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NEW YORK, OCTOBER 18, 1873.


## HILL SIDE RAILWAY.

We illustrate in the accompanying engravings a novel form of lowering railway, applicable, as will readily be perceived, to almost any case in which it is required to transport loads down high and loadinitous declivities precipitous declivities. It consists, briefly, in two self-balancing car-
criages, provided with ciages, provided with
reservoirs for the reception of fluid or granulated material (as shot), running upon suitable tracks. Other istationary receptacles are arranged upon the latter so as to supply the carriage reservoirs at suïtable times with a quantity of the water or other movable weight, the particular weight, the particular object of which willoe
explained as we proexplained as we pro-
ceed. In Fig. 1, a general perspective view of theentire apparatus is given; in describing the details reference is made to Figs. 2 and 3, which are respectively a representation of the bottom of one of the carriages and a plan view of the tracks and fixed receptacles.
The cars, A A, are connected together by means of a long rope, B, which passes up and around the grooved wheel, C. The latter corresponds in diameter to the distance be$t$ ween the centers of the tracks, and revolves in a plane parallel to their surface, transversely and longitudinally; in brief, the rope leaves the periphery of the wheel in the same line whatever the same line whatever the cars position of length of therail The length of the rails. The cars, as we have above
stated, are self-balancing, that is, the weight of one exactly counterbalances that of the other, and in order to move them it is only mecessary that a sufficient force should be exerted to overcome their inertia and the friction of the mechanism. Beneath the platform of each vehicle is arranged a tank, D, Fig. 3, which is provided with an opening and spring valve, at E , and a receiving spout at F . On its lower portion, and between the rails, is a reser voir, $G$, connecting with a wide receiver, $H$, by means of a tube, I. The receiver, $H$, is placed, as shown, near the upper end of the track, and its sides extend out under the rails. The reservoir, $G$, has in its bottom two spouts and sliding covers or valves, which are actuated by the handles extending above at $J$.

To understand the operation of the apparatus, let it be supposed that coal, for example, is to be transported from the top of the mountain. The car at the upper end of the track is luaded and started down, its descent being regulated by the brake, $K$, on the wheel, $C$. Of course, by the rope B, the second car is thus drawn upwards. As soon as car No. 1 is at the bottom, car No. 2 reaches the


DU BOIS' HILL SIDE OR LOWERING RAILWAY.

top. Car No. 1 is now unloaded. It is evident, however, that as the coal is removed the weight of car No. 2, which is keing filled above, will gradually counterbalance that of car No. 1, and hence begin its downward motion, probably before either filling or emptying is completed. To avoid this, the reservoir, G, is previously filled with water or shot, and one of its bottom spouts, by handle, J , being opened, its contents are allowed to enter the tank beneath the car by the spout F. This additional weight partially com. weight partially compensates for that of the coal removed, so that the upper car does not overbalance the lower and now empty car until the full load is in a place when there is a slight though sufficient difference in weight in favor of the loaded car, to cause it to start down the decline. Just before the empty carriage, which is of eourse thus drawn up, reaches the top of the track, an arm on its the track, an arm onits valve, $\mathbf{E}$, strises a projection, L, between the rails and underneath the car. The spout which valve, E, when shut, closes is thus thrown open, and consequently the contents of the tank empty into the receiver, H. From the latter the shot or water instantly descend the tube, I, refill the reservoir, G, to be again drawn out, as above described, into the car now at the bottom. The eyes for connecting the rope, B , to the cars, are attached to a rod M passing un der the latter, and arranged in connection with a spiral or other spring. By this means the rod being suitably graduated, a balance is formed which indicates the weight of the load upon the car.
The principle in-

volved in this novel invention is capable of a wide and general application, and from its use wide and general application, and from its use a material saving is effected in the articles which require to be lowered from one point to another. It may, by suitable modification, be arranged in buildings, the carriages ascending and descending vertically. If fluid be employed in preference to shot. alcohol or other spirits would be substituted in winter to prevent freezing, a proceeding involving very little expense as there is very little waste of the liquid used. In reference to special instances where it is considered that the device may be advantageously employed, the inventor enumerates the following: "In all elevated sand or gravel banks and brickyards; in stone quarries such as are along the Hudson river and Eastern coast; in are along the Hudson river and Eastern coast; in Rockland Lake, N. Y. in as mills, as those of the Newark Company, at Ron
dout, N. Y.; in coal mines, as exist upon the hills near Pittsburgh; in warehouses on high banks, as are found near Wheeling, Va., and Vickshurgh, Miss., and for moving lumber, as at St. Anthony." It requires but one person to attend to the lowering of the heaviest bodies. The apparatus may also be employed as an elevator, for the ascending platmay also be employed as an elevator, for the ascending plat-
form can be weighted with such articles as it is desired to form can be weighted with such articles as it is desired to
raise, instead of the usual counterbalancing weight, an adraise, instead of the usual counterbalancing weight, an ad-
vantage which applies to all cases in which the device may vantage whe
be used.
Patented March 18, 1873. For further information ad dress the inventor, Mr. Charles Du Bois, Fishkill-on-the Hudson, N. Y.

## Srientifir Ammican

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NEW YORK, SATURDAY, OĆTOBER 18, 1873.


## patent planing machine litigation.

Among the most memorable litigations that ever took pertaining to the Woodworth patented by William Woodworth, December 27 7 1828 , for the term of fourteen years, and twiceextended by Congress, for fourteen additional years. The monopoly became so for fourteen additional years. The monopoly became so burdensome and oppressive that the legislatures of various
States passed resolutions imploring Congress to grant no States passed resolutions imploring Congress to grant no
furtherextensions, and it finally expired in 1856, after an further"extensions, and it finally
existence of twenty-eight years.
Woodworth's device was an improvement on Hill's machine, which was defective in that it did not reduce the boards to a uniform thickness. Woodworth arranged the cutting cylinder above the bed; and in connection therewith used yielding pressure rollers to hold the boards in proper position. He thus obtained a new and important result, to wit, the production of plaued lumber of uniform thickness. This gave him the almost exclusive monopoly of mechanical planing, from which he or his assignees realized great wealth Many attempts were made to break down his patents, but they usually failed. A great variety of devices were brough forward, designed to evade the claim of Woodworth to th ielding pressure roller. In some of these the pressure wa applied upon the edges of the board by weights; in other by springs upon the face of the board ; in others! by iron bars resting upon the boards and pressed down by springs But the courts held that all these devices were infringe meits, producing substantially the same results as Wood worth's rollers and were therefore not substantial depart ures from his contrivance.
When the Woodworth monopoly expired, the lumber inter ests received a great impetus. Manufacturers were freed from the great tax, and the number of planing machines rap idly increased. The dealers little thought that, after the lapse of seventeen years from the expiration of the great original monopoiy, an attempt would be made under color of law to saddle another and even greater monopoly upon them. But we are sorry to say that this was the fact
In 1848 Joseph P. Woodbury applied for a patent for an improvement in planing machines, in which he used a yield ing pressure bar instead of Woodworth's yielding pressure roller. Lock Woodworth's roller so that it will not turn and we have, substantially, Woodbury's pressure bar. Long prior to 1848, the courts had decided that the use of yielding pressure bars were infringements on Woodworth's yielding pressure rollers; and therefore, while Woodbury's patent might have been new and patentable, he could not have used his device, had the patent then been allowed. But the Pat Woodbury's device to suppert a patent, and accordingly re jected his claim. The applicant then withdrew his petition and received back his money. As he could not obtain a pat ent, everybody who made planing machines had a free right to use his device, and they did so. Woodbury's invention is now to be found employed on almost every planing and molding machine in the land
In 1870, Woodbury renewed his application for a paten
but was again rejected. The Patent Office decided that its ormer decisions were correct. In Jan the Patent Office decided to sustain its previous decisions and rejected the cid. On the 29th of April 1878, the Patent Office arain re ase. On the at of ived the matter, and decided that all its previous decisions were good for nothing, unreliable, and consisted of a tissue
of blunders. So the patent was allowed, and the Woodbury of blunders. So the patent was allowed, and the Woodbury
party now flaunt the document in the faces of the lumber party now flaunt the document in the faces of the lumber
planers and molders, demanding payment of a heavy royalty under threat of instant stoppage of their mills.
The lumber merchants and manufacturers throughout the country, are naturally alarmed and indignant to find them selves overwhelmed, as it were, by this decision of a floun dering Patent Office, by which a merciless grab is now attempted upon their earnings, and they have combined for a common defense by legal means. They believe the patent to have been wrongfully granted, and will fight it in the courts to the bitter end. The union comprises all of the most enterprising lumber manufacturers in the country, and they are preparing for their defense in the most systematic style. The most prominent legal talent has been employed. The stakes on both sides are immense.
The dealers have agreed, in case Woodbury's claims are sustained by the courts, that they will remove his device from their machines and substitute another, unless he modifies his demand, which is one cent royalty on every hundred feet of lumber or molding of any sort, and which, if paid by all dealers will, it is estimated, amount to the sum of one milion dollars per annum. Whether Woodbury's claims will be sustained in the courts is of course uncertain. Some new judicial view of such cases may be announced, or evidence adduced that will nullify the patent. But otherwise, we should expect that the patent would be sustained, because in other cases, heretofore published by us, the courts have, under similar circumstanccs, invariably sustained the pat entee. It may be justly alleged in his behalf that, if he were Patent and first discoverer of this device, th for so many weary years, of the rigerror in depriving him, for so many weary years, of the rightful fruits of his inven-
tion. That the device is one of great public importance, and therefore worthy of a patent, is proven by the remarkable fact that it is used on about every planing machine in the world.
While this is true, it is nevertheless equally certain that the tax which the patentee requires, and which he may at any ime increase, will be for many years to come a grievou burden upon the public.

## THE PANIC OVER

The temporary nature of the financial crisis is proved by the fact that, during the short period intervening since our last issue, the excitement has nearly all subsided, and a bet er feeling of confidence is rapidly becoming restored in monetary circles. Although, as we have already observed, it seems hardly possible for the usual fall business transac ions not to feel in some degree the after effects of so close stringency of the money market, still we do not consider hat any serious or extended injury to trade resulting thererom need be at all apprehended. An example of its merely passing interference is well illustrated in the case of one of the oldest and largest dry goods firms in this city, which, although suspending one day, were enabled to resume payents on the next
As regards the manufacturing interests of the country, we are unable to find ground for the sinister predictions of many of our contemporaries. With the exception of a probable check to rapid advancement in the construction of some of the new railroads, due to the weakness of public confidence their securities, and the consequent throwing out of em loyment of a number of men heretofore employed in build ing or in manufacturing rolling stock and supplies, we can ot perceive any diminution in the prosecution of our great industries. Factories, founderies, and indeed all simila stablishments, so far as we can learn, are flourishing, and risk business seems to be the general rule. Moderation good management, and hopeful waiting for the storm to pas over have been the means of averting or, at most, confining
to a few the evil results of a disaster which might have made itself felt throughout the entire business community of the country.

## PUDDLE WALLS.

Our correspondent, S. W. G., of Elsah, Jersey county, Ill., writes for information relative to making a fish pond in a alley by constructing a dam across from one side to the other. The essential idea in a dam is its capacity for hold ing water. To this end it must be of sufficient substance, so
that its weight shall secure it from being overturned or pushed away by the pressure of the water. It must also b onstructed so as to be watertight.
To secure this last requirement the most effective method is to include within the dam a puddle wall. The correct method of pudding, so simple in itself, is not always practiced The popular ideas in regard to this important part of the work are crroneous. By many persons it is supposed tha the best material for the purpose is clay. This is an error Pure clay is, in some respects, the worst. Again, it is sup posed that the work must be compacted by a rammer. Ram ming is not effective in compacting it. There are still othe erroneous notions entertained on the subject, but we wil perhaps best expose the objectionable methods by simply valley, commence by rorect If the puddle is to extend across valley, commence by removing from the surface, where the
wall is to stand, all rubbish, brush, grass, roots and othe
perishable material, as well as all surface soil down to the solid natural gravel or groucd. In doing this, excavate a trench equal in width to the thickness of the was. Make ey, antom of the trench level acros extend it into and up evel surface to at all poin
Next, the to stand upon.
Next, the material. This skould be a gravelly loam, taken rom a bank where alternate layers of gravel and loam, or clay, are found. Screen from it by a rake all stones large than an egg. Spread it to an even depth of four inches in the lowest trench. Sprinkle water over the whole surface by a hose or buckets until the material is soaking wet, when another layer of dry material four inches deep is to be spread over the first one. A convenient method of regulating the depth is by setting up at frequent intervals stakes projecting eight inches above the bottom of the trench with notche cut four inches from the top. In placing the first layer, the workman is guided by the notches. The second layer is to be carefully graded to the top of the stakes. Now place plank, equal in length to the width of the trench, across near one end. Standing at one end of this plank with shovel, hold it upright, the back from you. In this position push the shovel to the bottom of the trench by aid of the foot on top of the blade, and then push the handle horizon tally from you with force. Withdrawing the shovel, move along the plank the width of the shovel; and placing its poin in a line with the position it before held, again press it t the bottom of the trench and horizontally from you. Con tinue this operation until you have moved along the entir length of the plank. In doing this, you have formed a wedge shaped opening across the trench. In returning aiong the plank, slice off, in the same manner, about an inch in thick ness from the edge of the opening nearest you, pushing compactly upon the material previously packed. Continue this process, cutting slice after slice, until the edge of the plank is reached. Turning the plank over gives room for more work. Follow this operation until the whole of the material is cut and compacted. In making these cuttings, the water which was put upon the lower layer of four inch es is squeezed up through the whole of the upper layer, and the whole thickness of material is rendered of the consistency of putty. The next morning the puddle will be found sufficiently hard to walk upon freely. Then repeat the entire ciently hard to walk upon freely. Then repeat the entire
process of spreading the two separate layers of four inches process of spreading the two separate layers of four inches
each, watering the first layer and cutting and compacting as each, watering the first layer and cutting and compacting as
before. By this method, double layer upon double layer is to be laid until the top of the wall is reached Some parts of the operation may appear unimportant and thus be neg. lected, but many who have so thought and acted have found to their sorrow, after the completion of the work, the neces sity of adhering strictly to what experience has shown, in some of our largest engineering works, to be the true method of making puddle walls.
The thickness of a wall should be in proportion to its hight and length. For small ponds, a wall four feet broad at top and gradually widened downwards at a rate of one and one half inches per foot of hight on each side, or three inches on b th sides, will be of ample strength. The puddle wall must be covered from the air on all sides by the filling and stone work used to form the dam.

## the fireless locomotive

The locomotive engine, run by steam generated from hot water forced into it from a stationary boiler previous to the start (described on pages 290 of our Vol. XXV. and 118 our Vol. XXVII.), is gradually fulfilling the anticipations f its projectors, and promises to lead us to a practical substitute for horse power in working city railroads and subur ban lines. The improvements, however, leave much to be done; but the imperfections of the present machine are such as are easily remedied by a skillful constructor
On October 3, a trial of a fireless locomoti ve took place between East New York and Canarsie. The dimensions of the engine are as follows: Boiler, 10 feet long by 46 inches diameter; two cylinders, 8 inches diameter by 12 inches stroke; two pairs of wheels, 30 inches diameter, coupled; ordinary slide valves, working without expansion, the en gine being provided with double eccentrics and links for re versing. The exhaust is blown into two condensers, one for each engine, fitted with 36 five eighth inch tubes for promoting condensation, and air pumps for creating partial vacuum. For the engine, such as it was, apologies were made by Mr. G. L. Laughland, the President of the Fireles Engine Sompany, and Mr. C. H. Haswell, the Consulting Engineer, and due allowance was made by the visitors for its many obvious imperfections. Its performances were as fol ows: It left East New York at 2.52 P.M., with the steam gage at 180 pounds, and ran the $3 \frac{1}{2}$ miles to Canarsie (down grades) in 12 m .45 s . At the end of the trip, the gage showed 108 pounds. During a 9 minutes stoppage, it fell to 104 pounds, and the run back (up grades), in 17 minutes, reduced it to 45 pounds. No fire was used on the locomotive, the en tire trip having been made by the steam rising from the hot water with which the locomotive was charged at the start. It drew one car with 120 passengers. The net weight of the engine was 4 tuns 3 cwt.; the car itself was estimated to weigh $7 \frac{1}{2}$ tuns empty, and with its load $12 \frac{1}{2}$ tuns.
The experiment was a successful demonstration of the possibility of running a locomotive by the proposed means but the poor construction of this particular machine render it necessary to defer any calculations as to the economy of he device. We understand from Mr. Schieffler, of the Gran Locomotive Works, Paterson, N. J., that an engine to b worked on this plan is to be designed and constructed at the establishment.

## the art of inventing

Many persons suppose that the capability of inventing is wholly a natural gift, but such is not the case. It is just as much an acquired art as any other profession. In order to insure success as an inventor, it is necessary for the student to go through a school of inventive studies and to confine his productions to a particular class. If a mechanical inventor he must understand mechanical movements and powers, as well as metals and timber and how to work them. He must study the relation between causes and results, he must acquire a knowledge of drafting, and must learn what has been accomplished in his particular line.
It is true that some wonderful inventions have been made by persons entirely unacquainted with the particular branch in which they were working, but such instances are rare. The more extended the knowledge which the artisan possessses, the more likely is he to make a valuable improvement. But constant and unceasing study is entirely unnecessary; in
fact it tires out the mind, which, like the fatigued body, fact it tires out the mind, which, like the fatigued body,
must have rest before it can successfully pursue its laborious must have rest before it can successfully pursue its laborious
journey. If, therefore, the mind becomes weary and confused, it is better to drop the subject for a time and take it up again.
Nearly twenty years ago, in the city of Boston, a friend of ours, still living, invited us to accompany him to see a model of an invention. We went with him, and a very enthusiastic young man showed us a beautifully made model, mostly
of finished brass, of a ship with a revolving mast geared into the paddle wheels in order to propel his ship against the wind. He said that he took the idea from a feed mill, run by wind, near Charlestown bridge. "But," said our friend, "that feed mill is on terra firma; but where will your ship
, thind, near Charlestown brige. "that feed mill is on terra firma; but where will your ship
be going when afloat? With the wind blowing against the be going when afloat? With the wind blowing against the
revolving sails, you will have to cast anchor in order to keep revolving sails, you will have to cast anchor in order to keep
it from blowing back wards." He had never studied cause it from blowing backwards." He had never studied cause
and effect; and he told us that he had spent six months and nearly $\$ 2,000$ in trying to accomplish an impossibility. Years of precious time and thousands of dollars are annual ly lost in a similar manner. Many hundreds of men have labored at models and expected to make fortunes by running an overshot or breast wheel in a dead pond by causing it to pump up its own water, and by similar impossibilities.
The educated inventor will never run into such wild cat schemes. But as he becomes more and more acquainted with the arts and sciences, he will find that every step forward must be directed to a practical result; and at last, when his life's work is done, he will see that all he has gawhen his life's work is done, he will see that all he has gathered will be only a drop from the ocean of Science, which
lies still spread before mankind for other minds than his to lies still spread befo
continue to explore.

## MANUFACTURE OF ARTCFICIAL BUTTER IN NEW YORK.

We have had occasion in former numbers of our paper to describe the new processes of making butter from substances other tban milk. It is to France that we are indebted for the practical inauguration of this new industry, which has now been transplanted to this country and is in full opera tion in this city. We devote a considerable space in the present number to the illustration of the devices and method of working, as practiced here, in which our readers, we have no doubt, will be much interested. Similar factories will be established in other cities and the manufacture promise to become extensive.

## SCIENTIFIC AND PRACTICAL INFORMATION CARBOLIC ACID.

Carbolic acid is now so generally employed as a disinfecting agent that a resumé of the various forms in which it is made, in the largest establishment carrying on its manufacture in England (Calvert's), may prove of interest. 1. Solid carbolic acid of three different qualities, the point of solidif cation of which varies from $81^{\circ}$ to $108^{\circ}$ Fah. 2. Liquid acid
of two different qualities, constituted almost entirely of of two different qualities, constituted almost entirely of
cresylicacid. According to Mr. Calvert, the disinfecting properties of the latter substance are the same as those of car bolic acid. 3. Soaps in which the proportion of carbolic acid varies from 5 to 20 per cent, according to the uses to which they are to be applied. 4. Disinfecting powder, composed of silex and 15 per cent cresylic acid. The silex is obtained from alum factories, where kaolin is treated with sulphuric acid. The disinfecting acids become thoroughly incorporated with it, forming a dry and pulverulent substance.
the passage of gases through vegetable colloidal membrane.
The experiments of M . Barthélemy lead to the conclusion that the natural colloidal surfaces of vegetables have, for carbonic aci d, an admissive power which is from thirteen to fifteen times more considerable than that for nitrogen, and
from six to seven times greater than that for oxygen. from six to seven times greater than that for oxygen.
These experiments, proving the dialysis of carbonic acid These experiments, proving the dialysis of carbonic acid
through the cuticle of leaves, are of the same nature as the investigations of Dutrochet on membranes and aqueous solutions to determine the endosmose by the cellules. In a word, cuticular respiration appears sufficiently proved by the presence of this membrane on all the organs.

