a WEEKLY JOURNAL 0F PRACTICAL INFORMATION ART SCIENCE, MECHANICS, CHEMISTRY, AND MA NUFACTURES.


## IMPROVED UNIVERSAL MILLING MACHINE.

The universal milling machine has long been known as one of the most useful of machines, on account of its adaptation to produce a large range of work in the making of small tools. It is readily applied to the execution of the endless variety of small jobs which, without it, have to be done, in every machine shop, by hand labor. The size of milling machines heretofore made has been suitable for the work upon twist drills, mills with spiral or straight teeth, the cutting of small gears, grooving, slotting, and all ordinary operations of milling upon tools usually employed on sewing machine work and other light machinery, and also by gun makers.
The machine represented in the engraving is of a larger size and has important additions to enlarge its range of work. It is provided with an adjustable center for supporting the end of the arbor carrying the cutters or mills. By the use of gearing upon the head of the machine, it is capable of making very heavy cuts. The anti-friction form of spindle and boxes are retained, and both spindle and boxes are of cast steel, hardened and ground. All the motions for producing angles, spirals, and bevels in use upon the smaller machine are applied to this larger size. The apparatus is especially designed for use by engine and locomotive builders, and upon a heavy class of machine tools.
Further information can be obtained by addressing the makers, Brown \& Sharps Manufacturing Company, Providence, R.I. The machine itself may be seen in the Centennial Exposition, in Machinery Hall, where it is located near the large Corliss engine.

Now. Test for Nitric Acid in water Nitric acid is one of the few acids all the neutral salts of which are soluble in water, rendering it impossible to precipitate it as we do sulphuric and other acids. A large number of tests have been proposed, and several are in use, a very delicate one b ing brucine to which it imparts on intense ing brucine, to which it imparts an intense red colon. Professor A. Vogel, of Munich employs gold leaf, which dissolves in the
aqua regia formed on adding hydrochlor:c aqua regia formed on adding hydrochlor:c
acid. If $1 \cdot 2$ cubic inches of water be mixed acid. If $1 \cdot 2$ cubic inches of water be mixed
with hydrochloric acid and golf leaf, and evaporated, a large percentage of nitrates is indicated by the gold leaf growing smaller, and the solution turning yellow If the quantity of nitrates is small, the gold is detected by chloride of tin; and even when very little gold has been dissolved, a light red precipitate will be noticed on standing. The advantage of this is that no sulphuric acid is employed, as this frequently contains nitric acid and other oxides of nitrogen, which make the reaction doubtful.

The Hog Bouncer Novel and Userul Invention.
The above is the name of a simple device invented by the cattle yard men at West Albany, New York, to induce hogs to move, from the cars in which they are transported, into the yard. Pigs, as a rule, are not of accommodating dispositions; and when it comes to prevailing upon a car load of them to move along upon a narrow gangway, the first ones that start upon the plank are apt to decline to proceed further, and so block the egress of the rest. This necessitates an astonishing amount of patience and beating, besides unlimited strong language, and of course often delays a cattle train for some time. The new invention for persuading the animal to pass on is the hog bouncer, made by bringing one end of the gangway plank to a firm support; then under the other end, two double car springs are placed. A powerful lever and a spring catch complete the device. Before the car door is opened, the platform is carried down so as to compress the springs by the lever, and the catch is hooked. The hogs are then allowed to pass along the platform, and, so long as they move along properly, the plank is undisturbed; but as soon as a crowd congregates and vociferously objects to going further, the catch is sprung. One end of the platform fies about three feet upward, and the result is a shower of living porkers, shot over the heads and upon the soft bodies of the drove. They are seldom injured, but vastly astonished; and it is needleas to add that the blockade is at once dispelled. The drovers find this device, ridic-


## UNIVERSAL MILLING MACHINE.

candidate be condemned physically, he will not be examined further. The passing of an examination must not be con sidered as giving assurance of appointment, as the departmen reserves the right to select persons of the highest attain ments, in case there should be more candidates than vacancies. A candidate for an appointment as second assistant engi eer must not be less than twenty-one nor more than thirt ears of age; he must be of good moral character and co ect habits; he must have worked not less than eightee onths in a steam engine manufactory, or else have served ot less than that period as an engineer on board a steame rovided with a condensing engine, and must produce fav rable testimonials from the director or head engineer as to is ability; he must be able to describe and sketch all the ifferent parts of the marine steam engine and boilers, and explain their uses and mechanical operation, the manner of putting them in operation, regulating their action, and guarding against danger.
He must be well acquainted with arithmetic, rudimentar mechanics, write a fair legible hand, and have some know edge of the chemistry of combustion and corrosion.
Candidates who exhibit the highest degree of practical ex erience and proassional skill will
Any person producing a false certificate of age, time of ervice, or character, or making a false statement to a board of examination, will be dropped immediately.

## The Clematis.

Few plants, of late years, have received more attention than the clematis for out-of-door decoration, and few are better adapted for cultivating as climbers in cool greenhouses, for covering some unsightly object in the pleasure grounds, for training on a trellis, and for training up the posts of the veranda. The gorgeous flowers of most of the varieties are really very attractive, the colors of the different kinds being white, blue, pink, and purple. The flowers of the native white, blue, pink, and purple. The flowers of the native
one, c. virginiana, are small and inconspicuous, of a greenish one, c. virginiana, are small and inconspicuous, of a greenish
color. C. vitalba, or traveler's joy, is one of the most ramcolor. C. vitalba, or traveler's joy, is one of the most ram-
pant growers in cultivation, and useful for covering quickly
any large screen or trellis. Its flowers,
however, are small and unattractive. From China and Japan have been introduced the most showy kinds we have, and from which have been raised most of the excellent varieties now to be found in our gardens. Of these, c. lanuginosa is the type. From $c$. patens, a white-flowering one, have also bee raised some fine varieties
The soil most suitable for the clematis is a well enriched, deep, open loam. There is no use in planting in poor soil, and expecting success. During their season of vigorous growth, they luxuriate in plenty of liquid manure. Attend regularly to the training o the young shoots, as they soon get entangled into such a mass that it is almost impossible to separate them. A beautiful position for training them is on some large rock in some open exposure, where they generally bloom freely, and form an inviting object. The propagation of the herbaceous kinds is ac complished by dividing the roots just as they commence to grow. The climbing kinds are generally propagated from layers and cuttings, although, for the purpose of giving more strength to weak varieties, and to produce plants quickly, budding and grafting are resorted to, using for a stock c. flammula a native of Eurone, from which have been raised some good varieties. Cuttings of raised some good varieties. Cuttings of
well firmed young wood root most freely, especially if taken from plants growing in greenhouse. They should be inserted in sand on the benches, or in pots, and get a good, brisk bottom heat, when they will soon root, and, if potted and grown in a genial temperature for a short time, then placed where they can receive more air, and keep in a cool house for the first year, will make excellent plants for putting out of doors the second year. Layering is per formed upon well ripened shoots of that year's growth by cutting about half through the shoot, just under a bud, and slitting an inch or two along; then pegging into a pot filled witb some porous soil. As soon as well rooted, separate from the parent plant well rooted, separate from the parent plant.
and treat as described for cuttings. If the layer should not be well rooted in the fall cut off the shoot and insert as a cutting giving a gentle heat, when it will soon emit roots from the cut portion.
Pruning should be performed with caution on the climbing varieties which produce flowers on last year's young wod, endeavor always to preserve as much as possible of . Such kinds as produce flowers on young wood of same ear should have all weak shoots thinned out, and buds that will produce good strong shoots encouraged.-Cultivator and Country Gentleman.

Demand and Supply in Invention
An interesting example of the effect of the demand of a mechanical product in securing a supply is illustrated by a recent inventor's experience in his endeavors to procure stee springs of great size and power. It appears that an English nventor has been actively engaged for some time in the con ruction of a tramway car, to be run by the motive power exerted by steel springs. The reports state that since his earlier experiments Mr. Leveaux has, by indefatigable per severance, induced the spring makers to astonish themselves by their productions. A band of steel has been rolled which, when tempered into a spring, will give a draft of 3,000 lbs. Another single band of steel has been rolled having a width of 4 inches, and a length of 184 feet In the application of this spring power, the services of station ary engines will be needed to wind them up, and there must needs be a decided loss by friction; and the ander mus ply whether the gain by the use of this silent power will off set the loss above indicated.

