, as already noted. As the pressure increases, cover C rises and A falls, and vice versa, thus causing C rises and A falls, and vice versa, thus causing
the apertures in $B$ to widen and close just so as to the apertures in B to widen and close just so as to
a imit a uniform flow of gas. To increase the a imit a uniform flow of gas. To increase the
pressure, weights may be disposed upon the cover, pressure, weights may be disposed upon the cover,
C. An economy of from 25 to 30 per cent is claimed to be gained, in the consumption of gas, through the use of this device.

COTTRELL AND BABCOCK'S PERFECTING PRESS FOR WOODCUT PRINTING-FIRM'S ROTARY ATTACHMENT. Two features are necessary to obtain a patent: First, the invention must be novel ; second, it must be useful; and when these features are clearly demonstrated to the examiners, the exclusive right, for seventeen years, to manufacture, lease, sell, or otherwise dispose of it, is awarded under letters patent.
But there is another feature of importance to the patentee or his assigns, namely, the propriety of his keeping as near as may be within the beaten track of mechanical appliance in his inventions or improvements, in order that the workman, when he takes hold of the new machine, may feel a certain degree of familiarity with its mechanical principles, and thus be enabled to prosecute his labor with equal confidence as formerly, when engaged on the old and superseded machinery. During nearly half a century of careful and patient observation, we have noticed several really valuable inventions fall stillborn to the world because of a non-observance of this common sense theory. The inventor may feel satisfied that he sees clearly his means to an end, irrespective of the reasonable convenience of those for whose uses the invention is designed; but the workman cannot appreciate the value of an improvement which compels him to learn his trade over again. In such cases, it will necessarily be uphill work with the inventor to introduce his machine;


LIEBDA's Gas REGULATOR.
short of usefulness and pecuniary profit to all parties con cerned.
The new perfecting press which is illustrated in the above engraving seems to belong to the last mentioned class of inventions, a caceful examination of which will present no thing unfamiliar to the modern pressman. It is simply a union of the rotary and drum cylinder presses, preserving the features of both with the greatest simplicity. Take off, in imagination, the type and impression cylinders and the second feed boards and piling apparatus, and we have the Cottrell improved four-roller printing machine remaining, without variation or modification. We shall proceed to describe the complete machine in a manner that will be understond by the craft for which it is designed, avoiding shop terms and speaking in the language of the pressroom.
Its foundation is the latest Cottrell and Babcock drum Its found on in inder press, embracing the Cottrill improved air spring and governor, the whole so substantially built as to sustain the
new rotary attachment without vibration, even when running at its bighest rate of speed.
The patent rotary attachment consists of two cylindersone for curved stereotype plates of the matter to be printed, the other to give the impression. These cylinders are supplied with a feed board, and revolve in harmony by the instrumentality of the usual gear wheel attachment, making two revolutions while the drum cylinder of the main press makes one, and yielding the sheet, when printed on one side grippers curved stereotype plates, to a supplementary set o
passes to the flat form on the bed of the main press, and is

| and $h$ e displays a lamentable lack of knowledge of human | passes to the flat form on the bed of the main press, and i |
| :--- | :--- | :--- |
| nature if, in his disappointment, he attributes his want of | printed on the other side and piled in the usual manner. |
| success to the stupidity or stubborn prejudice of the work- | The type cylinder is supplied with an ordinary distributin | success to the stupidity or stubborn prejudice of the work- The type cylinder is supplied with an ordinary distributing

man. On the other hand, when improvements which are the man. On the other hand, when improvements which are the
results of new combinations of existing and well understood
apparatus for three form rollers; and as printing, the form is necessarily rolled twice also agencies are presented to the public-properly constructed with a fresh supply of distributed ink each time-an exceland divested of every possible complication-they seldom fall lent featurein itself. There are four vibrating rollers, which thoroughly break up and distribute the ink be fore it is contributed to the form rollers. The space on the type cylinder not occupied by the curved plates serves for the ink table; and a simple device raises and drops the vibrators at the right times and places, thus avoiding all contact on their part with the stereotype plates. At each alternate revolution of the impression cylinder the impression is thrown off by a simple and reliable mechanical device, by which means the complete rotary attachment (as it gives the impression on its second revolution) works in harmony with the drum cylinder of the main press.
The great difficulty that most perfecting presses have to contend with is their tendency to set off. This difficulty is thoroughly over come in the press under consideration by the introduction of slip sheets, which are fed to the drum cylinder, the grippers which carry the slip sheets being so manipulated as to bold each sheet for two impressions before yielding it to the piling apparatus, where it is smoothly and evenly piled for future use.
These presses being designed particularly for illustrated periodicals of large circulation, the plain forms are printed by the new rotary attachment, and the cut forms on the flat bed of the main press by the drum cylinder. The superiority of the Cottrell air spring and governor attachment over the old coiled wire springs enables a press of the printing magnitude of $42 \times 60$ inches to keep up a durable speed of over 1,200 impressions per hour. After allowing for the time consumed in making ready forms of long numbers, and the stoppages incident to removing printed paper and supplying fresh piles to the feed boards, the manufacturers assert that an average of over 10,000 sheets per day, printed on both sides, will pass through the machine. The new patent rotary attach ment accomplishes its share of the work independently, and ment accophen in prinder to be prfected without interforing in any way with the the the we thu han way with the time of the main press; so that we thus have a clear issue of more than 20,000 single impressions per day of ten hours The usual method of making ready this class of illustrated work is by hard packing, the overlays of the cuts being made from certain cardboard, well known to the practical cylinder press printer, and the whole finally covered by a blanke of well worn billiard cloth. On the drum cylinder of the main press, of course, the modus operandi is the same as on the ordinary drum cylinder machine; while the rotary attachment is supplied with the necessary conveniences for the same class of make-ready
We have thus, we believe, given an intelligible description of this new perfecting press, from which it will be under

stood that the invention, according to the manufacturers' stood that the invention, according to the manufacturers
statement, doubles the capacity of the drum cylinder machine, without detracting from the finished quality of the presswork. The first of these machines is now in successful operation in one of Frank Leslie's pressrooms in this city. Messrs. Cottrell and Babcock's office is at No. 8 Spruce street, New York.

## Cutrespurdentr.

## ro the Editor of the Scientific American

I am pleased to see the illustration of Mr. J. B. Rogers' life-saving apparatus in your issue of September 25. At this lite-saving apparatus in your issue of September 25 . At this
time, when so much is being attempted by the United States government and so much is done by foreign powers, in perfecting the means of communicating with stranded vessels, any new devices, so well illustrated, command respect. It is to be hoped that at our grand Centennial Exposition there will be ample space allotted and ample means provided for practical experiments with all known devices for rescuing shipwrecked persons.
Allow me to quote (from a pamphlet published by me in 1872) some of the results of experiments in casting lines by projectiles: "The Manby mortar was fully illustrated in a pamphlet published in $18: 6$, and was for some time the popular means for getting communication with a wreck. Its weight, withits bed, was about 3 cwt ., and it carried a line of $1 \frac{1}{2}$ inches 200 yards, by a 24 lbs. shot, and adeep sea line 270 from Mauby's pamphlet. "It is of the first importance for a from Mauby's pamphlet. "It is of the first importance for a
lifeboat to resemble as much as possible those which the lifeboat to resemble as much as possible those which the
beach men are accustomed to and have conficence in, not beach men are accustomed to and have conficence in, not
only because it is necessary to humor the prejudices of such men, but whatever tends to increase their confidence must increase the chance of saving life." Whatever may be said of Manby's antiquated notions, the above advice is sound. The Boxer accelerating rocket has entirely superseded the Manby mortar in England. The effect is that, when the first charge is expended, when the rocket has attained a certain elevation or range, a second charge is fired. The line used is made of Italian hemp, 500 yards length and weighing 46 lbs . After getting the line on board a vessel, other, larger lines are hauled off, and finally a hawser is set up, and communication is established by means similar to those in your illustration. The principal objections to the general use of the Boxer rocket by the United States stations, and by humane societies, lies in the fact that it is costly, and that the inventor has given the right to use it into the hands of parties who naturally desire to profit by its sale. Could we have the privilege of manufacturing it in our laboratories, the cause of humanity would be greatly advanced.
I have been informed that the German government has in use a rocket which has a range of 800 yards, which is nearly double the range of the Boxer rocket. It has also another advantage over it by reason of the staff being attached in a direct line with the body of the rocket, which insures more accurateaim, the staff of the Boxer being attached to the side of the rocket. Measures should be taken to make rockets of our own, and if possible beat our transatlantic humanitarians.
In a report by Commander Jerningham, when Comptroller of the Coast Guard,hesays: "The experiment at Woolwich gives the following results: Manby mortar,caliber $5 \frac{1}{2}$ inches, elevation $33^{\circ}$, charge 10 ounces. The mean distance carried in 20 rounds was:
In fine weather, 6 thread Russia line, 245 yards. In fine weather, Manilla line, same size 285, yards. In moderate weather, with fresh breeze, hemp line, 237 yards. In moder ate weather, with fresh breeze, Manilla line, 279 yards. In strong gale, squally, elevation $28^{\circ}$, hemp line, 211 yards. In strong gale, squally, elevation $28^{\circ}$, Manilla line, 243 yards.
a strong wind requires less elevation than a moderate wind. A cross wind reduces the range more than a head wind. The quality and amount of powder is of much importance. A Manilla line, laid up slack, will stand 16 ounces portance. A Manilla line, laid up slack, will stand 16 ounces
when 12 will break a hemp line; 120 fathoms of Manilla when 12 will break a hemp line; 120 fathoms of Manilla
weighs 11 lbs. against $15 \frac{1}{\frac{1}{2}}$ lbs. of Russian. Lines properly balled, after the manner of spun yarn, were found less liable to foul and more portable than lines carried on racks in boxes. Manilla rope beckets attached to the shot are best; one shot was fired 27 times with the same becket. Manilla line will absorb less water and be liable to less injury from being putaway wet than hemp."
For want of space I cannot more fully quote this paper of Jerningham's. He alluded to firing off a block and double line when the wreck is near enough, in the same manner as Rogers does. He also speaks of an anchor shot that he had fired, in moderate weather 210 yards, in a gale 150.

In 1870 my attention was called to Rogers' apparatus. A report of trials made by the Admiralty states, in brief, as fol laws: "His anchor weighing 134 lbs., with a bluck and line
making 200, was thrown 134 yards from an 8 inch mortar with 12 ounces powder. In another experiment the anchor was thrown from a common howitzer.'
And again Captain Boys, of the Excellent training ship, fired an anchor weighing 128 lbs ., with a block and line of 1 inch, 156 yards with 8 ounces powder, once 152 yards, once 163 yards, and in the fourth shot, with 12 ounces, 217 yards. Experiments were made with Rogers' anchor at Liverpool, throwing a 1 inch line 200 yards, and a smaller one 400 ; but in this last case, the line broke. In November, 1870,the Royal Naval Reserve Club resolved that "this meeting strongly recommended its adoption by the Royal National Lifeboat Institution." The Royal National Lifeboat Institu
tion, through its executive agent Captain Ward, R. N., ex pressed the opinion in a letter to me that Rogers' apparatus would not take the place of the Boxer rocket, as he thought the anchor shot would be likely to attach itself to the wrong place; at the same time he said that Rogers had succeeded in throwing his anchor much farther than he expected. Notwithstanding the opinion of Captain Ward, I hope that the Rogers apparatus may be utilized in this country, where we have no Boxer rockets. If adopted, it may be made usefu in throwing an anchor off shore to facilitate the launching of lifeboats. In cases like that of the Italian bark Giovanni, lost on Cape Cod, with all her crew save one, last March, the distance being 400 or 500 yards, the mortar of the govern ment failed to carry a line far enough. In
The cost of the Boxer rocket apparatus, as I learn from I. and A. W. Burt, London, is $\$ 625$, which includes 24 rockets and sticks, 20 lights, 20 portfires, primers, lines, boxes, whip, hawser, tally boards, blocks, slings, triangle, 2 Ward belts, life lines, flags, tubes, fuzes, diagrams, and packing. Formerly Dennet's rockets were used by our society, but they were found to deteriorate by the necessary exposure on sea beaches; and they sometimes burst prematurely, so that our ociety has long ago discontinued their use.
The French use a different method from the English. Their nes are thrown by means of what they call fléches or arrows; more properly, they should be called clubs or sticks of wood, as well as of iron, which are thrown from various pieces of ordnance. The wooden ones have the advantage of floating sometimes within reach of the wreck.
A full detail of these means was given in a pamphlet pub lished by me in 1872, to which I refer. Could we exercise a much ingenuity in devising means for saving life as we do for killing, many lives might be saved.
Boston, Mass.
R. B. Forbes,

Chairman of Standing Committee of the Massachusetts
Humane Society.

## Water Wheel Buckets.

To the Editor of the Scientific American:
I give you a rule for the construction of the buckets of vershot water wheels, which $I$ have never seen in print:
Make the inner face of the buckets in the form of an epi ycloid, generated by a circle (whose diameter, $a$ B, see dia

gram, equals the depth, A B, of the rim of the wheel, minus he thickness, $a \mathrm{~A}$, of the buckets) revolved upon the circle E C, which forms the back of the buckets. Then the out r corner, A, will be flush with the rim. As may be seen by otating the diagram, this form of bucket retains its wate etter than either of the forms, C D and E F, in commo use, but does not carry any too far, that is past,the lowest
point of the wheel.
Townsend Wolcott. Noint of the wheel.
New York city.