THE FAIR OF THE AMERICAN INSTITUTE. There have been some alterations in the awards to be given by the American Institute during the present exhibition which, it seems, will enable the judges to discriminate more closely as to the relative merits of articles entered for
competition. Last year, the grand medal, a distinction requiring originality and an extraordinary degree of excellence quiring originality and an extraordinary degree of excellence
and utility in the invention for which it might be given, and
the medal of special award, for the best of a class, general excellence, etc., constituted the list; now, however, another
medal has been added, so that the three, respectively of gold, silver, and bronze, with of course the inferior honor of a favorable report, will render the task of thus signifying the value of a device one of much greater simplicity. It is frequently the case that committees feal that an article deserves distinction and yet not so high an honor as another device of far greater utility, while neither may merit the highest award; and similarly, when there are several inventions all of one class and yet each possessing important peculiarities, it is equally difficult, with but a single award to bestow, to determine to which exhibitor it justly belongs. In such instances, the matter is usually compromised by recommend instances, the matter is usually compromised by recommend
ing the granting of the same distinction to a number, with ing the granting of the same distinction to a number, with
the obvious result of causing general dissatisfaction on the the obvious result of causing general dissatisfaction on the
part of those who consider their devices merit some special part of those who consider their devices merit some special
honor,and engendering the ill feeling and dissensions caused by each individual claiming to have received the highest award. Another medal, though it may not entirely obviate this trouble, will perhaps render it an easier matter to stamp at once the best of a class, and yet grant to others of the same category a fair distinction, thus at least raising the standard and enhancing the value of the premiums.
Since our last visit, we note many additions to the display, but, with that tardiness which now seems to be the rule, many intending exhibitors have not yet appeared or, having entered, have not got their articles in proper shape. The fair has now been open nearly a month, and it seems to high time that its contents should be finally arranged.
The collection of

## MACHINISTS' TOOLS

presents some specimens of excellent workmanship and several novel improvements worthy of mention. Among others, we notice a planer from Messrs. He wes \& Phillips, which has a worm wheel outside of the table connecting with the latter by a rack and pinion. A lathe by the same firm has a novel arrangement of back gearing which renders its construction of much more compact form. Van Haagen \& Co., exhibit a friction planer whirh operates excellently and without any perceptible noise. Underneath the table and in the direction of its length is arranged a rark with teeth running longitudinally; into this mesh the projections on a friction wheel of the usual form, somewhat similar to the variety employed on ordinary friction hoisters. Connecting with the pinion is a shaft communicating with bevel friction gearing and a clutch outside, by means of which the motion of the table is changed. It might be supposed at first sight that the gearing under the table would slip under a heavy strain, but it seems that such is by no means the case. A rotary shaper, displayed by the above firm merits mention as a new machine capable of a large number of uses particularly in boring, planing, and keyway cutting, etc. An attechment to this, and in fact to any machine hav. iug either revolving or stationary spindles, is a new expansion boring tool, which consists of a slotted hub in which is screwed a shank for attachment to the spindle, and in the cavity iny which is pivoted the end of an arm. The inner xtremity of the latter is a worm wheel, the worm acting in which passes through the hub and is turned from outside. When the worm rotates, the arm is set to any desired angle, and there are arrangements for firmly holding it in place Its outer extremity carries the boring tool.

## There are several

## rock drills

on exhibition, but the Ingersoll is, just at present, the only one in actual operation. This machine has a novel improvement for holding the drill bar, which forms an automatic connection. Three tapered gibs, half round so as to fit the bar, are arranged to fit over and enclose its upper end. The collar drops over the gibs, thus wedging them against the bar firmly, grasping and retaining the same and allowing work to immediately commence at the next down stroke.

## stone pulverizing

is an operation of some interest carried on by the Zetetic Pulverizer. This machine consists of a stout winged wheel revolving at high speed in a heavy vertical circular box. Stone in moderate sized lumps is fed in through a hopper, and by centrifugal force dashed around within the box merging in
White, Cla
ny hight lark \& Co. exhibit a means of elevating water to any hight by a combination of their centrifugal pumps. Two small machines are used, one mounted lorizontally on
a vertical tube, and another similarly arranged at a disance above the former on a prolongation of the same pipe. The shaft passes straight down through the latter. The lower pump draws water through the lower part of the ube, and its discharge is led by a bent pipe to the upper por-
tion, to be acted upon by the pump above. The two porion, to be acted upon by the pump above. The two por which the shaft passes. Burden's

## VACUUM PUMP

is exbibited in several different sizes, and from its odd form and appearance attracts considerable attention. Each machine consists of a number of iron vessels in the shape of bell glasses, a description of one of which will answer for all. The mouth of the receptacle, which is placed in a trough, is closed by a grating, above which is a large valve lifting inwards. Steam enters from above, on the valve being lifted, and filling the vessel condenses, thus drawing in irst a small stream of water from a valve about midway up he side, which promotes further condensation. The vacuum formed finally lifts the large lower valve, and the vessel
fils completely. Then two other escape valves, opening out-
ward near the bottom, open, and the water is accelerated in he discharge by the steam entering as before.
Ryder's grate bar is an invention of novelty, and consists in every alternate bar of the grate being made corrugated on top, and movable, in a longitudinal direction, by means of mechanism connecting with a bandle outside. It is claimed that the fires can be thus kept clean with great facility and little trouble. The device, we understand, is to be practically tested under one of the boilers.
A novel feeding mechanism for sewing machines is exhib: ited in the main hall, by means of which almost any kind of ornamental stitching used for belts, harness, shoes, etc., can be admirably made. As displayed, it is simply a cam attached to the shaft of the feed wheel, so that the latter is carried sidewise at various times so as to produce a certain pattern by moving the cloth under the needle. A different cam is required for each variety of stitch. Near this machine is an
apparatus for sewing on buttons,
which, if it could only be arranged for every purpose, would be an inestimable boon to the unmarried male population of the country. The present device is adapted for shoe but-tons-small round affairs with projecting eyes-and uses the ordinary button just as it is supplied to the trade. The thread leads under the work, and the needle comes down through the eyes of the buttons, which slide down one at a time from a small inclined trough. A barb at the end of the needle catches the thread, carries it up through the leather, and makes any number of cbain stitches, changing from eye to outside. As soon as the button is firmly fastened, a loop of the thread, which projects through on the upper side of the leather, is slipped over it. The next button can be secured at any distance from the first, the thread leading along the under side of the material.
R. M. Hoe \& Co. exhibit a remarkably fine assortment of R. M. Hoe \& Co. exhibit a remarkably fine assortment of
saws, besides knives for cutting rubber and cork. The Mersaws, besides knives for cutting rubber and cork. The Mer-
iden Britannia Company also deserve a word of praise for an iden Britannia Company also deserve a word of praise for an
exceptionally good display of silver ware in novel and beautiful designs.

## Sir Edwin Landsecr.

Sir Edwin Landseer, the celebrated English painter, is dead. It is hardly necessary for us to particularize the works which have rendered his name famous, as no modern paintings are more generally familiar. As a delineator of animal life, Landseer had no superior; and although critics complain that he marred the effect of his pictures by semihumanizing his brutes, still it may with truth be asserted that such an appeal to a popular taste served in the main to highten the admiration of the world for his efforts, even while a more austere judgment condemned and lamented it as mere vagary of humor.
Springing from a family of artists, Landseer began his labors at a very early age, and exhibited his pictures in public when he had reached but fourteen years. Of late, however, his powers became impaired, and for many years past nothing has left his easel worthy of the great reputa-
tion which he had achieved. As a sculptor, a branch of art tion which he had achieved. As a sculptor, a branch of art in which he was induced to try his skill almost by popular acclamation, he produced bat one important work, namely, the couchant lions on the Nelson monument, in Trafalgar Square, London, which, however, it is generally admitted, afford no particular evidence of his genius or ability.
His chief forte lay in the representation of horses, dogs and game, of all of wbich he was unaffectedly fond, and painted with a wonderful fidelity to nature. Most of his works have been engraved, and copies are sold in most of our picture stores. Landseer was born in 1802 and was knighted in recognition of his merits in 1850.

## Joseph L. Hewes.

We notice, with much regret, the death of Mr. Joseph L. Hewes, a prominent manufacturer and inventor, resident in Newark, N. J. Left an orphan at fifteen, Mr. Hewes was taken under the guardianship of Seth Boyden, who, after giving him the benefit of an excellent education, entered him as an apprentice in his shops. From this period the subject of our sketch evinced great aptitude for invention, as well as no small mechanical skill, and, after several years of labor machinists' tools and engines in York. - At the beginning of machinists' tools and engines in York. - At the beginning of
the war, Mr. Hewes rendered very valuable assistance in the war, Mr. Hewes rendered very valuable assistance in
improving and remodeling arms, and it is stated that, through his timely aid, the first eight thousand of New Jersey volunteers were at once equipped for service. He had seven new inventions put in operation last year, and it is believed that the strain upon his energies in making some new machinery at the Industrial Exposition produced his fatal illness.

A Just Award.-The self-acting lubricating devices of Messrs. Nathan \& Dreyfus, of No. 108 Liberty street in this city, are, we notice, among the exhibits from the United States to which the highest prize, under the rules of competition, was awarded at the Vienna Exposition. This is a well merited recognition of valuable inventions which have exceilently withstood the test of experience.

Progress of the Hoosac Tunnel during September, 1873.-Headings advanced westward, 184 feet; eastward, 132. Total during month, 316 feet. Whole length opened, westward, 14,577 feet; eastward, 9,902 feet. Aggregate opened to Octobar 1, 24,479 feet. Length remaining to be opened, 552 feet. The whole length of the tunnel, is 25,031 feet.

## IMPROVED CAR BRAKE.

The invention herewith illustrated consists of a brake so constructed and attached to a railway car as to exert a much greater pressure upon the wheel than is ordinarily obtained. This result is claimed to be effected by a system of levers and auxiliary brakes, causing the rotary motion of the whe itself to contribute to the pressure upon its periphery.
The shafts of the brake wheels are connected by suitab means with a pivoted lever arranged under the car at A, and the latter, in turn, communicates with the brakes, B. These are arranged on an arm which is pivoted to a horizontal lever, C, which is also pivoted at its center to the framework of the platform, and carries two brakes, D and E. If the car wheels revolve from right to left, their peripheries, acting upon brakes, B, pressed closely against them, tend to draw such brakes downward, thereby tilting the lever, $\mathbf{C}$, and causing one of the pieces thereon, in this case D , to bind firmly against the wheels. If, however, the latter turn in the opposite direction, the brakes, B, are somewhat lifted, depressing the lever C , so as to cause the piece, E , to ac as an auxiliary brake. It is claimed that, by this means, the power of the brake is doubled; and in cases wher steam is employed, it will give the same power with one half the strain upon the braking apparatus.
For further particulars address the inventor, Mr. George W. Crowe, 125 West 5th street, Cincinnati, Ohio.

## IMPROVED ANIMAL TRAP.

The invention illustrated herewith is a device for catching and destroying mice, rats, squirrels, and other small animals. The trap is actuated by clockwork, and once wound up is self-setting. When sprung, a sharp toothed bar is rapidly rotated, striking the animal, killing it, and throwing it out of the box.
The case is made with an opening of a size proportionate to the hight of the animal to be trapped. The vertical shaft, A, is connected with a coiled spring and toothed wheel, part of the latter being shown at B. When the shaft is turned by the key, it coils up the spring without revolving wheel B: but when the spring is allowed to unwind, the said wheel is rapidly rotated. This motion by the cog teeth is transmitted to a similar wheel, C , the shaft of which extends above the case and terminates in a notched disk, D. Just beneath the wheel, C , and at E , is the toothed bar for destroying the animal.

F is a horizontal shaft, having at its forward end an upwardly projecting arm, $G$, which is caught and held perpendicular by the spring catch, $H$. At the middle of the same shaft is an arm, I, which passes down through a slot in the case, in such a position that a stop on the wheel, C, may take against it, and the motion of mechanism be thus arrested. At the inner end of shaft, $F$, is a cam or arm, J , which is so arranged in connection with a projection, $K$ (dotted lines), on the wheel, that said projection strikes it, thus turning the shaft, $F$, thereby raising the arm $G$, so as, , thereb raising the arm, $G$, so as to be again caught by the spring, $H$, and also lowering the arm, 1 , so that the wheel
be arrested, as already explained. be arrested, as already explained.
The shank of the bait hook, which The shank of the bait hook, which is
so placed that the animal cannot pass through the case without coming with in the sweep of bar, $E$, passes up through a slot and connects with a flaitened rock shaft which rests, as shown, upon the horizontal arm of the bent lever, $L$, the latter being pivoted at its angle to the top of the case. The vertical arm of the lever has a notch into which is caught the extremity of a which is caught the extremity of a spring, $M$, when the trap is set. Beneath the end of this spring is a bent lever, $\mathbf{N}$, also pivoted at its angle, and having a vertical arm, to accommodate which the notch is made in the disk, D. There is still another bent lever, 0 , only a part of which is seen, as it extends under the top of the case. This has a projection directly under the end of the spring, $M$ and connects with the perpendicular rod, $P$, so that when pushed down by the spring, M, it raises the catch, H, clear of the arm, $G$, and allows the shaft, K , to turn.
The illustration represents the trap as set. When the bait hook is agitated it turns the rock shaft so that the edge bears down the horizontal part of the lever, L, clearing the spring, M , from the notch. The spring, of course, comes down with some force on the projecting upper end of the lever, 0 , there by, as above described, releasing the arm, G, of the shaft, F. This releases the wheei, C, allowing it to be rotated by the wheel, B, acted upon by the coiled spring. By this means the toothed bar, $M$, is revolved with considerable force, killing the animal and tossing it clear of the box.

The disk, D, of course revolving with the wheel, C, the side of its notch strikes against the vertical arm of the lever, N, thereby raising the other arm, now directly under the spring, M, so as to elevate the end of the latter once more
into the notch on the lever, L, and, at the same time, allows into the notch on the lever, L, and, at the same time, allows
the lever, 0 , to be withdrawn from the catch, $H$, by a small spring. As the wheel, $C$, revolves the projection, $K$, strikes the cam, J, which throws the arm, $G$, into the catch, $H$, and


## CROWE'S IMPROVED CAR BRAKE

lowers the arm, I, to catch and stop the wheel. At the same disk, D, and its inner end drops away from the spring, M, so that the trap is thus reset.
The device is quite ingenious and very sudden in operation. We should imagine that it would speedily clear a cel. lar or other infested locality of troublesome vermin. lar or other infested locality of troublesome vermin.
Patented through the Scientific American Patent Agency, Patented through the Scientific American Patent Agency,
November 12, 1872. For further particulars regarding sale November 12, 1877 . For further particulars regarding sale
of rights, etc., address the inventor, Mr. George Barr, Clatsof rights, etc., address the invent
kanie, Columbia county, Oregon.

## action of Platinum and Palladium on the

 Hydrocarbons.The recent experiments of M. Coquillon on the above sub ject take as a point of departure the fact that a platinum incandescent in spiral form and heated to redness, remains forms different products of which the principal are aldehyde and acetic acid. All mono atomic alcohols, as well as their thers, act in analogous manner, and produce, in this incomplste combustion, aldehyde and the acid corresponding to the
aitable. Another curious peculiarity is that its surface becomes rough and wrinkled, and the spirals break, after a few days' experimenting. The weight is also sensibly diminished.

## Chloride of Iron Obtained by Dialysis.

It is now many years since the late Professor Graham dis-
covered that when a solution contained both crystalizable and uncrystalizable, or colloid, subsiances, the former would pass much more rapidly through an animal membrane that the latter. For performing this experiment, a hoop of hard rubber has a piece of parchment paper stretched over it, and the apparatus, which re sembles a sieve, is allowed to float upon the surface of water. The mixed solution is poured into the apparatus, and in a few days the greater part of the crystalizable body will be found in the water, while the uncrystalizable one will remain on the membrane. Professor Graham gave to this process of separation the name of "dialysis," and to the apparatus that of "dialyzer," which names have been generally adopted in all languages.
Since the discovery of dialysis, it has found many uses. It has been used with great advantage in analytical chemistry for separating crystaloid and colloid bodies, especially organic ones. Its greatest value has been in analyzing the contents of the stomach, when it is desired to show that poison has been taken. The presence of a poison in the slimy contents of the stomach would otherwise be difficult to prove. Recently it has, also, been employed in the arts, and Dr. Reimann describes in his Färberzeitung its use in the dye house for preparing iron salts: From mixed solutions of salts and gum, the salts can be separated while the gum remains behind. But not only so when a salt alone is placed in the dialyzer, the crystalizable portion of the alone which is usually the acid, passes through the membran first the base remaining on the dialyzer. Now there rana first, the base remaining on the dialyzer. Now there are a series of salts which require a proportionally large qnantity of acid to keep them in solution. Notable among these are
the sesquiosides, especially that of iron. The very acid the sesquioxides, especially that of iron. The very acid
salt of iron is extensive!y employed in dyeing silk as an iron salt of iron is extensive!y employed in dyeing silk as an iron
mordant for heavy black. An iron mordant which is very mordant for heavy black. An iron mordant which is very well as some nitrous acid, acts destructively upon the fiber, so that very heavily weighted black silk loses a greater part of its strength, and sometimes can be pulled apart. To avoid this dis advantage, the iron may be used in the form of dialyzed oxide of iron. In preparing such a solution, oxide of iron dissolved in muriatic acid (perchloride of iron) is placed in a dialyzer. After some time it will be found that the acid is mostly gone off, while a solution of the oxide of iron remains in the dialyser. Such a solution gives up its oxide of iron very readily to the im mersed fiber, which is thoroughly mor danted, while it cannot be attacked, since there is no acid, at least no excess of it, present. Such a solution is far more active than the ordinary iron mordant, because the iron in it has a great tendency to deposititself upon the fiber, while that in the acid mordant, being held by the acid, shows less of this tendency. It seems, too, from what has been learned, that the mordanting of fibers in a solution of salt is really a phenomenon of dialysis. The fibers may be regarded as a conglomerate of may be regarded as a conglomerate of membranes, and hence it is natural tha the silk, for instance, should take out the iron from a solution of its salt, and allow the acid to disseminate itself through the bath. This tendency of the fiber to take up the iron is assis ed by previous dialysis of the solution.
For technical purposes, especially for weighting silk, it is necessary to take away all the acid from the oxide solution. Here it is sufficient to obtain a solution containing but little acid and an excess of oxide of iron.
Fr. Oltmanns, an apothecary in Han-

## BARR'S ANIMAL TRAP.

cohol; while all the hydrocarbons, volatile oils, anilin ttc, participate in this property and maintain the incandes cence of the platinum spiral. The fixed oils and sulphureted essences, such as the essence of garlic or mustard, are without this effect.
Palladium has this property of remaining incandescent in hydrocarbureted vapors in even a greater degree than plati num; and with toluol, it similarly produces hydride ef benzoyl. When it is plunged in an incandescent state into proto-carbureted hydrogen, it continues in the same condi tion without requiring to be brought to redness by the bat tery. With bicarbureted hydrogen, while the platinum wire gives frequent explosions, palladium causes none. It extinguishes itself when the gaseous mixture is no longer
over, has for years prepared dialyzed
oxide of iron ír medical purposes and recently has also made it for use in dyeing. The dialyzed oxide of iron made by him contains 6 to 7 per cent of pure oxide of iron made by him contains 6 to 7 per cent of pure
sesquioxide of iron in solution; a quantity which, because sesquioxide of iron in solution; a quantity which, because
of the ease with which it acts on the fiber, is more then suffi of the ease with which it acts on the fiber, is more then suffi-
cient for most purposes, For weighing silk, and for many cient for most purposes, For weighing silk, and for many
similar purposes in the dye house, especially for all $c:$ ses similar purposes in the dye house, especially for all cises
where it is desirable to load the fiber heavily with the oxide of iron in mordanting, without attacking it, dialysed iron is inv?luable.