## Srixutific GMmricau.

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practical applications of the spectroscope.
PRACTICAL APPLICATiONS OF The spectroscope. The uses of the spectroscope may at present be divided luminous colored lines in the spectra of flames, which lines, as it is well known, appear in sets or systems, each substance producing a set of lines, peculiar to itself and not appertaining to any other substance : so that by this means many of the component elements of a substance may be determined by direct observation, without the necessity of going through the laborious process of chemical analysis. Another advantage is that the minutest quantity of materi al is sufficient for this method : a quantity so small that $i$ would not suffice for a chemical test made in the ordinary way, even if assisted by the microscope.
The second process is effected by enclosing the substance to be examined in a gaseous or vaporous condition in a glass tube, rarefying the gas or vapor, and illuminating it by the passage of an electric spark. Then special lines will appear, which differ, in some instances, from the lines produced by the same substance in a flame, and this by reason of the higher temperature: the local temperature of the atom when exposed to the electric current being the highest we can produce. The current does not heat up the tube, because its quantity of heat is too small, notwithstanding that it is of great intensity. It is evident that any substances easily volatilized, or gases, are adapted to this method of investigation.
The third class of spectroscope observations is especially adapted to solids, and consists in observing the spectrum of the electric spark passing between electrodes of the material to be investigated. Thus the spark passing between two copper electrodes will show the copper line, between iron electrodes the iron lines, etc. The spectrum seen in this way will also be affected by the spectrum of the atmosphere, gas, or vapor between the electrodes, through which the electric spark forces a passage.
A fourth class of observations may be made with the above method, using not the spectroscope, but a microscope with a spectroscopic eyepiece. The easiest way to sulmit the material under investigation to this test is to reduce the metal to the state of thin foil or plate, cut out a few pointed strips, and attach them to an ordinary glass slide, with the points a distance of $\frac{1}{8}$ of an inch or less apart ; then connect them with the poles of a small induction coil, and bring the space between the metallic points into the field and focus of the instrument. Then apply the spectroscopic eyepiece, let the current pass, and the peculiar spectrum of the metal will be seen.
A fifth use of the spectroscope is by attaching the spectroscopic eyepiece to the telescope in place of the microscope: this constitutes one of the most important uses of the spectroscope, and has given rise to a new branch of sci ence, astronomical chemistry; and by its means we have been able to determine the chemical constitution of the sun,
stars, and comets, and also of the atmosphere of most of the planets.
A sixth use of the spectroscope consists in the observa tion of the absorption spectra, when the light forming a complete spectrum is made to pass through a coiored transparent medium. A colored glass or a colored liquid is in pass, and obstructs all the others. White light consisting of all rays of light, as is proved by its analysis by the spectroscope, we can change it into red by removing all the orange, yellow, green, blue, and violet rays, and this is what a purely red glass or a red liquid accomplishes; we can change it also into blue by removing all the red, orange yellow, green, and violet rays, and this is what a purely blue glass effects. If, however, we test different colored media in this way with the spectroscope, we find that there are very
few pure colors, as most of them will not extinguish all the colors different from their own: thus, for instance, indigo, which is blue, will not extinguish all the red, and its color therefore contains red in its composition. Red blood will not extinguish the blue, but only a portion of the green, forming two broad bands in that part of the spectrum, called the blood bands. These bands are so characteristic of blood, belonging to no other substance whatsoever, that they serve as the basis for legal evidence as to whether suspected spots are blood or not. Some substances, like chlorophyllin, the sorption bands in different parts of the spectrum, quite selfcharacteristic and distinguishing them from all other substances of apparently the same color.
As a seventh class of observations, we may consider the absorption bands produced by colored gases and vapors, such as nitric oxide (especially when heated), chlorine, bromine vapor, iodine vapor, etc., all of which produce peculiar absorption spectra
Finally we may add an eighth class of observations, that of opaque substances visible by reflected light. Observations of this class are in many instances best made by the microscope armed with a spectroscopic eyepiece; and such sun shines on a piece of white paper placed under the spec-tro-microscope, the complete spectrum will be seen; but if on the paper a colored spot be present, and this be brought into the field, at once absorption bands will appear, which will of course differ, not only for substances of every color, but also for substances of the same color, if they be this property was recently made by Dr. P. H. Vander Weyde, and was mentioned by us on page 293 of our volume XXXIV. Dr. Vander Weyde was a witness in a case before the courts, involving an amount of nearly $\$ 100,000$, which
depended on the question whether the signature certifying a
check was genuine or not. One of the arguments brought forward to show that the signature was forged was that the blue ink with which it was written was of a kind differen from that used at the bank where the check was claimed to have been certified. Fortunately the different kinds of blu used for inks can easily be distinguished, one from the other, by spectroscopic analysis. Indigo will absorb the whole spectrum except the blue and red ; blue verdigris will absorb all except the blue and green ; perman $\rightarrow n t$ blue will leave, besides the blue, part of the violet visible; Prussian blue will absorb all except the blue. The spectra are of course modified and even disturbed by the enlargement of thecoarse fibers of the paper on which the writing is done and the spectral colors are, in some spots, darker or more intense, in others paler and almost colorless; but after careful comparison with the spectra of various inks, the peculiar absorption of the Prussian blue is seen to be so characteris tic that no doubt was left but that the ink used for the check in question was of the same kind as that used for other checks acknowledged to be genuine. The researches described of course cannot settle a matter of the kind in dispute, and are not claimed to do so. All that was intended was to disprove the allegation of the defense that the inks were different; and this it did most effectually, notwith standing that the spectroscope could not show that the ink of the different signatures proceeded from the same ink stand.

## WHY ARE WE RIGHT-HANDED?

There is, in Sir Charles Bell's Bridgwater treatise, ? quaintly-worded passage in which the author endeavors to deal with the reason why we normally use the right hand in preference to the left. After a surfeit of Haeckel and l)ar win : after, as must be the case when one attempts to keep en rapport with modern scientific thought, becoming fairly imbued with the notion that distinct creative acts never took place, and that the fire mist and the primal germ are our legitimate ancestors in unbroken line: there is somethin, positively refreshing to turn back to earlier writings, and there to find a material theory contemptuously dismissed in order that the author may anchor his faith to the idea that man was created right-handed by Divine intention. He says that "the preference of the right hand is not the effec of habit, but is a natural provision, and is bestowed for a very obvious purpose "; but what that purpose is he fails to make clear, except inferentially in the statement that " there ought to be no hesitation which hand is to be used or which foot is to be put forward ; nor is there, in fact, any such indecision." Any one who has ever witnessed the amusing spectacle of a squad of raw recruits learning the goose step will be disposed to combat this last assertion It requires longer teaching than would be imagined to im press upon the embryo soldier that the left foot is first to be moved. Experience goes clearly to show, besides, that the average individual steps off indiscriminately with either foot and hence the selection of the left foot, merely to secure uni formity in the military files, has beenmade, though the very fact again is curiously at variance with the above author's intimation that a heaven-implanted instinct teaches us to put the right foot forward.
We have mentioned Bell's treatise, not, however, for the sake of the theory which he maintains, but for the one which he rejects in a few brief lines. "It is affirmed," he says, " that the trunk of the artery going to the right arm passes off from the heart so as to admit the blood directly and more forcibly into the small vessels of the arm. 'This is assigning a cause which is unequal to the effect," he adds; and pro bably supposing that no other causes would ever be combined therewith to bring it up to equality, he curtly pronounces it a ' participation in the common error of seeking in the me chanism the cause of phenomena which have a deeper source," said source being supernatural. For the man who discovered the functions of motion and sensation pertaining to the brain and spinal marrow : who located the sensory nerves, and those which form the wonderful telegraph com manded by the will, and who showed that the nerves of the different senses are connected with distinct portions of the brain, so implicit a belief in the active interference of an Unknown Power with human mechanics is indeed strange. It is to this faith, however, that must be ascribed this neglect to prosecute the investigations which, very recently car ried through by a French physician, Dr Fleury, of Bordeaux have adduced facts showing that our natural impulse to use the members on the right side of the body is clearly tracea ble to probably physiological causes.
Dr. Fleury, after examining an immense number of human encephala, asserts that the left anterior lobe is a little lar ger than the right one. Again he shows that, by examining a large number of people, there is an unequal supply of blood to the two sides of the body. The brachio-cephalic trunk, which only exists on the right of the arch of the aor ta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger The left lobe of the brain, therefore, being more richly hematosed than the right, becomes stronger; and as, by the intersection of the nervous fiber, it commands the righ side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the na tural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery The augmentation of blood we have already seen suggested above; but the reason for it is here ascribed to the relativ size of the artery, and not to any directness of path from the heart. Dr. Fleury has carried his investigations through
the whole series of mammifers ; and he finds that the righthanded peculiarity exists in all that have arteries arranged similar to those of man. At the same time, such animals, notably the chimpanzee, the seals, and the beavers, are notably the most adroit and intelligent.

## THE PATENT DRIVE WELL

The long pending litigation in connection with the patent drive well has reached its first stage of settlement by the decision of Judge Benedict, U. S. Circuit Court, this city, an abstract of which we publish in another column.
Judge Benedict gives many interesting particulars concerning this invention, sustains the patent of Nelson $W$. Green therefor, and awards to him the honors of priority. This decision, unless hereafter reversed by the Supreme Court of the United States, brings all drive wells heretofore put down without the consent of Green, his assigns or agents, within the category of infringements. The number of wells now in use, not authorized by the original patentee, is very large; consequently the aggregate amount of royal-
ties to be collected by the owners must be great. We have ties to be collected by the owners must be great. We have
heard it said that the total sum was over two millions of heard it
The Green patent has heretofore been resisted on the ground that the invention was insufficient to support a patent, as it only consisted in running a tube down into a pool of water and applying a pump, which was an old idea, in common use long prior to the grant of the patent. Another reason for resistance was the alleged prior invention of By ron Mudge, who was one of Green's assistants in the early trials of the improvement. Judge Benedict holds that these and all the other alleged grounds of opposition to Green's patent are untenable.
The early history of the drive well is interesting and instructive. It appears from Judge Benedict's decision that Nelson W. Green, the inventor, was the Colonel of the Seventy-Sixth Regiment, which he had formed, then-1861-62-stationed at Cortland, N. Y. Rumors were cur rent that the rebels intended to carry out a general system for killing off the Union troops by poisoning all the wells as fast as the men advanced. It was to defeat this nefari-
ous project that Colonel (ireen invented the drive well, ous project that Colonel (ireen invented the drive well,
which he immediately tried in his own camp grounds, with complete success. From this beginning the invention has spread not only over this country, but throughout the world; and the war departments of nearly all governments now at tach to their military branches special corps and wagons to convey and operate the American drive wells wherever their armies move. One of the witnesses stated that one hundred and fifty thousand of these wells were in operation in New York State alone. Over a hundred and fifty patents have been granted for improvements. The drive well ranks almost next to the sewing machine in point of utility as a domestic apparatus. In thousands of localities it is only necessary to drive with a mallet, a tube down through the kitchen floor into the ground, in order to command an abun dant supply of pure water; thus the dwelling, the barn, and other parts of one's premises may be quickly and cheaply supplied. We have seen one of these wells inserted and finished, and animals drinking from the water it supplied, all within half an hour from the time the operator began his work.
Modern improvements, as all must admit, are highly use ful and convenient to society in peneral; but it cannot be denied that they are sadly destructive of the romance and poetry that twine about the good oldfashioned ways of doing things. Take thedrive well, for example. The lad of the rising generation clacks a squeaky pump handle, bendshimself double, and sticks his face under a rusty spout,in order t. get a drink of water. He knows nothing about the delights of the bucket, and the original method of water lifting, charmingly described half a century ago by Woodworth
'The old oaken bucket, the iron-bound bucket,
The moss-covered bucket which hung in the The moss-covered bucket which hung in the well. How quick to the white pebbled bottom it fell, Then soon with the emblem of truth overflowing
And dripping with coolness, it rose from the well.
How sweet from the green mossy brim to receive it,
As, poised on the curb, it inclined to my lips;
Not a full blushing goblet could tempt me to leave it, Though filled with the nectar that Jupiter sip The moss-covered bucket arose from the well

## DANGEROUS ARCHITECTURE.

The Chicago Chapter of the American Institute of Archi tects has lately found occasion to discipline a well known member for a violation of professional ethics, involved in supplying a couple of contractors with working drawings of a building now in progress, and receiving pay therefor, when no fees should be received, it appears according to their decision, other than from the client. We have no desire to criticize the architectural code of ethics, the refine ment of which the above serves well to indicate; but the question suggests itself as to whether in that code there is any provision whereby the architect who builds houses which, in point of sanitary precautions, are death traps can be called to an accounting. If not, we submit that it is time that some check of the kind were devised. Quite recently in this city, we have seen the heirs of an eminent architect
suing the people for $\$ 800,000$ fees for plans and superintending the building of an edifice, only partially completed, which is little more than a nest of airtight boxes, and which is so badly constructed that sanitary experts now insist that improvements involving heavy expense, pointing almost to
pronounced healthy. Several of our most eminent judges
have been rendered dangerously unwell through holding court in the rooms, to the great detriment of public busi-