## American Inventions in Europe.

To the Editor of the Scientific American
One characteristic of American exhibits, in the world's airs held in Europe, is that they do not consist of products o much as the agents for producing. Our tools, machines, and inventions are exposed before the world in a manner that conduces much to our credit as ingenious and persever-
ing, but with a corresponding loss to our material interests, as any one who has examined the matter carefully must now. I am fully convinced that not one in a thousand mong our implement makers knows to what extent and with what success our American products become models in Europe, and it is to call some attention to the matter that his is written.
Every circumstance in our country tends to promote this exposure of our tools and processes. Our isolated position rom the rest of the manufacturing world, and the prohibi tion of imported tools by a high tariff, prevents a knowledge
of what is done by others; and while we rely solely on our wn resources in devising machines and processes, other countries not only employ their own skill, but draw on us for all that is of use to them. Our skill is the base of any success we have had or can hope for, in creating a foreign market for American manufactured products. This every one knows; and yet we throw open our workshops to the inspection of every one, with a recklessness which is astonish ing to people in Europe; and we seem to lave no secrets worth preserving. A German, Swede, Pole, Russian, o other foreigner has, as a rule, only to present a card at the
doors of our workshops to be admitted and have every process pointed out and explained. This is not so in other countries, especially in those from which we can hope to draw useful suggestions as to commercial policy.
Without ignoring in any way the influence for good which may come from the reputation gained by exhibiting our andicraft, I would beg our engineers and manufacturers to onsider that such influence is a weak one compared to pric when it is desired to influence a buyer. The money cost of product is the only sure base upon which a market for i can be made; and while foreign orders may be, as they now and then are, secured, such orders will not be repeated un less we produce the article at less cost than it can be copied for in Europe. I repeat that our only power and hope of a foreign market, now so much needed, lies in two things skill in producing superior to, and labor more effective than those of Europe. Our boundless natural resources may be balanced against three or four thousand miles of sea carriage if we only keep our processes to ourselves, and show finished products instead. To go to America to learn to manipulat rocesses in working iron and wood is becoming part of the ducation of young mechanics and engineers from North Europe. I could at this time give names of many who ar making, or have made, this kind of tour through our work hops. Hundreds, yes thousands, come to America to be ome skilled, and then return home to astonish their friend with what has been learned, and to reap the result in highe wages, which for a time will be paid for their services.
I may be asked: How is this to be prevented? The nswer is simple enough. Shut up the shops, admit no on not supplied with proper reference, and not then, if the object is to acquire special information. This is done in Eng and, thoroughly and completely, and nearly as well on the continent. Why cannot it be done in America? It may be said that our tools and machines must be shown in order to ell them, and that they must be exhibited next year at Philadelphia. This is true; but there is a wide difference etween showing completed tools, implements, and machines and in exhibiting the mode and processes of constructing them. Suppose the Waltham Watch Company, who have just occupied their magnificent new premises in London were to send over some of the Clerkenwell manufacturers skilled men to examine the operations at Waltham, and then furnish to these men a set of machines and tools like those in use at Waltham. How long would the busines of exporting watches last? Yet this is what is continually done in many branches of our manufactures. Those opera tions of manufacture which do not find their way into ou scientific journals-little things, not scientific and seemingly unimportant-very often determine the cost of products, in way to secure or lose sales abroad. "It is the last cent that tells," and this last cent is generally taken off by some simple little expedient which, for a stranger to see, is for im to have and for us to lose
These things would soon be understood and appreciated if our implement makers would visit certain parts of Europ which I could point out, and see the copies of our machine and tools exhibited as "improvements on the American, and hear (to explain the assumption) how "Americans are cunning and inventive, but without the power to apply thei knowledge, because not educated," and so on. Somethin of this is done in England and France, but not much. These countries are not small enough and petty enough to tolerat such things; beside, we are too well known to be charge with incapacity.
A word of caution in this way will not be out of place for the coming year. Thousands in Europe are waiting for a aid on our workshops; and while nothing should be done o detract from the character of the Exposition in Philadel hia, you will excuse me for suggesting that the influence of your widespread journal could not be better used than in iving stronger expression to the present subject than is possible at the hands of

Observer.

## Electric Force and Molecular Motion.

To the Editor of the Scientific American:
Mr. W. E. Sawyer, in his letter on "What is the Electric Force?" in your issue of October 9, says: "When one pulls bell cord, and instantaneously a bell is rung in a distan room by the molecular transmission over or through the bel wire of the force applied at the cord, does not one realize hat he is as veritably, as wonderfully, and by a simila molecular motion,transmitting that signal as though he were ransmitting it by applying a battery to a telegraph wire,and hus setting the atomic particles in motion?"
I propounded the above question to myself, endeavored to realize it, and failed signally; therefore I apply to you fo help, and trust it will be given, for Mr. Sawyer's explana ons of the electric force seem soclear and forcible as to en ble almost any one to form a good idea of the subject.
When one pulls a bell rope, causing a bell to ring at a dis tant point, one can readily realize the disturbance of the tomic particles from ocular demonstration. He sees the movement of the cord where the force is applied, and also where the bell lever receives it, and the only rational ex planation is that of molecular transmission.
In the case of the telegraph, he sees no motion, either where the force is applied, or where it is taken off,even when he force so applied is very powerful. However, this may be deduced by reasoning, as Mr. Sawyer so ably shows, bu the real difficulty is at the end, where it is utilized. The wire terminates in a coil,and inside of this coil, entirely separated from it, is a bar of metal, and entirely separated from this is the bell lever. Now it is difficult to conceive how the mere molecular disturbance of the wire causes a like dis turbance in the bar which again causes the same in the bell
lever or armature. If the motion were transmitted directly to the bell lever by a material connection, as in the first case, th $t \mathrm{n}$ there would be no difficulty in understanding this application of the theory.
Philadelphia, Pa .
Thomas C. Marckley.

## An Amateur Chemist's Narrow Escape.

To the Editor of the scientific 1 merican:
I am, by accident, the discoverer of a most wonderful explosive; I say that I am the discoverer of it, for the simple reason that, so far as I can ascertain, it has not heretofore known. If I am wrong, I desire to be corrected. Of the nature of the explosive and the cause of its explosion, I am unable to speak; but from its composition, I should say that it was related to nitroglycerin; and its effective power confirms the idea, as, although its force was not nearly so powerful as that of nitroglycerin, it exercised it in much the same manner. I shall, most likely, and perhaps not without cause, be denounced as fool hardy, and be advised to let alone that of which I know nothing. But be this as it may, the following are the facts in regard to the composition of the compound, and the modus operandi of its discovery
I had been experimenting on the absorptive powers of turpentine, and among the other substances employed was nitric acid; I found, after the acid had been in contact with the turpentine some twenty four hours, that they had both undergone a material change in their nature; they had assumed an entirely different color, the acid being reddish, the turpentine yellow, and a third substance (between them) of an exceedingly red color, and their properties seemed to be changed in other respects. I thought this change might have been caused by some impurities in the acid, which was commercial; so I determined to repeat the experiment anduse chemically pure acid. To carry out my plans, I procured a common eight ounce, glass-stoppered bottle, and poured into it two ounces of acid and the same quantity of turpentine. They both remained perfectly clear and colorless,and showed, on account of the great difference in their specific gravities, a decided division line. I then placed the stopper in the bottle and shook it, then let the liquid subside, and noted that the turpentine retained its colorless condition, but the acid was of a reddish tint; I once more shook it, and, when the contents had returned to rest, the turpentine was of a yellow color, the nitric acid a fiery red; the division line between them was almost lost. I then shook it a third time, and noted that the whole quantity was blood red; I had but just placed it on a table to allow the contents to settle when it commenced to effervesce; I picked it up, tried to pull the stopper, found I could not, and turned to a window distant some two feet; the window was up, but the shutters were closed. I made a motion to open the shutters, when there was a terrific report; the hand in which I held the bottle was empty, my face covered with acid, and the room completely filled with gas and vapor.
I left the room immediately, and applied water and milk to my face to stop the biting of the acid, and then recurned to the scene of disaster. The floor was covered with glass
almost in a state of powder. In a piece of walnut furniture, almost in a state of powder. In a piece of walnut furniture, distant from the point of explosion fitteen feet,I found glass in pieces the size of shot, completely imbedded in the wood; the carpet, directly under where I nad held the bottle, was torn in sundry places, and the glass buried in the floor. The bottle was demolished in the strictest sense of the word, being reduced to pieces from the size of corn grans down to wheat, and even finer. The stopper of the bottle I have not been able to find, and I suppose it was demolished also. The way in which I escaped was miraculous; the hand in which I held the bottle was not so much as scratched. I think the bot tle must have passed from my hand before it exploded; but if it did, its passage and explosion were so instantaneous, that it seemed to burst in my hand.
I enclose for your inspection a sample of the remains of the botule.
E. G. Acheson.
[We are sorry to be compelled to dash the hopes of our correspondent by saying that his discovery is not new in many of our college laboratories.
The experiment above described is one usually performed before a class beginning the stidy of chemistry, in order to demonstrate the power with which nitric acid oxidizes bodies capable of undergoing oxidation, like phosphorus, sulphur, carbon, and the hydrocarbons. Turpentine also is generally the hydrocarbon selected, as being nearest at hand. It is also frequently repeated by tyros with effects presenting a striking similarity to those graphically depicted in this thrilling narrative, but young students seldom venture upon more
than a tew drops of the mixture. There is certainly a great than a tew drops of the mixture. There is certainly a great novelty in beginning to experiment upon four ounces of so unstable a body as nitric acid, and so volatile and inflammable an oil as turpentine. We make a publication of the results in this case, in the hope that it may be of service in preventing accident, if not loss of life, to other amateur experimenters.

## Steam Boiler Phenomena

To the Editor of the Scientific American:
In the account of steam boiler phenomena on page 193 of your current volume, the temperature of the feed water is not given in either case. This is an important item in considering cases of this kind.
If in the first case, the feed water were very hot, it would require bat lictle more heat to convert it into steam. This heat being supplied from the overheated boiler, the pressure would go up until the temperature of the iron was reduced to that of the feed water.

In the second case, if the feed water were cold, it would sooner absorb the heat of the boiler. It would then con dense the steam and produce a partial vacuum, as stated.
The action would be similar in the two cases, the pressure going up to a point corresponding to the amount and temper going up to a point corresponding to the amount and temper-
ature of the feed water and the heat contained in the iron of the boiler, and then falling, as I have no doubt it would have done in the first case if the pumping had been continued Perry, Ill.
L. D. Kennedy.

## American Grape Vines in France.

To the Editor of the Scientific American:
In regard to an article in your valuable paper of September 11, headed " American Grape Vines in France," I would re spectfully call your attention to a letter which appeared some time ago in the Gironde, of the Canton of Bourg, contributed by M. Marchal (a justice of peace). He attributes the plagues of the grape vines, known as oidium and phylloxera, not the introduction of parasites from America, but to a diseased condition of the vines, caused by old age and general exhaustion, of which the parasites, which attack the roots, take ad vantage. As the vines are multiplied from the old plants by cuttings, he considers that there is no renewal, but only a propagation or continuance of its former life and age. If, therefore, the cuttings from old vines are planted, it is not a recreation of a new plant, but simply a continuance of the
life of the older plant from which the cutting was translife of the older plant from which the cutting was trans-
ferred. The age, therefore, of a vine in general reaches to the time when it was first planted from the seed, consequenty he advises growers, under these circumstances, to plant new vines raised only from the seeds.
May not the success of the Am srican vines, being younger and more vigorous, and transplanted to different soil and to a different climate, be attributed to this law of Nature? To many, undoubtedly, this view will appear rational; and it certainly deserves a fair trial, not only in France but also in other countries, wherever the plant, that produces the gold n or ruby fluid which makes the heart glad, flourishes.
Kissingen, Bavaria.
John Eitel

## Elack oxide of Manganese

Don Julius de Valmagini, of Vienna, claims to have discov ered a new and valuable disinfectant in the ordinary black oxide of manganese. In the Bayerisches Industrie and Gerwerbeblatt, he writes as follows
" It is well known that ozone is the only substance which will rapidly decompose badly smelling gases; but up to this time we possess no method of preparing ozone cheaply and in large quantities. I have found by a series of experiments that ozone is present in black oxide of manganese (Braunstein) in large quantities, and that it is continually regenerat ed. It was not hitherto known that many kinds of oxide of manganese (manganite, pyrolusite, etc.) were ozone carriers;
but I can prove that they not only possess all the properties of the known ozone bearers, but are excellently adepted to use in all cases where ozone has proved useful.
(a) Ozone test paper, prepared with starch and iodide of potassium, is immediately blued by the liberation of iodine without any acid being added.
(b) A solution of chemical y pure iodide of potassium is at once decomposed by dropping into it a fragment or some of the pulverized mineral, the liberated iodine turning the solution brown. The liberated iodine is recognized by all its re actions, such as turnıng blue with starch paste, aissolving in chloroform or bisulphide of carbon, subliming at the boiling temperature, and the characteristic odor.
(c) Chemically pure binoxide of manganese, prepared artificially, shows the same reaction in chemically pure iodide of potassium as given above at $b$, reacting just like the natural
(d) When the pulverized mineral is strewn upon chemi cally pure silver and moistened, the silver is browned at once by the formation of oxide of silver; on heating, the brown spot entirely disäppears, p
(e) The air is also ozonized by contact with the surface of the mineral or of the powder.
$(f)$ The reaction about to be mentioned now was indeed nown, but was never considered as an ozone reaction, name ly: Tincture of guaiacum is colored deep blue by the oxide of manganese.
(g) Black oxide of manganese is also well adapted, by its ozonizing power, to destroy putrid gases, such as sulphuretted hydrogen, and putrefactive gases, and that too in a very short time.
Fro
From this it may be concluded that many kinds of man ganese ores could meet with extensive use for sanitary and building purposes."

The Soda Lakes of wyoming Territory. Professor Pontez, Geologist to the Union Pacific Railroad reports as follows on an interesting deposit of carbonate of soda in Wyoming Territory :
"The carbonate of soda deposit is, by nearest road for wagon, sixty-five miles from Rawlins Station, nearly due north. There are two lakes. The upper and larger one covers about 200 acres; the water has an average depth of
three feet and a specific gravity of 1.097 ; it therefore contains nearly one pound of soda to ten of water. The soda is nearly all carbonate. The second lake is situated about two miles east of the large lake, on a somewhat lower level. It is bowl-shaped, and covers rather more than three and one half acres. During the greater portion of the year, it is a concrete mass of crystals of carbonate of soda, mixed with a
cavated to the depth of six feet,but did not reach the bottom of the deposit. Its entire depth can only le ascertained by boring. It is a reservoir or pocket which receives its in crease from the periodic influx from the larger lake. The water, having no outlet, evaporates during the summer, and by autumn becomes a compact mass.
The quality of the carbonate is fully equal to the imported article used throughout the country. Its minimum or bottom price has been $\$ 15$ per tun, up to $\$ 67$, its present price. Estimating the quantity by the specific gravity of the water, its depth and area, the large lake covering 200 acres will yield on evaporation 78,000 tuns, which, at the market value, would realize, at $\$ 45$ per tun, $\$ 4,510,000$. Besides the cost of freight, the expense of preparing the article ior marke would be $\$ 4$ per tun, for evaporating.
The small lake already crystalized, and estimated only to the depth of six feet and an area of 155,000 feet, contain 30,660 tons, which, at $\$ 45$ per tun, would realize $\$ 1,379,700$, with no drawback except freight and commission.
The reason why this valuable deposit of a staple article has notalready been drawn on largely is the difficulty and expense of hauling it 55 miles. A range of mountains called the Seminole intervenes between the deposits and the Union Pacific Railroad."