The building of dikes at the mouth of the Seine has been the means of causing high water to appear at Havre 36 min neap tides.

## THE FOSSIL MAN OF MENTONE

The discovery of a human skeleton in one of the grottoes of Mentone, a village on the south coast of France, near Nice, has produced for some time past no small excitement in the scientific world. The cave in which it reposed is hollowed in the garumnian limestone immediately below the nummulitic tertiary deposit so well developed in the vi cinity. Some large imbedded rocks, probably post-eocene, gave rise to the natural excavation.
It appears, from the recent investigations of M. Rivière, that, at the upper portions of the caverns examined, remains of instruments and tools were found, belonging to the prehistoric epoch which immediately preceded, in the west of Europe, the appearance of metals. Below the surface, beds abound, remains of human industry indicating a civilization even more primitive than the antiquity assigned them by the superposed masses. In this locality was discovered, at a depth of 21 feet, the famous human skeleton depicted in our engraving. The earth was evidently in virgin condition, and hence the virgin condition, and hence the
remains clearly belonged to the remains clearly belonged to the
geological and palæontological geological and palæontological
age of its surrounding deposit. age of its surrounding deposit.
While, however, the fauna disWhile, however, the fauna dis-
covered in connection with the covered in connection with the
human relics indicate a very anhuman relics indicate a very an-
cient palæontological epoch, the cient palæontological epoch, the
bone and stone instruments, and especially the necklace found on the skeleton, seem to point to a more recent period. The presence of cave bears and hyenas, the rhinoceros tichorinus, and the rhinoceros tichorinus, and bos primogenius, evidently relate to the most ancient quarternary eposh, the age of the bear; while, on the other hand, the abundance of remains of deer of various
species and of small hight (chaspecies and of small hight (cha-
mois especially), the fact of the multiplicity of bone tools, needles, chisels, and abaton of command, together with the peculiar necklace which closely resembles that found on the fossil man of Cra-Magno, lead to the conclusion that the series of objects belongs to an age posterior to that of the bear, namely, to that of the reindeer. It is believed, however, says Dr. Garrigou, in La Nature, that the original owner of the siseleton existed during the latter age, and was buried in a cave formerly inhabited by men of the preceding epoch.
A NEW DEER SEA SOUNDING INSTRUMENT.


It would be difficult, we imagine, to devise a more simple and inexpensive apparatus for deep sea sounding than that represented in the accompanying illustration. There is no represented in the accompanying illustration. There is no
intricate mechanism, no series of wheels or dials requiring careful adjustment, and not even a line; nothing, in fact, es.
sentially more than a piece of metal wire, screw-threaded from end to end, and a fan working thereon rotated by the from end to end, and a fan working thereon rotated
motion of the machine. The screw is cut to a certain pitch, mothat the descent of the apparatus must be through a so that the descent of the apparatus must one revolution. The further the instrument travels down, the higher the fan will climb up the rod. As soon as bottom is reached, and the machine begins its ascent, the fan (of course acted upon in a different direction) runs down the screw, but a messenger on the latter, pushed up by the fan, remains at and in dicates the highest limit attained. It is only then necessary to pick up the apparatus when it comes to the surface and observe the distance that the messenger has been carried up, and the depth in fathoms is infallibly told.


THE FOSSIL MAN OF MENTONE.
Compared with the intricate systems for sounding carried by such vessels as the Challenger, and in other marine exploring expeditions, the present device is a marvel of simtools ordinerily found in can be made on board, with the steamer, or, at most, with one special instrument for cutting the screw thread upon the wire. The remainder of the apparatus is a block of wood or other light material for lifting buoy the gock of whin up a lifting buoy, the grapplers which bring up specimens of the bottom, and a watch buoy. By noting the time of descent, together with the bearing and distance of the watch buoy from the point at which the machine rises to the surface, the bearing will show the difference of direction between surface and submarine currents, and the distance, the velocity. Thus, in the single instrument, is afforded a means of determining depth, character of bottom, and set and rapidity of currents.
The credit of this very ingenious invention is due to Captain Tıuman Hotchkiss, of Stratford, Conn., a gentleman of large maritime experience, to whom we are indebted for the substance of the detailed description which follows.
From Fig. 1 the particulars of the device will be under stood. A is the screw threaded rod, made of brass or steel, and B is the fan, boxed and tapped to travel thereon. $C$ is the messenger, traveling on the screw and fitting the upper end of the fan by a coupling so as to be moved by the fan only up the screw. At $D$ is a socket screwed to the lower end of the rod, A, which carries the grapnel, E , the latter hanging to the bent end of a bolt which passes through the socket. This bolt also serves as a pivot for an unevenly balanced lever, F, Fig. 2, which passes through a slot at right angles to the plane of the grapnel. The upper end of rod, A, hooks in an eye on the bottom of the lifting buoy, G. H is the watch buoy, provided with anchor and flag.

Fig. 2 shows the machine descending and also the mode of adjusting it. It will be observed that the arms of the lever, F, differ considerably in size, and that they are provided with hooked ends, the curve on the arm on the right turning downward, and that on the left arm in the opposite direction. By this means the two weights represented are supported, one weight, the heavier, extending down to about the level of the bottom of the grapnel. The latter of course remains closed, as is evident from its form. The fan and messenger are then carried down to the bottom of the rod; and thus adjusted, the machine is let go, the watch buoy being previously carried to the place of descent. The time is then noted and a careful watch kept for the return of the apparatus. In descending, the rotating fan climbs up the screw, carrying the messenger with it; and the weights, overcoming the lifting power of the buoy, continue dragging the machine down until bottom is reached. At that moment the lower weight is lifted from its hook and drops clear, the smaller weight overbalances the lever and also falls off, and the jaws of the grapnel, opening against the resisting soil, grab a portion of the bottom. The lifting buoy now easily carries up the apparatus freed from the weights; and soon reaching the surface (Fig. 3), is easily recognized by the flag which it carries, blowing out clear.
The machine is then recovered, and the position of the messenger noted, as already described. As there are thirtymessenger noted, as already described. As there are thirty-
eight turns of the screw thread per inch of rod, it is only
necessary to measure the distance in inches between the messenger and socket, D (minus the length of the fan), and to multiply the result by thirty-eight, when the depth in fathoms is at once known.
The machine may be made of any desired size; and in cases where the grapnel is likely to catch in seaweed or other obstruction, the power of the lifting buoy can be easily increased to tear away the hold.

THE FECUNDATION OF FLOWERS BY INSECTS.
Among the numerous discoveries with which vegetable physiology has of late been enriched, none is more interest ing or more curious than the part taken by insects in the de velopment of flowers. The fact seems hardly credible, more over, ihat, after all the theories which have been invented to ex plain the passage of the pollen to the stigma of the same flower (to explain which even the intervention of water, which is high ly destructible to the pallen of terrestrial plants has been men tioned as possible), in the majority of cases the fioral organs ar so disposed as to absolutely pre vent this contact, and that th pollen needs to be deposited on the stigma of a sister flower or even on a blossom belonging to a separate stalk.
Generally, when the pollen of a flower, through some means, accomplishes its self-fecundation the result is a deleterious action upon the stigma, and the plan remains barren, as, for example in many species of the genus oncidium. The aquatic plants, of which the pollen is transport ed by water, are few in number while the pollen and stigma exhibita peculiar disposition. With others (coniferce, graminees), in some cases the wind carries th pollen, but the flowers are insig nificant, destitute of nectar and of odor, and their pollen is in such great abundance that it has given rise to a fable in certain countries, of a rain of sulphur.
Our attention, at present, however, will be directed to the flowers the pollen of which is carried by insects involuntari ly from one blossom to another. Such flowers seem to appeal to the insect to enter their open leaves by exhibiting the brightest colors, and most beautiful and varied forms, be sides secreting quantities of the nectar upon which their visitor subsists. Nothing can be more wonderful than the thousands of different shapes of corolla, of stamens, and of pistils; and yet all are arranged so as not only to cover the insect, in spite of himself, with pollen, but, at the same time, to separate completely the pollen and stigma of the same flower. Often the mechanical disposition of the va rious parts of the blossom and their play at the moment of the entrance of the intruder is extremely complicated, a Darwin has demonstrated in the case of many of the orchi dacex; but there are other flowers of which the construc tion is easily understood and which are equally ingenious and surprising. One of the simplest is the sage (salvia pra tensis) a very common plant of the labiatce, or mint family characterized by the existence of two stamens instead of four, portions of the flowers of which our illustration (extracted from the pages of La Nature) represents.
The corolla, A B, is deeply divided into two lips; the up per, which corresponds to two divisions of the corolla, turn backward in the form of an arch, and incloses the style and the anthers. The lower lip is divided into three lobes, of

which the middle one is large and concave: while those on the sides are smaller and roll from within outwards. The tube of the corolla is somewhat crooked at the base, and this crook or depression contains the secreted nectar. Of the peculiar form of the atamens, a clear idea will be gained
from Figs. C and D. In C the corolla has been cut longitu dinally so as to leave the stamens intact. In Fig. D, a portion of the stamensis shown separately. The anthers have a long connective astride the filaments. The latter are very short, and are inserted in the sides of the tube of the corolla $f$, in Fig. C and D. One anther, $a$, is developed regularly the other, $a^{\prime}$, is transformed into a flattened appendix, nearly rectangular, slightly curved, and convex outside. These two orgai:s are so placed together as to form a kind of spoon, which very exactly clises the tube of the corolla. They even adhere quite strongly by their anterior points. The connective, which is almost unapparent on the inferiur side, is elongated on the upper portion into a delicate arched filament which carries at its extremity the only pollen-enclos ing cell of the anther.
If it be attempted to push a needle or bit of stick into the tube of the corolla, the little spoon, $a^{\prime}$, will just be enconntered. By a light effort, the connectives are turnad around the filaments, when the fertile anthers, concealed under the superior lip, project themselves forward and deposit their pollen upon the intruding instrument. On withdrawing the latter, the elasticity of the filaments carries the anthers back under the upper lip. Up to the time when the pollen is ripe. the style, which is also concealed at the bottom of the upper lip, does not arrive at complete development and the bi fidal stigma, $s$, hardly extends beyond the corolla, Fig. A. In the advanced flower, deprived of its pollen, the style elon gates downwards and carries the stigma at the level of the entrance of the tube(see $s$, Fig. B).
It is now easy to follow the action of the flower, when a bee, for instance, visits it. The insect alights upon the lower lip of the corolla, and, to reach the hidden nectar, tries to penetrate the tube. But this it cannot do without, as already slown, pushing before it the short branches of the two levers formed by the connectives. At the same time the arched upper parts advance and embrace the body of the bee, applying the open anthers to its abdomen so that the insect emerges covered with the fine pollen. As long as it seeks the nectar of flowers of the same age as that just left and of which the styles are still very short, the stigmas can receive but little pollen; but when the bee attempts to enter an older blossom than B, the elongated stigma grazes along its back, rubs off the pollen, and thus becomes fecundated. Since the pollen of the salvia is derosited on the back of the insect, it is evident that little can be given to a flower of another species the construction of which requires the placing of the substance upon the head or trunk. While whatever may be the flowers which the bee visits before entering another salvia, the pollen with which it is charged is not rubbed off or wa
blossom is entered.

## UP THE AMAZONS.

No. 2.
volume of the great river and its tributaries.
The Amazons is the most voluminous of rivers. At the narrows of Obydos, six hundred miles from the sea, half a million cubic feet of water pass any given point every second. Born in Lake Lauricocha, among the Andes of Peru, the main trunk runs northerly for five hundred miles in a the main trunk runs northerly for five continuous series of rapids: and then,
from the frontier of Ecuador, it flows from the frontier of Ecuador, it flows
easterly, twenty-five hundred miles easterly, twenty-five hundred miles continent. The average current of the Great River in its passage through Brazil is three miles an hour. At Ta botinga, two thousand miles from its mouth, the width is a mile and a half, with a depth of eleven fathoms; at the entrance of the Madeira, it is three miles wide, and belcw Santaren, it is ten. The tributaries are in keeping with this colossal trunk. In fact, the Amazons is a great river system, rathe than one river. It has twelve affluents over a thousand miles long, the largest the Madeira, equaling the Arkansas,
entering the Amazons nine hundred entering the Amazo
miles from its mouth.
Besides these and a host of minor tributaries, there is a wonderful net work of natural canals aloneside of the main river and joining the tributaries, called igarapés, paranas, and furos. These bypaths are of immense advan. tage for intercommunication. They are characteristic of the country, and are so numerous that Amazonia is truly a cluster of islands. Atlogether, this vast inland fresh water sea drains a territory of two million square miles, reaching from the An-
des to the Atlantic and throwing out its arms to the Orinoco and Paraguay. On the Lower Amazons, the annual rise reaches its maximum about the middle of June, and its minimum in December, the difference of level being about fifty feet.

## extent of natiation.

No other river runs in so deep a channel to so great a distance. No other river can furnish over six thousand miles of continuous navigation for large vessels. For two thousand miles from its mouth, the main stream has not less than seven fathoms of water; and not a fall interrupts navigation for twenty five hundred miles. The Pongo de Manertche is the western limitt to navigation on the Amazons
proper. While the current is ever east, there is a constant trade wind westward, so that navigation up or down has always something in its favor. In August and September, a ways something in its favor. In August and september, a strong breeze sweeps up the lower part of the main trunk,
so that schooners often go from Pará to Obydos in ten days, so that schooners often go from P
or one third of the ordinary time.
or one third of the ordinary time.
As to the tributaries: the first in order, the Tocantins,
As to the tributaries: the first in order, the Tocantins,
could furnish a natural highway to the rich province of could furnish a natural highway to the rich province of
Minas Geraes, were it not for rapids one hundred and fifty niles from its mouth. This interruption will some day be circumvented by a railroad. Above the falls, a steamer can go six hundred miles. The Xingú is navigable nearly one hundred miles. From Santarem, steamers ascend the broad Tapajós about sixty leagues, to the rapids of Itaitúba; and passing these, traders go by canal to Diamantino and Cuyabá on the confines of Paraguay. From Itaitúba, there is com munication vid Manes with the Madeira. Near Obydos en ters the Trombétas, navigable one hundred miles. And just beyond Serpa, the great Madeira pours its flood of waters. This majestic tributary is about two thousand miles long, This majestic tributary is about two thousand miles long,
one branch rising near Lake Titicaca, a second starting one branch rising near Lake Titicaca, a second starting
within fifteen miles of the source of the Paraguay, and a within fifteen miles of the source of the Paraguay, and a
third washing down the gold and diamonds of the Sierras. It has a three mile current, and at its mouth is two miles wide and sixty-six feet deep. It is navigable to San Anto nio, a distance variously estimated from five to seven hun dred miles. Here begins a series of rapids, nineieen in num ber, having a total fall of thirty-eight fathoms; above which steamer can ascend to Santa Cruz, in the heart of Bolivia Colonel Church, who sounded the Marmoré for six hundred miles above the rapids in October (the dry season), found no where in midchannel less than fifteen feet of water, an aver age current of two miles an hour, and a width varying from six to twelve hundred feet. A railway around the formidable rapids which separate Bolivia from the Lower Madeira is now in process of construction by the Madeira and Marmoré Railroad Company. The track extends from San Antonio to Guajarámirim, a distance of one hundred and eighty miles, and by the terms of the contract the road is to be fin ished in April in 1874. This is one of the most important enterprizes on foot; but great difficulties have been encoun tered, as the scarcity of laborers, the attacks of Indians, and the prevalence of epidemics. The company, however, in spite of all obstacles, declare that this great connecting link must and shall be built. As soon as completed, the National Bolivian Navigation Company will be ready to put a fleet of steamers and barges on the Marmoré and Guaporé. Both Brazil and Bolivia are interested in this railway, and have conceded to the company over one million acees of territory along the line. The affluents of the Madeira water a region as large as the basin of the Nile and nearly as rich. The valley of the Beni above is famous for its gold, Peruvian bark, coffee, and cacao, which now have to climb the mountains of La Paz and cross to the Pacific.
One hundred miles west of the Madeira enters the Rio Negro, which is navigable to San Gabriel; but at present steamers go only to Santa Isabel, or five hundred and fortysix miles. It is a deep though sluggish river, the depth at Manáos at high water being forty-four fathoms. Steamers, therefore, do not usually cast anchor, but fasten to buoys The Rio Branco branch can also be navigated by smal


## MOUTH OF THE AMAZONS

ers for sixty leagues. Above the rapids of San Gabrie, the Negro is connected by the Cassiquian with the Orinoco and hence the commerce of this part of the river is natur ally in the hands of Venezuelans.
Next in order is the Purús, one of the most promising trib utaries of the Amazons. Recently opened to the world by the daring Chandless, this hitherto mysterious river, pos sessed by the untameable Chunchos, has suddenly become one of the most attractive and valuable streans in the world. Rising in the richest part of the Andes and entering the Amazons only forty-five leagues above the city of Manáos, it is navigable for steamers, the greater part of the year, for over twelve hundred miles. At the distance of eight hundred miles from its mouth, the depth is never less than twelve feet. It is nearly, if not fully, equal to the Madeira in size, but is exceedingly winding in its course. Parallel to the Paras is the almost equally important Sturna. It is
navigable, for steamers drawing three or four feet of water, for fifteen hundred miles. Like the Purús, it is a very crooked river, and has a two and a half mile current. Five hundred miles from its mouth, it has a depth of two fathoms at low water.
The Jutahi and Japurá are first class tributaries; the latter is navigable for ten days by steamer, when falls are reached where there is a lofty table topped mountain. The Icá has no rapids and is navigable into New Granada. It is a healthy river, and is of considerable commercial value. The Jávari is navigable for an unknown distance, and is called the "Golden Dream of the Peruvians," who think it is the eastern outlet of their country. The Napo could be ascended by a flat bottom steamer five hundred miles; it is the natural highway eastward for Ecuador. The noble Ucayáli has been navigated by a steamer of five hundred tuns for six hundred miles in the dry season; and a small steamer has ascended over seven hundred miles, or within wo hundred miles from arient Cuzco, ad three hund two hund mile frem hundre Ucayali will und 1 lh Ucayali will undoubtedy connect Lima with the Amazons Finally, the Huallága has an average depth of three fathoms for a hundred miles; but canoe navigation begins at Tingo Maria, one hundred and twenty miles from Huánaco Such are the vast capabilities of this gigantic river, fitly called the Mediterranean of the New World.

## the natural wealth

of the country is in proportion. No spot on the globe con tains so much vegetable matter as the Vailey of the Ama zons. Within it we may draw a circle of eleven hundred miles in diameter which shall include an evergreen, unbroken forest of grand and beautiful and valuable trees, in endless variety. In truth, it is this very excessive exuberance which offers the chief obstacle to settlement. We know next to nothing of the interior ; but the margins of the main trunk and especially of the tributaries abound with precious woods, drugs, dye stuffs, edible fruits, and other useful products. Among the most important of these for exportation are: Moira, pinima, moira piránga, moira coatiára, itaúba, palo di sangre, massarandúba, sapucáya, jacaranda, cedar, and cumarú; salsaparilla, vanilla, cupaiba; cinchóna and guaraná; cacao, coffee, tonka beans, nuts, facinchona and guarana; cacao, cofiee, tonka beans, nuts, fa-
rina, tapioca, cotton, rice, tobacco, and sugar; rubber, piassába, pita, and copal, and a host of others unknown to com. merce.