Architects and plumbers deserve to be gaged by differen rules from other professions and trades, for the reason that the largest part of their work is out of sight; and many a bad defect may be rendered invisible until it asserts itself through the fair exterior. We know when a physician does his work well, and we have a remedy against him for malpractice. So also the law protects us against ignorant o conscienceless lawyers; but there are few cases where the owner of property has refused to pay his architect on the
ground that the design is radically bad. The defense that the proprietor accepted the plan, which the professional genthe proprietor accepted the plan, which the professional gen-
tleman would urge, seems to us a specious one, for it presupposes an expert knowledge in the layman, whose only object in consulting the architect is to obtain expert assist ance. A precisely parallel case would be that of an engin eer who should defend himself against a charge of waste or bad fitting or bad material, in the engine entrusted to him to build, by saying that his client had selected that type of engine in preference to others submitted.
We are quite aware that there are a great many pains taking architects who know the faults of their brethren and lament them; but that does no help matters. What we want is a class of architects who can do something more than put the confused notions of their clients into tasteful shapes. It is their business to be sanitary engineers as well as architects; and it is time that the fact were generally understood that it is a worse fault to put abominably designed drains and ventilating arrangements in a building than to make the exterior a combination of all known styles, and the interior richer in hallways than in apartments. Here are two cases of flagrant malpractice which we take from the recent report of the Massachusetts Board of Health. conspicuous public building, costing nearly $\$ 200,000$, became pervaded with a nauseous odor, which grew apace until the
occupation of the edifice was rendered dangerous. Under occupation of the edifice was rendered dangerous. Under the cellar floor were found some square cesspools, into which covered with flat stones, led. One of these reservoirs of filth overflowed and saturated the concrete pavement, so that the stench remained permanent for a long time after the cesspool was abolished. What good service the cesspoo served is past comprehension; and the brick drain, in these
days of smooth pipes, evinced the ignorance or cupidity of days of smooth pipes, evinced the ignorance or cupidity of
the planner. Another architect put a huge brick drain under a building for the length of 200 feet. It was too large der a building for the length of 200 feet. It was too large
for self-cleaning, and consequently became a prolonged cesspool. . In addition to this, another reservoir was arranged outside the building, where the sewage of five hundred per sons was allowed to accumulate. And all this in the im mediate presence of a good and sufficient sewer.
Now these defects might well have resulted in epidemics and deaths. Who is answerable? The landlord, we have heard it recently stated; and even in public journals, tenants have been urged to sue the proprietors for damages when illness or death occurs in their family through faulty construction in the house. Legally, the landlord may be responsible; but we cannot consider him morally so, certainly, in such cases as are above cited Would not then, the Am rican Institute of Architects do the community a service by bringing members who evince ignorance in the maters we have pointed out to a rigid accoun there is no code of ethics which will not warrant the stern censure of men who, by careless or incompetence, not
only bring discredit upon their profession, but imperil the lives of their fellow beings. It is needless to say that suc censure should be so marked as to result in a withdrawal of public confidence from the person disciplined.

## THE CENTENNIAL EXPOSITION.

The judges in group 21, on metal, wood, and steel working machinery, have nearly completed their work. Out of 600 exhibits in their group, more than 300 , it is reported will receive bronze medals with written certificates of excel lence. Attendance at the Exposition now averages from 20, 000 to 30,000 people a day; but a decrease is expected dur ing the harvesting season, which will be followed by lar ger crowds than have yet appeared, during the cool fal months. It seems reasonably certain that, financially, the Exposition will make some profit rather than show a deficit.
The hotel and boarding housekeepers of Philadelphia are The hotel and boarding housekeepers of Philadelphia are
not reaping the rich returns so confidently expected. When the immense throng, attracted by the opening day ceremon ies, visited the city, speculators thought their opportunity had come, and prices were exacted in accordance with thei elevated notions. When the people dispersed after the ceremonies, they advertised the condition of affairs; and as a result, those houses which charged exhorbitantly are now avoided. Thousands of visitors who intended residing in the city during their short stay now strain a point to find accommodations in the suburbs, or even in New York. It is reported that the permanent increase in Philadelphia doe ot now exceed 10,000 people, and that dozens of lodging closed from lack of business
Dom Pedro has again visited the Exposition, and has made a minute survey of its contents. The marvelous work of the Walter press, on which an edition of the New York Times is daily printed, is said to have astonished him more than all else. The Tunis cafe, that of the strange musicians
and dancing woman, was recently shut up by the authorities, because visitors were compelled to purchase a little cup of coffee for twenty-five cents. in order to gain ad-
mittance. This was considered virtually requiring an ad Itssion fee, which is contrary to the regulations.
It is said that the judges on
It is said that the judges on machine tools are seriously puzzled to know how to award proper distinctions. Th competition is so remarkably close, and most of the tools ar so good, that the judges assert that nothing but the mos severe tests will enable them to arrive at impartial conclu sions. Some time ago, in an editorial, we deprecated the habit workmen have got into of nickel-plating their pro ductions, and suggested that, for objects exhibited at the Centennial, it would be much more satisfactory to finish with the file and scraper. These tools are difficult to han dle; but when skillfully manaed the results they give hpeak very plainly for the ability of the workmen. The Putman very plainly for the ability of the workmen. The Putman
Machine Company, of Fitchburg, Mass., seem to have Machine Company, of Fitchburg, Mass., seem to have adopted this advice, and a number of excellent machine
tools are thus finished. Plain surfaces, handles, wheels, tools are thus finished. Plain surfaces, handles, wheels,
and gearing are all brilliantly finished; and many an expert and gearing are all brilliantly finished; and many an expert mechanic has been heard to inveigh somewhat contemptu-
ously against "this shiftless habit of nickel plating" before bringing his eyes close to the metal and discovering the vir gin surface.

## accurate tools.

A prominent feature of the display of the Pratt \& Whitney Company, of Hartford, Conn., is the gages, the accuracy and fit of which are remarkable. A specimen of the work of th finely made tools manufactured by the above concern is ex hibited in a pistol, which is shown in the condition in which it left the machines, without having undergone any subse quent finishing operation. Both the finish and the fit of the parts are excellent.

We have already stated that the general arrangement of the Exposition is such as to render it not easy for the visi tor to obtain readily a comprehensive view of any one clas of objects. For this reason it is difficult to realize, until on has become familiar with the general aspects of the display how complete the collection are. Take, for example,

## FISH.

To acquire all the available information of an icthyologi cal nature, it is necessary to visit almost every departmen and section. Scores of fish of various species may be studied alive in the aquaria of Agricultural Hall, or may be seen frozen in the refrigerators. Or, if the visitor desires to study fish more comprehensively, he may, by stepping ove to the Government Building, examine a large series of finel colored plaster casts of ocean edible, and other fish. Su perb collections of fish, prepared in alcohol, as scientific specimens, are to be found in the Norwegian and Swedish sections, and besides these are stuffed fish in endles variety.
If fish as food be the object of an investigation, the visitor may examine every preparation of it that can be conceived France has a remarkable collection of fish preparations and, in fact, almost every nation which catches fish has a representation at the Centennial. Japan forwards smoked salmon, done up in bags, like hams. China sends powdered fish, and Norway a similar exhibit of fish meal. From Orego
sorts.
If it be desired to know about the many articles, useful in arts and industries, derived from fish, the visitor may se arts and industries, derived from fish, the visitor may see
oils obtained from various fishes, isinglass, with sizes and glues, fish skins tanned to excellent leather, besides score of other utilizations, down to delicate fancy work ornament made of fish bones and scales.
Fishermen will find tackle, from the heavy surface and rawl lines used in the cod fisheries down to the delicat gossamer threads and flies for trout. Then there are the more important implements used by whalers and others such as the common harpoons, gun harpoons, lances, and walrus spears, besides the rakes and tongs used by oyster men. Nets of all kinds, some made of bamboo, some o whalebone, some even of human hair, may be seen; and with them all the various traps and pots, rods and reels, artificia bait, fishing baskets, boats of every conceivable shape, from kyales up to whaling vessels; all the inventions for curing fish, refrigerators, apparatus for drying fish in the sun models of smoke houses, all the machinery for producin fish oil, and for preparing fish guano; may be foundin the collection.
Should the visitor prefer devoting himself wholly to th cientific consideration of fish, he can look at the Agassiz collecting tank, and the preserving mixtures, by the aid o which fine specimens can be brought from far-off lands. He can see how Professor Baird models his casts of fish ou of papier maché and plaster, and also examine the method for drying the skins of fish for scientific use, and even the photographic instruments employed to take pictures of fish. Then there is the subject of fish culture, including the pans, pails, spawning vats; and later in the season, the actual habits of the fish during the spawning may be watched. Allied closely to the subject of fishes are those of ponges and seaweed, of pearls and pearl oysters, and of corals. We have only indicated the extent of the collection s a whole. To describe the various specimens or the dif ferent appliances would fill a volume; the above, however will suffice to afford a general idea of the time and labo which a careful examination of all the fish of the world, a gathered in the Centennial buildings, will require, and give the reader an idea of the task before him if he visits the Exhibition with the intention of studying the industries of this one class of exhibits.

To make aqua regia, distil together 16 ozs. spirit of nite nd 4 ozs. common salt. Another way is to mix equal part nitric acid and muriatic acid, or nitric acid 2 parts and mu riatic acid 1 part.