## The Practical Determination of Coal Tar Colors.

The colors fabricated from coal tar are commercially known by such a variety of names that it has become quite difficult for consumers to recognize the nature of the boaies employed by them. The following information, communicat ed to the Muster Zeiturg by H. Goldschmidt, will serve as a practical guide in determining the principal dyes, etc. now produced.
The red coal tar colors most frequently met with in com merce are fuchsin, saffranin, and red corallin. These three are easily distinguished by their action in the presence of an acid, which will color an aqueous solution of tuchsin, yel low; of saffranin, violet blue; and with corallin, will give an orange yellow precipitate. The violet coloring matter are the violets of phenyl, of iodice, and of methyl. The first two are but partially soluble in alcohol and in water. To distinguish them, a certain quantity of the specimen is dissolved in alcohol, and ammonia is added. If the solution becomes red, phenyl violet is recognized; if colorless, then one of the other two. Todetermine which one, dissoive another portion of the specimen in water and add ammonia violet of iodine gives a clear liquid; violet of methyl gives a colorless but troubled liquid.
Coal tar blues are aniline and alkali blues. The last is al ways soluble in water. Aniline blue present two modifica tions, of which one is soluble in water and the other in alco hol. The two blues are easily distinguishable from the fac that aniline blue always gives a blue solution; while that of alkali blue is colorless until an acid is added.
The green aniline colors most commonly found are alde hyde green and green of iodine, sinple or with picric acid. Determine first whether the body is soluble in water; if so, then it is iodine green. If not easily soluble, cissolve it in alcohol, and add cyanide of potassium. If the liquid then becomes colorless, the body is aldthy de green; if it turns brown, picric acid iodine grten is present.
The commonest yellow colors are picric acid and its salts and naphthaline, all soluble in water. Dissolve, add cy anide of potassium, and heat; if the liquor becomes readish brown picric acid or a picrate is present; but if the color simply darkens, a little napthaline is denuted. In the first case, to determine between picric acid ald a picrate, treat with benzinc and heat; picricacid, alone, dissolves.
The orange hues are yellow corallin, the salts of chrisan in and of chrysotoluidin, Victoria orange asd a mixture of naphthalin and fuchsin known as aniliue orange. Add ammonia; if it dissolves, giving a red liquor, corallin or a chrisanilin combination is present. To distinguish which, aissolve a little of the sample in alcohol, add zinc and diluted sul phuric acid: if the liquor becomes colorless, coralin is cenot ed. If ammonia, as above, does not color the solution, dis solve in water and treat with acid: if there be any change chrysotoluidin is recognized; but if a precipitate is formed it is a sign that the substance is either Victoria or aulin orange. 'I'o distinguish which of the two, add to the aqueoussolution cyanide of potassium; if the liquor turns brown on heating, Victoria orange is present; if the color changes but very slightly, aniline orange.
The browns are those of aniline, maroon, grenat, and two species of phenyl brown, one made with carbonic acid, the other with phenylenaiamine. Determine, first, whether the substance is soluble in water. If not, add hydrochloric acid; and if a yellow color is produced, maroon is present. If the acid occasions no change, aad to a portion of the solutio some ammonia; if there be a precipitate, the substance is
anilin brown or phenyleudiamine brown; if the ammonia is without action, it is grenat (isopurpurate of putassium). without action, it is grenat (isopurpurate of potussium).
Phenyl brown and anilin brown are distinguishable from the Phenyl brown and anilin brown are distinguishable from the
fact that the last yields a precipitate when cyanide of potasfact that the last yields a precipitate when cyanide of potas-
sium is added to it, while phenyl brown similariy treated undergoes no chavge.
In preparing lard for the market, it should first be cut into pieces about the size of a walnut, and these should be allowed to stand in water for half an hour. Then work the material with the hands in 5 or 6 successive portions of water. Next pour off the water, melt the lard in a water bath, and strain through fine linen. In the first straining, it will be impossible to get rid of all the water; so that after cooling an draining, it will be necessary to remelt the lard and finally draining,

## IMPRJVED VENTILATING HEATER

A new heater is illustrated in the annexed engraving, which, besides supplying a uniform current of hot air, thus warming the apartment, is so constructed as to draw in fresh air, thus at the same time ventilating the room. There is no contact of the incoming air with red hot metal or with the hot coals, and hence the warm current is delivered pure and uncharged with carbonic acid. For churches, school rooms, halls, and other apartments where ventilation is much more frequently bad than good, the entilating heater appears to be especially suited,and may advantageously replace the usual forms of stove. A perspective view of the invention is given in Fig. 1; the construction is exhibited in the sectional view, Fig. 2. From the latter it will be seen that there is a direct connection between fire box and lue, so that there can be no impediment to the draft. Surrounding the flue is a chamber, $A$, into which fresh air is led by the pipe, $B$, the latter connecting with the space between the flooring and with the wen the fooring and with tmosphere outside the buildng. In passing up through the chamber, as shown by the arperforated metallic plates, one of which is shown in Fig. 3. These, in addition to impeding the flow of the current, heat the same, since the plates themselves become quickly warmed by the flue walls. The heated air then makes its escape into the room through the openings at C .
We are informed that the consumption of fuel in the stove is small, one hod of coal being sufficient for a ten hours' supply, provided the fire be properly cared for. Either hard or soft coal may be burnt.

The construction is simple,
and there are no parts to get out of order, nor is there any opportunity for fouling or clogging in the flues. Dampers being absent from the stove, all casualties from careless regulation are avoided. Patented through the Scientific American Patent Agency, September 7, 1875. For further information, address the inventor, Mr. M. C. C. Church, Parkersburg, W. Va.

## PORTABLE STEAM ENGINES.

The portable engine illustrated on this page is one manu factured by Messrs. Clayton and Shuttleworth, of Lincoln, England, and was awarded the first prize given for portables at the last trials of the Royal Agricultural Society of England. The competitive trials by the Royal Society are of the most severe and searching nature; and in the case of all descriptions of engines, paid engineers of responsibi. lity and eminence are intrusted with the duty of minutely examining and reporting as to the merits of each competing the merits of each competing engine, embracing the distinctive points of strength, proportional and general construction, economy of fuel, quality of material, workmanship, and general efficiency. A combinatinn of these advantages, it is claimed, have given to Messrs. Clayton and Shuttleworth the leading position in England, as portable engine makers, and to this date they have manufactured 13,000 of such engines, and their present producrion is 25 engines per week.

The following are some of the distinguishing features of the engine herewith illustrated.
The boiler is butt- jointed and riveted by hydraulic machinery, which process of manufacture makes incomparably stronger work than the old box is in plan of hammering. The fire ly Low Moor iron. The boiler is lagged steam-jacketed and lagged. All wearing parts,such as slide bars, nuts, pins, etc., are case-hardened. The engines are fitted with improved adjustable side blocks, carriages, and bearings, all of the best quality of gun metal. The crank
shaft is bent, in preference to using the cheaper overneck kind. A second lock-up safety valve and Salter's spring balance are affixed to each engine. Reversing gear is added, allowing the engine to run either way. The feed pump is supplied with an arrangement for heating the water; it is continuous in its action, and cannot get out of order.
The workmanship and material used in the construction

meeting, looking not tired and weary, but quite refreshed with his bodily labor.'

The Origin of Coal.
The discovery of diatoms in coal, by Count Castracane, re cently announced, is of much interest, as throwing addi tional light on the mode of formation of carboniferous coal ny but very modern forma tions: but Count Castracane has succeeded in showing that they date from the palæozoic epoch, and as far back, at east, as the carboniferous pe iod. Hesays. "All the forms I have been able to observe among the ashes of the coal present such an appearance that the most practised ana sharpest eye could not detect the slightest difference beween them and actually living diatoms: outline, structure, shape, and number of the flut-ings-in short, all the pecularities which characterize the species that we meet with in the state of actual vegetation -agree exactly with those of he carboniferous period " It an scarcely be denied that th ristence of these minut forms of aquatic vegetation in the substance of carboniferous coal goes to confirm the view of those who (like Professo Bischof) hold that this miner al has been formed in presence of water, and the great pre ponderance of fresh wate orms of the diatomacea proves that this was fresh wa ter; still the occasional occur ence of marine forms leads to the inference that the water of the ocean occasionally had ccess to the lagoons or inland lakes.
In fine, the presence of dia ms, taken in connection with
boilers are tested to 200 lbs. per square inch. Mr. W. C. Oastler, 43 Exchange Place, New York, the agent for Messrs. Aveling \& Porter's road engines, steam plows, etc., is also the representative of Messrs. Clayton and Shuttleworth in he United States.

## Laborious Rest.

Speaking of the habits of English statesmen, a Liverpool paper states that two hours before the recent meeting at Hawarden " Mr. Gladstone was engaged in his favorite ex ercise of felling trees. For a portion of two days he has


CLAYTON AND SHUTTLEWORTH'S ENGLISH PORTABLE ENGINE. the strategraphical phenomena of carboniferous coal beds, appears to bear out the views of those who hold that the mineral has been formed from the decay of successive gene rations of plants and forest trees, growing with their stems partially immersed in the stagnant waters of vast lagoons these lagoons being nearly on a level with the waters of th sea, which sometimes gained access to them, and carried with them marine forms.

Epizootic in Horses.
This disease, that swept over this entire country and proved so serious in the fall of 1872 is appearing again this fall though probably in a milde form. Nearly all the horse of this and other cities are af fected with it already, and it is certain to spread to the country very soon. Horses that are in good condition will suffer the least from its at tack. Its first symptom is a slight cough, which gradual ly becomes more frequent and severe, accompanied with running at the nose and swell ing of the throat between the jaw bones. Horses that ar in rood heart and are properl in good heart and are properl ly be lightly only be slightly affected A writer in the Ohio Farme advises the simplest treat ment possible. Keep the horses in a warm, comforta ble, clean, and well ventilated stable, blanketed in wet, cold weather; feed well with oat and sweet hay (corn is to heating), with a good bra ma3h once a day; the only medicine needed is to thor oughly rub the throat wit some rood liniment if should become much swoll shou bers eareful swollen, them take cold. A little them take cold. A little ex ercise every day at light work or careful driving, we deen been welding the ax upon a large tree in a lane at the out• beneficial; but any violent exercise, or anything approaching skirts of Hawarden village, and he succeeded in bringing it to the ground late yesterday afternoon. Those who saw him ay that he went to work in true woodman fashion, with his braces thrown off behind him and his shirt collar unfastened. After completing his task, he walked home with his axe slung over his shoulder, and two hours afterward was at the
ver exertion, will be almost certain to produce serious re sults.
The aim should be to keep the horse in as strong heart as possible, and Nature will soon work out the disease. The usual term of this distressing and destructive malady is from twelve to twenty days.

## THE MANATEE OR COW FISH.

The manatee, says Mr. Frank Buckland, is one of the rarest possibly and most interesting beasts that has been brought to England for many years past. His external appearance is very puzzling. At one moment he looks like a pig, the next moment he reminds us of a porpoise or herring hog. The home of the manatee is the shallow bays and quiet rivers of Central and South America. He is purely herbivorous, and lives up the water plants which abound in those tropical regions. Mr. Bartlett, of the Zoölogical Gardens, London, has discovered that he is exceedingly fond of lettuces and vegetable marrows, cut into slices. His hind legs are flattened out into a fan, somewhat resembling a porpoise's tail. When he wishes to move forward he gets way on by moving his tail up and down; and-as those who unpacked him from his traveling box know-he is able to use this beaver-
like tail with very great force. The manalike tail with very great force. The manatee is purely mammalian, and suckles its voung at the breast.
"The manatee is allied to the dugong found in Australia. The dugong has a face ornamented with a big, hooked nose, and when I see the figure of Punch performing in the street, it puts me in mind of the dugong. The dugong and the manatee are without doubt the origin of the fable of the mermaid; either of them, especially the dugong, when coming to the surface of the water to breathe or look round, is very human. The manatee now in the gardens is 7 feet 2 inches long; a full grown beast is from 14 feet to 16 feet long.

Unfortunately for this animal, the flesh is very good eating. It has the flavor of pork with the taste of veal, reminding one of that cu ious relish 'beef cut with a hammy knife.' The skin of the manatee is like the rind of a prickly pear; he has stiff bristles inside his mouth; this is really a form of whalebone, as found in the whale's mouth. The animal seems to be a compromise between a pig and a porpoise.

## LAND TORTOISES

The two large tortoises, living at present in the Zoölogical Gardens, belong to a species indigenous and peculiar to Al dabra, a small island, or rather group of small islands, situated in the Indian Ocean, about 180 miles northwest of Ma dagascar.
The animals, of which a faithful representation has been given by our artist, have left their island home a long time ago. They were kept in a semi-domesticated state in a paddock, partly for the sake of their young, partly as a kind of curiosity, the male being the largest individual of its kind existing at present, of which the proprietor was very proud, and in which the islanders generally took an interest.

The female lays twice a year, between July and September, some forty eggs, which are hatched in about ten weeks. The young of such domesticated tortoises are allowed to grow till they are four years old, and from 12 inches to 15 inches long, when they are considered fit for the table. Some of the young individuals which are now on the continent of Europe are the offspring of the animals now in the Zoölogical Gardens. The tortoises were transported in separate cages and that separate cages, and that for the male had to be iron could do it, his strength being so great that, if he gets a good purchase with his feet and brings his shell against a square bar two inches thick, he is able to break it like a reed. In spite of every precaution, he nearly succeeded in getting out of the cage on board of the steamer conveying him to Aden. The sailor had placed the cage of the female opposite to his, and as soon as he obtained a sight of her he commenced to raise himse-f on his hind legs, and to break through the roof o the cage. There is no doubt that he soon would have suc ceeded in his efforts if Dr. Brooks had not resorted to the expedient of greasing from time to time the inside of the cage, so that he could no longer support himself against th slippery sides.
The two individuals differ from each other considerably not only in size, but also in the form of the shell; andin the Seychelles they were thought to belong to different races


## THE MANATEE OR COW FISH.

growing! The center of each of the scutes along the mid dle of the back is raised into a hummock, and also the other sutes are divided by deep grooves or sutures. The color is a dirty brown, gradually changing into black towards the center of each scute. The shell of the female is 3 feet 4 inches long, and 3 feet 10 inches broad (measured over the curvature); the circumference of its foreleg is 13 inches. The shell is perfectly smooth, nearly polished, without any unevenness.
They feed on vegetables of all kinds, of which they con sume daily a large quantity; in the Zoölogical Gardens they seem to prefer cabbage and vegetable marrow, but eat grass freely. A constant supply of water to drink is essential without it they would perish in a short time. They are fond of basking in the sun, but dislike a long exposure to the di


LAND TORTOISES IN THE ZOOLOGICAL GARDENS, LONDON
as much as a tun, but we should not care to recommend thi experiment, as the shells of these large tortoises are com paratively much thinner than those of the smaller kinds.
These tortoises never bite, and the male is so tame as to take the food out of the hand. He was thus sketched while being fed with a vegetable marrow. He is fond of being stroked and rubbed about the head and neck, which he stretches out of the shell to their full length. He shows great affection for the female, and this wa especially apparent when he was released from the two months' confinement in his cage; he seemed stiff, without any inclina tion to move, until the female was placed before him, when he at once stretched ou his head, and followed her about in their inclosure. Some time before sunset they go to rest, one with the fore part of the shell resting against that of the other. Th male has a loud voice, compared by the keeper to the roaring of a bull.