## SAILING CRAFT AND steamers.

The present traffic in the riches of this inexhaustible region is far behind the world's expectations; but it has wonderfully increased since the introduction of steamers in 1853. It is impossible to ascertain the number of sailing vessels on the river; but the variety is extraordinary, for the Indian is a carpenter and shipwright by intuition. Thus we see: First, the canoe proper, or "dug out." Second, the montaria, a small boat made of five planks, or a canoe increased by two narrow boards for the sides and small trian. gular pieces for stem and stern. The paddle serves for both steering and propelling. Third, the montaria-possante, a large montaria with oars. Fourth, the igarité, a large canoe or montaria with two masts, rudder keal, and palm leaf awning or cabin nor thats, Fifth, the galiota palm leaf with wooden covering. Sixth, the cobérta, a large galiota with one or two wooden cabins. Seventh, the vigiléngas, a large igarité, short and broad, flat bottom with keel fore and aft, first made at Viges. Eighth, the batelao, a barge with square sails but no deck, to carry cattle; sometimes propelled by long oars. Ninth, the barco, a batelao with deck. Tenth, The escuna or schooner.
Of steamer there are now thirty-five afloat on the Amazons, varying in tunnage from seventeen to eight hundred and sixty-four. The aggregate tunnage is over ten thousand. Twenty of these belong to three companies, which receive a large subsidy from the Government 000 . The oldest and most powerful line (" Comparihia de Navagacao a vapor de Amazonas") is owned in London, but is under the management of the distinguished and energetic Sr. Pimeuta Bueno, of Pará. This company is endeavoring to swallow up the other two, having just purchased the Paraense line and nearly completed negotiations for the Fluvial, and thus monopolize the carrying trade on the river. Officially made free to the world in 1867 , the navigation of the Amazons is virtually restricted to the Brazilian flag. Foreign vessels may go up the main river as far as Manaos; up the Tapajos to Santarem ; and up the Madeira to Borba. On the Maranon the Peruvian government has two large steamers, doing monthly service, besides several small ones for the tributaries; and an Englisi firm at Iquitos has recently inaugurated a private line between that point and Pará. Goods for Peru pass Pará free of duty. Two regular steamers leava Pará for Manaos and intermediate points, on the 2 d and 18 th of each month, and a monthly steamer plies between Manaos and Loreto, on the Brazilian frontier, connecting with the Peruvian Morona for Yurimaguas on the Huallága. The other steamers run from Pará and Manaos to numerous villages along the main river and the tributaries. The navigation of these tributarien, but
ust commenced, is most important, for they are the real ources of the characteristic products of the country; th region bordering the main trunk yields scarcely anything
On the Tocantins a steamer goes once a month to Cametá On the Tocantins a steamer goes once a month to Cametá once a month (during high water) to Baiao and to the first falls. Almost the only trade on this river is in Brazil nuts. The Xingu has one occasional steamer going just above Souzil for rubber, of which the annual product is five or six thousand arrobas. The Tapajos has a monthly steamer a far as Itaituba ( 175 miles) leaving Santarem the 28th, and bringing down rubber, salsaparilla, tobacco, farina, cacao, coffee, copaiba, pepper, nuts, pirarucú, pitch, hides, lumber and limestone. The annnal amount of the Topajos cacao is is 100,000 arrobas, rubber the same, pirarucú 50,000 arr $\quad$ bas salsaparilla 1,000 arrobas, nuts 40,000 bushels, hides 20,000 A steamer leaves Mansos for San Antonio, on the Madeira the 27 th of each month, and oftener when there is a cargo.

## present and prospective commerce.

At present the trade on this chief tributary is inconsiderable, its value, in 1872 , amounting to only $\$ 279,312$. The exports consist of rubber (about 25,000 arrobas), hides, tallow, quina, copaiba, cacao, nuts, fish, tobacco (of superior quality for pipes), and salsaparilla. But the moment the railway around the falls is finished, a magnificent country will roll its wealth down the Madeira. Above the falls are the cities of Exaltocion, Trinidad, Santa Cruz, Oruro, Cocha bamba and La Paz; there is the Bene valley, famous for its gold, silver, tin, copper, lead and mercury mines; and from the banks of the Marmorá will be exported, as soon as an outlet can be made, cinchona bark, rubber, coffee, cacao, salsaparilla, tobacco, farina, cotton, llama and alpaca wool, cattle and hides. At present, cattle can be bought there at $\$ 7$ a head ; cinchona, $\$ 45$ a quintal; cacao, $\$ 1.50$ an arroba; sugar, $\$ 1$ an arroba.
On the Rio Negro a steanner makes six trips a year as far as Santa Isabel ( 546 miles) for piassába and salsaparilla. The value of the trade on this tributary, in 1872 , was $\$ 62,586$; it is now on the increase. The rich cacao and coffee, once raised in this region, is no longer cultivated; and no one can be found to cut the celebrated moira pinima-the most beautiful wood in the world. Not a stick can be found for sale in the city of Manaos; while everybody confesses that there is an abundance of it up the Negro, especially on its branch, the Brarcco, near the boundary line of Guiana. A regular monthly steamer (and often an extra one) goes up
the Purús, one thousand miles to Hyutanahau, bringing down the Purús, one thousand miles to Hyutanahau, bringing down rubber, copaiba, salsaparilla, nuts; turtle oil and fish. The commerce on this river is rapidly increasing. Its value in
1872 was $\$ 627,602$. There are more inhabitants along the banks of the Puyús than on any other tributary.* There is a monthly steamer, likewise, on the Juruá, ascending to Marary (five hundred miles), and the trade is similar to that on the Purús. The Peruvian steamers, plying between Lonto and Yurimagnos, takes up dry goods and hardware in exchange for Moyabamba hats and salsaparilla. Her rate down stream is eighteen miles an hour and from ten to twelve up, while the Brazilian steamers descend at the rate of twelve or fifteen miles an hour, but make only eight up stream.
Such is this great fluvial highway, as thus far developed. Unless checked by blind legislation, the commerce of the Amazons, leavened by Anglo-Saxon capital and Anglo-Saxon enterprise, is destined to assume proportions commensurate with the magnitude of the river.

James Orton.
The latest inteligence contradicts the report of
and announces that he has found gold in abundance.

## NOTE ON AN ELECTRO-DYNAMIC EXPERIMENT.

In charging a secondary couple of leaden plates with the magneto-electric machine of Gramme, we have observed a
phenomenon which affords quite a curious example of the phenomenon which affords quite a curious example of the
reciprocal transformation of mechanical power into electricity, and of electricity into mechanical power.
The machine of Gramme possessing, as is well known, the remarkable property of furnishing currents influenced in the same direction, the secondary couple is charged by the aid of this machine as if under the influence of a voltaic pile, and enables us to obtain, at the end of a few moments, by a suc cessive chemical action accumulated upon a large surface, temporary effects of an intensity superior to those which the machine produces in a continuous manner. It is easy to verify this, either by the incandescence of a thread of platinum, or by any other physical action. But if, instead of thus discharging the secondary couple, it is left in communication with the machine, and if we cease to make it revolve, if we even stop it entirely, by opposing a sufficient resistance, it will immediately be observed to put itself in motion again under the influence of the secondary couple which it has just charged, not in a contrary direction, but in the same direction as the motion with which it was animated while charging the secondary couple.
The velocity is less, it is true, than that which is given to it in order to develope electricity, but it is still sufficiently great, and the rotation may be prolonged two or three min utes, that is, during the time employed by the secondary couple to discharge itself. The dynamo electric machine operates in this case as an electro-magnetic motive power,
and the secondary couple gives back to it, under the same form, the power which it has stored up. Electricity serves only, as it were, as the intermediate machinery in this com. munication and restoration of motion.
we measure the forces called into play, we can plainly ascertain that this restoration is not complete on account of
the loss inevitable in every transformation. But as the measure of the product of the secondary couple, effected by one of us in a previous experiment conducted after an ther method, has demonstrated that this couple was a good receiver of the electric force, it is probable that one would find here, all the circumstances being the same, only a trifling waste in the transformation.
The direction of the rotatory motion communicated to the machine by the discharge of the secondary couple is, $w$ have said, the same as that in which the machine was turned in charging the couple. Now if the machine in turning in a certain direction has charged this couple, it is difficult to conceive, at first view, that under the influence of the dis charge of the couple it turns still in the same direction; for it must then tend to recharge the secondary couple, so that the latter would be discharged and charged at the same time.
Nothing seems more paradoxical. Nevertheless the fact is easily proved, and is very simply explained in the follow ing manner: If we consider in the first place the direction of the current furnished by the machine, that of the current given back by the secondary couple (which is the reverse of the preceding), and if we take into account the actions resulting, we confess that, according to the laws of induction and of electro-dynamics, the rotating ought indeed to act in the direction indicated by experience. If we ob serve, on the other hand, that the secondary couple, once charged, has a temporary intensity superior to that of the machine, that is, that it can furnish in a given time, by means of the accumulation which takes place, a quantity of electricity superior to that which the machine would produce during the same time, we understand that it could overcome or surmount the feebler intensity which the machine tends to develope by its rotation even under the influence of the discharge of the secondary couple
The motion then takes place by virtue of a difference intensity between the current furnished by the secondary couple and that which the machine would tend to develope by the simple fact of its rotation. Thus is explained, according to us, this apparent paradox of electro-dynamies. We will add that the experiment can be easily repeated, with the smallest as with the largest models of Gramme's machine.

On the Manufacture of Ether
O. Süffenguth states that the best method of making large quantilies of ether is by the continuous process. A retort, quantilies of ether is by the continuous process. A retort,
containing a mixture of nine parts sulphuric acil of $66^{\circ} \mathrm{B}$. containing a mixture of nine parts sulphuric acid of $66^{\circ}$ B.
and five parts 90 per cent alcohol, is heated to $284^{\circ}$ Fah. and alcohol allowed to flow in continuously to keep the mixture at a constant level. Heretofore a direct fire has been applied under the copper or iron retort; but owing to the inflamma bility and volatility of the ether, this is evidently dangerous; and moreover, the direct fire soon destroys the retort, or at least dissolves the leaden lining. This is now entirely avoided by the use of superheated, high pressure steam for heating the retort. Even though this method is rather more expensive, it prevents igniting and exploding the ether vapor which quite compensates for the cost. Another advantage is the ease with which a constant temperature is maintained by regulating the pressure, so that the operation is no longer ependent upon the care and experience of the workmen. Various materials have been used for the retort or still; Various materials have been used for the retort or stin,
sometimes copper alone, sometimes copper lined with lead, and also iron lined with lead. Experience has proved that the last named is not only the cheapest but will last the longest. If the operation is carefully conducted, 66 per cent of ether of a specific gravity of 0.730 will be obtained. Half a pound of sulphuric acid makes 100 pounds of ether, and the apparatus is so constructed that it can be refilled without interrupting the operation. Great attention to the regulation of the temperature and to the flowing in of the alcohol are the principal conditions for obtaining a large
The crude ether thus obtained is freed from the acid dissolved in it and washed, after which it is rectified in a suit able apparatus. Attempts have been made to rectify it in he process of its manufacture, by conducting the ether va rils a space between the Fah.) Here the water and alcohol are condensed, whil the ether passes up into a second vessel filled with pieces of quick lime of the size of a man's fist, which take up the sul-
phurous acid. It is now warmed and enters from beneath into a cylinder holding a leaden basket of dried wood charoal, or alternate layers of charcoal and pieces of coke scaked in a solution of soda and well dried. From here it is conducted through a cooler into the receiver. This continuous rectification is more difficult and requires greater attention on the part of the workmen than where the purification is a separate operation, first on account of the continual reg alation of the temperature in the different parts of the appa aratus, and secondly because the lime sometimes stops up the goes on regularly nor is the product always pure. It seems to be better, in practice, to keep separate the two operations of making and of purifying the ether.

Bees as Architects
Now we exercise a patient observation on Nature, analy zing, investigating, calculating, and combining our facts, and say coolly with Professor Haughton, " bees construct the largest amount of cell with the smallest amount of ma-
terial:" or with Quatrefages, "their instinct is certainly the most developed of all living creatures with the exeep tion of ants." "The hexagons and rhomboids of bee archl-
tecture show the proper proportions, between the length
and breadth of the cell, which wili save most wax, as is found by the closest mathematical investigation," says another great authority. Man is obliged to use all sorts of engines for measurement-angles, rules, plumb lineso produce his buildings, and guide his hand; the bee executes her work inmediately from her mind, without instruments or toois of any kind. "She has successfully solved a problem in higher mathematics, which the discovery of the differential calculus, a century and a half ago, alone enables us to solves at all without the greatest difficulty." "The inclination of the planes of the cell is always just, so that, if the surfaces on which she works are unequal, still the axis running through its inequalities is in the true direction, and the junction of the two axes forms the angle $60^{\circ}$ as accurately as if there were none." The manner in which she adapts her work to the requirements of the moment and the place is marvelous. A center comb burdened with honey was seen by Huber and others to have broken away from its place, and to be leaning against the next so as to prevent the passage of the bees. As it was October, and the bees could get no fresh material, they immediately gnawed away wax from the older structure, with which they made two horizontal bridges to keep the comb in its place, and then fastened it above and at the sides, with all sorts of irregular pillars, joists, and buttresses; after which they removed so much of the lower cells and honey, which blocked the way, as to leave the necessary thorougafares to diffeent parts of the hive, showing design, sagacity, and resource. Huber mentions how they will find out a mistake in their work, and remedy it. Certain pieces of wood had been fastened by him inside a glass hive, to receive the foundation of combs. These had been placed too close to allow of the customary passages. The bees at first built on, not perceiving the defect, but soon changed their lines so as to give the proper distance, though they were obliged to curve the combs out of all usual form. Huber then tried the experiment another way. He glazed the floor as well as the roof of the hive. The bees cannot make their work adhere to glass, and they began to built horizontally from side to side; he interposed other plates of glass in diferent directions, and they curved their combs into the strangest shapes, in order to make them reach the wooden supports. He says that this proceeding denoted more than instinct, as glass was not a substance against which bees could be warned hy Nature, and that they changed the direction of the work before reaching the glass, at the distance precisely suitable for making the necessary turns-enlarging the cells on the outer side greatly, and on the inner side diminishing them proportionately. As different insects were working on the different sides, there must have been some means of communicating the proportion to be observed; while the bottom being common to both sets of cells, the difficulty of thus regularly varying their dimensions must have been great indeed. The diameter of the cells also varies according to the grubs to be bred in them. Those for males have the same six sides, with three lozenges at bottom, as those for workers, and the angles are the same; but the diameter of the first is $3 \frac{1}{3}$ lines-that for the workers only $2 \frac{2}{5}$. When changing from one size, to another, they will make several rows of cells intermediate insize, gradually increasing or diminishing, as required. When there is a great abundance of honey, they will increase both the diameter and the depth of their cells, which are found sometimes as much as an inch and ahalf in depth.-Good Words.

## Enameled Iron.

M. Peligot has made a report, to the Society for the En couragement of Industry, on the enameled wrought and castiron work introduced by M. Paris about twenty-five years ago, and for which the Society have awarded him two medals. According to the report in question, the enamsl used is a true transparent glass which allows the color of the iron to show through, very tenacious, having the same power of dilatation as iron, and capable of resisting powerful acids. The ordinary white enameled ware of Paris generally contains lead, and often in large proporticns, and is liable to be attacked by even very weak acids. M. Paris' ware has been employed for many purposes: cast iron vases for gardens decorated in imitation of old Rouen ware have been exposed to all weathers without suffering any injury; a chimney in enameled plate iron was set up at the Mazas prison in 1849 the doors of the gold assay furnace in the laboratory of the Paris mint are of the same, and have borne the effect of nitrous vapors since 1850 ; in 1866 this enameled iron was selected for street names and house number plates, in several districts of Paris, and the report states that, while other manufacturers make enameled ware of the same appearance as that of M. Paris, the latte
Specimens of new applications, lately introduced by M Paris, were presented to the Society, and included chairs, tables, and stools for gardens, enameled on sheet iron and mounted on castings ; and stands for dishes, decanters, etc., made in imitation of ancient earthenware, but presenting the superior advantage of bearing heat well.

Action of Nitric Acid on Chromate of Lead.-On reating chromate of lead with about double its weight of nitric acid, a solution of chromic acid is obtained, according to M. E. Duvillier, containing but two per cent of oxide of lead. It is considered that the nitric acid decomposes the recipita itself to chromic acid and nitrown nitufe acid employth

MANUFACTURE OF ARTIFICIAL BUTTER IN NEW YORK. Latin for milk), which gives to buttermilk its sour taste. $^{\text {M }}$
Milk is a mechanical mixture of butter, casein, and water, the latter holding in solution sugar of milk, or lactin, and several salts. The butter is held suspended in the milk by the caseous or cheesy matter, and the whey, with which it is intimately blended. Milk is thus a true emulsion, resulting from a mixture of these thres ingredients, and owes its opacity and white color to the diffusion through it of the butyraceous oil. The particles of butter in milk consistof very minute globules $\frac{1}{25 \pi} \sigma_{\text {inca }}$ in diameter, suspended in the surrounding serous fluid

Fig. 1.


MANUFACTURE OF ARTIFICIAL BUTTER.-THE HASHING MA CHINE.
When milk is allowed to stand for some time, the lighter particles of butter rise to the surface, constituting, with a certain quantity of the other ingredients, cream, leaving the casein, from which cheese is made, and the whey below. All the particles of butter, however, are not eliminated by this means. Still the remainder is by no means rich in oily matter, as the poverty of skim milk plainly shows.
When the cream is agitated for some time, or churned, the semi-solid particles of fat aggregate, and we have a mass of butter. The remaining fluid, termed buttermilk, contains casein and lactin, or sugar of milk, in solution. This sugar very soon decomposes, forming lactic acid (from lac-

In the manufacture of cheese the casein (Latin, caseum, cheese) of course is the principal ingredient. The casein is coagulated by an acid, usually obtained from the stomach of a young calf and called rennet. The curd thus obtained is pressed, and, after a variety of manipulations, becomes cheese.
Butter is a rather complex organic compound, consisting chiefly of olein, margarin, and stearin. The olein is the largest and most important constituent, and one most familiar to our eyes, in the shape, more or less pure, of the fixed oils, of which olive oil is a good example, as it contains seventy-five per cent of olein.
The three substances named exist in all natural fats, from which chemists have long been enabled to produce butters which, owing to bad odors and flavors, have never been suited to human wants.
M. Mouriez, of France, was the first to solve the difficul ty, and some six years ago gave to the world an excellent method of making good butter from hard beef fats, known as beef suet. This process will be found in the Science RECORD for 1873
The process, with modifications by M. Paraf, has latterly been introduced in this country, and is now in successful practical operation in this city, on a large scale, at the espractical operation in this city, on a large scale, at the es-
tablishment of the Oleo-Margarine Manufacturing Company tablishment of the Oleo-Margarine Manufacturing Company,
in 56th street, near Third avenue, where one or two tuns of in 56th street, near Third avenue, where one or two tuns of
the new butter are now daily turned out, and find a ready market.
The article to which we refer does not differ materially in composition from ordinary butter, olein (and that of a very pure character) being the principal ingredient, no casein being present, which is the primary cause of rancidity in butter. The olein from which this artificial butter is prepared is obtained from beef suet.
The general process of manufacturing artificial butter is as follows: The suet is first washed thoroughly, for two hours, in water, to remove all superfluous animal matter hours, in water, to remove all superflous and illustration(Fig.1), ground thoroughly, and pressed through illustration(Fig.1), ground thoroughly, and pressed through
a fine sieve or plate of iron pierced with fine holes, which forms one side of the machine. The machine consists of a series of sharp blades set on an axis like the thread of a screw. These are contained in a closely fitting chamber or cylinder placed horizontally. The cylinder is divided into two portions, hinged together on one side, and capable of being securely fastened or bolted on the other, when the machine is in operation. The upper half can be readily thrown back, should the machine become clogged or when it be comes necessary to cleanse it. The shaft on which the and is geared in the ording through one end of a belt and pulley, to the shaft of the engine transmitting the pow A large iron trough lined with porcelain is supported above the cylinder with its revolving knives. This trough
or feeder has an aperture in one corner, which fits over a corresponding hole in the upper part of the sylinder, through which the suet is fed to the machine. When the machine is in operation, the suet is not only effectually hashed in the cylinder, but forced by the screw thread set knives through fine holes bored in the opposite end of the cylinder. The machine we saw in operation was capable, it was stated, of hashing 1,000 pounds of suet in an hour. The fat comes out of the hasher in the form of a jelly considerably whiter than when put in, owing to its finely divided state, and the uniform distribution of olein through it.
The material is now in a proper condition for the second operation, which has forits object the separation of the fluid olein, and the solid margarin and stearin from the animal


MANUFACTURE OF ARTIFICIAL BUTTER.-FILLING THE BAGS FOR THE PRESS.
tissues which enveloped them. For this purpose it is put intoa number of steam vats, shown in the illustration (Fig. 2). These vats are of the ordinary wooden description, with team pipes entering the bottom, the steam being admitted or cut off at pleasure by stop cocks. Here the fat is raised nearly to the temperature of boiling water, the steaming being continued for two hours. The heat causes a separation of the olein and stearin from the animal matter, the former rising to the top, while the latter sinks to the bot tom. The material is well stirred during the time the het tom. The and when the is is continued, and when the process is completed the oil is
drawn off while still hot, and then allowed to cool slowly in

Fig. 2.