## TWO NEW DENTAL INVENTIONS

A very ingenious electric plugger, in which the circuit can be established or interrupted at will, has been patented (March 21, 1876) by Dr. Allen Spencer, of Columbus, Ohio. The mallet hand piece, composed of an inner tube, is mounted in a casing. The whe outt cap, and connects with the bat tery. Armatures, formed of two cylindrical cores of soft tery. Armatures, formed of two cylindrical cores of soft iron, are mounted in the inner tube. The core, D, is fixed, and the core, $\mathrm{F}^{\prime}$, movable endwise. A metallic rod plays
through the fixed core; and, by the spring, $d$, pressing on a through the fixed core; and, by the spring, $d$, pressing on a
shoulder, is forced slightly beyond the inner end of the core, shoulder, is forced slightly beyond the inner end o
D , so that it may be acted upon by the movable D , so that it may be acted upon by the movable
core, $\mathrm{E}^{\prime}$. A tool holder is attached to the outer core, $\mathrm{E}^{\prime}$. A tool holder is attached to the outer
end of the rod, F , for the insertion of different end of the rod, F , for the insertion of different
plugger points. The movable core is pressed against a collar, $a^{\prime}$, by a spiral spring, $f^{\prime}$. This spring surrounds a neck, $F^{\prime}$, and bears at one end upon the collar, $a^{\prime}$, and at the other against a nonconducting ring. Two posts, $\mathrm{H} \mathrm{H}^{1}$, are screwed into the butt cap, and connected by a crosshead, $\mathrm{H}^{?}$. A set screw, $\mathrm{I}^{\mathrm{I}}$, projects against a disk, $j$, of soft iron, around which, and between the posts, $H$ $\mathrm{H}^{1}$, is coiled a thin band spring, $\mathrm{J}^{\prime}$, of copper. One end of the spring is connected to the disk beneath the plate, and the other end to the post, H . A collar, K , on the neck of the movable core carries an insulated break, consisting of a rod, $K^{\prime}$, of wood, which acts on a plate spring, $k^{\prime}$, secured at one end in the butt cap, $b$, by a screw communicating with one end of the helix wire, the other end of the helix wire being connected with the insulated post, $\mathrm{H}^{1}$. The outer end of the spring, $k^{\prime}$, abuts against the guide, $k$, which forms a contact stop. A simple circuit break or key, which may be operated by the mouth, or freferably by the foot, is connected with one of the battery wires, sufficient length of wire being employed, as shown, when the key is used, to admit of its ready manipulation by the operator. It is composed of two rubber sides, L L' ${ }^{\prime}$, connected by a spring, $l$, at the rear, so as to admit of the sides of the key being pressed toward each other at their outer ends.
In operation, the armatures, $\mathrm{D}^{\prime} \mathrm{E}^{\prime}$, being magnetized, the sliding one, $\mathrm{E}^{\prime}$, carries down the disk, $j$, until the endwise-moving break rod, $\mathrm{K}^{\prime}$, strikes the spring, $k^{\prime}$, breaking the circuit and interrupting the current at the same time that the hammerlike stroke of the moving core upon the shaft, F , operates the plugger point. The cores being demagnetized by the breaking of the circuit, the moving one is quickly returned by its spring, $f^{4}$, to its normal position, closing the circuit ; and the shaft also, at the same time, is protruded beyond the end of the fixed core, D , retracting the plugger point with it. The above operation is repeated and continues as long as the break key closes the circuit. In this way the operator has complete control over the instrument. The battery is, by preference, provided with a vibrator to cause the current to pulsate The vibrator is shown as mounted in a cylinder, N , supported upon the battery cover or box, $\mathrm{N}^{\prime}$.
When the connections are all made and the vibrator is started by hand, the motion becomes self-sustaining because of the impulse given the spool magnet by its attraction toward the disk, $R$, at every pulsation of the current; and as the pulsations pass by the wires through the corrs, $\mathrm{DE} \mathrm{E}^{\prime}$, of the mallet, they become magnetized, and the plugger point strikes its blow. The speed of the pulsations is controlled by the thumbscrew, $\mathrm{P}^{\prime}$; when the screw is set toward the spring, $P$, the vibrations are more rapid, and when set further off they become slower. The set screw of the vibrator serves also to regulate the force of the blow by determining the instant at which, with reference to the stroke of the mallet, the circuit shall be broken; whereas the set screw, $I^{2}$, of the automatic break, serves merely to regulate the frequency of the blows.


WILLIAMS' METHOD OF MANUFACTURING DENTAL FOIL.
Another new invention relating to dental manipulation is a means of covering foil with a coating of carbon to render it moro easily worked without becoming adhesive
Heretofore, non-cohesive or soft foil has generally been made by imperfectly refining, and by leaving traces of silver, copper, and iron, which cause it to be somewhat stiff and copper, and iron, which cause it to be somewhat stiff and
liable to discoloration in the mouth. In order to produce a
foil for dentists that can be absolutelypure, and which, even when freshly annealed, does not stick at all or only slightly when rolled up or manipulated. Dr. Richard S. Williams, of New York city, takes the sheet of foil, A, places it upon a wire gauze, B, and, with the aid of any suitable flame, causes a slight deposit of fine carbon upon the surface of the foil To prevent the ascending current of heat from the flame from displacing the foil when laid on the gauze, a sheet of mica, C, is placed upon it. With a Bunsen gas burner, as shown at D, the amount of carbon to be deposited may be readily regulated by stopping up one or more of the air passages, $a$, of the
burner. The less air admitted, the greater will be the depolated by stopping up one or more of the air passages, $a$, of the
burner. The less air admitted, the greater will be the depo-


SPENCER'S ELECTRO-MAGNETIC DENTAL MALLET.

A New Smoke Consumer
The Pittsburgh Chronicle says: There has recently been introduced in Zug's Sable Iron Mills a smoke-consuming ap paratus, which certainly accomplishes all that can be desired. t would be hard to conceive anything more simple in it construction and operation. A one half inch steam pipe uns along the forward wall of the furnace, some 20 inches bove the grate bars. From this transverse pipe project in wardly a number of short pipes, terminating in a small ori ce. Each of these pipes is surrounded by a sleeve of arger pipe, $1 \frac{1}{4}$ inches in diameter. The annular space be larger pipe, $1 \frac{1}{2}$ inches in diameter. The annular space be
tween the interior of the larger and the exterior of the smaller pipes communicates with a flue, opening into the outer air at the side of the furnace When a pressure of 20 lbs . per square inch ha been attained, steam is turned into the smalle pipe. Its escape from the orifices acts upon th ir-filed annular space, much as the steam in th Giffard injector does upon the feed water, and drawing it rapidly through the pipe, projects air and steam into the furnace. The heat of the fire decomposes the steam, and at the same time the carbon-laden smoke is utterly consumed and con verted into a bright, clear flame that lights up the nterior of the furnace. This operation is observ able through a mica door in the rear of the fur nace. Fixing the eye on the top of the smok tack, and noting the moment when steam i urned into the consumer, the inky torrent of moke is first seen rolling skyward With th hiss of the escaping steam these clouds are dissi pated, like fog before the sun, and in a few sec onds only a faintly depicted vapor is wreathing up ward from the stack. The engineer states tha the decrease in consumption of fuel amounts to 20 per cent since the introduction of the consumer The boilers are of the Wiegand pattern

## Setting Milk.

Mr. L. S. Hardin, of Louisville, Ky., has recent y made a series of experiments regarding the stting of milk. He states that deep setting ac companied with refrigeration is the best plan The milk is placed in cans from 12 to 20 inche deep and 8 in diameter. These are put in a refri gerator box, with a shelf in the top, upon which ic is placed, and the temperature is reduced below $50^{\circ}$. The milk is skimmed after 36 hours. Th ream is churned at $58^{\circ}$ in warm, and at $63^{\circ}$ in cold weather. The butter is said to be of superio lavor and aroma, uniform in quality, and to kee well; and a greater weight is obtained from a giv on quantity of milk with less labor and less cost than by ther methods.

January 25, 1876.

Artificial Vanilla made from Wood Tar. It appears that the series of dyestuffs which may be obtained from tar is by no means exhausted; while another large and equally important class of substances, also obtained from tar, is daily increasing: substances not intended to please the eye, but for the nose and mouth, namely per fumes and flavors. The manufacture of salicylic acid from carbolic or phenic alcohol opened the prospect of a cheap manufacture of great numbers of various flavoring principles, which had been commenced by the nitro-benzole or so called oil of mirbane, which perfumers use in place of oil of bitter almonds. Soon beuzoic acid and oil of wintergreen or gaultheria were produced, and then many closely related fla voring principles;and now it has been proved that vanilla flavor can be made artificially from one of the tar products. According to the German Industrie Blätter, Reimer re ported to the German Chemical Association that he had made from beechwood tar. first oil of guaiacum, and from this va nillin, the flavoring principle of the expensive vanilla bean He obtained this by searching for a common reaction of the various phenols or carbolates (the creosote-like constituent of all tars) by which differentaromatic aldehydes are formed from each.
When phenol or carbolic acid is mixed with chloroform and an excess of a caustic soda solution, and proper time for reaction is allowed, the unchanged remainder of the chloro form must be removed, and replaced by an acid; then an oily aldehyde of salicylicacid will be separated, which may be purified by combination with bisulphite of soda, and de composed by some diluted acid. Oil of guaiacum, treate in this way produces (as mentioned) vanillin, which is th aldehyde of vanillic acid.
Marasse, who several years ago found the oil of guaiacum in the creosote of beechwood tar, observed then that this body smells agreeably like vanilla, a smell which is also pe culiar to guaiacum wood (lignum vito, iron wood) and its re sin, out of which the oil of guaiacum was first made in 182 by Unverdorben.
It is to be expected that, out of the numerous carbolates a present known, by applying the reaction discovered by Rei mer it will become possible to produce artificially many other
way.

A NEW copper paint is made in Paris from porous copper deposited by the galvanic battery mixed with a varnish. The solvent of the varnish is benzine. The copper is very pure and is easily pulverized, and, when mixed with the benzine varnish, may be applied to iron, brass, plaster, or wood When mixed with oils,the copper acquires an antique green hue.

## APPARATUS FOR SETTING METAL AXLES.

We illustrate herewith a new apparatus by means of which he axles of wagons, carriages, and other similar vehicles can be straightened or set, should they happen to become ent out of shape, without removing them from the body of he vehicle.
The bar, A, supports two heads, B and B'. The head, B is adapted to slide upon the bar, $A$, and has attached to it a hinged yoke, C , consisting of three parts, $c, c^{1}, c^{2}$. The part $c$, is secured at its lower end to the head, $B$. To the upper $c$, is secured at its lower end to the head, b. To the upper end of said part, $c$, is hinged one end of the part, $c^{1}$, the unper side of which may be curved to conform to the shape of
the upper side of the axle, if desired. To the other end of the upper side of the axle, if desired. To the other end of
the said part, $c^{1}$, is hinged the part, $c^{2}$. The head, $\mathrm{B}^{\prime}$, is the said part, $c^{1}$, is hinged the part, $c^{2}$. The head, $\mathrm{B}^{\prime}$, is
adapted to slide upon the bar, A , and is provided with an adapted to slide upon the bar, A, and is provided with an aperture or eye by whicle. Between the two heads the bar is en axle of the vehicle. Between the two heads the bar is en itted with a powerful screw, D, provided with a lever, $E$, a one end, by which it may be turned, and having its other end ounded off to form a proper bearing surface against the axle while in operation. The operation is as follows: The whee is removed from the axle to be straightened, and the ba placed longitudinally beside said axle in proper position to

bring the end of the screw to bear in the required place. The heads are then adjusted and secured, the head, B, being passed under the body of the vehicle, the hinged yoke passed ver the axle and fastened to the head, and the head, $\mathrm{B}^{\prime}$ being simply passed up on to the end of the axle. Thescrew is then put into operation and made to bear upon the axle until it assumes its proper shape. Patented December 21, 1875, by Mr. Frederick Bex, of Washington, D. C.