## Remarkable Electrical Phenomena

The night of July 7-8, 1875, will be long remembered in Switzerland for thunder storms, several of them of almost unex ampled severity. Of these, one that brok over Geneva was unprecedently severe and disastrous. It appears to have originated to westward, in the department of Ain, and took an easterly course up the valle, of the Rhone to Geneva, on reaching which i spread over a wider area, and thence direc ted its course over Savoy. As midnigh came on, though the heat was suffocating and not a breath of wind stirred below on the streets, light objects on the roofs of the houses bega to be whirled about and carried off as by a tempest of wind At the same time a dull rumbling sound, resembling netthe hat of wind nor that of thunder, announced the approach of the thunderstorm, and at 12 midnight exactly it burs over Geneva in all its fury. An avalanche of enormous hail stones, with no trace of rain, was precipitated from the sky and shot against opposing objects by a tempest of wind from the southwest. In a moment the street lamps were extin guished, and in a brief interval incredible damage was in flicted, the glass and tiles of houses smashed to powder trees stripped of their bark on the side facing the west, and crops of every sort were, in many places, all but totally de stroyed. The smallest of the hailstones were the size o hazel nuts, many were as large as walnuts and chesnuts, and ome even as large as hen's egg. Some of th hailstones measured four inches in diameter, and six hours after they fel weighed upwards of 10 ozs For the most part the hail stones were of a flattish or lenticular form, with a cen tral nucleus of 0.16 to 0.40 inch diameter, developed in several concentric layers of ice, generally from 6 to 8 alternately transparent and opaque. A map has been printed in the Journal de $G e$ nève, showing the district where the storm was felt a well as the degree of its in tensity in each locality. The lectrical phenomena wer very remarkable; the flash es of lightning succeeded each other with such rapidi y, from midnight tillia few minutes after 1 o'clock in the morning, that a mean of from 2 to 3 were counted each second, or from 8,000 to 10,000 per hour. Elec trical phosphorescense was remarkably intense before and during the hail. Th ground, animals, prominen objects, as well as the hail stones, were strongly phos phorescent. Immediatel after the hail, ozone was greatly developed, the smel being so pronounced as to be compared, by nearly all observers, to garlic. Th incessant electrical dis charges passed from clou
ch ref a powerful miday sun, which they avoid by does not sink at any time of the year below $70^{\circ}$ Seychelles , ine utmos of early autumn ; and we believe that neglect in this respect has been the cause why the specimens imported into England some thirty years ago never survived their transmission to Europe for more than a few months. Twenty-four hours exposure to a temperature below $50^{\circ}$ is fatal to them
Their walk is slow and clumsy, but is not impeded by the weight of as many people as can possibly find room on the back of their shell. The male is luelieved to be able to carry
hunder was very rarely heard. - Natur
A good cheap paint for barns and outhouses is made a fllows: Put $\frac{1}{2}$ bushel of good lime in a clean barrel, and dd sufficient water to make a thin whitewash; stir it wel with a flattened stick until every lum $\rho$ of lime is dissolved Then add 50 lbs . mineral paint, 50 lbs. whiting, 50 lbs road dust, finely sifted. Mix to a thick paste with linseed oil and thin gradually to the properconsistence with sweet buttermilk, fresh from the churn. The covering quality is improved by the addition of 1 gallon soft soap.

## THE SHOEMAKER＇S OPPORTUNITY．

Not liking the crippled motion of the feet of a certain young American，whose unsteady gait when shod was very unlike his graceful carriage when barefoot，we protested
that broader shoes should be furnished him＂＇They are not that broader shoes should be furnished him＇＂They are not to be had＂was the mother＇s reply．The child was wearing
shoes half an inch longer than his feet，but they were too shoes half an inch longer than his feet，but they were too narrow，by half an inch，across the toes．To make matters worse，the heel was much too wide，allowing a slipping of the ankle from side to side，which even the stiff counters could not keep from causing a marked overrunning of the sole． Remembering the reform which was made a few years ago in the matter of men＇s foot wear，we thought it altogether likely that the makers of children＇s shoes，or some of them at least，might have been led to pay some regard to the shape of children＇s feet；so we volunteered to find a suitable shoe for our friend＇s child．Our search was long and faith ful：but we had to give it up defeated．There may be deal－ ers in New York who sell children＇s shoes bearing some rea－ sonable resemblance to children＇s feet；we sincerely hope

here are；but we failed to find any．
The accompanying outline shows he relation between the sole of the child＇s foot－a perfect foot，such as a sculptor might copy－and the sole of the broadest shoes that could be found of corresponding length． Though they were button gaiters， and so far rights and lefts，not the slightest recognition of the right and left character of a child＇s feet is dis cernible in their shape，or the shape of any other children＇s shoes that we found in the market．We almos always have trouble in fitting chil dren，their feet are usually so chub by，＂said one honest salesman．＂Why then don＇t you have the shoes made properly？＂we enquired．＂Because we could not sell them，＂was the re ply．＂A mother invariably judges a shoe by its looks．Show her one with a sole broad enough for a baby，and she will scarcely look atit．She wants some－ thing pretty and stylish．＂

Short－sighted shoemaker！To allow her to get off with the notion that anything could be prettier than her darling＇s tootsy－wootsies！
The society for the prevention of cruelty to children may go far before they find a more suitable occasion for the exer cise of their authority．The a grgegate amount of pain in flicted upon small children by misshapen shoes must be something enormous．
But surely all mothers are not vain and pitiless－though most of them are sadly uncritical of customary abuses．We are confident that any shoemaker who will adopt for a trade－ mark the foregoing design－first come，first served，gratis－ and advertise to furnish suitable foot wear for small chil－ dren，will receive the thanks of thousands and be rewarded with a profitable business．
There is room for improvement in the material as well as in the shape of babies＇shoes．A young creeper will ruin in a fortnight a pair of shoes costing a dollar or more at retail A buckskin moccasin neatly made would be far more dura－ ble，vastly more comfortable，and much cheaper．Hard soles can well be dispensed with until after the child begin to run about outdoors；even then the uppers should be soft and easy．
Who，at this season of revivals，will lead off with the Centennial moccasin？
Mrs．Maxwell＇s Museum of Natural History in Colorado．
＂On the corner of one of the streets in the town of Bowlder， Colorado，is a building with a narrow and somewhat rickety staircase leading up on the outside．At the top of the stair－ case is the sign＇Museum．＇Somebody had said in my hear ing that all the animals in the museum were shot and stuffed by Mrs．Maxwell herself，and the collection was nearly a complete one of the native animals of Colorado．I went to the museum，expecting to be much amused by a grotesque exhi－ bition of stiff and ungainly corpses of beasts，onlyin teres ＂I stopped short on the threshold in utter amazeme The door opened into a little vestibule room，with a center table piled with books on natural history，shelves containing uinerals ranged on the walls，and a great deer standing by the table，in as easy and natural a position as if he had just walked in．This was Mrs．Maxwell＇s reading room and study．On the right hand a door stood open into the mus－ eum．The first thing upon which my eyes fell was a black and－tan terrier，lying on a mat．Not until a second or two did the strange stillness of the creature suggest to me that it was not alive．Even after I had stood close by its side I could hardly believe it．As I moved about the room I found myself looking back at it from point after point，and where－ ever we went its eyes followed us，as the motionless eyes of a good portrait will alwaysseem to follow one about．There was not a single view in which he did not look as alive as a live dog can when he does not stir．The dog alone is enough to prove Mrs．Maxwell＇s claim to be called an artist．
＂In the opposite corner was a huge bison，head down， forefeet planted wide apart and at a slant，eyes viciously glaring at the door－as distinct a charge as ever bison made． Next to him，on a high perch，was a huge eagle，flying with outstretched wings，carrying in his claws the limp body of a lamb．High above them was a row of cublinking owls，
labeled＇The Night Watch．＇In a cage on the floor were two tiny young owls，se gray and fluffy they looked like little more han owls＇heads fastened on feather pincushions．Mrs． Maxwell opened the cage and let them out．One of them flew instantly up to its companions on the shelf，perched it self solemnly in the row，and sat there motionless，excep or now and then lolling its head to right or left．The ef ect of this on the expression of the whole row of stuffed owls was something indescribable．It would have surprised nobody at any minute if，one and all，they had begun to loll their heads．
＂The distinctive feature of the museum，however，is a dramatic group of animals placed at the further end of the room．Here are arranged mounds of earth，rocks，and pine rees，in a by no means bad imitation of a wild，rocky land cape．And among these rocks and trees are grouped the tuffed animals，in their fumilies，in pairs，or singly，and very one in a most life－like and significant attitude．A do is licking two exquisite little fawns，while the stag looks on with a proud expression．A bear is crawling out of the mouth of a cave．A fox is slyly prowling along，ready to pring on a rabbit．A mountain lion is springing literally hrough the branches of a tree on a deer，who is running for life，with eyes bloodshot，tongue out，and every muscle tens and strained．Three mountain sheep－father，mother，and little one－are climbing a rocky precipice．A group of ptar migans shows the three colors－rinter，spring，and summer A mother grouse is clucking about with a brood of chickens in the most inimitably natural way．And last，not least，in an out－of－way corner is a touch of drollery for the children－ little wooden house，like a dog－kennel，and coming out of the door a very tiny squirrel，on his hind legs，with a very tiny yellow duckling hanging on his arm．The conscious strut grotesque love－making of the pair is as positive and as udicrous as anything ever seen in a German picture book Only the most artistic arrangement of every fiber，every feather，every hair could have produced such a result．W laughed till we were glad to sit down on the railing，close to he grizzly bear，and rest．

But a funnier thing still was on the left hand－a group of monkeys sitting round a small table，playing poker．One scratching his head and scowling in perplexity and dismay at his bad cards，and another leaning back smirking with satisfaction over his certain triumph with his aces；one smoking with a nonchalant air；and all so absorbed in th game that they do not see the monkey on the floor，who is reaching a cautious paw and drawing the stakes－a ten do ar bill－off the edge of the table．Beard himself never painted droller group of monkeys，nor one half so life－like．It wil lways be a mystery to me how，to these dead，stiff faces Mrs．Maxwell succeeds in giving so live and keen and ind vidual a look
＂I found，upon talking with her，that she nas had for reat many years this passion for collecting birds and beasts． She began the collection for her own pleasure，and took sev－ eral courses of instruction from taxidermists，that she might be familiar with all the processes．Her own methods，how ever，are peculiar．She molds the animal first of plaster， just as she wishes it to stand．Then she covers it with the skin，fitting the skin to it，instead of stuffing the skin out sill it is in the shape of an animal．It seems that there is wice as much skin on an anımal as it needs to cover it，and hat one reason stuffed animals ordinarily look so frightfully unnatural is that tne skin is stuffed till it is stretched out of all proper proportions．
Mrs．Maxwell is，then，in reality a sculptor of animals． None of the animals in her museum are，properly speaking， stuffed animals．＇They are sculptured anımals，covered with skins appropriate to their kind．Her first collection she had sold，five years ago，to obtain money to make a larger hall Her great desire is to make a Colorado museum which the truly a complete one of all the animals Indian relics． Coloradoans ought to join hands with her in the enterprise and all strangers who visit Colorado ought to see her mus um－not only as a collection interesting in itself，but a evidence how independent a genuine passion for anything is of outside stimulus and help．＂一Mrs．Hunt，in the Indepen dent．

## Boilers．

At a recent session of the British Iron and Steel Institute，Mr T．R．Crampton said：In the case of boiler performance，the uestion was how much water would a boiler evaporate with a given weight of coal，and the boiler which gave the highest performance in this way with the smallest area of heating surface was the best boiler．The question of what horse power the steam thus generated would develop was one which depended upon the class of engine to which the steam was supplied，and hence it had nothing whatever to do with the boiler．The class of boiler Mr．Crampton considered unim－ portant so long as good circulation and sufficient surface were provided for the work to be done．As a general rule，it was de－ sirable to use the most simple construction of boiler possible under the given conditions；but under special circumstances greater complexity was justifiable to obtan the necessary area of heating surface within the required space．Mr．Crampton added that in 1842 he introduced the type of locomotive boil er with the firebox crown made flush with the barrel－the
latter being made larger than in the older type－and he found that the additional water space thus provided at the sides of the tubes in the barrel had a decidedly beneficial ef－ fect on the circulation．For use in iron works in connection with a puddling or heating furnace，Mr．Crampton recom monded a vertical boiler，say，about 8 fett diameter by 30
feet high，resting on the ground and free at the top，this boil r being surrounded by a brickwork casing，to the space be ween which and the boiler the heated gases from the fur nace are admitted by a lateral flue，while they are led off a the top．Inside the boiler should be placed a tube some inches ess in diameter than the boiler，thus dividing the ascending and descending currents，and thus promoting the circulation A boiler thus arranged，Mr．Crampton stated，would neve burn．and the gases would be discharged to the chimney with their temperatures reduced to $500^{\circ}$ ．