MERUFACTURE OF ARTIFIOIAL BUTTER IN_NEW_YORK.-THE STEAMINGIVATS.
tanks placed below the steam vats. About 90 per cent of a mixture of olein, margarin, and stearin are thus obtained from a given weight of suet, the remainder ( 10 per cent) being, of course, the tissue and muscular and fiberous parts of the material.
The real fat being thus separated from the superfluous animal matter, the next step is the separation of the fluid olein from the solid margarin and stearin. One of the lower tanks, seen beneath thesteam vats in the large illustraneath thesteam vats in the large illustra-
tion (Fig. 2), containing the mix.ed fluid tion (Fig. 2), containing the mixed fluid
and solid parts of the fat, is moved to and solid parts of the fat, is moved to a small table in another part of the
room. On the table are small tin molds, room. On the table are smalltin molds,
six or eight inches long, four or five six or eight inches long, four or five
wide, and two or three deep, each- onc taining a small cotton bag, with suffcient margin of cloth to form a double lap from each side. Here may be seen the operation of bag filling (Fig. 3).
The partly crystalized and lumpy fat is ladied into these molds until full, when the laps of cloth from each side are turned over upon the top, and the material inclosed. The bags contain about two pounds each, and after using once are carefully washed to avoid any taint or rancidity which might inju riously affect the butter Our sense of smell being acute in some sense of we applied one of the bame directions, we applied one of the and sweet. This,
trils. It was clean and swe though apparently a small matter, the proprietors of the establishment have not overlooked. The floor, indeed, and all the articles in use gave evidence of care and cleanliness, which is next to godliness.
When the bags are full they are put between sheets of galvanized iron and placed in the oil press (Fig. 4), which is a combination of the toggle joint with解 pressure is graduallo from the pores of the cotton a fine yellow presently oil, which drips into a receiving trough at the bottom of the press, and is afterwards dipped or ladled into ordinary gal
vanized iron milk cans. vanized iron milk cans.
It is this oil, olein, containing in solution more or less margarin and stearin, from which the butter is now to be churned, as we shall presently describe. This expressed oil has neither taste nor smell, and is a very pure article of olein. Th:e residuum left in the bags is solid stearin, which, the proprietors informed us, is worth two or three cents per pound more than the ordinary stearic acid, and is used chief ly for candle-making.
We now come to the last operations connected with the manufacture of the artificial butter, to wit, the churning (Fig. 5), which is the same as the ordinary churning of cream. The churns have revolving paddles, and the oil on being placed in the churns is mixed with one fifth of its weight of sour milk. The churning operation is continued for twenty minutes, when the compound has assumed the semi-solid condition of soft butter, which a slight diminu tion of temperature renders firm. The churns are worked in a cool chaabber, rendered so by means of a reservoir of ice suspended overhead. The butter is now colored yellow by admixture of a little vegetable annatto, which is harmless, and after being salted is worked like ordinary butter on a working table, with a presser, as shown in the illustration (Fig. 6). The churning of the oil with the sour milk in creases its weight from the absorption of water, so that three pounds of oil will make four pounds of butter. From one hundred pounds of suet, seventy pounds of butter are produced, twenty pounds of stearin, and ten pounds of scraps. The change from the liquid to the semi-solid condition is due probably to some molecular change or oxida dition is due probably to some molecular cha
We tasted some of the butter thus made and the market. With the exception of a slight granular consistency, we could perceive no difference between it and good ordinary firkin butter. This peculiarity, it is stated, disappears after keeping for some length of time. The butter made in this way can be afforded much cheaper than the ordinary article, but it must not be supposed that the cow's occupation is forever gone. Suet is an article the supply of which is limited, and it is only in large cities, or localities where beef cattle are largely slaughtered, that it will prove profitable to engage in the manufacture of this artificial butter. The company expect, we were told, to enlarge their works to the capacity of some twelve tuns of butter per day. This is only about one tenth the quantity daily consumed in the city of New York.
The buiter made can be transported to and will keep in warm climates, owing, as before stated, to the absence of the rcadily putrescible compounds existing in ordinary butter. Shipments have already been made to South America; and as regards home consumption, it is said that hotels in this city, and even a fashionalile club, are customers of the company for this artificial butter.

MANUFACTURE OF ARTIFICIAL BUTTER.-EXPRESSING THE OLEIN

Preparation of Pure Chlorophyll.
"The plant used in my experiments," says F. A. Harsten, "was the ivy (hedra helix) which possesses two advantages frst,that it can be obtained at ¿ll seasons of the year; second, phyll of this plant is not easily decomposed by such agents a phyll of this plant is not easily decomposed by such agents as
light or alkalies. The leaves are chopped up fine and mixed


ANUFACTURE OF aRTIFICIAL BUTTER.-EXPRESSING THE OLEIN aves for the action of the benzole. The alcohol extract the water from the leaves and also the bitter principle (hederin)

the alcohol has been removed by pressing, the leaves are mixed with benzole, and let stand for 24 hours, in which time the benzole extracts the chlorophyll. The benzole is now pressed and distilled off. The residue remaining in the re tort is of a fatty nature and dark brown color. Three hun dred grains of leaves furnish about 8 grains of residue which contains fat, chloropbyll, and a yellow coloring substance This residue is boiled for 10 minute with ris 80 rains of 10 minutes with and 150 grains and 4 grain 4 or tered through 4 or 5 thicknesses of paper and a dark green alkaline fluid obtained while the insoluble fatty soap and the yel low coloring matter remain in the filter From the green solution the chlorophyl soap and soluble fatty soaps are separated by common salt, or nitrate of soda, and the soaps washed with solutions of the same salts. After the soap is freed from alkali, it is dissolved in water and sulphate of copper added. In this way a beautiful ly colored powder is obtained, which con tains chlorophyll oxide of copper and copper soap. It is washed rapidly to re move all the sulphate of copper, and then moved. The dry powder is boil, and the dried. The dry powder is boiled with absolute alcohol and then washed wit ether and benzole. These solvents remove all the copper soap and some of the chlo rophyll compound. The chlorophyll ox ide of copper which remains is suspended in alcohol and decomposed by a current o sulphuretted hydrogen. By exposure to theair, the alcohol evaporates, leaving the chlorophyll in the form of fine brittle grains of a dark green color, almost black It is insoluble in water, but dissolves in alcohol and hydrochloric acid with a very beautiful green color. This green colo differs, however, from the graen of th leaves, since the latter is modified by the yellow coloring matter.
I have the following grounds for considering the chloro phyll free from fats: 1. It was dry and brittle; 2. On heat ing it, no smell of acrolein was produced ; 3. It is easily solu ble in alcohol and hydrochloric acid
I have also prepared compounds of chlorophyll with lead and silver, but neither can be employed for preparing pure chlorophyll. The chlorophyll oxide of silver blackened easily in the light. The lead soap could not be removed so readily from the chlorophyll lead compound, by the use of absolute alcohol, ether and benzole, as the copper soap.'

New Plan for obtaining a Powerful Light.
Herr Edelmann, of Munich, has devised a very simple and satisfactory mode of obtaining a pswerful light, well suited for photographic purposes, if the materials employed be judiciously selected. He has found that the oxyhydrogen flame produced from common coal gas and oxygən at ordi nary pressure produces an intense light, of any desired color if, by means of it, we burn a mixture of picrate of ammonia with a suitable metallic salt
To this end a hollow cone of hard gas carbon-similar to that used in electric lamps-is prepared of the following dimensions: Hight, one and three quarter inches; diameter, one inch, tapering to three quarters of an inch, and pierced by a tabe tapering in the same direction from half to one quarter of an inch. This conical carbon tube is placed, nar row end down, upon an upright oxyhydrogen jet, the compound nozzle of which fits into the narrow end of the inverted cone of carbon. The oxyhydrogen jet is the usual kind of double tube, the coal gas issuing round the oxygen nozzle; and when the gases are ignited, they burn through the center of the cone, which then rese
furnace one and a half inches in depth. the number of intensely bright colored flames required. MANUFACTURE OF ARTIFICIAL BUTTER.-WORKING THE BUTTER PREPARATORY,TO PAOKING. results. For photographic purposes the in order to produce the desired effects, we spread over the inner surface of a cone, with a spatula, a paste made by rubbing together in a mortar picrate of ammonia, the metallic salt desired, and alcohol. The cones are then allowed to dry at ordinary temperature, and placed over the double tube when light is required. To produce the flame, the oxygen tube, which should be movable in a vertical direction, is raised as high as possible, the coal gas lighted, and the oxygen then turned on. By moving the oxygen tube slowly downwards, and regulating the gas supplies, the point at which the greatest brilliancy is propoint at which the greatest brilliancy is proobtained is very intense and steady while it obtain
lasts.
If a white light be desired, sulphide of antimony or magnesium filings can be mixed with the picrate of ammonia; but if it be desired to use the light for showing on the screen metallic spectra, the chlorides of sodium yellow, thallium green, iridium blue, and calcium are most suitable; while Herr Edelmann finds that the chlorates or nitrates of strontium red, barium pale green, and cop-
per deep green, afford the most satisfactory
antimony would be most suitable, but it should be mixed with the picrate of ammonia with caution.
This plan of obtaining a powerful metallic light is special ly recommended for illustrating some of the phenomena of spectrum analysis. At present it is usual to employ the spectrum analysis. At present it is usual to employ the
electric light for the purpose of projecting spectra on a electric light for the purpose of projecting spectra on a
screen in order to exhibit them to a large audience. The cost screen in order to exhibit them to a large audience. The sost
and inconvenience of the electric light is. however, so great and inconvenience of the electric light is. however, so great
as to debar many from trying to exhibit these beautiful ex. as to debar many from trying to exhibit these beautiful ex-
periments. Edelmann now proposes the above plan for producing intensely brilliant metallic. flames as a substitute for electric method, and states that he has succeeded perfectly in projecting the spectra on a considerable scale when using the very simple and inexpensive source of light above de-scribed.-British Journal of Photography.

## LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

## NUMBER 14.

BRUSSELS, September, 1873.
Leaving Berlin immediately after breakfast by expres train, after a ride of four hours across a level and frequently sterile country, which is remarkably devoid of interest,
we arrived at the pleasant and quaint old German town of HaNOVER.
Here we dined, and then spent two hours strolling about the prinsipal streets and the noble park, and calling at the celebrated polytechnic school, of which our venerable and dis tinguished friend, Dr. Karmarsch, is the head. The curious
architecture of the older buildings of the town, in which architecture of the older buildings of the town, in which
wooden framing with brick filling produce an odd and not unpleasing effect, contrast remarkably with the pretty cottages and fine modern residences which have been built in brick and stucco near the railroad station. Hanover is well known as the capital of the late kingdom of the same name, but is not less widely known as the birthplace of Herschel and the home of Leibnitz.
Resuming our journey toward Cologne, we were entertained by the conversation of an intelligent young Turk, whose place of residence was Constantinople, but who had left his home and his harem to see the great exhibition and to travel in Europe. We were pleased to learn that the women of his country are, at last, offered some opportunities of acquiring knowledge. There are twenty-four advanced schools for young women, in his native city, which are fully attended, the students being from fifteen to eighteen years of age. The seclusion of females is, however, quite as carefully looked to as ever, and our fellow traveller was great ly shocked and surprised by our accounts of the progress and of the aspirations of the strong-minded of the sex in the United States.
Crossing the Rhine on a fine specimen of a very bad kind of iron bridge, the lattice girder, the traveller finds himself in
cologne,.
or Cöln, as the Germans call the city. It is a curious old town, with exceedingly narrow and labyrinthine streets; but it contains almost nothing to attract the stranger, with the important exception of its great cathedral. This famous structure is well worthy of the reputation it has acquired, notwithstanding the fact that that it is still far from completion, although commenced six centuries ago. Its immense size and its symmetry of form, and the beauties of its architecture, make it probably the finest specimen of the gothic style in existence. The length of the building is something over 500 feet, its breadth 231, and the hight of the principal towers, when finished, will be 532 feet. The ridge of the roof is 250 feet above the pavement, the nave rises 165 feet, and the aisles 80 feet. No description can do justice to this magnificent and colossal pile; and only repeated visits and comparison with surrounding objects ena-
ble the traveller to obtain a just idea of its immensity. The ble the traveller to obtain a just idea of its immensity. The
gracefulness and the richness of gothic architecture are nowhere in the world, probably, more fully illustrated than in the cathedral of Cologne. The work of completion is now progressing rapidly, but the building has been so long in course of erection that the repairing of the decaying stonework of the earlier must accompany the labor of completing the later construction. The excursion up

## tHE RHINE

is always anticipated by the traveller in Europe with a degree of interest which is perhaps unequaled by that felt in any other part of his journeyings. And ha is probably seldom dissppointed. Our little party certainly was not, and the long sail from Cologne to Mayence, occupying the whole day, was one of extraordinary pleasure, while the return next day over the same route was hardly less enjoyable. There is probably no point on the Rhine at which the natural beauties of the scenery exceed those of our own noble Hudson where it breaks through the Highlands at West Point; no part of the Rhine can equal in its picturesque and wild beauty those northwestern examples of fine river scene-
ry, the Dalles of the St. Louis or of the St. Croix, and ry, the Dalles of the St. Louis or of the St. Croix, and
nowhere on the Rhine can be found any one spot of as great nowhere on the Rhine can be found any one spot of as great
historical interest as many that might be named in Great Britain; yet it may well be asserted that in no other part of the world can the intelligent traveller and the appreciative observer of Nature find such a combination of these attractions, in one uninterrupted series, as upon this splendid German river, between Cologne and Mayence. Magnificent scenery of ever changing but neverintermitted beauty, picturesque old ruins of castles, around which cluster the most interesting and important reminiscences of a thousand years of German bistory, and each of which is founded upon
some promontory or ctrages mountrin site whreh fiselif is of
ten the subject of an old and romantic tradition, or of some still more improbable but none the less interesting fairy tale, in which sprite or gnome or nymph lures an unfortunate victim to destruction or leads him to unimaginable bliss, are seen at every turn. Leaving Colugne, and passing Bonn, the noted Sieben Gebirge (seven mountains) rise into view, their rugged sides and ruined castles awakening in the traveller a sensation of mingled admiration, surprise,
and interest which is not again lost until he reaches Mayand interest which is not again lost until he reaches May-
ence. On the one side, at an imposing hight, is the splendid old ruin of

## DRACHENFELS

near which Siegfried, the hero of that noble but sanguinary ancient German poem, the Niebelungenlied, killed the dragon so many centuries ago. On the other side is Rolandseck, another fine ruin, which has been rendered famous by Schiller, who here lays the plot of his "Knight of GottenSchiller, who here lays the plot of his "Knight of Gotten-
burg." In the river we notice the island in which was imburg." In the river we notice the island in which was im
mured the beautiful girl who had supposed her long absent mured the beautiful girl who had supposed her long absent
lover lost forever, one of the thousands who fell fighting lover lost forever, one of the thousands who fell fighting
the barbarians of the East; and above, on the top of the overhanging precipice which forms the river bank, is the castle built by the lover after his return from a long imprisonment, and where he spent the remainder of his life, looking down upon the roof which sheltered his lost bride. Farthei on, the high rock Erpelerlei raises its basalt crest seven hundred feet above the river; and from top to bottom, wherever earth will lie and wherever terraces can be made to sustain them, it is clothed with a mantle of green vine laden with the wine-producing grape.
We pass the old city of

## coblentz

and, opposite, the immense fortification of Ehrenbreitstein with its four hundred guns and its immense range of outly. ing works. It is stated that this almostimpregnable strong hold has sufficient storage capacity to provision $8,000 \mathrm{men}$ for ten years, and that the cost of the fortification amounted to nearly ten millions of dollars. We pass the bridge of boats and go on up the river, meeting with beautiful gems of scenery and romantic ruins at every bend of the stream.
We pass the extensive ruins of Rhinefels, and the beautiful We pass the extensive ruins of Rhinefels, and the beautiful
remains of Rhinestein, the homes of the booty-loving and law-defying old robbers who, in ancient times, took toll of all who passed on the river. We pass around the projecting rock where, sitting high above the stream, the beautiful Lurlei, by her entrancing songs, draws the unfortunate fishermen resistingly into the raging whirlpool at her feet. Then we pass the two old castles, which, confronting each other, are called the "Mouse" and the "Cat." Near Bingen we see an island in the middle of the stream on which is an old tower, and, overlooking it from the river bank, is the equally old castle of Ehrenfels. Here, according to tradition, the rich and avaricious old Bishop Hatto (of Southey's ballad) stored his grain in the tower, and lived in comfort in
his castle, while the people, far and near, were dying of his castle, while the people, far and near, were dying of
famine. Holding his grain in expectation of a rich harvest famine. Holding his grain in expectation of a rich harvest
of gold when the highest attainable price should induce him to sell, the miserly wretch finally removed, for safety, to the tower where he could better watch his treasure, as well
as defend himself against the attack of the maddened people. He was there destroyed by an army of starving rats, which gathered from all directions to feast upon his stores, and to visit upon the wicked proprietor a righteous judg. ment. We pass

## JOHANNISBERG,

the source of the finest of Rhenish wine, and, steaming along through a more level and less beautiful country, we gaze with intense interest upon the scenes which were, centuries ago, so at+ractive to Charlemagne, and which were so often visited by his successors.
At Mayence we find another bridge of boats, and we watch the operation of opening and closing, to allow the passage of vessels, with some curiosity. The rapidity and ease with which a section is dropped down with the current and swung out of the way is as remarkable as is the difficulty and the slowness with which it is hauled back into its place. Near the bridge are several schiffmühle, grinding away very busily, and, about them, are several small boats, either bringing grain to be ground, or taking to the city the flour which has been prepared for the market.
Some distance lower down, we passed a dredging machine, anchored in midchannel and dredging most effectively, its machinery driven, like the schiffmühle, by great paddle
wheels turned by the current. With unusual reluctance we wheels turned by the current. With unusual reluctance we
left this beautiful valley of the Rhine, the nost fruitful of all regions of poetry and romance, and pursued our journey westward. A few hours were spent at

## AIX-LA-CHAPELLE,

an interesting old town in which we found another of the the great German technical schools. With a splendid building, erected by private contributions of public spirited citizens, a fine corps of instructors, and a small but well selected
and increasing stock of apparatus, and more than full of students, this school is doing its share of the important work which is so rapidly bringing continental nations into suc cessful competition with Great Britain, in industrial pur-
suits. The current expenses of the institution are defrayed by tine State.
Another moderately long ride by rail brought us across the frontier, and we made our next stop at

LIEGE,
Belgium, near which busy and pleasant city is the town of
Seraing and the great establishment of the Socitte Cockerill,
the world. It was this Cockerill company which exhibited the immense blast furnace blowing engine, which, with their lo comotive and marine engines, formed so striking a collection in the machinery hall of the great exhibition. The principal works are situated in the valley of the Meuse, six miles from Liége and upon a great coal formation which constitutes one of the principal deposits of Belgium. The works were founded by Cockerill Brothers, a half century ago, for the purpose of manufacturing steam engines and flax spinning machinery. The frst blast furnace was erected in 1826.
The establishment now comprises four collieries, produc ing annually about 350,000 tuns of excellent bituminous coal, thirty iron mines from which are raised 150,000 tuns of ore per year, five blast furnaces yielding 55,000 tuns of pig ron, four new blast furnaces for the production of Besse mer metal, which are still unfinished, two iron and one cop per founderies turning out 5,000 tuns of excellent castings a rolling mill which turns out 40,000 tuns of rails and other sorts of rolled iron, a large steel works containing ten Bessemer converters and producing 17,000 tuns of steel per annum, a forge which has an annual production of 1,500 uns, large machine shops employing 1,500 workmen, bridge and boiler shop in which are built 6,000 tuns of boilers and bridges annually and, beside all this, the company has, at Antwerp, a large shipbuilding yard.