## IMPROVED SHAFT COUPLING

The annexed engravings represent a new shaft coupling, in which two shaft ends and the sleeve are connected by longitudinal wedge keys alone, these being driven in on opposite tudinal wedge keys alone, these being driven in on opposite
sides of the ends and between the bushings and the sleeve. sides of the ends and between the bushings and the sleeve.
Through the center of the hub passes the shaft aperture, which is enlarged at each end, as shown. At A, Fig. 1, are bushes fitted in and keyed down to the shaft by the keys, B, which firmly press the shaft against the opposite side of the hole, where it is secured against revolving in the coupling by the key, C, Fig. 2. The bushes are preferably located on opposite sides of the hub, though they may be, if desired, on the same side.
If the device is to be placed in a position where much jarring occurs, the wedge keys, B, may be prolonged through the coupling, and be set up on the nuts on the ends. The coupling as thus arranged is especially intended to obviate the use of bolts,screws, and flat tapered keys or wedges, so as to be readily removed by driving out the keys by means of a drift. For coupling fly and other wheels to shafts (see Fig. 3) a tight fit is obtained by boring the hole about one hundredth of an inch small er than the shaft, the seg. ment or bushing being bored in its place in the wheel. in its place in the wheel. The inventor claims that this attachment of wheel and shaft is easily effected, and
the wheel may be removed the wheel may be removed
without requiring sledging, forcing with power screws, etc. Similarly, steam engine cranks can be attached to shafts as firmly as by a shrinking fit, while the injurious strain on the metal produced by the latter is avoided.
Patented through the Scientific American Patent Agency April 4, 1876. For further particulars relative to rights to manufacture, etc., address the inventor, Mr. S. M. Guss, Reading, Pa.

## IMPROVED AUTOMATIC SIGNAL BUOY

The means in general use for warning vessels approach ing coasts, reefs, or shoals are of two kinds, those which are seen and those which are heard. To the first class belong lighthouses and buoys ; to the second, fog whistles,

Hig. .
bells, horns, sirens, guns, and similar sound producers. Al though of late years, mainly through the development o electric illumination, it has been possible to construct light houses of extraordinary powers, no beacon ever has been or probably ever will be devised which a heavy fog cannot render practically inefficient. True, it may be similarly as serted that the varying conditions of the atmosphere exercise a potent influence on the transmission of sound, and thus tend to decrease the value of the sound signal; but the fact remains nevertheless that the latter stands superior to the light, for, as Tyndall has proved, "even against a moderate gale and unfavorable conditions for sound transmission, sig nals may be relied on for sending sound to a distance of two


## GUSS' SHAFT COUPLING

or three miles,and, under ordinary conditions of fog, considerably further." What the lighthouse is to the coast, the buoy is to the hidden reef or shoal; but, unlike the for mer, it is useless save by day. Moreover, while we have supplemented the lighthouse by the stationary sound signal, we have devised no parallel invention to supplement the buoy. The object has been a sounding apparatus and buoy combined, the former of which will sound under all circum stances; the best we have hitherto done is to fasten a bell to the buoy or apply a whistle, and have relied on waves to ock the support and so toll the bell or blow the whistle, the latter by air forced out by the moving water inside. These latter by air forced out by the moving water inside. These
devices all become inoperative during a calm ; and when
a heavy fog is likewise present, the mariner, aided neither bysightnor by hearing, perforce must feel his way, as best he can, by the lead. It is safe to believe that, had we been possessed of some efficient system of sounding buoys, the Atlantic, the Schiller, the Deutschland, and other ill-fated essels, warned from the reefs and shoals, would not have erminated their voyages in wreck and disaster. There can, therefore, be no question as to the importance and necessity of inventions looking to the perfection of such a system; and for this reason, for the device which we here illustrate, and which belongs to that class, the careful consideration of light ouse boards and similar bodies is bespoken.
Before proceeding to examine the mechanical construction,
a few results of scientific in vestigation into the pheno mena of sea waves may be classes: those of translation classes. those of translation, and those of oscillation. $\mathrm{O}_{1}$ dinary sea waves are oscillatory, but become waves of translation as they enter shallow water. They are, in character, cycloidal. The motion of the water is that of alternately flowing to and from a point. Toward the top of the wave the movement of particles is in the direction of the wave; but in the trough, the movement is in the opposite direction. Motion is greatest at the crest tion is greatest at the crest and at the lower portion of he trough. At half the hight of the wave there is o motion.
It has further been proved that the depth to which water is agitated by waves is not much greater than the hight of the wave measured from trough to crest. Accurately, wave 10 feet high and 32 feet long would only agitate the water 6 inches at 10 feet below the surface; at a depth equal o the length of the wave, the motion is diminished to 5 that of the surface. Hence, for practical purposes, we may consider the depth of motion below the surface to be commensurate with the hight of the wave above.
The highest waves ever measured occur off the Cape of Good Hope, and reach a total hight, from trough to crest, of 45 feet : that is, $22 \cdot 5$ feet above and the same beneath the verage level, indicated by the dotted line in our engraving. Ocean waves at a distance from land rarely seem higher than 20 feet; and it is only where circumstances, in the


COURTENAY'S AUTOMATIC SIGNAL BUOY.
shape of prevalent opposing winds and currents, combine on
shallow water that rollers of the exceptional hight, first noted, are generated.
Sufficient has now been explained to make it clear that, if a hollow cylinder be immersed in water agitated by waves to a depth greater than the hight of the waves, the water enter ing that cylinder will seek not the level of the waves, but the mean average level located at half the hight of the waves. Consequently, while the heaviest billows may roll past the cylinder, the surface of the liquid therein will be unnoved, and will not rise and fall with the varying depres sion or elevation of the sea surface immediately adjoining: that is to say, referring to the engraving, let A, Fig. 1, be the long hollow cylinder which extends in the water to a depth exceeding the hight of the wave indicated by the sinuous line. Disregard the rest of the drawing, and consider that cylinder as fixed; then the water level will remain constant at the point, $B$, and the lower end of the cylinder will be in still water. Waves will produce no effect on the enclosed column of water. But now consider the cylinder attached, as it is, to the bottom of a float, C , which rests on the surface of the water and which must rise and fall with every undulation. Then we have the conditions of a fixed immovable column, encompassed by a rising and falling envelope: in other words, we have a moving cylinder and a fixed piston, by which we can compress air by wave power. The tube, A, it will be observed, extends up to the top of the buoy. There a powerful whistle is placed. D is a diaphragm, in A, between which and the plate on top of the buoy extend two tubes, E, open above, and having at their lower extremities ball valves, as shown. A central open tube, F, leads from diaphragm to whistle. Suppose the apparatus to be carried from the position where the diaphragm, $D$, comes just above mean water level, Fig. 1, to the summit of the wave as in Fig. 2. Then the space between the constant water level, B, and said diaphragm will have been greatly enlarged, and air must have been drawn in through the trough of the wave, the diaphragm must descend upon the water piston; and the air compressed, being prevented by the ball valves from escaping through the tubes, $E$, is driven out through the central tube, $F$, and so sounds the whistle. It is obvious that any disturbance of the surface of the water must produce this effect. Long low ground swells must do it as well as short chopping waves; but, of course, the higher the waves the longer is eacl sound given. Thus, where waves are 8 feet high and average, as they do, 8 in a
minute, the sounds afforded would minute, the sounds afforded would be similar in number. Where they are 20 feet high they run at but 4 per minute, and there would be but 4 sounds in this period. There will clearly be a difference in the intervals; but in all cases the force of the blast is the same, since that depends first on the weight of the buoy and length of the tube. We thus have a means of determining, mathematically, exactly the size and proportions of the instrument required to produce a given effect. On one hand, the resistance offered by the water piston equals the pressure of a column of water of
similar depth. Knowing the pressure, per square inch, resimilar depth. Knowing the pressure, per square inch, re-
quired to blow the whistle, the tube is lengthened in accordquired to blow the whistle, the tube is lengthened in accordone atmosphere. Now to compress the air, we have the whole weight of the apparatus applied to the area of the diaphragm. 'The water in the tube is the gage of pressure; for should the expansive force of the air exceed the resist ance of the column, the water would, of course, be forced out at the bottom. Having fixed the desired pressure, a simple calculation, based on the laws of specific gravity, determines the weight and proportions of the apparatus, as well as the pressure which may be obtained.
The buoy is fastened by a suitable anchor and chain off the reef or shoal, and is kept from the whirling motion which might interfere with the proper effect of the waves by the rudder, G. Its design is such that it stands vertical in any sea. By proper anchoring, it may be placed in mid ocean to mark a latitude and longitude point, as well as in a roadway to warn vessels off bars and sands. It may be located from 10 to 15 miles from the reef or other danger to
be avoided, so as to warn a ship of her position, and enbe avoided, so as to warn a ship of her position, and en
able her to continue her course in safety. It may be used whenever an undulation of 12 inches in hight exists; so that practically it is as efficient in rivers, where waves are com-
paratively little more than ripples, as at sea, where the highest billows may occur. The sound of the whistle of a buoy, located near a harbor of this city, has been heard 9 miles to leeward, 3 miles to windward, and 6 miles across the wind, or everywhere over a radius of 3 miles. In a dangerous locality, reefs or sands may be provided with buoys having whistles tuned to different notes, so that, merely by the locality of the various sounds, the masters of
The invention seems to us of unusual importance and The invention seems to us of unusual importance and value. It is scientifically correct in principle, mechanically
simple, and in action, automatic. It remains for the test of simple, and in action, automatic. It remains for the test of
actual and continued experiment to demonstrate practically its complete efficiency.
Patented in foreign countries and in the United States, through the Scientific American Patent Agency. For fur ther information, address the inventor, Mr. J. M. Courtenay, of Idlewild, Cornwall-on-Hudson, N. Y., or Mr. James Bigler, Newburgh, N. Y.
plating Articles with German Silver.
Many unsuccessful attempts have been made to nickel smalt articles by boiling, just as pins, hooks and eyes, etc., are silvered or tinned A Nuremberg chemist, named Dr. Kayser, has succeeded in coating metals with an alloy re-
sembling ferman silver, thus giving them a handsome fin-
ish, and making the surface more durable and permanent than that of tin or silver. He first melts together 1 part cop per and 5 parts pure tin-preferably the Australian, which has recently come into commerce, almost alsolutely pure, yet cheaper than Banca tin. 'The alloy is granulated as us ual, but too not fine, and then mixed with water and tartar as free from lime as possible, into a paste. To each 200 parts of the granulated alloy is added 1 part ignited oxide of nickel, and the articles are laid in it. After boiling a short time, they become beautifully silvered. Some fresh oxide of nickel must, of course, be added from time to time. Brass and copper articles can easily be silvered in this manner without previous preparation; those of iron must first be copper-plated. By adding some carbonate of nickel to the above bath, or to a common white bath, and boiling, a coat-
ing richer in nickel is obtained, and darker, varying in color from that of platinum to a blue black, according to the amount of nickel salt added.