## Lime in the Blast Furnace．

Mr．I．Lowthian Bell，says：＂When limestone，in its natural tate，is used as a flux，it quickly reaches a zone where the heat is sufficient to separate the carbonic acid from its calcar eous base．The temperature of this region，indeed，is so in ense that not only the carbonic acid associated with the lime ut a portion of that due to the deoxidation and carbon im regnation of the ore，is reduced to the form of carbonic ox ide．
I have shown；on a former occasion，that the smelting of a un of iron is probably accompanied by the conversion of 6.58 wt ．of carbon from the state of carbonic oxide to that of car－ bonic acid．The carbon in its acidified form，in the quantity of limestone consumed，upon one occasion，in a 48 feet fur－ are，was 1.92 cwt．Hence，we may infer that，were there no reduction of carbonic acid to a lower condition of oxidation， we ought to find，for each tun of iron produced， 8.50 cwt ．of carbon，combined with its maximum dose of oxygen．
Instead of this quantity，only $5 \cdot 47 \mathrm{cwt}$ ．of carbon so oxi－ dized was found，in the escaping gases of one of the smaller furnaces referred to，per tun of iron of its make．
This change in the composition of the escaping gases of blast furnace involves more serious consequences than what，perhaps，at first sight might appear．

There is the beat absorbed by splitting up carbonic acid containing $(8.50-5.47) 3.03 \mathrm{cwt}$ ．of carbon

## $16,{ }^{\prime} 68$

The coke consumed upon the occasion which furnished these data amounted to 28.92 cwt ．per tun of iron，and the heat estimated to be afforded by its combustion was 104，012 units． The proportion of the total heat generated，which was absorbed by the expulsion of carbonic acid from the limestone，and the decomposition of this compound of oxygen and carbon，amount－ ed to 22 per cent．Of this， 16 per cent is due to the use of limestone，and 6 to the dissociation of the carbonic acid，pro－ duced by the reduction and carbon impregnation of the ore． An expenditure of 16 per cent of the heating power of the fuel．which is rendered necessary by the presence of one of the constituent parts of our flux，affords primá facie a strong reason why we should seek to relieve the furnace of a duty represented by about $4 \frac{1}{2}$ cwt．of coke，particularly as balf his weight of inexpensive small coal sufficed for the pur－ poses of the limekiln．
I am not aware that the experience of any iron smelter justifies the belief that any approach to this economy was ver realized by the substitution of lime for limestone． With the same quality of coke in each case，one of the smaller furnaces（ 48 feet）gave the following results：
Man

| tuns． |  | cwt． | per cent． |  | cwt． |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 419 | $3 \cdot 34$ | 29.06 | 41.9 | Limestone per |  |
| 444 | $2 \cdot 20$ | 3964 | 42\％ | Burnt lime | 11／14 |
| Other exa <br> he followin | mples f | ges： | ces of | similar dimen | s gave |
| 4 days＇make per furnace． | $\begin{aligned} & \text { Average } \\ & \text { No. } \end{aligned}$ | $\begin{gathered} \text { Coke } \\ \hline \text { per tun } \end{gathered}$ | $\begin{aligned} & \text { Yield per } \\ & \text { mine. } \end{aligned}$ |  |  |
| tuns． |  | cwt． | perce |  | cwt． |
| 404 | $2 \cdot 65$ | 29.31 | 42.0 | Limestone per tun | $15 \cdot 89$ |
| 451 | $2 \cdot 10$ | $27 \cdot 99$ | $42 \cdot 6$ | Burnt lime | 11／46 |

In the first two cases given，the consumption of fuel is practically the same，but the produce of Cleveland iron， when smelted with calcined limestone，is somewhat bet ter．Discarding this cause of difference，the sole advan tage from the use of lime is the increased make and superior quality of the iron．In the next two examples，an improve－ ment in production and grade of metal is also observable， along with an economy of 1.32 cwts ．of coke，part of which is probably due to the better yield from theironstone（Cleve and），as well as to a somewhat superior quality of coke re－ ceived at the w orks，when calcined limestone was bting used． In none of these instances，judging by the relative qualities of burnt and raw limestone employed，has one half of its carbonic acid been expelled．
The apparent want of reconciliation between the theory and practice in the consumption of fuel，when using the flux raw or calcined，is，in my judgment，in a great measure in dependent of the imperfect expulsion of carbonic acid from the latter；and further，I am of opinion that a conuplete se－ paration of this element would fail to effect，in a larger fur for this process．＂

Sale of Sewing Machines．－From the Seuing Macline Journal，we learn that there were sold，during the year 1 s 74 ， 602,074 sewing machines of the different American makes and that，since 1853 ，when the first sewing machines were made，up to the end of 1874，there have been in the aggre gate $3,785,968$ made and sold．Quite a busin：ss．

The Fraunhofer Lines of Diffraction and Prismatic Spectra.

## pron torn cen

Having been engaged during the past year in making photographs of absorption spectra of organic bodies, in which a solar spectrum with Fraunhofer lines was formed by a diffraction grating, I have resorted to the following method of forming such solar spectra, a description of which may prove of interest to those who are experimenting in the same field.
The grating generally used was made by Mr. L. M. Rutherford; it is ruled on speculum metal, 6,481 lines to the inch; it gives spectra by reflection. Other gratings on glass, now in my possession, give spectra by reflection and by transmission. The method answers equally well for both. It may be briefly stated as follows:

A beam of light is directed by the silvered plane mirror of a heliostat, A, into a darkened room.
It is received on an achromatic lens, B, 3.93 inches in diameter; focal distance from posterior surface, 23.50 inches. A slit, C, is then placed within the focus of this lens, distance being $18 \cdot 86$ inches from the lens, $B$.

After passing through the narrow slit, which is about 004 inch wide, the light is received upon a second achromatic lens, $D$, of the same diameter as the first, but with a focal

distance of $45^{\circ} 2$ inches. The distance of this lens from the slit is 644 inches, and the focussing of the lines of the spectrum on a paper screen or on the ground glass of the camera is azcomplished by moving the lens, D , nearer to or farther from the slit, C, or by moving the camera or screen, F, it self.
The grating, E, mounted on a suitable stand, is placed at a distance of $31 \cdot 4$ inches from the second lens. All parts of the apparatus being carefully adjusted, so that A, B, C, D, E are on the same horizontal axis, the grating is then arranged on its vertical axis, to throw the center of its reflected image on the opening of the slit, C.
The lines of the grating being accurately parallel to the sides of the slit, a series of beautiful spectra are produced on each side of the slit, any or all of which may be received on suitably adjusted screens, one of which is represented at F. In all of these spectra, if the slit has been very narrow, the prominent Fraunhofer, with numerous other lines, appear sharply defined.
Of the spectra described above, only the first, second, and third orders on each side of the image of the slit are available for general use on account of the overlapping of those that follow. Of those that are available, I have preferred to use the second order, since in this the dispersion is much greater than in the first, and by the apparatus described above a spectrum of a length of more than $11 \cdot 8$ inches is obtained.
For the projection of the prismatic spectrum a prism is substituted in place of the grating, when a very fine spec trum is produced, the focus of the violet end of which is very much closer to the prism than that of the red end.
In the diffraction spectra, also, it is necessary to vary the angle at which the screen is placed, to define sharply the lines at the extremities of each spectrum. In the spectra of the first order on each side, the screen is placed very nearly at right angles to a line drawn from the grating to $b$, in the spectrum. As each order in succession is examined, the divergence from this angle is greater and greater, and at the same time the focal distance of the lines meves nearer to the grating.

The lenses I have employed were those of a very fine photographic combination; they give with the rest of the ar rangement a spectrum in which the definition of the lines is perfect, and they are present by hundreds. Though the lenses are 3.93 inches in diameter, only the central portion of each is used, a diaphragm with a circular aperture of 1.97 inches or less being placed in front of $B$.
To form the absorbent spectra of any organic substance, a suitable solution of the same is poured into a cell with parallel sides. This is placed at any convenient point between $A$ and $B$, care being taken that the faces of the cell are at right angles to the course of the ray, A B. The slit may in this case be opened wider, when each spectrum will show the characteristic absorbent bands of the substance em ployed, the position being indicated (and if required, record ed) by their relation to the lines of the solar spectrum in which they are produced.

When the calcium or electric light is to be used for lecture room demonstration of diffraction spectra, the lens, B, should have as short a focus and as large a diameter as possible. The grating may also be so arranged on its vertical axis as to throw its image at a right angle to the line, B E, to be there received on a screen. Though by this device the spectra on one side of the image of the grating are greatly elongated and those on theother compressed, it presents the advantage of enabling the audience to see all the spectra at once, and also the optical contrivances by which they are produced.

At Pribram, in Bohemia, the Adalbert shaft of the silver and lead mines has reached the extraordinary depth of nearLy 3,300 feet.

Useful Recipes for the Shop, the Household, for the Shop,
and the Farm.
Varnish brushes should never be allowed to touch water, as it not only injures the elasticity of the hair, but a resinous substance is formed in the hilt of the brush, which ous substance is formed in the hilt of the brush, which
can never be thoroughly removed, and which will work can never be thoroughly removed, and which will work
out little by little when the brush is used, destroying the glassy surface which otherwise might be obtained.
Paint intended for outside work, which will not be protected by varnish, is mixed as follows: Crush the color if
in lumps, and mix to a stiff paste with linseed oil, boiled or raw-the latter is preferable; then, if a dark color, add brown Japan or gold size, in the proportion of $\frac{1}{2}$ pint to a gallon of oil ; in a light color, use patent dryer in similar quantities.
A large stick of cypress timber will rot off cypress tenons, or tenons of any other kind of timber (if put together when the cypress is green), if kept under shelter. Cypress will dry rot itself, if over 15 or 18 inches square: and green oak of any kind, 12 inches square, will rot a dry $1 \frac{1}{4}$ inch pin of the same wood,or a pin of any other wood, if dry, and driven the same wood, or a pin
tight to exclude all air.
Horses will work much more easily, and lose less of their effective force, by working abreast, than when they are placed in single file. If four horses are to draw a load in one wagon, it is better to have a long double whiffletree, with a span of horses on each side of the tongue, than to have one span placed before the other.
A skilıful sawyer, in sawing a log into scantling, which he knows will spring, will first mark off the ends into cuts ; and then, after sawing once through on one side of the log, will saw a slab off the other side, and finish in the middle. By this means the lumber will be about as true as if the timber were not inclined to spring at all
Chimneys are excellent lightning conductors. In view of which, it is recommended: First, that they be kept clean then, that all the grates in a house be connected by means of a strong wire, such as is used for telegraph purposes, with a piece of metal in the earth, or with the iron gas or water pipes.

## Veneered Diamonds.

The enterprising capitalists who are pecunarily interested in the Keely motor will doubtless be glad to learn of another great discovery, which promises results certainly as astound ing as those due to the " watery vapor." Abundant oppor tunities for investment are offered. The discoverer has worked twenty-eight years at the process, a little more than
double K-ely's time; ard unlike the latter colossal genius, he double K-ely's time; and unlike the latter colossal genius, he
does'nt keep the secret to himself, or lock it in the bosoms of does'nt keep the secret to himself, or lock it in the bosoms of
a chosen few, but spreads it before an astonished world in this wise. Any body can try it for himself, and have a small Golconda in an incredibly short period of time. We extract from gigantic advertisements in the daily journals, the "Process of Producing the Parisian Diamonds."

The bodyis of crystal, which is the hardest and best substance that could possibly be used for the purpose. Then, after the crystals are cut in proper shape, they are put into a galvanic battery, which coats them over with a liquid, that is made of diamonds which are too small to be cut and the chippings and cuttings that are taken off of diamonds during the process of shaping them. Thus all of the small particles of diamonds that have heretofore been comparativel worthless, can now, since this great discovery, be used to worthess, can now, since

## The Law of the Rail.

Some one, who has taken the trouble to post himself on the law governing railroad passenger travel, says that extra charges for failure to buy tickets are universally sustained
by the courts, but there must be a full opportunity to buy by the courts, but there must be a full opportunity to buy
afforded by the ticket seller. Passengers must show tickets afforded by the ticket seller. Passengers must show tickets when asked for. As to stopping off, there is only one deci
sion, which is that a passenger cannot stop off, and resume his journey, without the previous assent of the company. As to the obligation of the road to furnish a seat to a passenger, a decision says: "A passenger who exhibits his ticket need not surrenaer it untrl he has been furnished with a seat." A railroad is not liable for things stolen out of a pas senger's seat, there being no previous delivery to the company's servants; for the same reason the company is not
liable for baggage in the passenger's own care. Passengers who neglect to look after their own baggage on arrival at their destination cannot recover it if it is lost without fault of the carrier. Baggage left in station houses for the passenger's convenience, after it has reached its destination, comes under a new class of rights and duties, the baggage master assuming the position of a gratuitous bailee, who only becomes liable in cases of gross negligence. The obligation of the railroad as carrier ceases when it has delivered it to its owner at the place of destination, or when he has had reasonable opportunity of receiving and removing it. It will interest sportsmen to know that they may recover for the value of dogs when they entrust them to baggage masters for hire dogs when they entrust them to baggage masters
because of their exclusion from the passenger cars.

Ourdoor Amusements.
During the recent festival of the German turners in this ity, a variety of curious gymnastic amusements were under then.
The
The competitive exercises on the horizontal bar attracted much attention, some of the contestants exhibitung great strength, ability, and endurance. There was also a swimming race in the East river. Twelve swimmers were taken in a tugboat nearly to Blackwell's Island (about 350 yards), and at a given signal all jumped into the water and struck out
for the New York shore. After a few dozen strokes three swimmers became exhausted, and were picked up by the boats in attendance. Of the entire number only four swam to the shore. Another amusing feature, and one whicb caused a great deal of merriment, was boat tilting. Ten boats were each manned by one rower and another man, who stood at the stem armed with a long pole topped with rubber. As the two boats were rowed past each other, each man tried to push off his opponent into the water with his pole.

## Common sense Ventilation.

" The best practical statement I have met about ventila tion," says Colonel Waring in the last Atlantic, " was contained in the remark of a mining engineer in Pennsylvania ' Air is like a rope; you can pull it better tban you can push '.' All mechanical appliances for pushing air into a room or a house are disapponting. What we need to do is to pull out the vitiated air already in the room; the fresh supply will take care of itself if means for its admission are provided. It has been usual to withdraw the air through openings near the ceiling, that is, to carry off the warmer and therefor lighter portions, leaving the colder strata at the bottom of the room, with their gradual accumulation of cooled carbonic acid undisturbed. Much the better plan would be to draw this lower air out from a point near the floor, allowing the upper and warmer portions to descend and take its place An open fire, with a large chimney throat, is the best ventil ator for any room; the one half or two thirds of the heat carried up the chimney is the price paid for immunity from disease; and large though this seems, from its daily draft on the wood pile or coal bin, it is trifling when compared with doctors' bills and the loss of strength and efflciency that in variably result from living in unventilated apartments.