## the seraing establishment

covers an area of 200 acres, and employs 9,000 workmen. On the place are over 250 steam engines, having a collective power of 8,000 horses. Two millions of dollars are paid an nually in wages, 350,000 tuns of coal are consumed, and the annual receipts from sales amount to tive or six millions of dollars. This immense establishment has grown up from the small beginnings of John Cockerill and mainly through his energy and business capacity. The great engineer is now deceased, and the works are carried on by the "Société John Cockerill" among whom, it is said, is no less a personage than the King of the Belgians. The coal raised from The coking is done partly in ordinary ovens, and partly in The coking is done partly in ordinary ovens, and partly in
Appold kilns, which are said to work finely. The coke is Appold kilns, which are said to work finely. The coke is
hard, clean, and bright, and seems capable of sustaining a barden clean, and bright, and seems capable of sustaining a Durden nearly equal to that
Pig iron for ordinary purposes is made, of very good quality, from ores of the neighborhood, but ores are imported
from Spain and from England for Bessemer pig. Molding from Spain and from England for Bessemer pig. Molding
sand, fire brick, and fire clay are obtained from the neighborhood, and thus the principal part of the raw materials used in the works is obtained from deposits closeat hand.
The castings made in the founderies are unusually smooth and clean. The work turned out in the machine and boiler shops is exceedingly creditable. An important feature of the practice here is the use of steel for nearly all moving parts of machinery. It has displaced iron almost entirely parts of machinery. It has displaced iron almost entirely
in forged work, and, to some extent, it is substituted for in forged work, and, to some extent, it is substituted for
iron in even cast pieces. This introduction of steel has taken iron in even cast pieces. This introduction of steel has taken
piace here more than at any other place which we have ever piace here more than at any other place which we have ever
visited, and the general success here met with may be taken as an indication of one of the directions in which improvement is going forward. The new steel plant will be expected to produce one hundred and fifty tuns per day of Bessemer metal. The riveting in the boiler and bridge work is, wherever possible, steam riveted. The work, in all departments, seems invariably well done, and is finding a market in all parts of Europe, and, to some extent, even in Great Britain and the United States.
The workmen are paid about three fourths as much here as in Great Britain. Molders receive about seventy five cents per day, puddlers a dollar to a dollar and a half, pattern makers seventy-five cents, machinists from seventy five cents to a dollar, riveters seventy cents, and foremen in the several shops from one to two dollars. A day's work is twelve hours, nominally; actually it is sometimes less and not infrequently more. A few women are still employed in the lighter kinds of labor.
The workmen of Belgium are probably more nearly equal in skill to the English mechanics with whom they compete than are those of any other European country.
R. H. T.

## Solidification of Nitrous oxide

According to Wills, nitrous oxide may be easily solidified by causing a rapid current of air to pass through tre liquified gas. Differing in this respect from carbonic acid, nitrous oxide may be kept liquid for some time in open vessels. Carbonic acid solidifies, as soon as it escapes fromits containing reservoir, because the tension of the vapor of the solidified acid, even at the moment of its formation, is considerably superior to atmospheric pressure; while liquid nitrous oxide attains $-133^{\circ}$ Fah. and solidifies at $-146^{\circ}$, so that the tension
of its vapor is weaker than one atmosphere. The density of of its vapor is weaker than one atmosphere. The density of
the liquid protoxide at $32^{\circ}$ Fah. is equal to 0.9004 ; its coefficient of dilation is very considerable. It is insoluble in water.
A Correction.-In our article on "Specific Heat," on page 208, current volume, the expression (lines 45 and 46) "Specific heat at temperature $39^{\circ} 1^{\circ}(\mathrm{T})=1(\mathrm{C})$," should read: "Specific heat at temperature $39 \cdot 1^{\circ}=1$; specific heat at temperature $\mathrm{T}=\mathrm{C}$."

Iv Saginaw county, Mich., a poor man named Reif, while boring a well, is repcrted to have been greatly frightened by the upward flow of gas, the escape of which shook the ap a flame fifty feet frigh.

Recovery of silver from Cyanide Baths. Dr. Graegeis states that there are many methods of accom plishing this object; but none have been so easily carried
out or have obtained enough of the silver as to be satisfacout or have obtained enough of the silver as to be satisfac tory. The process recently described by Ney, in which the silver was precipitated as a chloride by the addition of muri atic acid, had both these faults. The silver was not all pre cipitated, the subsequent treatment of the precipitate was not a simple one; and beside, the operation was atemely
with a strong evolution of prussic acid, which is extremely unpleasant to many persons, not to say dangerous to life
"By accident"" says Dr. Graeger, "I discovered a method of obtaining all the silver in a very simple and easy manner, and one that may be operated by persons who are not chemists. It is based upon an observation made by myself tha cyanide of silver is perfectly reduced to metallic silver by grape sugar, provided the solution contains no free alkaline cyanides (cyanide of potassium or of sodium). The cyanide of potassium present is destroyed by adding a suitable quan tity of a solution of green vitriol, which converts it into ferro cyanide of potassium. Then grape sugar will reduce the silver in the alkaline solution. In carrying out this method, the silver bath, which has become useless, is allowed to set tle, and is then decanted into a large iron kettle, where it is warmed, and protosulphate of iron slowly added until a slight precipitate (oxide of iron) is formed, which does not disappear on stirring. It is next heated to boiling and made disappear on stirring. It is next heated to boiling and made
strongly alkaline by adding caustic soda or potash, if neces sary; and a solution of grape sugar is then added gradually sary; and a solution of grape sugar is then added gradually
until the liquid acquires a brownish yellow color. The heat until the liquid acquires a brownish yellow color. The heat after which the clear solution is removed by means of a si phcn , and the sediment, consisting of metalic silver and oxide of iron, is thrown on a filter, washed, dried and ignit ex. This residue is then treated with nitric acid, which dis solves all the silver and but little of the oxide of iron. The very last trace of silver in the bath is thus separated and dissolved in nitric acid. To test this process, the following experiment was made: 085 gramme nitrate of silver was dissolved in 8 cubicinches distilled water, and chloride of sodium, sulphate of copper, sulphate of zinc, caustic soda and carbonate of soda added, together with enough cyanide of potassium to produce a perfectly clear solution. One third part of this solution was treated with a suitable quantity of sulphate o iron, heated to boiling, and the glucose added. The precipi tate obtained, when treated as above cally with chloride of sodium solution, showed 0.238 grammes
of nitrate of silver; this taken three times $=0.814$ grammes of nitrate of silver; this taken three times $=0.814$ grammes
instead of 0.85 gramme taken, or 84 per cent. A second experiment gave 94.5 per cent. These results are very favorable especially when we consider that we were dealing with a solution containing only 4 parts of silver in 10,000 of wate It is a striking phenomenon that not a trace of the copper which was purposely added to test this point, was reduced by the grape sugar."-Polytechnisches Notizblatt.

## 

## mproved Sheet Metal Roofing.

Eeler and Frederic w. Matthiessen, La Salle, Ill.-This in in the construction of roofs, and for similar purpose metallic arrangement of the corrugations in the direction crosswise to the pitch of the roof, also crosswise to the length direction of the gutters, eaves troughs etc. This fine corrugation may be made one elghth of an Inch deep by half
an inch in width, or in other proportions. It can be very fine and stil allow by its curvings the expansion and contraction of the metallic sheet in the direction crosswise to the corrugation, and thus allow of the bending of the sheets transversely to the corrugation sufficiently to permitt the
the various modes of uniting the sheets of roofing now practiced.

Improved Mode of Attaching Journals to Feed Rollers.
George M. Amsden, South Boston, Mass.-This invention consists in mak ing shafts with ends flaring conically outward, around which the rollers ar cast. Screws and nuts on the shaft just beside the rollers draw the journals tight in
cause.

## Improved Donbletree Equalizer.

Wm. Martin, Clarence, Iowa.-This invention relates to double trees that are usually pivoted to the tongue of a vehicle or the end of a plow beam to
allow a certain amount of vibratory movement. It consists in remedying the objectionable looseness on the beam or tongue and the want of a prop er limitation of the motion of the said double tree by extending rearwardily holds the doubletree steady until a greater force a friction device whic the other, and which, at the same time, regulates the extent of its motion.
Improved Bridge.
$\begin{gathered}\text { Benjamin F. Davis, } \\ \text { method of constre, Texas,--This invention consists in a nove }\end{gathered}$
meting the arches and chords of truss bridges by successive layers of planks nalled together, and at the extremities of banded and braced wedges.

Improved Adding Machine.
Solomon Pool, Chapel Hill,N. C. - This invention consists in the use of concentric circles wron center
plate, around a common center the eircles divided into two or more sec plate, around cotions it to ten spaqes each, and so arranged that when an
tions, and the section
tnner circle is turned ten spaces, it turns the next outer circle one space, by means of a drop catch falling through a graded opening in the partitton between them, from thn outer circumference of the inner circle, and catch
ing teeth arranged on the inner circumference of the circle. The teeth are ing teeth arranged on the inner circumference of the circle. The teeth are
so graded as to allow the drop, working loosely when down in the opening of the partition, to slide over them when the outer circle is turned backof the

Improved Car Coupling.
Wm. H. Waddell, Lyttleton Waddeil and John A. Lutz, Churchville, va.This invention consists in a spring-pressed lever in rear of drawhead, provided on one end with a foot plece by which the other end may be removed
from over the link hook and allow it to rise ; in a treadle and a grapple hook to hold the lever; in a grapple hook bar and trigger, so contrived that the latter lifts the former and allows a spring-pressed lever to turn back and ock the link hook; and finally in the comblnation of the essential parts so as to form an improved car coupling.

Improved Fruit and Egg Carrier. egz or frutt carrler made of a series of rows -The invention consists in an egz or frult carrier made of a series of rows of cardboard pentagonal cells, angied retesmes on the lisitie of the ent proceb of frame.

Improved Porter's Box.
Isaac Barman, Portland, Oregon. - This invention consists in a box for th of porters in stores, warehouses and similar establishments, the objec y them in their work. It has apartments, a receptacle for nails, stencil tencil brush, ink, etc., conveniently and compactly arranged.

## Improved Steering Apparatus.

William E. Thomas, Queenstown, Md.-This Invention relates to mean by which rudders may be worked insteeringships, vessels, or boats, and con-
ists in combining with the rudder a sprocket wheel, chain and reversely treaded screws rotating in oppos:te directions, also in connecting slidnng the pinions with screws.

Improved Lemon Squeezer.
Edward M. Sammis, Babylon, N. Y.-This invention has for its object to urish an improved lemon squeezer, so constructed that a whole lemo may be put into it and the juice expressed without its being necessary to out over the operator. The invention consists in the knife secured in the vity of a lemon squeezer; in the arrangement of the knife in the cav ormed in the knob or projection, and in side flanges which overlap th de edges and thus prevent the juice from squirting out.

## Improved Lamp.

John C. Wharton, Nashyille, Tenn.-This invention consist he con truction of a lamp in such manner as to interpose a body of water, o
ther incombustible fuld, between a small quantity of oil in contact with he wick and the main body of oil contained in a separate reservotr; also oas to supply the flame automatically with ollfrom sald reservoir throug the water to the wick : also, in certain cases, when a more complicated bu afer lamp is desired, to isolate the oil contalned in a suitable reservo fom all contact with any atmosphere whatever, thus preventing the po
bility of ignition within the lamp.

Improved Combined Chair and $\begin{aligned} & \text { SSecretary, }\end{aligned}$ C. Tayler, Thibodeaux, La.-The object of this inven
George C. Taylor, Thibodeaux, La.-The object of this invention is to urnish a convenient piece of furniture for family or business use, whic
ombines the advantages of an arm chair, secretary, writing table, draw s, etc., if used by a business man or invalid, with those of a work rece acle, scrap bag, needle and thread repository, etc., if used by a lady. The Whole is portable, and may be easily moved to any desired place. The in ention consistsmainly in combining an arm chair with a case or secretar aving movable pigeon hole arrangement, drawers, and folding leave the secretary to be lifted by the arms of the chair and rolled about.

$$
\begin{aligned}
& \text { Improved Coal Breaker. } \\
& \text { ressona, Pa.-This invention con }
\end{aligned}
$$

Improved Coal Breaker.
Rufus A. Wilder, Cressona, Pa.- This invention consists in casting teeth on both sides of the rack plate composing the cylindrical breaker, so that the plate, when
he other side.
Improved Harvester Reel.
Charles F. Goddard, St. Ansgar, Iowa.- This invention has for its objec furnish an Improved harvester reel, which shall be so constructed tha rain upon the platform. The invention consists in the reel shaft, made in two parts, provided with grooved and recessed flanged collars at their in
er ends. The reel shaft is made in two parts, having flanged collar er ends. The reel shaft is made in two parts, having flanged collars
formed upon their inner or adjacent ends, the flanges of which are secure belted to each other. In the adjacent faces of the flanges are the ree placed in a cavity formed to receive it in the central parts of the flanged collars, which cavity is made larger than the disk, so that the sald disk may be moved longitudinally in a recess with relation to the shaft. The inner art of the shaft is made hollow to receive a rod which passes through it and of the rod is connected one end of a lever. The other end of the lever extends back into such a position that the driver can readily operate it with is foot to adjust the reel bars.
Collecting Dust in the Manufacture of White Lead.
Micalah Tolle, St. Louis, Mo.-The object of this invention is to utiliz e lead dust which escapes in white lead factories after having passe through the separator in which the corroded lead has been separated from
the uncorroded lead, so that a considerable saving be accomplished, and the ealth of the workman be protected against the deleterious influences of the lead dust. The invention consists, principally, in the combination of an elevator with a casing or spout, through which the uncorroded lead it onducted on the elevator, which is submerged in a tank of water, so tha ne lead dust carried down from the separa

Combing and Mixing Tampico and Bristles George Willett, Burlington, assignor to Enoch B. Whiting, St. Albans the tampico and bristles are carried by endless belt carriers and so present ed to said holders that they project about half their length or more from the side as they are carried slowly along past a comb, so arranged and operated that it combs out the projecting portions thus subjected to it. The
invention also consists of a combination, in one machine, of two of these invention also consists of a combination, in one machine, of two of these movable holders and combs with endless carrier belts so arranged that they
take the partly combed stock from the first holders and comb, and reverse and transfer it to the second holders, so that the uncombed portion is pre sented to the second comb to be completed by it. The stock is latd on the endless carrier belts a little in advance of the holders, and spread and mixed as evenly as possible, so that it combs together. It may be run
through the machine several times till the mixing and combing are satis. through t
factory.

## Improved Clothes Reel.

Dennis L. Huff, Bay City, Mich evolving reels used for hanging clothes to dry; and it consists of an Irangement of tie rods or braces upon the upper side of the arms to re-
nforce and protect the spider in which the inner ends of the arms ar secured.
Improved Rotary Engine.
Francis J. Hollen weger, New Rochelle, assignor to himself, Joseph Mar n , and Charles F . Spaulding, of New York city.-This invention relates to two steam chambers and a rotary piston arranged between them, having
similar spiral cavities in their adjacent faces. The chambers are provided th passages for the induction and eduction of the steam, and with pas ages for conducting the steam from the Inlet to the outlet, passing suc-
essively through the cavities, so as to retain the steam and cause it to act by expansion upon the piston, causing said piston to make several revoluIdes of the piston, balances it and limits its friction. The chambers ovided with bolts to enable them to be accurately adjusted to faces of e piston, and with grooves for containing water of condensation fo ubricating said faces and packing them steam tight.

Improved Combined Water Cooler and Filter. Cased filter with a dead air space between; also of a partition in the inne case, dividing it into two compartments-one for the ice and the water to be filtered, and the other for the filtered water, with a filter in the bottom of the former compartment, arrangedin three divisions, through which the die one charcoal. The filter is also arranged with a sloping top, against which the filtering substances pack by granulation, so that the water mus pass through them.

Improved Machine for Sorting Potatoes. Davin. King, Garrettsville, O .-This invention relates to means where two inclined endless screens, the fine one arranged with its upper end proadi the unmerchantable petatoes. It also consists in using cords and wetgrits to oplerate with tiooks in rolidng the bags.

Improved Letter Envelope.
John D. McAnulty, No. 127 South Ninth, corner of Fourth street, Brook na, E. D., N. Y.-This invention consists of a lock formed in the flaps of he other, so contri a $T$ shaped silt in one, and a dovetail-shaped tongue nd then unfolding it, a practicable lock is formed, which, when sealed, annot be opened without mutilating the envelope to such extent as that
clearly show that it has been opened. An engraving of this device was clearly show that it has been opened. An engraving of this
published on page 590 , volume 28 of the Scientieic American.

Improved Machine for Making Window Sash. James Travers, Roslyn, N. Y.-This invention is a device for facilitating
the manufacture of window sashes; and consists in a guide for governing the position of the stiles and meeting rails of the sashes in sawing the ovetails and mortises for putting them together
Combined Chest Protector and Shirt Bosom Support. of this invention is to supply to the public a chest protector tiff material, so that the same may serve also as a support to the shir font, and not only keep the chest warm and comfortable but prevent als he ungainly folds and wrinkles of the shirt front. This invention consist milar fabric, and suspended around the neck or otherwise applied to the Improved Tyre Tightener.
Milo E. Jacobs, Winnebago, Ill.- The object of this invention is to pro
vide a device for tightening tyres, when cold, around the wheel withour re vide a device for tightening tyres, when cold, around the wheel without re-
moving them, so that the same are fully protected and strengthened when moving them, so that the same are fully protected and strengthened whe in use. It consists of the tyre with two ends, so constructed that they are
recessed to pass beside each other, and rest with face plates toward the ellies, to be tightened by means of a screw bolt passing through them.

Improved Manufacture of Dies for Punching. Robert J. Mullin, Providence, R. I., assignor to himself and Michael R.
fanley, of same place.-The object of this invention is to improve the die sed for the cold pusening of a more durable, require less stell, and off er a greater punching surface. Th hers so that the foce does not break off in hardening or when working with t. The invention, which is intended to overcome this trouble, consists in
welding the steel into the fron base, flush at the top and extending to within short distancefrom the bottom, so that there is a greater depho of steel an

Improved Machine for Dressing Wood Rails. Horatio G. Angle, Chicago, III.-This invention consists of a amail truck
n ordinary wheels, and have lateral guide wheels adapted to run along th ood ratls or stringers after they have been laid. Vertical and horizont otary planing tools are arranged in advance of the front wheels to plane he upper and inner surfaces of the stringers as the truck is moved along perated by belts and pulleys in the ordinary way, driven by steam or by y power. The depth of the cutiting on the upper surface is regulated a vertical adjustment of the frame on the front truck axle, and the adjust-
ment of the vertical cutters for turning curves and the like is effiected by a nent of the vertical cutters for turning curves and the like is effiected by Improved Eaves Trough Hanger. ire, passing around and over the eaves trough, and which is provide ith loops and fa
Improved Grinding Mill.
Ephraim H. Austin, Scott's Hill, Teinn.-This! invention pertains to 4 m ovements in grist mills of the ordinary kind, having spectal reference ner, and the means of connecting the water wheel, shaft and spindle of th unner.

Improved Turbine Water Wheel.
Angus A. Herriman, Greensborough, N. C.-The object of this inventio heet of water is admitted to strike the wheel without any space for expa ion or break of the water, whether the gate be fully or partially open, hat thereby the greatest a ttainable percentage of power with a partially drawn gate is obtained. The invention consists in the arrangement of
flexible wings or guide plates in connection with a circular sllding gate flexible wings
and the chutes.
Ovett B. Knapp, Brandon, Wis.-This invention
mping windmils in pumping windmills in which an oscillating regulator vane with automatic
apparatus for working it so as to take the wind or not, and another to tur he wheel which has non-adjustable vanes edgewise to the wind for sto ping it, are used; and it consists in having the oscillating regulator van rranged below the shaft on which it is suspended and around which scillates, whereby it is made more sensitive to the effect of the wind, an emiddle or above it.

## Improved Sled Brake.

Peter Cable, Elizabeth, Ill.-This invention consists in the arrangemen of a toggle lever having a rule joint and projecting arm or brace for attach
ment of the operating rod, whereby a dog pivoted to the runner may be aused to take into the snow, and is held in that position without contin ance of the force necessary to apply at the ourset.

## Improved Corpse Cooler

John Hoff man, T or the use of undertakers and others, an improved cooling and ventilatin
casket, through which a constant current of fresh cold air is supplied hich carries off all gases of decomposition, conveying the same to the imney, window, or other place, so that dead bodies may not only be pr erved a greater length of time without difficulty, but also without causing
nnoyance by foul and putrid odors. The invention consists of a caske noyance by foul and putrid odors. The invention consists of a caske
connected with ventilating plpes or tubes, and a cooler which sends a cur rent of fresh air through apertures of the casket, the cooler forming at the ame time one of the supports for the casket.