## Infusorial Earth.

The numerous uses which the silicious remains of the microscopic animals, known as diatoms or infusoria, have found is illustrated by the following list given by Gruene and Hagemann, the proprietors of the large German mines at Oberohe and Hutzel

1. As pure silica in the finest state of division, it is employed in the manufacture of water glass, water glass soap, artificial stone, cements, fatty lute, and ultramarine.
2. Because it is a poor conductor of heat, it is employed for packing steam and hot air apparatus and pipes, where it excels every other material in lightness, for isolating fire boxes and catching radiant heat by protecting shields filled with the earth, etc., for filling the space around money safes and ice chests, for lining and encasing the conduits for melted metals in founderies, and in laboratories as a support for heating vessels that break easily.
3. Because of its property of absorbing liquids, in which t surpasses that of any other material previously known. it is employed for rapid filtration, making precipitates solid, making dynamite and other explosives, and making cheap colors, because the infusoria take colors like cotton. In sur gery it is used for absorptive bandages and supports.
The ability of infusorial earth to take up five times its own weight of liquid, and to suck it up rapidly without becoming fluid, enables it to replace the filter press. It is simply necessary to surround the filter with a layer of dry infusoria, in order to obtain in a very short space of time the same result that is attained ly ordinary filtration in clays or even weeks. Simple drying restores to the infusorial earth its absorptive power.
4. Owing to its great volume and slight weight, it is employed for packing very fragile objects and glass apparatus, ployed for packing very fragile ondects and glass apparatus,
etc., casts.
5. Owing to its fineness, it is used as a cheap polish for glass and metal, and is an excellent material for cleaning greasy vessels and pieces of machinery.

The Civil Engineers' convention.
I'he papers read before this body during its recent session in Philadelphia, besides those noted last week, included one by Mr. Charles McDonald on the general arrangement
and intermediate spans on the Portage viaduct of the Erie and intermediate spans on the Portage viaduct of the Erie
railway, and another by Mr. L. L. Buck, on the erection of Virragus bridge in Peru, of which brief abstracts cannot be satisfactorily made. Mr. T. (. Fllis, from the committee appointed to report upon a uniform method of gaging streams in connection with the observation of the rainfall, stated that no uniform method would be applicable to streams of all sizes and characters. The committee recommended a permanent and continuous record of the hights and discharges of such streams as come under observation, and suggested that members be requested to exert themselves to procure the establishment of permanent gages: also that engineers of cities be requested to keep a record of the hight of water daily, so that by suitable means the ap proximate discharge could be obtained. In this way a vast amount of valuable material might be gained, which could be worked up when occasion demanded.
Mr. J. J. Croes
Mr. J. J. Croes criticised the Croton waterworks, and as serted that the masonry in the aqueducts had not been built strong enough to withstand the pressure of water without being upheld by earth embankments.
Mr. Corthill, chief assistant engineer of the Mississippi Jetty Works, stated that the shallowest point on the bar is now $17 \frac{1}{2}$ feet. Formerly there was but 9 feet of water at average flood tide, for a distance of nearly 3,000 feet. At this day there is only 200 feet distance between the 20 feet of water inside the bar and the same depth outside it, and at many points there is now 30 feet. There has been exca vated by the river current thus confined more than $3,000,000$ cubic yards of material
General W. Sooy Smith, chairman of the committee on tests of American iron and steel, made a brief report, urging the importance and necessity of securing the necessary appropriation by the government for carrying to completion the work already accomplished by the board appointed by the government to test iron, steel, and other metals. As an in consumer of the metals to be tested, the fact was stated that, in the columns of one government building now in course of construction, and in the beams of another recently built, more money has been wasted than would be required to de fray the expenses in making tests for a vear to come; and this waste, in a greater or less degree, is believed to run through private. Themetal parts of the buildings, public and pri-
vate, are alarmingly waste. The report was accepted, with request to the board to prepare an appeal to Congress.
Mr. (lemens Herschel, of Boston, Mr. (lemens Herschel, of Boston, sulmitted a paper com mendatory of the introduction into the United States of a netric system of weights and measures, which he support objections to than Sellers, of Philadelphi, the very large cost entailed by the change, an estimate of this in the workshops of Sellers \& Co. amounting to $\$ 150,000$ He remarked that we have already the advantages of the decimal system, which the (ierman people did not have, and decimal system, which the German people did not have, and
other advantages, to secure which the introduction of the other advantages, to secure which the introduction of the
metric system was mainly predicated. The salbect was finally disposed of by its reference to a committee of five, to eport upon it at the next annual meeting, in November.
A paper, by Mr. William P. Shinn, of Pittslourgh, on rail road accounts and returns, was next read and discussed Sundry reports from special committees were then read, after which the convention adjoined sine die.

## The Value of a Trade.

The old story of the uncertainty of riches and the importance of learning a trade is brought to mind by the following, which appeared in a recent number of the New
York Ledger : Karl Frostern, the old nailmaker of Luben, York Ledger: Karl Frostern, the old nailmaker of Luben,
in Silesia, was a jolly, story-telling man, who sang at his in Silesia, was a jolly, story-telling man, who san
work, and whose busy hammer mademerry music.
Not far away lived Herr von Koben, a wealthy land owner, whose only son, when not at school, was wont to come to the nailer's, where he would sit by the hour and watch the bright sparks as they flew in showers from the ringing anvil. "Come, Master Conrad," said the nailer, one day in a jolly mood; "why not set the world an example? Show them that the son of a rich man can learn a trade. Who knows but that it may profit you one of these days?"
The youth fell in with the humor of the thing; and pulling off his fine jacket, he donned a leathern apron, and went to the anvil. He was a bright quick lad, and, when he had once attempted to make a nail, he had a pride to make it well; and so it came to pass that ere long he could make hoe nails as deftly and as well as could old Karl.
'lime passed on, and Herr von Koben died, leaving his great wealth to his son Conrad. A few years thereafter the armies of Frederick came sweeping through Silesia, and Conrad's inheritance was lost. In poverty he wandered away towards the mountains of Bohemia, until he came to a town where a host of shoemakers were at a stand for want of nails. Shoes were in great demand for the soldiers, and a great price was offered for nails. "Here," thought Conrad, " is my opportunity. Let us see how my trade will serve me." And he told the shomakers if they would help him to a shop and a forge, he would make nails for them. 'They furnished him what was required, and he went at the work in earnest. He made letter nails than had ever before been seen in that section. He took apprentices, and enlarged his shop, and in time Von Kolen's nails were demanded on both sides of the mountains. By slow but sure degrees he arose to opulence as a manufacturer, honored and respected as the founder of his own fortune. And it all came, as he was proud to tell his children in the after years, from his having learned a trade in his youth.

## Correspondence.

## The Vick sburg Cut-OA

Tothe Editor of the Scientific American:
In your issue of June 17, I find an article over the signa ture of C. (9. Dahlgren, evidently intended for a correction of errors in a former number, by some other party; but in which Major D. has himself fallen into grave errors, which those who have read his article will readily perceive from reading the following correct statement of the situations bere and since the cut-off.
Before the cut-off from Young's Point, the Mississipp iver ran a little east of south about four miles, thence nearly ortheast six miles, to the United States Cemetery, thenc about southwest,half south, to Vicksburg and the landing two miles: in all, from Young's Point, twelve miles. The river continues in this last direction about six miles below Vicks burg, to Brown and Johnson's plantation, thence a little south of east to Warrenton, about three miles. The upper edge of the cut-off and foot of the island made thereby is immediately opposite the foot of Crawford street, a stree running east and west from the river, and about the center of our city, the wharf, boat, and general steamboat land ing being immediately above, and the Mississippi River Ele vator Company's magnificent elevator, and the landing for the St. Louis, Memphis, and Vicksburg Anchor line of pack ets, below it. The island itself, made by the cut-off, is about one and one half miles long. The present distance to Young's Point by the cut-off is about seven miles; hence you will see that the distance cut off is about five miles, nearly all of which is north of the center of our city, measuring from th head of the cut-off around the island to Vicksburg. From the above you will readily see that Vicksburg has not as ye suffered anything from the cut-off. I am not aware of any steamboat having passed our city, going up or down, sinc the cut-off, without landing, except coal tow boats with heavy tows; nor do I believe that one has so passed. The damage resulting from the cut-off, if any, will exhibitits ef fects years hence. In deed many affect to believe that no in jury will result to our city from it, while others fear its final effects upon Vicksburg, its commerce, etc. By giving the above a place in your columns, you will do a simple act of justice to our city, and oblige a thirty-eight years' Vick Vrger.
Vicksburg, Miss.

## PRACTICAL MECHANISM. <br> by JOSHUA ROBE. <br> Second $\overline{\text { Serife-Number VI. }}$ <br> Pattern making.

To give the required form to various patterns, recourse must frequently be had to that useful machine, the lathe. The lathe adapted for pattern work is strong and steady in the framework, to avoid the tremor red be of good and dura ble workmanship and should also be handy, that is to say, the parts requiring frequent adjustment should be provided with the readiest means for accomplishing that end; and especially is this the case with the hand rest and the manne of holding it to the lathe bod, as it is, in the progress of a piece of work, almost constantly changed in position. Fig. 43 shows the method, still followed by many wood turners, of holding the hand rest; it is a primitive arrangement, but the tightening and loosening of the wedge, E , is found to take less time than screwing up the nut. In Fig. 43, A

is the hand rest, B B the lathe shears, C the clamp, and D the nut upon the bolt, $E$, the head of which slides in a groove running along the foot of the hand rest. It will be observed that the nut, being beneath the lathe shears, is somewhat unhandy to get at, and the wrench may not per haps at the moment be at hand; while, in any event, screwing up a nut with a wrench is a slow process. In some cases there is substituted, for the nut, a wheel with a tapped hole in its center; but it is still not perfect, because the workman, in slacking it off, gives the wheel a twist; and while his attention is absorbed in the intricacy of his work, the momentum of the rim of the wheel has kept it turning, so that it either unscrewsitself altogether and falls off, or runs so far back that it requires handling twice to bring it home when refastening it. A much better method is now in many cases adopted; it is shown in Fig. 44, in which A A represents the lathe shears, B the hand rest, Cthe fastening bolt, $D$ a piece hinged at each end and having through its center a hole to receive the fastening bolt, and a counter ink or recess to receive the nut and prevent it unscrewing $E$ represents a hinged plate, and $F$ a lever, having a cam at