## A Hen Crocodile.

A female crocodile, recently shos in Florida, measured ten feet eight inches in length, and presented many points of contrast with the other. Her teeth were regular and white and sharp. The mottled black and yellow of her back and sides were distributed evenly, the yellow rather predominat ing than otherwise; while in the case of the male, no part was yellow except the belly-the sides shading off into the lusterless black which covered almost all of the back and tail. The ovary of the female contained four hundred and twenty eggs, varying in size from a No. 8 shot to a hen's egg , and all perfectly spherical. It may be added, in pass. ing, that the female crocodile lays twenty or thirty eggs at a time, which she puts in layers in a hole in the mud or sand on the shore, covering each layer with a coat of earth and reeds and grass. She then leaves the process of hatching to the fermentation of this mass, which reaches the right degree of heat in about a month's time.

## Just So.

We have waited long and patiently, says the Philadelphia Evening Bulletin, for Keely, because he said he wanted time to make his engine and to secure himself by patent in Eu rope. Since the announcement was first made, he has had time enough to have built one of the pyramids of Egyps, and to have obtained patents from every government on the civilized earth. Therefore, if Keely does notsoon place that engine on a railroad track, and run it over to New York with a spoonful or two of water, it will be only natural that the public should finally determine that the enterprise is a hum bug. Perhaps we may save time and ease popular expectation by expressing that opinion now.
For the preservation of wood by means of copper salts,says M. Rottier, cupric acetate and indigo, though good, are to expensive. Heating wood after impregnation with coppe sulphates does not give reliable results. Cachou can only be used under certain circumstances. Ammoniacal copper salts are, however, susceptible of very general application, and when applied have more permanent effects than those of other copper salts.

The clay smoking pipes marked T. D., which have been n use longer than the oldest inhabitant, are made by Messrs. W. White \& Sons, of Glasgow, Scotland, an honest old Quaker house which has conducted the manufacture for a century and a half. Over one million of these pipes are im ported and consumed in this country annually.

[^0]NEW BOOKS AND PUBLICATIONS.
Life boats, Projectiles, and other Means for Saving Life By R. B. Forbes. Boston, Mass. : W. P. Lunt, 102 Washington Street.
Mr. Forbes is Chairman of the Standing Committee of the Massachusett Humane Society, and he details some of his views on another page of this
ssue His work now before us is a well written resume of what has been saving life in case and in Curope in inve saving life in case of shipwreck; and it should be read by all shipowner
and seafaring men, as well as by philanthropists and others who are tryin

## 出ecent gmeticau and foreign ezatents.

Improved Wooden Frame for Hinged Awnings. Henry Sykes, New York city, assignor to himself and William
Campbell, Brooklyn, N. Y.-This awning frame consists of metallic crew-threaded elbow couplings and wooden bars, provided with tenons, which are screwed into the said couplings, so as to make
perfectly rigid and smooth frame. It is stiffer than iron frames and is not liable to rust, or to cause injury to the cioth.

## Improved Farriers, Tool.

Michel Baltes, Franksville, Wis.-This is an instrument for cutting Michel Baltes, Franksville, Wis.-This is an instrument for cutting
grooves in horses' hoofs to receive the clinch of the shoe nails. A straight jaw has a notch formed in the inner edge of its forward
end. A curved jaw has an edge formed upon its forward end, and end. A curved jaw has an edge formed upon its forward end, and
a spring is arranged in connection with the two jaws. In using the instrument, the straight $j_{u} w$ is placed against the hoof upon the upper side of the projecting part of the nail, and with the nail in the notch of the said jaw. The edge of the curved jaw is pressed
against the hoof, and with an outward and downward pressure against the hoof, and with an outward and downward pressure
enough of the hoof will be scraped out to form a groove for the clinch. The use of this instrument avoids the use of a rasp to form
a groove for the clinch, and avoids the injurious rasping of the hoof a groove for the clinch, and a
to take out the said grooves

## mproved Toy Whistle.

Henry B. King, Paterson, N. J.- This is a whistle or reed with fun-nel-shaped mouth and guide wing, the whole attached to a cord and whirled through the air to produce a sound. A vane keeps the mouth steadily agaiust the wind, and produces thereby the sound
which, if more than one whistle or reed be used. may be varied so as to be harmonious and pleasant to the ear.

Improved Compusition for Presexving Eggs. Joseph K. Boone, Boonc ville, Mo.--This is a compouad of alum servation of eggs, which are dipped in, and allowed to remain for servation of eggs, which are dipped in, and allowed to remain for
ten seconds. A cement is formed on the eggshell, producing an airtight polished surface.

## Improved Feed Wat $\mathbf{r}$ Regulator.

Christopher M. Bridges, Leon, Iowa, assignor to himself and Creed Bobbitt, of same place -a float in a chamber coonected to the
boiler at the water level rises when the water fills the chamber, and opens a passage from the chamber containiag the float chamber, and thus allowing the boiler pressure to close the che.ik valve in the
supply pipe from the tank. A circulation of the hot water of the boiler by this means will be maintained through the pump as long
as the water in the boiler is high enough to keep the chamber full and the float up; but when the water falls in the boiler below the connection with the chamber, the pump will exhaust the chamber, and the float will fall and close the passage from the float chamber The check valve then, being relieved of the boiler pressure, will facilitating the circulation of the water, so that steam is made faster and more economically

Improved Life-Preserving Stool.
Henry H. Nash, Baltimore, Md.- The object of this invention is to provide a simple, cheap, and effective life-preserving stonol, applicable for use upon steamers and other sea-going vessels. It con
sists simply in arranging one or more disks of cork between two rounded boards, which constitute the seat of the stoo
Machine for Grinding and Fitting Peart Veneers.
Jacob Hoffman and Georg Hoffman, Philadelphia, Pa.-The in Jacob Hoffman and Georg Hoffman, Pailadelphia, Pa.-The in-
vention consists in a recessed gage and holder for the veneers, combined with the carriage, and an end-beveled gage connected with found in practice greatly to facilitate the grimding of the veneer.

## Improved Meat Chopper.

H. P. Rankin, Allegheny, Pa.-The invention consists of a meatends there above, so as to prevent the meat from escaping over the edges; and so that when one or more sections become uneven, the
same may be replaced without destroying the whole block. same may be replaced without destroying the whole block

## Improved Crimping Machine.

Thomas J. Greenwood, Warren, Ill.-This is a base plate, whereon is a crimping block or former, on which the boot is to be stretched.
There is a clamp, which is the counterpart of some portions of the There is a clamp, which is the counterpart of some portions of the
block, and a base plate for pressing the leather into shape upon it. A shaft, cam, and lever act uate the clamp, the shaft being detachably supported in its bearings, so that it can be taken out of the way readily for removing and applying the clamp, and the clamp being notched or serrated in the seat on which the cam works, to hold it

Improved Endless Chain Pump Bucket
Jared S. Manley, Canton, Pa.-A circular disk is placed between
two semi-globular pieces of rubber, and the whole is secured to two semi-globular pieces of rubber, and the whole is secured together oy a bolt having washers, and swivels at the end

Improved Blind Slat Adjuster.
George A. Myers, Brooklyn, E. D., N. Y.-This is a device for ad-
justing and fastening the slats of a window blind at any desired justing and fastening the slats of a window blind at any desired
angle, and for securing the blinds at an angle with each other. A wire attached to one cleat of the blind is secured at the other end wire attached to one cleat of the blind is secured at the other end
to a block which slides in ways. After the slats are adjusted, the wire holds all in place, by a screw securing the block at any desired point on the ways.
Improved Apparatus for Holding Meat in Cutting. William Tetley, Pana, Ill.-This is a curved bar hinged at one
side of the butcher's block so as to be detachable. It is brought side of the butcher's block so as to be detachable. It is brought
over the meat to be cut, so as to hold the same by pins projecting over the meat to be cut, so as to hold the same by pins projecting
downward from the bar and into the meat, and is suitably secured downward from the bar and into
on the opposite side of the block.

Improved Hose and Pipe Coupling.
Henry G. Koebler, Cleveland, Ohio.-One portion of the coupling enters the opposite portion. About the inner piece is a ring groove.
On the outer piece are beveled spring catches, which, when the parts are pressed together, are forced into the grooves. Suitable spring tongs are used to pull the catches outward in uncoupling. Alfred J. Park, Virginia, Mo.- lhis consists of a vertical frame supported on a pivot, and al-o on wheels resting on a bed, so that it
has free rotation about a perpendicu ar axis. In the frame are posts having curved gooves in their sides to receive the shaft rappling device at one end, and a rope for raising or lowering it rappling dev.
the other.

Improved Eaves Trough
Chas. A. Codding, Dowagiac, Mich.-This invent tain improvements in the half-round eaves troughs attached to the lower edges of the roofs of houses for the purpose of conducting
way the water. It consists of a band of metal, soldered upon the ransverse lap seam and fastened at one end beneath the stiffening ube, and bent over the edge of the trough and soldered at the other. It also consists in a brace bar, one end of which is bent
round and soldered to the tube, and the other soldered to the opposite side of the trough, to braceand hold the sides of the trough the proper distance apart.

## Improved Drag.

Improved Drag.
David Miller, Carrollton, Md.-This invention relates to certain
improvements in that class of drags in which a single log of wood improvements in that class of drags in which a single log of wood
is provided with draft attachments, and is drawn laterally across
the field for the purpose of crushing and pulverizing the clods and the field for the purpose of crushing and pulverizing the clods and
leveling the surface of the ground. It consists in the combination, leveling the surface of the ground. It consists in the combination,
with such a drag, of a pair of handles rigidly attached thereto and projecting to the rear, provided with a pair of wheels, upon whic upon the handles, so as to avoid stumps and stones, and facilitate the turning of the corners at the end of the row, the said wheels nd handles serving also to prevent the drag from rolling under the

Improved Method of Makinz Pills.
Jacob Dunton, Philadelphia, Pa.-This invention relates to cerain improvements in the manufacture of pills, made by comp-eson in dies or molds. In manufacturing pills according to thi ethod, it is found that the pill compressed of materials containing icles and stability of form; and in removing them from the die, the attraction of adhesion is often greater than that of cohesion, an they crumble and break in such a manner as to render this method of compressing certain materials into pills wholly impracticable This invention is intended to obviate this difficulty, and it consists in the method of drying the material to be compressed, so as to
expel the moisture and insure the more thorough cohesion of partiexpel the moisture and insure the more thor
cles, and the lubrication of the die or mold.

Improved Three-Horse Equalizer.
Ezra Graham, Manchester, Iowa.-The invention relates to an abled to draw their respective proportions of weight. It consists in two unequal levers jointed on the same pole pin, and connected by a chain passing over a rear pulley

## Improved Wash Board.

Edwin S. Heath, North Hope, Pa.-The invention relates to the construction and arrangement of parts whereby the corrugated zinc plates which form the rubbing surfaces of the wash board are
secured together and to the flexible grooved and bent frame piece.

Improved Car Coupling.
George Wernimont, Dubuque, Iowa.- The invention consists of leral shafr ghi hain with a swinging crank frame that raises the pin arm an pin in the drawhead for uncoupling

> Improved Dinner Box.

James S. Davis, Monroe, Mich., assignor to himself and George $R$. he solid food entering at one side between suitable partitions, and coffee or tea holder, connected to the front by slides, in such manner as to fasten the drawers in the case. This makes a simple and efficient arrangement, by which as maoy
as desired may be had for the solid food.
Process for Forming the Ends of Carriage Slat Bows Charles Renton, Meriden, Conn.-This is an improved diefor form ng the ends of slat bows for carriage tops, or similar forgings. The
inention consists in passing the ends of the slat bows through a series of gradually narrowing and deepening dies with incline edges, which raise the stock by the impressions given to the ends without the edging used at present.

Improved Carbonic Acid Motive Power
John Westcott, Tocoi, Fla.-This invention has in view the utili-
zation of carbonic acid and other gases as motive poweis, and it cousists in storing up the carbonic acid gas in a separate receive from that in which it is generated through the agency of the sur face attraction of animal or vegetable charcoal, the latter materia
absorbing five times its volume of the gas, so that large quantities of the gas may be stored up without increased $r$ sk to the tensile strength of the receiver. and yet be easily developed and eliminate by heat so as to furnish an available motive power. The invention
also consists in the method of developing and eliminating and expanding the gas from its condensation upon the absorbent material
by means of a vehicle of boiling oil passing through pipes in the by mean

## Improved Harvester Rake.

Moses Ray, Valley Grove, W. Va.- Chis invention relates to cer driven by the harvester mechanism, and terminating in a pulles which engages with a frictional contact two other similar pulleys, one on each side. Around these pulleys passes a band to which is
attached an arm or extensioa, one end of which is provided with a attached an arm or extension, one end of which is provided with a
friction roller and moves in a groove in the adjustable supporting frame, and the otber end carrying at right angles to the arm a bar rel. In said barrel is contained a loose staudard which carries the
rake. The standard falls out of the barrel of its own gravity when on the descending part of its revolution, and the rake takes the
gavel at the cutter head and delivers it at the side of the harveste in the rear, a projecting arm attached to the rake standard strikiog a pin upon the table and giving the rake the necessary sweep. On
the ascent of the rake, the standard is telescoped into the barre the ascent of the rake, the standard is telescoped into the barrel
and out of the way until ready for the next gavel. The entire frame work carrying the above described mechanism is pivoted upon the engage with vertical supports and give necessary adjustment to the rake for high or low grain.

## mproved Die Stock.

Virginius J. Reece, Greenfield, Mass.-In place of the bushing at present in use, adjustable guides are used, that are made in the
shape of curved elbow levers, pivoted at one end to the die stock and acted upon by a sliding plate having eccentrically curved slote, which engage lugs of the guides at the corners of the same. The
free ends of the guides are thrown, by the curning of the plate, in one direction toward the center of the die stock, being in any position at equal distance therefrom, so that they may be set to any
size of bolt, and be firmly secured in position by a clamp screw.

Improved Gate Fastening.
William Leach, Omaha, Neb.-This invention relates to fasten-
ings that enable a gate to be latched automatically as it swings to the head post, and consists in combining a rod having reversel

Improved Fireplace Heater.
John B. Oldershaw, Baltimore, Md.-This invention consists in to and side as well as the cylinder, the two being connected by
chute.