Inventions Patented in England by Americans, [Compiled from the Commisssoners of Patents' Journal.] From September 9 to September 18, 1873, inclusi utoratic Valve.-G. L. Kitson et al., Philad
last Furnace.-B. Ray, Hudson, N. Y., et al. Braciett.-J. B. Morrison, Brooklyn, N. Y. rake.-E.P. Jones (of Shell Mound, Mies.), London, England. Bridge.-J. B. Eads, St. Louis, Mo.
Bridge.-J. B. Eads, St, Louis, Mo.
Cloci Case, ETC.-C. W. Roberts, Chicago, IIl.
 Fed Water Indicator.-A.s. Goodrich et al., New York eity. bekling Machine, etc.-J. Rinek, Easton, Pa.
Paper Bag.-E. J. Howlettet al., Philadelphia, Pa
PUDDLING Process a ND FURNACE.- W. Sellers, Philadelphia, Pa., et at. Rubber Tubing, etc.-C. Righter, New York city
Screw Press.-G. B. Boomer (of Syracuse, N. Y), Screw Valve.-P. Corrigan, New York city.
STEAM Boler and elegraph Paper, etc.-T. A. Edison, Newark. N. J. Tor.-T. Alexander, Washington, D.C.
ransmitting Motion, etc.-T. A. Weston, Ridgewood, N. J
Raveling Sidewafe.-A. Speer, Passaic, N.J. raveling Sidewalk.-A. Speer, Passaic, N.
Wrindmile.-A. P. Brown, New York city.
Ventilating and Pumping.-G. W. Richar
w York eity



Cheap Engines and Pipe for Sale. See Brady Chicaro Exposition-Se on exhibition. C. Forsaith \& Cpring Hammer, there Wanted- New or second hand tools, of fol
Iowing description: One Lathe of about tain. ft. Shears; one horizontal Boring Mill to bore up to 30
in. cylinder ; one Planer about 22 in. by 32 in. 8 ft. bevel. in. cylinder; one Planer about 32 n. by 32 in., 8 ft. bevel.
Partics offering will name makers, state where tools can be examined, and the 10 w
Wanted - A machine to separate gravel from
and temper clay for brickmaking. J. B. Roberts, Box 49, Pensacola, Fla
49, Pensacola, Fra.
Wanted - Breech loading dbl. bl. C. F. Guns made. Only the Iron work fileo and ifted. No stock.
Makers, please address E.A.F. Toepperwein, Gunsmith.
Leon Springs, Bexar counit, Tex.
$\underset{\text { E. S. Proctor, Mosa Biluff, Texas, wishes }}{\text { nfor }}$ Sure cure for Slinping Belts-Sutton's pat-
ent Palley Cover is warranted to do double the work before the belt will silp. See Scl. Am. June 21st, 1873,
Paze 389. Circulars free. J.W.Sutton,95 Liberty St.,N.Y. Tool Chests with best tools only. For chr.
cular, address J. T. Pratt \& co.,53 Fulton St., New York. Turning, Sawing, or some article in wood
to make wauted. Charies Sperry, Westbrook, ct. For Sale-An interest in a well established,
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thousand dollars. The goods made are in extensive perranent demand, the machinerye used is is simple, and
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business and first rate article for manufacture, will find this a obona flae opportunity. Address F. C. Beach, Box
773, New York $\underset{\text { send address to N. A. Wright, oswego, N. Y. }}{\text { Kins }}$. please Steel
boro' $V$ It Stamps made by Douglas, BrattleEngines, Boilers, \&c., bought, sold and ex-
changed. All kinds constantly on hand. Send fur circular. E. E. Roberts, 52 Broad way, New York. Brown's Coalyard Quarry \& Contractors' Ap-
paratus for hoisting and conveyngmaterial by ron cabie Dovetailing Machines and Surface Planers,
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200 H.P. High grades-for sale at two thirds cost.' E. E.
 \& Sons, Philadelphia, Pa.
Engines, \&...receiived for repairs and saie.
10 per cent commssion and cost of repairs deducted when sold. E. E. Roberts, 22 Broad way, New York. Sewing Machine Needle Machinery-Groov-
ers, Reducers, wire Cutters, Eye Punches, de. Hendey Err, Reducers, , , ire cuterers,
Brothers, Wolcottrille, Conn.
Brothers, Woicotetvile, Con.
Machine Sho \& Foundry for sale-For Par-
ticulars, address Wamoner \& Matthews, Westmmster, Md. $\$ 50$ will buy the Riight of a Toy Gun,
huntinn scene combined. Address George Stackhouse, Mount Washington, Pa.
Key Seat Cutting Machine.T.R.Bailey \& Vail. English Roof Paint, all mixed in oil ready Patent Petroleum Linsed Oill works in all
paints as Boiled Linseed Oil. Price orly 5octs. a gallon, 116 Madden Lane, New York.
Rayner \& Bro., Thin Board Manufacturers,
13 Cannon St., N. Y., have of of Davis' Patent Chemical Metallic Paint - All shandes
Pround in oill and all mived reat for ground in oil, and all mixed ready for use. Put up in
cans, barrels, and half harrels. Price, 500 ., 81, and 81.50 per gal. Send for card of colors. New York City Oil
Company, Sole Agents, 116 Maiden Lane, New York. 2nd hand Engines, \& ©.... Buocht, Sold, and
Exchangea- 500 on hand. E.E. B berts,52 Broad way, N.Y. We eel all Chemicals, Metallic, Oxides, and

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Wire Rope. T. R. Biliey $\&$ Vall. Mining, Wrecking, Pumping, Drainage, or
Irrigating Miachnery, tor sale or rent. See advertisement, Irrigating achinery, for sale or
Andrew's Patent, Inside page.
Portable Hoistiug and Pumping Engines--
Ames Portable Engines-Saw Mills, Edgers, Burr Mills, Ames Portanbe Eurbengines- verical and Horizootal Engines and Bnilers; all with raluable improvements. Hampson,
Whitehill \& Co., Newubrgh steam Engine Works, Depot Whitehill \& Co., Newburgh steam Engine Works, Depot
98 Cortlandt street, New York. Lathes, Planers, Drills, Milling and Index
Machines. Geo. s. Lincoln $\$$ Co., Hartord, Conn. 2 to 8 H.P.Engines,Twiss Bros.N.Haven,Ct. For Solid Emery Wheels and Machinery, All Fruit-can Tools,Ferracute,Bridgeton, N.J. For best Presses, Dies and Fruit Can Tools
Bilss \& williams. cor. of Plymouth \& Jay,Brooklyn,N. Stave \& Shingle Machinery. T.R.Bailey \&Vail. Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The
larger sizes anve a range of over two miles. These arms are tndispensable in modern warfare.
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dies. Staping machine for Wood worlding. T. R. Bailes

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hill. Boston. Mass.
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ither
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righting, strong and cheap. All Hardware and Tin Houses have it.
Peck's Patent Drop Press. For circulars,
address Milo. Peck \& Co.. New Haven, Cona.


## 

C.C. . says: I have a hay press which works
nt the following manner: E and $E$ are levers with track wheels at the lower end, C and C', which ronlo on $\mathbb{X}$ Yas
a sill or track, and ratse the follower, W, up and down


In the hay box. $A$ chain is fastened to 0 pin in the side
of the track, $H$, then passes over a pulley at $B$, thence overa pulleyat A, $A$, thence overa second pulley at B,thence
over a second pulley at $A$, thence to the power $P$,
 be the pressure on $W$, when the levers are 3 feet farther
apat
at the bottom than at the top? The levers are 8
pet feet 8 fnches 1 long. What power is galned by the 4 pul
eeyswhen 1 e end lemsis involving the principle of this machine have
been solved in our paper on several previous occasions. seen solved in our paper on se ereral previrous occasions
But as this is rather an ingenious combination, perhaps
sme of our readers mas like to worl $\underset{\text { A hemishere has tits base ixied in a horizontal posi }}{\text { E. C. M. propor }}$ Ahemisphere has its base inxed in a horizontal posil
tion, and a body, under the infuence of gravity, moves down the convex silde of it from the highest point. How
far from the base will the body be when it leaves the far from the base wilit the body be when it leaves the
surface of the hemisphere ? TThis is a very inter-
esting problem which we throw open to competitiout esting problem, which we throw open to competition
among our readers, as we juage it will be mor proftable for them to answer the question themselves,
than to read our solution It will be necesars than to read our solution. It will be necessary to as.
sume some force acting which will impel the body down the surface of the hemisphere with a given velocity, as
it is evident that, if the body were balanced at the hig It 18 evident that, if the body were balanced at the highW. J. asks: Is there any kind of gas that
will cause iron to rust, or to torm a hard coatiog on it In 12 or 24 hours?
W. J. B. asks: How can I prepare umber from the crude earth?
W. asks: How is silk numbered? Woolen yarn is in runs of 1,60 yards to the pound, that 1 is, 10
runs sarn is 10 times 1,60 yards to the pound: cotton is
is on is 100 times 840 yards to the pound
Z. Y. asks Will some one please explain
the best way to make a wagon wheel ? G. C. MC. asks: How can I enamel bricks
so that they will not take in water from the outside of the wall?
C. M. N. asks: How can I make out the dates on worn coins? Haw aware of course of the ue use
of the microscope, but is there not something else?

$\underset{\text { E. . B. H. will find information for making }}{\text { a microscope onpp. } 276 \text { and } 288, \text { vol. } 27 .-\mathrm{F} \text {. w. P. cail }}$ make linseed oil varnish by following the directions on
p. 150 , vol. 23. The lifting power of balloons is detailed p. 150, vol. 28. The lifting power of balloons 18 detailed
on p. 89, vol. 25.-J. C. . W.
should consult a local geolothe tree was found making hara rubber on p. ssis, wol. 28. Type metal is
composed of lead, tin and antimony it can be readily composed of fead, tin and ant mony; it can be readily
cast in a plaster of Paris mold.-. . C. G. can make his
black -G. T. H. will tind the explanation of time around the earth on p. 401, vol. 23.-J. H. W. W. will fnd that the three
formulas are the same, and it matters not which form he uses. Muspratt Is undoubtedly correct
D.asks: What is mildew on textile fabrics? sists of microscopic fungi, the growth of which is pro ducen by motstare and a close atomosphere. .2. A reme.
dy for mildewed linen is as follows : Soap the surface
d. dy for mildeewed linen is as follows: Soap the surface
of the articles well and rub into them, while wet, Inely
powdered chalk.
S. D. E. says: I want to construct a 15 inch ron, and a grinder to match, and grind the surfaces to a proper curve: then Itin the reflector over, and put a
Sheet of pure nickel, say one thirty-second of an inch sheet of pure nickel, say one thirty-second of an in
thick, bet ween the shell and grinder, and heat tull the tin fows. When cold, I grind till the two meetall over, coat
with pitch, and polish. Will this make a good refector? with pitch, and polilsh. Will this make a good reffector?
if so, what should the focal distance be of the If so, what thoull the focal distance be of the above
size and how large must the small reflector be ? Greg.
 througha h hole in the large refector. Is this plan the
best? If not, what is? I want to construct the instrubest? If not, what is? I I wat to construct the instru-
ment in the most approved manner. I can easily polish ment in the most approved manner. I can easily polish
a refector, but eannot make a refractor. By making the base of cast iron it need not be over $13 / 2$ inch thick, if
 ish the iron, and nickel plate it after you get a goo
figure. The Newtonian planis most convenient. Th diagonal mirror reflects the cone of rays at right angle to the eyepiece at the side of the telescope tube. Your
previousinquiry was answered on page 139 of our curprevious inquil
J. W. asks: Is there any liquid which will
 pearance of the paper? Answer: Try a strong solution
of oxalic actid applied with a camel s hair brush. Heat the solution if
poison.
G. G. asks: What is a cheap and durable mode of putting git or silvered iettering on glass to
have it look neat and tasty? Answer: Glass can b gilded or silvered by blending powdered gold or silve
leaf with gum water and a little borax and applying the leaf with gum water and a little borax and applying the
mixture, or painting the letters on the glass by means of a camel's hair pencil. The article is then heated in an
oven or furace to burn the gum and vitrify the borax, oven or fursace to burn the gum and vitrify the borax,
which cements the gold or silver to ths surface. It is Which cements the gold or silver to
aiterwards polished with a burnisher
J. B. P. asks: How can I increase the draft of my furnace? The boiler has 39 three inch tubes; smoke
stack is 24 inches in diameter and 40 feet high. Would an addition of 5,10 or 15 feet, to hight of stack, help it?
Would a blower introduced into smoke stack above the Would a blower introduced hto smoke stack above the fiues be of use? Answer: Ap
usual way, below the furnace.
W. D. N. says: I am not satisfied by your
answer to Y. E. about his engine and shaft. If, as you say, a shaft were just strong enough to transmit 12 horse power, of course the thirteenth horse would be the
featherthat would break the camel's back. But I claim that twice (approximately) the power may be transmit-
ted without endangering the shaft, provided it be ample to bear the strain of 12 horss power. By referring to th
diagram it will be seen that the crank B and connectin

od D are at a right angle, at which point (if I compr end you) is the maximum moment of strain. The
crank, C , and connecting rod, E , are nearly on the back tenter,and consequently are exertingno particular forc $E$ begin to exert a twisting or wringing force upon th shaft A ; increasing it until they reach the point occ pied by B and D. In the meantime, B and D bave bee theirs, and at the same time; therefore it ine increase the shaft is not endangered because the force is no greater at any point of stroke, but more power may be ransmitted for the reason that this same maximu olution, each engine being an auxiliary to the other to assist it over the dead centers, without sufferinga relaxation or suspension of force (not motion) during any
part of the stroke or revolution. Answer: We will try

and make our meaning plain, by the aid of the accom panying diagram. In the case of the single engine, ex erting a pressure $P$ on a crank a b, supposirg, for the
sake of simplicity, that all the positions of the connect ing rod are parallel, the maximum twisting moment is
$\mathrm{P} \times \mathrm{a}$. Now add a second crank, at right angles to the first, with same pressure $P$ on the second crank pin and the position of maximum strain, or the point at which the greatest twisting moment is exerted, will be as.rep-
resented in the sketeh, when each crank is $45^{\circ}$ from vertical position. In, this case, the twisting moment $\mathrm{P} \times \mathrm{ab} \times \cos .45^{\circ}+\mathrm{P} \times \mathrm{ac} \times \sin .45^{\circ}=\mathrm{P} \times \mathrm{ab} \times 2 \times \sin 45^{\circ}=$ $\mathrm{P} \times \mathrm{ab} \times \sqrt{2}=\mathrm{P} \times \mathrm{ab} \times 1 \cdot 418$. Hence the maximum strain
C. H. H. says: I am running a axis engine Inch top saw. Sometimes the pistor rod makesa grating
noise in the stuffing box ; at cthers, it runs still. 1 Ihave the cuse? eaks, for want of oll, or because the engine is out of ne. It would be necessary for us to make an inspec Hon, before giving a decided opinion.
J. E. H. asks:
ardness, that 18 , what is there a about ope substance that
. What is the nakes it harder than another? 2 . Let iron and steel be the
substances: why Is it that, by heating Iron and plunging it into cold water, it will harden the iron? 3. How many elements will fre take out of wood? 4 . Will light pas
lhrough commen window $\overline{\text { glass }}$ aster or slower han or In the same time as, through the atmosphere? Answers 1. Hardness is the quality of bodies by which the mole cules maintain their relative positions when a force is applied. One substance is harder than another, when
it takes more force to disturb the position of its mole. cules. 2. When a metalis hardened by being tempered it is supposed that a different arrangement of the mole cules takes place. 3. Wood contains water, carbon
oxyen, and from to 5 percent tof ash. When the wood oxygen, and from 1 to 5 percent of ash. When the wood
is burned.all the constituents, except the ash, combine is burned. all the constituents, except the ash, combine
with the oxygen of the air. 4. Light passes through lass more slowly than through the air
 the direction north. By the familliar laws of the paral. 1elogram of forces, these two forces, relatively 5 and 12,
acting at right angles, produce the $\mathbf{r}$ esultant 13 , which

we are taught In works on mechanics 1s equitvalent to
the components 5 and $12 . \mathrm{This}$ we can admit in the ense of equal in effect, but as indicating measure o
orce, 13 is not equivalent to $5+12=17$ evidently has become of this force 4 , which appears in component and not in the resultant? Answer: It is well known that If we.apply a foree to produce motion in a given
direction, only so much of that force as acts in the re uired direction tends to produce motion. The rest o the force is, in general, apparently lost; but in realit it is converted into somethng else. For instance, sup
pose that pressure is applied to a pump handie in a d rection obilque to its axis; then some of the force eithe compresses the fibers of the handle, in which case it
converted into heat, or it produces greater pressure the pivot of the handle, when it appears as friction Take the case given in your illustration, and suppose
hata force of 13 acts obliguely on the pump hande that a force of 13 acts obliquely on the pump handle: 16
may be replaced by two forces, one of 12 , atright angle o the axis, tending to produce motion, and another Here we have replaceds force producing end pressure. naving a volume of 17 pounds, and it may be asked, ho id we obtain the additional four pounds? But the a
swer to this question is, quite evidently that we ressure by making the force act tn a different directio and that all the apparent gain was counteracted by the act that part of the increased force acted at right a
 air the radius." Elsewhere it says: "It follows, the that the area of a circle is equal to the square of the
radus multiplied by the circumterence, or $8 \cdot 1166$." eems to me there is great difference between the hal adius and the square of the che circere must also b ratio between circumference and dameter. The num ber 3.1416 I take to be the ratio. Can you explain this Answer: The circumference of any circle is equal the product of the diameter and the ratio of the circum
ference to the diameter, which latter is constant fo all circles, and is expressed approximately by the num
ber $3 \cdot 1416$. Hence the second rule, as quoted by you making the circumference of any circle and the numbe $3 \cdot 1416$ synonymous. is wrongly expressed. The numbe
$3 \cdot 116$, besides representing the ratio between the ci cumference and the diameter of any circle, is the circum diameter is equal to one. You can readily correct th rule, by inserting, after the term "circumference," thes
W. H. Y. says: In your answer to T. O'N. turn belt from one horizontal shaft to another. also ho zontal, at right angles to it, guide pulleys are generall employer Not so ceiving side of pulley be in a line with the delivering ide. Answer : The case you mention is a special on and does not militate with the statement that in genera yuide pulleys are employed. We areglad, however,
you have called attention to the matter ; and it woul have been better if we had mentioned the exceptional case in our answe
S. M. asks: In the case of a cast iron plun
ger, about 3 inches long and $3 / /$ inch in diameter, having to work perpendicularly, how will it do to have the hole around the plunger to make it work steadily? Will it
work true and run well if not oiled? The plunger is flat on one side of its section. Is there any other compo ition that would do better? Answer: The device men tioned by our c
factory results.
E. M. K. Says: On
xXVII, C. E.G., tells D. G. on his engine. We are running a 35 horse power engine
at 75 revolutions, belting on to 52 feet of 3 inch line at 75 revolutions, belting on to 52 feet of 3 inch line
shafting, and thence to a saw mandrel. When we are shafting, and thence to a saw mandrel. When we are
sa wing wide boards ( (ith a 5 inch saw) the governor doe not letsteam on quick enough. Why cannot we use
butterfly valve on it, and let our saw run well, instea of slacking down in the log from 12 to 24 inches? $W$ se the same engine to run a grist mill with - 4 run
tones, 2 grinding wheat and 2 corn. The saw mill stand still when the grist mill is running. I have been think ing of putting a string on the rod that carries the pea hat steadies the governor so as to open the governo
quicker. Will it work, and will the butterfly velve wor on this engine? The balance wheel welghs about 3600 on this engine? The balance wheel weigsi abour a,
or 4,008 lbs. Answer: There are governors in the market with valves that will give full opening. The butterily
valve, arranged as you propose, is often used. B. W. asks: Will wire rope wear well in
uspending clock weights? Answer: We think you will



 limposible oto
data ara sent.