its pivoted end. $\Lambda$ slot for the fastening bolt to pass through is provided in the plate, $E$. In this arrangement, a very moderate amount of force applied to bring up the cam lever will cause the plate, D, to be pressed down, carrying with it the nut. This arrangement is simple, cheap, durable, and very handy, and may be applied on any existing lathe to the hand rest, slide rest, or tail stock. 'There are other simple and useful contrivances devised for the same purpose; but generally speaking, the lathe requires to be designed to accommodate them, and they are not superior in action to the astem above described.
The running head of the lathe requires particular mention. The mandrel should always be of steel, turned true, hardened, and trued by an emery wheel after the hardening process. It should be well fitted to its bearing; for if it is not, an unpleasant jarring noise will be produced when the latter is set in motion.
Hard steel coned bearings are very desirable, and will work perfectly when properly made, lasting practically unimpaired for years. They are, however, expensive to make;
and in view of the present active competition in producing cheaply, most mechanics, knowing the difficulty attending cheaply, most mechanics, knowing the difinculty attending the proper fitting of this style of mandrel, feel more or less
dubious as to the perfection of such lathes until they have dubious as to the perfection of such lathes until they have
been well tried. Next to a hard steel coned bearing, we been well tried. Next to a hard steel coned bearing, we
should prefer a cylindrical one of hard brass : that is to say, a mixture of five parts copper, one part tin, and one quarter part zinc. 'The length of the journal should be three times its diameter ; the brasses should be made in halves, and ad justed so that the faces of the brasses are butted when the cap screws are tightened home, and the journal is at a nea working fit in the bearings. It will then be a long time be fore the brasses will require letting together for adjustment If, however, the joint faces of the brasses are left open, the cap screws are apt to slack back, there being no pressure on them to retain them in their places. It is an advantage to have the mandrel bored nearly through its length, say with in one inch of the tail pin or screw, whose coned end forms the bearing for that end of the mandrel. The size of the hole re ferred to should be as large as is consistent with the strength of the mandrel. This arrangement is shown in Fig. 45. The usefulness of this bore or hole is that, when a number of small pieces require to be turned, a nipping chuck can be screwed on the mandrel, and a long piece of stuff can be pushed up the hole, and the projecting end to be operated upon nipped in the chuck; then, when a piece is finished all we have to do is to advance our long piece of stuff and proceed again.
The method ordinarily employed is to drive a plug into the mandrel, and form the projecting end to the shape ie quired. By this plan more stuff is lost than is used ; and if the plug is not well fitted and driven, it loosens while being operated upon, to say nothing of the trouble of extract ing the stub from the mandrel when the work is cut off Another purpose served by the long bore is that it will form a guide for a boring bar.
The cone pulleys should be as light as possible for a pow

er lathe. Hard wood is very suitable for them, the manner of fastening to the mandrel being shown in Fig. 45. The cone pulley, A, is bored to fit the mandrel, B, tightly, and secured at the end to receive the light brass bush, $C$, which is keyed to the mandrel and screwed to the pulley. The reason for making the cone pulley of wood is that, if it were of iron, and consequently heavy, it would, from its weight, require time to get up to its full speed; and from its momentum, it would take some little time to stop in both cases, especially if the work were heavy. The tail stock should, in addition to the hand wheel, be provided with an arm;and a lever, to give rapid motion to the spindle when used for boring purposes, should be added, the arrangement being as illustrated in Fig. 46, in which A represents the arm or or fulcrum, and $B$ the lever which is applied after the rand wheel is removed. The end of the screw must becut and whel
 the ion, since the lev moves from its end as a center, while the tail stock spindle moves in a straight line. The supporting frames of the lathe need not be very heavy, but should be well braced to the shears or bed, and screwed fast

to the floor. It is not an uncommon thing, when an unusual ly large job is being done in the lathe, to brace or shore the lathe by means of braces placed between the lathe shears and the floor, wall, and ceiling. Of this arrangement it is sufficient to say that it is merely a makeshift, and is only re sorted to when the floor is springy. In cases where it is necssary to use one lathe for both large and small work, the countershaft overhead should be so placed that the belt will run quarter-cross when the lathe head is placed across the ewo, in which position there will be full swing for large ewo, in which position them flon to ceiling.
brdk from

It remains now to provide, for large work, a means of sup porting the hand rest. The handiest is the portable tripod rest shown in Fig. 47. The legs, A A A, are curved so as to get the rest close up to a large chuck. Heavy weights, in the form of a $U$, as shown at B B B, may be clamped, by means of the set screw, to the legs, to give additional steadiness if required; but if good spread be given to the legs, so that they may form an angle of about $60^{\circ}$ to the floor (taken

from the point of the foot to where the leg joins the hub), the weights may be dispensed with; and at the same time more space will be occupied, so that it may not be possible at all times, on account of surrounding objects, to get such a broadly spread rest into the position required; hence a narrower spread, in conjunction with the weights, is, undersuch condition, the most desirable.
We come now to the various chucking contrivances employed by the pattern maker. In Fig. 48, A represents a fork center, the taper part of which fits into the lathe mandrel in place of a center, the extreme end, $B$, being a flat projection, providing that there is a recess in the mandrel to receive it, as there should be. But if the lathe mandrel is bored up a great distance, then the extra length which may be given to the conical part of the fork will cause adhesion sufficient

o drive the work. The broad part is wedge-shaped on the edge view, the center point, $C$, being turned conical, similar to a common center. The center, C , acts to keep the work true, and as a guide in taking the work in and out of the lathe, while the prongs, D and E, drive it. This tool, however, is only to be depended upon for small work; forlarger work, center plates are used. They are made of metal and screwed firmly to the work. Of these centerplates, one has slot in it, so that it may be used in conjunction with the fork; while another has a conical hole in the center, which hole is made to fit the back center of the lathe. They may be made of hard wood, screwed to a small iron face plate; such plates are made useful for a variety of purposes. A pair of such center plates are shown in Fig. 49, A being that to receive the back center, and B that for the fork center. Another driving chuck for small work is shown in Fig. 50

the part, A, having an internal screw to fit the driving screw on the lathe spindle, and the point, B, being a coarse screw intended to screw into the work : which latter should have a small hole bored up it to prevent (especially in the case of hard woods) the pressure of the screw from splitting the work.
The following imitation shellac varnish is used by many furniture manufacturers: Gum sundarac $1 \ddagger$ lbs.: pale rosin 1tlbs. ; beazine 2 gallone. Dissolve by a gentle heat.

WICKERSHAM'S FIRE PLACE ARCH BAR. The usual support for the brick arch of chimney fireplaces is a flat iron bar, made either straight or slightly curved. To this, the principal objection is the liability of obstruction to the passage of the smoke by reason of the thickness of the superincumbent brick arch or wall. In order to obviate this, the inventor of the device herewith illustrated employs an

arch bar of improved construction, and combines therewith a plate for directing the smoke. The front part of the bar has a horizontal flange, $A$, on its upper edge, which is turned inward and made sufficiently wide to support the brickwork above. To the lower edge of the plate, $A$, is united the back plate, B, which extends upward and inward at an angle of aloout $25^{\circ}$. An inwardly projecting foot, C, Fig. 2, on plate, A, centers recesses in the fireplace jambs, and thus firmly secures the arch bar. The ends of the latter, $D$, also project laterally and enter recesses in front of the jambs.
It will be perceived that, by reason of the thin lower edge of the arch bar, and also the inclination of the back plate and the smooth surface of the same, no obstruction is offered to the passage of the products of combustion into the flue. The back plate has also the additional function of turning any downward-setting current of cold air, and thus creating a whirl, which is claimed to aid the draft instead of impeding it. Another result of the employment of this arch har is that the back wall, E , of the fireplace may be extended three or four inches higher and at least two inches forward, thus increasing the heating and reflecting surface. In practice a supplemental flange or plate, F, Fig. 1 (which has the same form and inclination as the back plate, $B$ ), is supported by a tongue pivoted on the latter, while its lower edge is attached to the framework of the grate. Holes are formed in the front plate, $A$, to allow of the escape of heated air into the flue. The arch bar may be cast in a single piece if lesired. It appears well calculated to improve the draft of chimneys and the heating capacity of grate fireplaces, besides affording sowe incidental protection to mantels from the action of smoke and heat.
Patented through the Scientific American Patent Agency, May 9, 1876. For further information address the inventor, Mr. Isaac Me('own Wickersham, Harrodsburg, Mercer county, Ky.

## A NEW AUTOMATIC CAR BRARE.

Mr. Alfred James, of Seymour, Jackson county, Ind., has patented (July 6, 1875) an automatic brake for cars, operated

Fig. 1.

by compressed air and embodying some novel and interesting mechanical features. Larger drawings than we are here able to present are necessary to convey a complete idea of its construction, but the annexed diagrams will suffice to give a general notion of the new points.

Fig. 2.


Under the car is arranged an auxiliary shaft, C, Fig. 1, carrying a friction wheel, $D$, which, by the action of a coiled spring. is drawn against and rotated by the car axle when he vehicle is in motion. A pitman on the wheel, $D$, con.
nects with the rod, $e$, Fig. 2, which draws in air through the opening, $F$, whence a pipe leads to the roof of the car. This air is compressed in the annular chamber, G, beside which is a cylinder, H , in the larger bore of which is a plunger, $h$, which acts on a yoke, $I$, which last connects with the swinging frame in which the shaft, C , is mounted. The small bore of the cylinder, $H$, has an adjustable nut, $J$, and a valve acted upon by a spring, which valve, when opened, allows access of air from cylinder, $G$, behind the plunger, $h$. At M , Fig. 1, is the brake cylinder, in which are two pistons, moving in relatively opposite directions so as to act on the brake levers, $o o^{\prime}$.
The air pressure at which it is required to operate the brakes is regulated by adjusting the valve in H . As soon as pressure is generated in $G$, the air passes to the brakecylinder, M, and shuts the inlet valve there located. As soon, however, as the desired point is exceeded, the valve in $H$ opens, the air enters behind the plunger, $h$, acts on the yoke, I, and so pulls the friction wheel out of contact with the axle, thus stopping further storage of compressed air. Now when the brakes are to be applied, the engineer pulls a cord so as to swing the lever, T, as shown in Fig. 1. A rod con nected to this moves a bell crank on the brake cylinder to close a discharge valve thereon. By suitable mechanism, the inlet valve is then opened, the compressed air forces the pistons outward, the brakelevers areacted upon, and the brakes applied. The brakes can be thus thrown into action on any single car or any number of cars. No special engine is re quired to compress the air, as the power is obtained by the advance of the train. The accidental uncoupling of thecars is sufficient to throw the brakes into action, and injury to the brake system under one car has no effect on the rest of the train. The inventor may be addressed as above.

## TOLMAN'S IMPROVED LAMP CHIMNEY.

We illustrate herewith another simple patented household convenience, from which no doubt a considerable sum will be realized. It consists of the ordinary lamp chimney with a hole through $i t$, by which the necessity of removing the

same in order to light the wick is avoided. The device is shown in full size in Fig. 2, and the chimney attached to the lamp in Fig. 1. The hole has an eyelet fitted in it, from which extends a shank downward, to form a support for the cover, the stem of which is pivoted. The shank and stem are set so as to spring the cover slightly into the aperture, which is tightly closed by the convex side of the cover pressing against the eyelet. Simple as this invention may seem to the general reader, it belongs to that class of patents which often produce to the inventor much more money than greater inventions on less used machines.
Patented through the Scientific American Patent Agency, May 30, 1876. For further information address the inven or, Mr. Elijah Tolman, Jr., P. O. box 48, Taunton, Bristol county, Mass

## William D. Russell

By the death of Mr. William D. Russell, president and business manager of the Baxter Steam Engine Company, Newark, N. J., loses one of her most energetic and prominent citizens. On Friday evening, June 16, Mr. Russell returned to his home from Philadelphia, and at about ten o'clock was taken ill. A physician was at once summoned, and pronounced his attack one of paralysis. Shortly after midnight he fell into a stupor, and died in the morning from affection of the brain. His disease is suppcsed to have been affection of the brain. His insease is mentain, in view of pressing business engagements, and possibly from being overheated while at Philadelphia. Mr. Russell was for many years engaged in the rubber business in New York city, but some years since
became a large stockholder in and president of the Baxter

Steam Engine Company. He was also interested in the Baxter Steam Canal Company.
We have known Mr. Russell for many years, and can at test his many good qualities. He was genial and pleasan test his many good qualities. He was genial and pleasant
in his intercourse with men, and will be missed by a large number of personal and business acquaintances.