Improved Hot Air Registers.
Edward A. Tuttle, New York city.-This is a combination of wal
frame and register frame, fitting closely together in front, having lags for fastening screws in a divergent angle between said frames.
In another register, patented to the same inventor, there is a segfan, arranged on opposite sides of the slide. The pin for working the fan is arranged half the length of the throw of the slide from the pivot of the fan, in combination of a groove or slot of forty-five and a projection of the frame are so arranged that, by turning the fans a little beyond the vertical position to which they are brought to open the register, the notches pass beyond the projections, and
thus free the fans to slide endwise far enough to withdraw the opposite pivot from its bearing for taking out the fan withdraw the opposite pivot from its be

Improved Strainer for Pumps.
Leonard Blass, Germantown, N.Y.-This inveation consists in the combination of a cylinder having a cap screwed upon its lower end
and a cap plate bolted to its upper end, and provided with an inle pipe and an outlet pipe. The tube has a flange formed upon its upper end, a wire gauze plate attached to its beveled lower end, and a hole formed in its side, combined with each other to adapt the device to be attached to a pump pipe.

Improved Refrigerator
Henry G. Gleyre, Glasgow, Mo.-In this refrigerator, the interior is supplied with cold and pure air, while it is also used as a watel cooler. The ice receptacle has an inclined perforated rear flange, nd forms, with the rear walls, an intermediate ventilating flue. munication between the ice receptacle and ventilating outlet for the passage of air outside of the refrigerator

Improved Wagon Springs.
Michael Feigel, New Utrecht, N. Y.-This is a novel combination wagon, ning gearing, to prevent the platform from sagging in the middle, and thus throwirg the weight upon the ifth wheel, instead of keep-
ing it around the king bolt, thus enabling the vehicie to be much ng it around the king bolt, th
more easly guided by the team.

Improved Earth auger
William Low, Webster, Mich.-The cutting bits have a point nd curved downward from the junction with the bottom to the point. They are arranged at opposite sides of the center with space between for the passage of stcnes, in combination with the bottoms, pirally molded for clearance.

Improved Pocket Book Lock.
Julius Hanau and Sigmund Bendit, New York city.-This invention consists of a series of short pieces of wire placed side by side
in a little box, in combination with a spring at one or both ends of the series, so contrived that the hasp may engage between any two pocket book being more or less full, the row of rods being ranged in the line of the hasp. Thus the fastening is self-adjusting to the fullness of the book.

Improved Road Scraper
Edward Huber, Marion, Ohio.-This invention is an improvement body thereof by the action of the bail or draft rod when the hanales are raised to a vertical, or nearly vertical, position. The ele-
vation of the handles causes their spring catches to slide off the vation of the handles causes their spring catches to shaper, thus
horizontal lugs affixed to the sides of the body of the scraper allowing the latter to revolve and discharge its contents.

Improved Invalid Lounge.
Andrew Shiels, Portland, Oregon.-This invention relates to certain improvements in lounges, and consists in the combination,
with the hinged bottom boards, of devices which enable the patient to adjust himself either from a recumbent to a sitting posture, or

Improved Horse-Detaching Apparatus.
Johusa W. Glover, Mount Savage, Ky., assignor to himself and
William R. Kitchen, same place.-This consists of spring catche for William R. Kitchen, same place.-This consists of spring catches for detaching the traces by a cord passing over guide pulleys, and up
nto the carriage box, where a weight is attached for automatically detaching in case the carriage is suddenly overtarned and the driver prevented from pulling the cord.

## Improved Clothes Dryer.

John Sutton, Deep River, Iowa.-This consists of two racks sus pended from a long plate supported at the middle on the top of a standard having a long narrow base, having swing feet to throw out out obliquely for use when the braces are adjusted on arms projecting from the standara below the top plate, a and having braces to hold them out obliquely for use. Other clothes-supportng arms are used, some being permanently and others detachably connected, the whole making a rack that can be

Improved Hollow staff for watches.
William A. Belcher and David J. Plume, Ophir City, Utah Ter.This is an improved staff, which may be quickly replaced when one
of the pivots is broken off, without in the least interfering with the of the pivots is broken off, without in the least interfering with the balance wheel or other parts. The staff is made hollow, with de-
tachable center plug, that is readily removed and replaced without tachable center plug, that is read

Improved Chimney Cowl
Theodore C. Nativel, San Jose, Cal.-The ventilating cowl is The inner part, or flue, has vertical exterior ribs, which form bearing or support for the section of the outer flue, leaving air passages between. The flue sections are beveled at their ends to form
a close and strong joint, and the ribs act as buttresses for each flue.

Improved Turbine water wheel.
Y. W. Larmoa, Russellville, Ky.-This invention contemplates the improvement of turbine wheels so that they may run more easily gainst back water, under a less bead of water, and be susceptible of adjustment of the power. The several features of improvercent mize water and enable the power to be graduated with facility.

## Improved Steaming Table.

Asahel J. Randell, Belvidere Seminary, N. J. - This invention re ates to a culinary apparatus combined with a falling-leated table designed for cooking by steam. Beneath the table top is a case,
which contains a steam chest having an upper bottom, beneath wich is a drawer which extends entirely through the case and forms a tire chamber. A lamp and a gas burner are placed in this chtmber, either of which may be used in the absence of the other There is a removable bread tray in which is a dough mixer, and case contains drawers for keeping dishes, table linen, and simila partments may be accomodated with the essentials of housekeep ing in a small space.

## 

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tisement. Address Union Iron Mills, Pitssurgh, Pa. for lithograph, \&c.
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rovalty.
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\&c., address L . V . Emery Wheel Co.. Weiss port, Pa. American Metaline Co., 61 Warren St., N.Y. Cits Genune Concord Axles-Brown,Fisherville,N.H.
 For 13, 15,16 and 18 , inch Swing Engine Lathes,
जdidress Star Tool Co... Providence, R. I.

## (4) (a)

A. K. can cast iron free from air holes by
following the directions on p. 409, vol. $31 .-\mathrm{F}$.
 31.-R. J. will find that casehardening iron is de-
scribed on p . 69 vol. $31-\mathrm{R}$ N will find directions for frosting glass on p. 264 , vol. 30 .
(1) B. B. N. asks: How and why does the nagnet attract the compass needle, and extract
its magnetism? A. By its superior power. When its magnetism? A. By its superior power. When
the two are placed with opposite poles in contact or near together, they tend to neutralize each
other; but the magnet, being more powerful, denagnetizes and even reverses the polarity of the eedle.
(2) W. S. R. Says: I have a telegraph
sounder, of which only one spool is wrapeed, and sounder, of which only one spool is wrapped, and
I wouldilike to wrap the other spool myself. $I$ have enough wire to do it, but the good one is wrapped
to the right, and I would like to know if the other is wrapped to the left, or as the first one is done. A. Wrap the same way and cornect the inside ends together.
(3) J.T. S. asks: if I dissolve or liquefy
wood or paper insulphuric acid, is there any way of separatiog the liquid wood or paper from the acid? A. The action of sulphuric acid on woody
fiber is to extract the elements of water, leaving tiber is to extract the elements of water, leaving
it black and charrec. If the clean fiber, of the
ond wood be digested in strong sulphuric acid for sevlose will be converted into starch. If the acid is
then largely diluted with water, boiled for several then largely diluted with water, boiled for several
hours, and then carefully neutralized with chalk, hours, and then carefully neutralized with chalk,
a mass of glucose (grape sugar) will be obtained, which, if the process has been well conducted,
may exceed in weight the woody fiber employed. (4) P. D. B. says: I am in want of some material that will hold water, and in which ice, in
congealing, will not adhere to the sides. congealing, will not adhere to the sides. A. Try
vessels lined with smooth non-conductors, like porcelain, glass, etc.
(5) L. H. R. asks: How can I obtain a vacu um in a glass tube without the useof an air pump
I wish to seal the ends of the tube in such a manner as to admit the two wires from a battery, for an electrical experiment. A. Close one end of
the tube by means of a blowpipe, and displace the air contained in the tube by means of carbonic
acid gas. Then hermetically seal the open end of acid gas. Then hermetically seal the open end of
the tube into the mouth of a strong glass bottle or flask containinga quantity of caustic potassa. Af-
ter a long time the potassa will have absorbed the ter a long time the pontassa will have absossbed. Are
carbonic acid contained in the tube, thereby forming a nearly perfect vacuum. That part of the tube ust above ents connection with the bottle
may then be softened by means of a blowpipe (or may then be softened by means of a blowpipe (or
Buncen lamp, drawn, out and sealed. The wires,
previously placed in position in the tube, should previously plac
(6) J M. G. asks: 1 . Do bones that have bee exposed for some years on the prairies lose
any of ther valuable properties as fertilizers? Very protably. 2. Is the demand for crushed
bones sufficient in the Northern States to justify one in shipping the same from Texas? A. We do not think it would be advisable.
$(7$ F. C. \& Co. ask: What alloy of metals
urns nitrate of silver black, and what are the turns nitrate of silver black, and what are the
proportions? A. Nearly all the common metals
and their allo. and their alloys, when brought into contact with
an aqueous solution of nitrate of silver, precipitates the silver in the form of a fine black powder.
What will take the rust off the steel points o drawing instruments? A. Try a little emery pa-
8. J. C. L. asks: How can I make a small
cord (about 1 or of an inch thick) impervious to dampness without diminishing its pliability?
Saturate it with in Saturate it witha con.
in ammonia, and dry.
(9) F. A. W. says. 1. In melting silver I have used a tux of pumicestone and borax: and
when I cast, part of the tlux runs in with the silWen. Host, can I avoid this? A. The wumicestone
ver. How should be added in sufficiently large quantities to
absorb the superfluous borax. Do not crush you absorb the superfluous borax. Do not crush your
pumicestone too fine. 2 . How can I get the silve pumicestone too fine. 2. How can I get the silve
out of the pickle into which the bars are put af er being cast, the pickle being made of sulphuric form of chloride by the addition of muriatic acid Then heat the precipitate together with a quantit of borax and a little rosin, in a small crucible, un-
til the metal is reduced. The flux may then be reHhe melal is reduced. The flux may then
(10) B. asks: Is glucine to be had in New York? A. We do not recognize any substance by
(11) W. O. C asks. Can you give me a re. cipe with which I can dissolve pieces of imitation
tortoiseshell, so as to zun it into molds? A. You tortoiseshell, so as to un it into molds? A. You
do not state of what your imitation shell is comdo not state of what your imitation shell is com-
posed. We of course must know its composition ent.
Is there anything. not injurious, which will comoletely remove dandrutf? A. Dand ruff or pts riasis is a chronic inflammation of the skin, attended
with redness and itehing and characterized by the wrodections and itching, and characterized by the production of minute white sc:iles or scurt in
great quantity. It may attack any region, but the is the firstconsideration in its treatment. The us of tonic inf usions and of sedative or alkaline lotions to the atfected part are measures to be em-
ployed. A wash frequently used is the following: ployed. A wash frequently used is the following:
Boil lib. rosemary in 2 quarts water, and add to the filtered liquid 1 oz, spirit of lavender and $1 / 4$ oz It of tartar
(12) G.F L. asks: Is there any substance which will absorb coal gas when mixed in small A. It can be absorbed by a solution of cuorous chloride in hydrochloric acid, presenting a large bsorbing surface.
(13) L. S. C. asks: In the manufacture of tities of muddy sediment in the bottom of juic vats, also a great quantity of skimmings : both are somewhat gummy in character, but as valuable
as clear juice, if purifed. Can this material be filtered through bone black, charcoal or any other A. You will require charcoal filtration, and Du mont's filter will proba',ly work to your satisfac tion. It consists of a wooden box of the form o a four sided truncated pyramid with a double bottom. The inner bottom is a metallic plate pierced with numerous holes; upon ita cotton cloth is laid, and coarse-grained animal charcoal moist-
ened with water is then spread layer by layer, each layer being rendered of uniform thickness and packed or pressed closely together by means oof a trowel. When the bone black has been thus
formed into a compact bed or stratum of about ${ }^{15}$ inches ia thickness, and within 5 to 10 inches from the top of the hox, it is covered witt another
cotton cloth, and with another metalic plate cotton cloth, and with another metallic plate
pierced with holes. The object of the second cloth and metallic cover is to collect any substances which would other wise obstruct the interstices of the superior stratum of the bone black, an incon-
venien aceident which is easily prevented by the use of such a cover, and this cover is readily ex changed for another, should it become itself ob structed. It is important, in order to avoid false the same level of about three inches above the cover of the bone black. This is accomplished by means of a self-regulating cock. Animal char-
coal is expected to purify, on an average, an equal coal is expected to purify, on an average, an equal
weight of fine, or $t$ wice its weight of seconds, sugar. The same bone black may be employed any number of imes, provided the substances
which it has withdrawn from the sirup be removed. This is often done by simple rekilnng. Consult
to 1,000 .
(14) C. Z. P. nsks: In one of your late numbers you said that silver (metallic) is to be re-obdirted from nitrate of siver by metting it with
borax or rosin. Will this be applicable for oxides or other metals, such as lead or zinc? A Gold
may be redaced by this methof, but not lead, zinc, any of the more common metals.
(15) S. B. P. asks. If the lower metals are alkaline, are the higher metals acids? Is there
any distinct division between the alkaline and ony distincts. We do not understand your classification of the metals. The term alkali is restricted to those bodies, such as potash and
soda, which have an acrid nauseous taste, and are soda, which have an acrid nauseous taste, and are
unctuous to the touch. If the netals be arrange unctuousto with reference to their a affinity for oxygen, the nobie metals-gold, silver, platinum the alkalies at the other. Those elements baving the greatest affinity for oxygen are called electro positive; while those at the other end of the list are definite dividiog line between these, each ele-
no ment being negative to the one preceding,and pos itive to the one following it.
(16 C. L. W asks: What oil is best for
iling silk for insulation? A. Paraffin oill. (17) O. B. asks: What is the formula $f$ (1) O. B. asks: What is the formula fo
producing oxide of gold? A. The potoxide of gold is obtained as a dark green powder by pre-
cipitating the protochloride of gold by a dilute cipitating the protochloride of gold by a dilute
solution of potash.
(18) I. B. M. asks: Wh t is the name of a
microscopic organism, occurring in an infusion of walnut leaves last spring, and consisting of a cup-staped head anchored by a thread to a twig
The thread slowly contracts to a spiral spring, and then suddenly ar.d projects the head forward, as if to secure food. d. The microscopic orgal isms described by you are infusorial animalcules. of
the family vorticellidce or bell animalcules. The he family vorticeliaide or bell animalcules. The at the top of a long flexible stalk, the other exas the stem or leaves of an aquatic plant. This stem, sler der as it is, is nevertheless a hollow tube, through the entire length of which runs a muscular thread of still more minute diameter. When in activity and secure from danger, the little vor-
ticella stretches its stalk to the utmost, while its fringe of cilia is constantly drawing to its mouth any luckless animalcule that may cume within the alarm the cilia vanisb, atd the stalk, with the rapidity of lightning, draws itself up into a little spiral
coil. Butthe vorticella is not wholly condemned to pass a sort n vegetable existence, rooted, as it were, to a single spot by its slender stalk; its creator has foreseen the arrival of a period in its
existence when the power of locomotion would become necessary, and this necessity is provided for in a manner calculated to excite our highest admiration. At the lower extremity of the body
of the animal, at the point of its junction with the stalk, a new fringe of cilia is developed; and when this is cully formed, the vorticelia quits its stalk, (19) w. W. B. asss: 1 . What is the form of zalvanometer used in testing the connection of a
lightning rod with the ground? A. An ordinary lightning rod wilh the ground? A. An ordinary
tangent galvanometer of the form designed by Dr. Bradey is most convenient. 2. What is the il addition to that of the rod are necessary. Call these B and C , and the rod A . Measure the resistance of $A$ ard $B$ together, then $A$ and $C$, and tinall
Band $C$. Add the resistance of $A$ and $B$ to that of A and $\mathbb{C}$, subtract the resistance of B and C from will gam, and divide the remainder by 2 . This a sink vault be a gord place to insert a lightning
rod? A. Yes, provided it exposes sufficient sur
on rod?
face.
(20) J. W. F. says: In a roinstorm, four barrels of water were caught on one half of a roof
of a bouse $16 \times 24$ feet. I claim that the same amount of water weuld have fallen on a piece or ground $8 \times 24$ (leaving out projection of eaves). A riend claimed that tha roof, being 14 pitch, con
tained more square feet, consequently would catch more rain. Which is right? A. You are right. It is the same problem as that of perpendicular pickets in a feoce running up hill; ;it takes
che same number of pickets over a hill as upon the same number of pickets over a hill as upon
level ground. When the rain is driven obliquely level ground. When the rain is driven obliquely
against the roof, there will, of course, be more to fall upon one iocline, but just to the same extent ill there be less falling upon the other.
(21) A. B. C. asks: 1. What is thm proper pronunciation of Léclanché? A. Lehclanchui.
Please explain why the zince of a battery is the positive pole or element (as stated on p. 107, vol.
33 ) when the flow of electricity is from the other pole to the zinc? A. There seem, at first sight,
to be some inconsistency in using the terms positive and negativein connection with the zinc plase of a battery; but as any part of a circuit consid-
ered by itcelf must present both a positive and ered by itself must present both a positive and of practical importance, these are the ones alluded to when any are mentioned: the negative pole being that one towards which the current is directed. When the metal itself is referred to, we call that
one positive which is consumed, because, in this case, attention is more particularly called to the direction of the current in the battery, and here it is from the metal on which the action takes place . Which of the following four methods is best ap phed to lightning arresters for telegraph offices
Points, connected with the live wire presented points corinected with the live whe line points pre sented between ground poirts, line points pre
sented to a plain ground surface pon sented to a plain ground surface, or ground
points presented to plain surface connected with the line? A. Experiments, made for the purpose, showing that those lightning arresters are most efficacocous which combine, in one system, opposed
points and opposed plates separated by very thin pieces of mica 4. Why do you think that the best one? A By their difusuive property, points
tend to prevent an accumulation or charge some times, however, the sudden presence of a great
quantity of er ectricity exceeds this power of points; in such cases, the plates act like condensers, in which the potential becomes so high that a
discharge takes place between them rather than through the instruments; this is what constitutes their prlncipal advartage. 5. Is the efficiency of
the arrester increased by increasing the number of points? A. Yes.
(22) E. M. C. snys: Our orchards have to have few enemies, as no bird ro'nd here will eat them. But I have several times noticed small gatherings of red ants, and upon examination
found them to he eating a large caterpillar and found them to be eating a large caterpillar; and
since then $I$ have often seen two or three auts atsince then I have often seen two or three art ts at-
tack, kill, and eat large caterpillars. Is this commun? A. Yes. It is by mo means a new dis-
(23) A. K asks: 1. How can a wrii ing ink be made that will stand the test of acids, so that turpentine, and coal tar in the same solvent have beten used for this purpose. 2. What color is most
permanent? A. Writing fuids are, as a rule, more permanent? A. Writing fuids are, as a rule, more
permanent than ordinary black ink. After a permanent than ordinary black ink. After a
short exposure to the air they become black, or nearly so.
(24) B. B S. says: I have never succeede in making a perfect ink or fluid from any recipe, combination of both. How can I make a bright limpid, and bluish green at first, turning black on drying? A. Try the following: 12 ozs. nutgalls, 8 ozs. each sulphate of indigo and copperas, a few cloves, 4 or 5 ozs. gum arabic, for a gallon of ink. The addition of the sulphate of indigo renders the ink more permanent and less liable to mould. It
is blue when first written with, but soon becomes an intense black. It is a true solution, and in composition nearly resembles that of P. \& J. Arnold.
(25) C. O. O. says: I am using tin for plaby being heated so often. What can I do to make it flow more freely? A. This is probably due to impurity in the bath. You should state what are the character and the composition of the articles
(26) R. S. W. asks: How can brass be melted on a small scale, by amateurs? A. The operation is rarely at first accomplished by ama-
teurs without considerable difficulty. It requires a good furnace, capable of fusing copper, and a crucible capable of withstanding the high temperature. For this latter reason black lead crucibles re generally employed. The crucible is placed When well made fire, so as to heat up gradually. pieces, and force your fire until the copper is just fluid : then place in your zinc, stirring the fused alloy meanwhile Do not allow the temperature to rise too high, as in this case a great part of the with will be volatilized, and, coming into contact to a copious white vapor of oxide of zinc. It is advisable to keep the surface of the fused metal covered with a quantity of chloride of ammoniface free from oxide and clean.
(27) H T. C. asks: Is there any scientific nethod rground, without digging or boring?
(28) W. A. D. asks: 1. Is there an article of the nature of oilcloth, or thin rubber cloth, that heated, from underneath, to a temperature of from $100^{\circ}$ to $140^{\circ}$ or $150^{\circ}$ Fab., and will admit of a hower of water being thrown on immediately after the discharge of heated air, without injury to the covering or any disagreeable odor from the material? It must needs be airtight and watertight. A. Try a suitable modification of asbestos
cloth. 3. What material could I get for heating the space in the manner described? A. Try
(29).J. A. says: I liave seen an argument hat, the cearth's rotation not being equal, the earth is consequently hollow. What are the centrifugal and centripetal forces in this connection ? A. Consult "Sketches of Creation," by Professo Winchell, pp. 36--60.
(30) A. E. says: I have been troubled for a long time with my well water. The well is over 40
feet deep; the water is delicious, clear, and cool ; and yet, on holding a glass of it between you and the sunlight or lamplight, you can see minute living creatures. I hare are also earth worms occasionally drawn up in the bucket. Will you tell me the cause of these appearances? A. It is very unusual for animal life to be developed in water of such a character as you describe. The earth worms have probably gotten in accidentally, and the living creatures may not have come from germs present
in the water itself. 2 . Is wholesome water ever found in this condition? A. If you fill a quart bottle half full of the water, close it with a goo cork, put it in a warm room, and then after a week's time find on opening the bottle there is no smell, the water is probably wholesome.
(31) J. J. G. asks : 1. Why will not aniline used separately-first the blue, and finally the yel ow-in order to obtain the desired shade of green 2. What colors can I take that will make any shade of green ink I may want? A. Verdig
in acetic acid gives an elegant green.
(32) W. H. B. asks : Is there any way to remove printed matter from postal cards, sufficientA. Remove the pcinting by means of a sharp steel eraser, and polish with a good bone or ivory paper knife.