 wish to varnish it. 2. Can you give me the recipe for
Worcestershire sauce? Answers: For a waterproof Worcestershre sauce? Answers: For a waterproof
varnish, take of india rubber 11/2 ozs., bisulphuret of car-
bon 1 pint; digest in the cold until the solution is combon 1 pint; digest in the cold until the solution is com-
plete. Or take linseed oill 1 gallon, dried white copperas and sugar of lead, each 33 ozs., , litharge, 8 ozs.; conl slowly and decant the clear portion. If too thici thin down with quick drying linseed oil. 2. We have determine its com
A. J. C. asks: Can water be carried over a
hill 50 feet high with a siphon, or can it be raised any higher with a siphon than it can be raised by suction?
If a siphon were laid over a hill 50 feet high and filled water run out, or would 33 feet perpendicular hight of
water remain in the tube with a vacuum in the tube water remain in the tube with a vacuum in the tube
above, provided the tube was perfectly airtight? Anwer: The difference of level between the highest point must never be more than the hight to which the water
will rise, by the pressure of the atmosphere, in a vacuS. M. L. asks: 1. Of what material should I make a palr of rollers for drawing stalks bet ween? The
drawing will make considerable friction. Should they be of iron or wood? Would wooden rollers, with a
covering of belting or rubber, be preferable to either? covering of belting or rubber, be preferable to either?
2. The stalks being of une qual size, it is desirable to have the rollers fitted in rubber sockets, so that they will open prevent me from having the rollers connected by geir
wheels. Would the friction of one roller upon the other we sufficient to draw the stalks through? It is not my
object to have the stalks crushed. 3. These rollers being about four feet from the driving power, can I derive the about four feet from the driving power, can I derive the
same desirable effects from the rollers by having them
driven by a small belt or endless chain as I would by driven by a small belt or endless chain as I would by
having them driven by gear wheels? 4 . Would I derive preparing a model for the Patent offlice, is it necessar that the model be made of the same material that it designed to construct it of in manufacturing for genera
use? Or may brass or other soft metals be used instead his object is by means very common way of effecting jecting teeth, which catch the stalks. 2. Rollers which wringers. 3. A belt would probably give the best results.
4. We think not, but could not answercertainly without osed machine. 5. Aithou for the Patent Office may be made of any convenient
material. N. S. A. asks: Does frost or hoar frost ever
form if the mercury stands at any point above $32^{\circ}$ Fah.? Answer: Hoar frost is frozen dew, and is never form at a higher temperature than $32^{\circ}$ Fahrenhelt. It is true,
however, that a thermometer placed in the vicinity might marka higher temperature, because frost is some imes.formed by rapid evaporation of moisture fro lower than that of the surrounding at mosphere. But if
some of the frost were collected and placed on the bulb of the
to 32 .
W. W. McC. asks: How are iron, copper,
and brass pipes bent for use on locomotive engines, such as for pumps, injectors, sand, heater and blower
pipes? Are they bent hot or cold; and if cold, are they filled with anything, such as resin, solder, or lead? Answer: Small copper pipes are generally filled with resin,
and bent without being heated. Curves in large copper pipes are formed by bammering the separate pieces be-
fore they are brazedtogether. Small wrought iron pipes can be bent by hesting them and applying pressure care-
fully. They are not generally filled with anything. cast iron, from patterns
T. W. H. asks for a correct rule for figurfeet of water, the fall being also given. Answer: Let $\mathrm{Q}=$ number of cubic feet of water discharged per minute.
$\mathrm{h}=$ hight of fall, measured vertically, in feet. $\mathrm{P}=$ horse power of the water. $P=(Q \times h \times 62 \cdot 5) \div 33,000$, or thehorse power of the water is equal to the product of the quantity of water discharged per minute, the hight of the fall, and
$62 \cdot 5$, divided by 33,000 . Example: What is the power of a water fall, 10 feet high, discharging 50 cubic feet of water per minute? $\mathrm{P}=(50 \times 10 \times 62 \cdot 5) \div 33,000=0.947$ horse power.
All this power cannot be realized by the application of a All this power cannot be realized by the application of a
hydraulic machine, but an amount, varying from 15 to 80 hydraulic machine, but an amou
C. D. asks: How is iron, such as porcelain
ketties, etc., enameled? What are good books on the process? Answer: Iron vessels are enameled by first
cleaning with dilute sulphuric acid ; the porcelain mixture is then appled in the form of a paste consisting of calcined ground sits, borax and potters clay; and whe over the surface, and then fused in a furnace. For de-
tails, consult Tomlinson's "Cyclopedia" and the article D. G. H. asks: 1. Is there an easy and thor ough method of curing memorane, such as bladder, so
that it will be dry, soft, tough, inodorous and durable 2. I have read in your journal of a new substance,
harder than asphaltum, for covering roads. Can you harder than asphaltum, for covering roads. Can you
refer me to it? Has any trial been made of it in your city, and with what result? How will it do for cellar
floors? 3. What is fuchsin? Answer : 1. There is no preparing goldbeater's skin, which is tedious and difffcult. 2. "The Coming Pavement"" was published on page 16 of our present volume. 3. Fuchsin is a brilliant
red color made from coal tar. See page 73 of our vol-
J. M. asks : 1 . Can a wire rope be employed
as a belt to run over two pulleys of 16 and 40 inches diamas a belt to run over two pulleys of 16 and 40 inches diamtimes a minute, so as to be trustworthy? 2. How should
the pulleys be made? Answers: 1. Yes. 2. Consult a the pulleys be
W. C. A. asks: What gives to Russia leath
rits peculiar finish and smell, and what kind of skin is used? Does the odor proceed from some article used
n the process of tanning or dressing? Why is it no in the process of tanning or dressing? Why is it no
manufactured in other countries as well as in Russia nswer: Russia leather, known as $j$ nucten R has long
nong
een esteemed for its valuable qualities of resisting been esteemed for its valuable qualities of resisting
moisture and the attacks of insects. Russia was lon
the only country the the only country that produced it, but it has lately bee made in Paris. Its odor and peculiar qualities are at
tributed to the oil of birch bark with which it is impreg. nated after tanning. In Russia this leather is manufac ured from all kinds of skins; but in Paris only sheep and goat skins are used. The method of preparing thi
article is not very generally known out of the seats o ight into the process: The dried skins are softened b oaking in waterforflue or six days in summer, ten o twelve in winter, and then well cleansed and deprived
of their hair, by steeping in milk of lime. During the the hair and epidermis are detached, they are worked
upon the beam with knives. The hair is removed from upon the beam with knives. The hair is removed from
ox and cow hides by piling them upon one another an thus inducing fermentation. For more delicate skins
bran water baths are sometimes used. The usua steeping and heating, etc., are afterwards given, and
hen the clean skins are introduced into a vat, holdng a fermented menstruum of rye, oatmeal, salt an until raised. The tanning process is then begun by first
und teeping the skins in an infusion of oak or willow bark, and afterwards they are interstratified in a tan pit with layers of coarse willow bark, and charged with th
liquor of the last steep. Fresh bark and solution ubstituted for the exhausted material, every fifteen to wentydays, and from three to six such changes are re-
quired, according to the thickness of the pkins. Ver thin skins get but two. After this tanning process, the eather is immersed for a day or two longer in a thit
paste of oatmeal, salt and water to remove its rigidit and then cleaned and allowed to drain. The currying
then begins. The moist leather is placed, grain side downwards on a table and treated with a mixture of oil
from sea calves and that distlled from birch bark. On part of birch oil and two parts of the other is the stan dard composition. A bout 9 ozs. of the mixture are used to each medium sized skin, and it is laid on carefully in
a uniform and entire coat. The skinsare then stretched eds in open shed and left so till dry
B. F. W. asks: Is there any way of dissol
ng gum benzoin so that it will mix with linseed oil? s there any way to harden the surface of common win dow glass? If so, how is it done? Answer: Gum ben
win will only dissolve sparingly in linseed oil. Dige the gum in the oil with frequent stirring. 2. There is no method, that we are aware of, of making the surface
window glass any harder than it ordinarily is, yet pre erving its transparency.
P. O'B. asks for a formula for preparing solution of gum arabic. This mucilage seems to be a by the action of dilute boiling acids, or by aninfusion of When potato starch is exposed to a heat of about 400 Fah. You can make gum dextrin, on the large scale,
by observing the following process and proportions Malt (crushed small) $1 \mathrm{lb} .$, warm water 2 gal., mix, hea the wnole to $145^{\circ}$ Fah., add potato starch 5 lbs.,raise th liquid becomes thin and clear. Then innstantly run of After boiling 3 or 4 minutes, filter and evaporate to dry hess by steam h ?at. There are various other processes, but we cannot det termine whether
reasonable profit by manufacturing
J. F. asks: Can a man give power enough
to saw cord wood by a cog wheel with 120 cogs on which s a crank, a pinion wheel with 18 cogs, and a balanc diameter for a drive wheel, with a belt attached driving
the saw, the pulley on the saw shaft being 7 inches diameter? Answer: Yes; but as there is always a loss
from friction, etc., with every connection, he can proba-
bly do better with the old fashioned buck saw and horse If he is sound in the back.
M. L. L. says: When we see a chain of lightning pass. from the clouds to the a chain of light-
tance of four miles, we feel no jar until we hear the retant. What is it that causes the jar and wakes the win-
port.
dows rattle? Is it caused by the sound passing through the air, or is it caused by the electricity coming in con-
tact with the earth? Answer: The jar that y cu speak E. P. M. asks: What are the inside dimenions of a square box flume, one mile in length, to be
placed under ground and capable of carrying from 1,000 to 1,200 or 1,500 inches of water, it being fed from a rester in the reservoir overcome the friction in the pipe so as to give an outlet to the water on a level with the bot-
tom of the reservoir? Answer: You do not furnish enough data to enable us to determine the size of the
the box. In our article on "Friction of Water In Pipes," on page 48 of our current volume, you will ind information as to loss of head. The box should be set so as to
preserve the level or fall. A. L.R. asks: 1 . Does not an inside cylinthan an outside cylinder engine of the same size? If so,
is not an inside cylinder engine better as a passenger locomotive? 2. What good book would you recommend
on locomotives? Answer: 1 . We think not. 2. Weissenborn's work, now in course of publication.

 loading rifled cannon and small arms? Answer: 1. Use
spelter solder and sal ammoniac. 2. The specifications and drawings issued at the Patent Office are divided into classes, and those of any class are sent for ten cents
each. Breechloaders are in class 18 . We cannot advise
E. T. L. asks: Where a book of recipes is
compiled from various sources, and few if any of the recipes, processes, etc., are original, does the copyright
of such a book protect it from being published in part by others, or prevent others from copying from it? I other words, what does the copyright cover in such a
case, the whole book, the arrangement,or only the title? Answer: Matter which has already been published can
no be protected by copyright. The copyright of such book as you mention woulc cover the title and the or
W. A. B. cannot remove the scale from his
boiler. Answer: Send us a specimen of the scale.
W. S. P. asks. 1 . If an engine of sixteen another engine of same dimensions, will the engine No
which is worked by air have the same number of horse ower as engine No. 1? 2 . If so, what temperature wil een the two engines? 3. If theair be exhausted in large pipe or tunnel, 4 feet in diameter and 100 yards ong, open at the end furthest from the exhaust. What
would be the telnperature in any part of the pipe o
unnel? 4 . Will compressed atmospheric air work oncentric rotary engine? Answers: 1. No 2 . You wil find a table of temperatures due to pressure on page 155
current volume. 3 . This question could not be answered ithout knowing the size of the compressing cylinde
P. J. T. says: What are the proper dimenlease state diameter and pitch of screw wheel. 2. What
ized boiler is best suited for the same: Answer: oat from 25 to 30 feet long. Screw from $1 / 2$ to 2 feet in ameter, 3 feet pitch.
H. A. F.asks: How can I cure a dog that i nswer: Your animal is probably suffering from mange Administer flowers of sulphur internally, and wash ex
T. R. F. asks: Can any of the readers of th phuric acid $\left(\mathrm{SO}_{3}\right)$ and nitric acid $\left(\mathrm{NO}_{5}\right)$ can be seen? AnWer: We have no dcubt that Professor Chandler of the
chool of Mines, Coiumbia College, would give ou young correspondent an opportunity to see
wants In the fine iaboratory of that institution.
C. E. asks for a description of the vulcaniz zing process would be too lengthy for this place. It
onsists incombining sulphur or the mineral sulphure consists in' combining sulphur or the mineral sulphurets of sulphur on caoutchouc was made by Charles Good ear, of New York, in 1842. See specifications of pa England, 1843.
W. F. H. asks: Is cider boiled in an iron rought to the boiling point, then skimmed and straine nd barreled up tight, will it keep sweet during the sum
mer Anser: We would not risk boiling cider in an ron kettle, either as regards health or for the purpose
f preserving it. Boiling would cause its change to vi gar more quickly than anything else. We will give yo process which has proved successsul, but which the
rade may consider trade secrets. To 1 barrel of new cider, add $1 / 2$ part sugar and 2 handfuls of fish sounds to
clarify. Let stand 2 weeks in cool place, then rack off ato a well washed cask or barrel, and add from 1 to hen rack off into another barrel. of whisky, stirring well, then bottle. This cider wil eep sweet through the summer
J. S. asks: Is a safety valve 3 inches in di sin in diameter, with four 12 inch flues in each? 44 inch do any sized boiler? This is my rule; is it correct? Fro
and six tenths to eight tenths of a square inch area of valv for each square foot of grate surface. Answer: We ex-
pect soon to publish some remarks on the proper pro-
portions of safety ommon use. You will find some rules in back number of our paper. Your allowance agrees well with th
H. asks: Can you suggesta cheap and quick
method of restoring a bady gmoked celling other than craping it? Answer: Wash the celling with a brush
J. W. asks: What are the principal surface
ndications of a lead or silver vein, and does said vein al ways keep in one direction? If so, will it not termi-
nate at some point? Answer: The ores of silver belong hiefly to primitive rocks, and occur in veins which trav greenstone, sienite, hornblende and porphyry. They
have also been observed in veins which traverse gray wacke, compact limestone, etc., but seldom or never i more recent secondary rocks. Galena, or sulphuret of most frequently in secondary rocks, especially in com-
pact limestone. In Silesia, galena occurs in a bed of brown ferruginous marl, in the famous mines of Mis souri in red clay, often marly, containing masses of
quartzand resting on limestone; in Pennsylvania in limestone; in New York traversing a slaty rock; in Massa-
chusetts at Southampton the bulk of the vein is quartz in Maine in granite. Veins are often divided into sever branches which sometimes terminate in the contiguou
rocks and sometimes wind and return into the principa
W. asks: What is the difference in the same ball 100 feet under water? Answer: Under water its weight would be diminished by the weight of a
equal volume of water. C. F. H. asks: How can I guardagainst the and belts used in grinding and polishing iron and steel
Is there any kind of shield, that can be worn by a work Is there any kind of shield, that can be worn by a work
man, that will prevent the fine metallie particles from inding access to the lungs? Answer : Put a hood ove
the wheel and run a small pipe to an exhaust air blowe The suction will take off all dust. This plan is used in dust framishments, one
A. F. G. says: I accidentally found that I
can temper gun or other springs under the hammer by can temper gun or other springs under the hammer by
using the following recipe 1 oz. corrosive sublima
and 1 oz. sal ammoniac, a few handfuls salt, dissolved in water, putting fine salt in the smithy fire while at wor Dip your hammer in the solution and keep the anvil wet
all the time. Work the steel till nearly cold. This will sive the required temper without any other process.
Answer Ans wer: We do not think that your chemicals hav
much to do with your success in temnering steel the welding, hammering and gradual cooling have D. R. K. states that the lamp black in his Answer: There is no method of preventing the lamp
black from rising to the top, unless you make the fluid hick enough or of sufficient consistency to hold it, a ng ink, which we hope will prove better and cheape redness in a covered vessel), $1 / 4$ oz., triturate with good black ink
portions.



 | Inpe? What per cent of volume could be elevated to |
| :--- |
| thath |

 on such a matter without knowing more about it.
B. P. asks: Is there any method by which
can utilize the domestic supply of water for motive can utilize the domestic supply of water for motive
power? Would a smallturbine wheel attached to the water pipe furnish sufflcient power to run three print ing presses? Answer; A small turb'ne would do the
business. Some years ago we witnessed the operation of the large presses of the Traveller newspaper in Bos-
ton by means of a turbine, and probably you can get the nformation you wish at that establishment.
H. asks: Can I warm a room $15 \times 20$ by the
. 15 of a gas stove in order to make it sufficiently comortable for a sitting and sleeping room? Answer Unless your ioom is exposed, or has a large glass window
surface, you could probably make it comfortable by eans of a gas stove. But unless you can provide
mall pipe to carry off the products of combustion, we ould not advise you to use it.
G. A. W. asks: 1 . What are the uses of col-
lodion, and (2) of what is it made? best solvents for the same? Answers: 1. Collodion 1 ion with chemical agents that are sensitive to light. is also used in surgery, both in the natural state and com oined with medicinal substances. As a dressing fo wounds, it unites the cut or torn surfaces closely, an
revents the action of the air; and it being transparent the wound can be inspected when necessary. 2. Collo dion is gun cotton or pyroxylin dissolved in a mixture o
alcohol and common ether. Pyroxylin is made by im nersing clean carded cotton for 4 or 5 minutes in a mix ure of equal parts of concentrated nitric and sulphuric acids. The cotton is then squeezed free of acid, $a_{2}$ ter
wards washed thoroughly and finally carefully dried $b$ hot water or steam at a heat not higher than $180^{\circ}$ Fah
3 Collodion will dissolve Venice turpentine, castor oil
A. B. asks: How is fire communicated to he gas in a kerosene lamp, thereby causing an explo
ion: Is it through the wick, or does it take fire from he heating of the lamp? Answer: Generally there a leak; and when the oil gets low, the space above it i
filled with gas, which is thus readily inflamed. In the
R. W. asks: How can I make blue and glazing without melting the ingredients into glass be
ore it can be applied to the work? Answer: A glaz ore it can be applied to the work? Answer: A glaze
or common earthenware is made as follows: White ead (pure) 53 parts, quartz or ground Aints 36 parts, parts; reduce to an impalpable powder, grind with water
to a very thin paste, dip and fuse. This may be colored lue by oxide of copper, added in quantities accordin hrowing common salt into the heated furnace containing the ware
T. W. D. asks: What substance is there heat, will oleach vegeta ble substances on a large scale ulphur will not do. Answar: Chlorine is probanly th ost effective bleaching agent known; and in the form can use gaseous chlorine instead of the usual solutio of chloride of lime, and in the same way as sulphurous
acid gas. The vegetable substances must first be boiled a weak solution of soda or potash to remove resinous matters. grease, dirt, etc., and then hung up after wash ng, in a capacious room, into which chlorine gas is ad
itted. You can make chlorine as folluws: In a lead n retort, capable of being heated by steam underneat ilx cautiously oil of vitriol and water each 7 parts, an
ll mixed intimately with peroxide of manganese 3 parts
The gas comes off slowly at first, but a gentle hea
J. W. H. says, in reply to H. M.. who asked milk or cream, the yolks of $18 \mathrm{eggs}, 11 / 2 \mathrm{lbs}$. of sugar, an gallon of vanilla ice cream. Any other flavor may be
used. Takethe yolks and the sugar (well pulverized) nd beat them yoll together the sugar (well pulverized and beat them well together. Mask the beans well and
add them. Put the milk over the fire, boil it , take it off, add the eggs, etc., and again boil it, being very caref
ot to burn it ; in a few minutes take it off. Let it cool, after which you may freeze it in the ordinary way and you will have nic
J. D. replies to a querist, who asked if a 12
horse power separator will run harder with tumbling stand with rods what 10 will do with a belt. I know this by experience.
Minerals, etc.-Specimens have been re ceived Îrom the following correspondents, and examined with the results stated
I. O.-Your pebbles are quartz. The largest
ored by oxide of iron. They are of no value.

## COMMUNICATIONS RECEIVED

The Editor of the Scientific American acknowledges, with much pleasure, the re ceipt of original papers and contributions pon the following subjects
On Patent Systems. By T. W.
On the Marsupialia. By N. B. H
On Flying Spiders. By T. C. E.
On the Witch Hazel. By S. F. C. On a Proposed Balloon. By J. C. W
On Cooking Stoves. By D. R. W. On Cooking Stoves. By D. R. W.
On Poisonous Undershirts. By J. N. On Patent Rights. By H. A. W. Also enquiries from the following
Correspondents who write oask the address of certai manufacturers, or where specified articles are to be had
also those naving goods for sale, or who want to find mountsumficient to cover the cost of publication unde the head of "Business and Personal." which is speeiall
\$rientifir Ammican.
[October 18, 1873.

| [OFFICIAL.] |  |
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| Letters Patent of the United States <br> were granted for the week ending | Packing, piston, C.A.Hodge.............................. 142,914 Padare floats, adjusting, J. B. Baptista............ 142,835 |
|  | Pail, milking, A. J. Johnson....................... 142,977 ${ }^{\text {Pa }}$ |
| were granted for the week ending |  |
|  | Pile supporter, C, West......................................... 142,972Pinchers, die, W. E. Snediker...........................142,955 |
|  |  |
|  |  |
|  | W8, forming, H. .B. Morrison .............. $14,2,2929$ |
|  |  |
| Anchor, C. A. Chamberlin........................ 121,769 |  |
| pit shield, J. | Planing cutter head, J. D. Kimball.............. 14,7,94 |
| tie, G. Brodie |  |
| Bale tie, F . | Planter, corn, M. Knickerbocker................. 142,922 |
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