1. How can I make a liquid preparation to apply to cuts and bruises, such as will quickly dry and form an artificialcuticle? A. Use collodion. 2. Is collodion dissolved in ether a good preparation
for this purpose? A. Yes. 3. Can collodion be dissolved in alcohol? A. Collodion is a solution of negative entton in ether, or a mixture of ether and alcohol. Gun cotton is insoluble in alcohol alone.
(33) F. A. H. asks: Cnn a good durable white ink be made? If so, what are the ingredients? A. Shake up a litcle finely ground oxide
of zinc with a small quantity of gum water. This, of zinc with a small quantity of gum water. This, we think, will answer your purpos
(34) G. M. S. says: How do you compound nitric acid with water so as to give galvanized
iron the snowflake finish? A. Use muriatic acid iron the snowflake finish? A. Use muriatic acid 3 parts, nitric acid 1 part, and water 3 part immediately afterward with pure water.
Why does metal blister after it comes $o$ water, immeciately after galvanizing? A. This may be due to the fact of the metallic surface not having been perfectly clean, or on account of the too rapid cooling of the surface.
(35) C. W. B. asks: How can I crystallize alum, so that it will adbere readily, in quantity
solution of the salt in boiling water, and set it aside to cool
(36) C. L
(36) C. L. C. says: A grain of corn consists of the heart or soft part (the germ) and a hard por ion; which of these would produce the most spir its, starch, and sugar, respectively? What differ the hard and soft parts? A. We do not find any published statement that furnishes the desired in formation, and an experimental investigation (楊 J. S.
(37) J. S. asts Is there anything that can be mixed with glue to make it harder? A. Try mon pitch and gutta percha. Apply hot
Minerals, etc.-Specimens have been re ceived from the following correspondents,and xamined, with the results stated
J.U.B. F.-It is sulphide of iron.-C.B. K.-It is a rock composed of felspar and hornblende. The brilliant yellow metallic particles are sulphide of iron.-D. H.-It is decomposed potash mica For a possible advantageous use of such mica, see Monthly for August, 1875.-E. A.H.-You are right. A further examination, however, shows that thes specimens contain a small percentage of lime and silicic acid. It is largely used in the manufacture of paints, for which the mineral sent would an wer.-M. M. C.-It is difficult to account for the yresence of such a mass of the mineral whic f iron. Such concretions sometimes occur, but the fact of one being in a well may be due to accidental circumstances.

## COMMUNICATIONS RECEIVED.

## The Editor of the Scientific American a

 original papers and contributions upon the following subjects:On Large and Small Wygon Wheels. By S. L. M On Tens and Hundreds. By W.S. H.
On Weather Predictions. By M. O'R.
On the Keely Motor. By F. K.
On Railroad Cars. By S.
On Natural Phen
J. K.

On Mouse Traps. By C. R.
On the Relation of Time A. w.
inquiries and answers from the following
G. V. B.-J. G.-R. S. W.-J. T. F.-B. S.-H. D

HINTS TO CORRESPONDENTS.
Correspondents whose inquiries fail to appear hould repeat them. If not then published, they may concthem. The address of the writer should delines them.
Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket. but we generallytake pleasure in answering briefly by mail, if the writer's address is given.
Hundreds of inquiries analogous to the following are sent: "Who makes an air or steam engine suitable for driving a sewing machine? Who sells podouneters? Who sells machines for making matches? Who sells steel drills, used in riveting All such personal inquiries are printed, as will be observed. in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired inform
can in this way be expeditiously obtained.

OFFICIAL
INDEX OF INVENTIONS Letters Fatent of the United states wero Granted in the weok ending September 21, 1875. AHD EACH BEARING THAT DATE. [Those marked (r)are relssued patents.]

Addressing machine, G. H. Stout.
Bale-rolling attachment, H. Reisel

Bedstead fastening, C. T. Laib
Bedstead, sofa, J. B. Kine...
Bell. door. E. M. Lockwood.
Belt and band, driving, E. G. Isaacs...
Belting, clasp for machine, G. H. Fox
Blind, inside Venetian, J. Seaman
Blind slat adjuster, G. A. Myers
Blind slats, compressing ends of, E. Cathe
Bilind. Venetian. T. Fuyat.................
Blind. Venetian, T. Fuya
Bolt, F. E. S. Crane....
Book. F. E. S. Crane...........
Book supporter, R. T. Stoddard
Boot and shoe, M. Robling..
Boot and shoe fastening. H.
Boot and shoe fastening. H. E. De..........
Boot and shoe heel, R. Vlint
Boot and shoe heel, R. Vlnt
Boot channel opener etc
Brick for constructing retorts, M. Foste
Bride bit, B. L. Rowle
Buckle, D. L. Smith...
Buckle, harness, T. J. Magrud.
Burner, lamp, A. Taplin (r)
Burner, hamp, A. Maphn (r).
Burnisher holder, A. Swallow
Button hook, Rasines \& Pow
Buttons, attaching, D. Heaton
Can, metallic, G. W. Bell.-
Can paint, J. F. Drummond
Car coupling, G. H. \& C. L. McGlothien
Car heater, railroad, E. H. Ashcroft
Car coupling, G. H. \& C. L. AcGlothlen....
Car heater, rallioad, E. Hshcrof (r)....
Car poles, draw fron for street, L. C. Prouty
Car, sleeping, Field \& Pullman
Car, sleeping, E. P. Kellogg...

Car, sleeping, E. Wheeler (1)
Car starter, L. C. Parkes..
Car, stock, J. R. McPherso Car, stock, J. R. McPherson..........
Car, stock, Steventon \& McGrath. Carbureter, air and gas, Porter \& Grim Carpetstretcher, B. Darragh. Carriage seat irons, bending. E
Carriage spring, J. Cunningham.
Carriage spring, J. Cunningham
Carriage spring, H. M. Curtis.
Carriage spring, J. Fredenburg
Cartridge shells, necking, Salisbury \& Wells.
Cement, narble, A. Boag .........
Centering device. M. T. Greenwood
Centrifugal machine, C. C. Webber
Chandeliers, clutch for. E. C. Bruen
Chuck, planer, H. Thomas.
Church pew, I. Lancaster
Churn, E. Groat
Churn, E. Husher......
Curn, , P. P. Mangum.
Cigar box, revenue stamp, F. C. Hamilton Clock case, w. N. Weeden
Cloth press, w. Hebdon..
Coal-agglomerating press, A. G. Lasserre.
Coal hod, G. Seyfang Coal hod, G. Seyfang.
Coal tar ourner, Brooke \& Wrigh
Cock, shower and bath, H. J. Baile Condensing vapors, gases, etc.. Speir \& Mather.

## Corset. D. H. Horne

Countersink, T. P. Farmer.........
Cradle rocking device, L. L. King
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