## ELLIOTT'S APPARATUS FOR APPLYING CROTON OIL.

Croton oil and other substances possessing similar quali ties are used by physicians as counter irritants to subdue and destroy internal or deeply seated diseases and to induce or substitate therefor a superficial inflammation. The ex ternal application of this medicament is attended with ver

beneficial effects; and in order to admit of said application in an easy and expeditious manner, to avoid unnecessary suf fering to patients, and to insure a proper deposition of the irritant, the present device has been contrived. Fig. 1 shows the method of its manipulation, and Fig. 2 its internal con struction.
The apparatus consists of a case or tube containing at one end a reservoir for the reception of the irritant. At the bottom of the case a roller is pivoted, the whole periphery of which is studded with needle points projecting a short distance from the surface. The position of the roller within the case is such that a portion only of its diameter projects beyond the lower open end. The irritant is conveyed to the roller by means of a peculiarly constructed tapering stopper, the lower portion of which is contained within a circular brush, the featherends of which rub against the needle points.
The operation of the instrument is as follows: The croton oil is conveyed to the roller by slightly loosening the taper stopper in its seat, an application which is greatly facilitated by the double milling on its flanged head. The oil runs down the brush, and is evenly spread upon the needle points as they pass through the brush, as they pass through the boint being entirely and freshly coated with oil at every revolution of the wheel; thus, as the roller is passed up or down on the surface upon which the counter irri-
 tant is to be applied, no needle point enters the skin without leaving a deposit; and a pecu liar advantage that this mode of applying the oil has over the ordinary method is that the needle point enters and leaves the skin at different angles, thus enlarging the hole at the bottom of the puncture and causing the oil to be deposited therein. Another advantage is that, on tender or particularly painful spots, the roller can be applied with the utmost delicacy of touch, in a striking contrast to the appli. cation of the pounding instrument now in use. And lastly, a large amount of surface can be perfectly, as well as expeditiously, covered or acted upon.
The invention was patented in Canada, February 1, 1876. For further information address the inventor, Dr. J. W. Elliott, Box 76, Toronto, Ontario, Canada.

## Or-Moulu.

The or-moulu of the brass founder, popularly known as an imitation of red gold, is extensively used by the French workmen in metals. It is generally found in combination with grate and stove work. It is composed of a greater portion of copper and less zinc than ordinary brass, is cleaned readily by means of acid, and is burnished with facility. To give this material the rich appearance, it is not unfrequently brightened up after dipping by means of a scratch brush, the action of which helps to produce a very brilliant goldlike surface. It is protected from tarnish by the application of lacquer.

## nMPROVED MILITARY TELEGRAPH.

We extract from La Nature the annexed engravings relating to M. Trouve's new military telegraph, an apparatus of very ingenious construction. It is composed of a cable containing two wires, which is extended between the stations; and at each of the latter is a battery and instrument. The stations are simply the individuals who work the line, The stations are simply the individuals who work the line,
and instruments and batteries are secured to their persons. and instruments and batteries are secured to their persons.
The officer on the right, in Fig. 1 , is supposed to be establishing a line. Attached to his belt is a box containing the battery; and to this is connected the telegraph instrument, which is about as big as a watch, and which can easily be carried in the pocket or hooked to an epaulette. The soldier shown starting off with the line carries on his back, knapsackfashion, an apparatus which is represented in detail in Fig. 2. On the upper part is a large coil of wire, and below is the battery in a box. The instrument ry in a box. The instrument
during transportation is hooked, during transportation is hooked,
as shown in Fig. 1, to the frame as shown in Fig. 1 ,
of the apparatus.
of the apparatus.
As the soldier advances the As the soldier advances the
cable unwinds. If, for example, he is a skirmisher sent out to reconnoitre, he can now transmit intelligence of his discovery of the eneny, since he has only to unhook his instrument and signal. Each coil carries about six tenths of a mile of wire. Signals can, however, be sent. from any point within this distance. The cable is insulated, each conducting wire being cov ered with rubber, and both uni. ted being enveloped in the same
substance. With this safeguard, substance. With this safeguard,
the cable can be laid over moist the cable can be laid over moist
earth or even through streams, earth or even through streams, without its electrical qualities becoming impaired. In laying the line, however, the soldier is required to select a course as much away from roads and open country as possible, and to extend his wire on trees, so that it will be out of the reach of injury. Two men may, of course, be sent out; so that, when the coil carried by one is exhausted, the other may attach his cable, and thus extend the line for several miles.
Fig. 3 represents the telegraph instrument at one half its natural size. It is simply a case of metal containing an elec-tro-magnet which, when the current passes, attracts its ar


TROUVE'S MILITARY TELEGRAPH.-FIg. 2.
mature with an audible click. This amply suffices for sending sound signals. The key for transmitting messages merely closes circuit, and is arranged as shown at the upper part of the case.

The Fastest Cable Telegraphy.
On a recent occasion, when all the Atlantic cables were interrupted except the Direct, the entire business for two days was done on this one wire, and the average speed mainThe highest speed attained was 18 words per minute. Length of cable, 2,500 nautical miles. This is the fastest ocean te legraphy ever executed on a cable of equal length.

## A Relic of Slavery in England.

Mr. Samuel Smiles, in his recent excellent little work entitled " Thrift," devotes a chapter to the consideration of why it is that English workmen, earning, as many do, better wages than the average class of clerks, are unable to live thereon. After examining various probable causes, he comes
to the conclusion that the reckless extravaganceand indifference regarding the future, peculiar to many of the highest

paid laborers, must be what Darwin would call an inversion -in this case an hereditary remnant of the original savage -or else a survival of slavery in the state. The facts which the author gives in support of the last view will surprise many, for it is not generally known, we believe, that actual slavery existed in Great Britain up to the beginning of the present century. In ancient times the Saxons were notorious slave dealers, and the Irish were their best customers. After the Norman conquest the Saxons became slaves themselves and it was not until the commencement of the 15th century in Henry IV.'s time, that Saxon mechanics were allowed to put their children to school

## TROUVE'S MILITARY TELEGRAPH.

Queen Elizabeth emancipated the last serfs in England, but the Scottish serfs were not freed until 1799. Before then colliers and salters belonged to the soil. They were bought and sold with it, and their masters simply provided them with the sustenance necessary to keep them in working con dition. They never were required to save for any purpose, for they had no right to their own savings. The habit of improvidence was then formed among the colliers and iron workers, and it still continues.

## Useful Recipes for the Shop,

A new cement for uniting metallic to non-metallic sub stances is composed of thin-made glue mixed to the consist ence of thick varnish with wood ashes. The ashes should be added gradually to the glue during ebullition, with con stant stirring, and the cement should be used hot.
A strong mucilage capable of fastening wood or porcelain and glass together is made of $8 \frac{1}{8}$ ozs. strong gum arabic solu tion, to which a solution of 30 grains sulphate of aluminum dissolved in $\frac{2}{8}$ oz. water is added.
Carbolic acid paper, now largely used for packing fresh meats, in order to preserve them, is prepared by melting 5 parts stearin at a gentle heat and then stirring in 2 parts carbolic acid, and afterwards 5 parts melted paraffin. The mass is well stirred until cool, and is then applied with a brush to the paper.
Care should be exercised in handling carbolic acid, as in certain cases it is an active poison. A saturated solution of carbolic acid in alcohol, with an equal quantity of water, rubbed into a scratch on a cat's nose, has killed the animal almost as promptly as prussic acid would have done.
A method recommended for removing moths from carpets is to pour strong alum water on the floor to a distance of half a yard around the edges before tacking down. Then occasionally spread dry salt over the carpet before sweeping. The best method of producing crystalline surfaces on tinned iron and other metals is to immerse the plates for not longer than 10 seconds in a mixture of 3 parts hydrochloric and 1 part nitric acid diluted with an equal bulk of water. Wash the plates in water after their immersion.

## Artificial Tobacco.

Tobacco leaves for the manufacture of Havana cigars are now being produced in New Ycrk, thanks to the industry of some of her citizens, aided by the progress of chemical sci once. The material used is a kind of brown wrapping pa per, made of straw especially for this purpose. The paper after coming from the mill, is saturated with the juic pressed from tobacco stems and other offal ; then the sheet are rolled through a machine, which gives them the perfect appearance of the tobacco leaf, and the peculiar spots are printed on them as on calico. The paper thus prepared is especially adapted for wrappers around the cigars, and is such an improvement on the natural tobacco leaf (being much stronger, more economical, and easier of manipulation) tha the Havana cigar makers desire no other wrapping for cigars, and import it largely from New York; and no Havana steamer leaves here at present without taking out quantities 5,000 reams in one cargo, and occasionally as much as 30 000 reams of this artificial tobacco leaf has been exported It is stated that this tobacco-flavored straw paper make lso a filling superior to the genuine leaf; and it is im possible to detect the delicate film of paper interlapped with
some broken leaves of real tobacco in the finished cigar, his, the paper so very neatly holds in form. ray or nearly white ash, just like that of the best quality of tobacco.

The Manufacture of Glucose.
As there is just now much inquiry as to the process of making glucose or grape sugar directly from starch or other vegetable matter, the following will be of interest:
Dilute sulphuric acid and the fecula of the potato are the active agents in the production of grape sugar from starch.

The principal processes are th following: The boiling of starch meal with dilute sulphuric acid is effected on a small scale in leaden pans; but in an extensive preparation, iron pans are em ployed. The requisite quantity of water is first heated to the boiling point, and to thisis added the sulphuric acid diluted with 3 parts by weight of water. The starch is also brought, by the addition of water, to a milky con sistence. The liquids so pre pared are mixed, and the boiling continued until all the starch is converted into sugar. An inter mediate stage, not usually no ticed by the manufacturer, is the conversion of the starch into dex trin, which, in its turn, suffers conversion into sugar. The en tire conversion of the dextrin into grape sugar cannot be with certainty ascertained by the io dine test, as sometimes a purple red tint is produced, while in others there is no change. The most reliable test is that with al
cohol, founded on the well known insolubility of dextrin in an alcoholic menstruum. If no precipitate is thrown down there is no dextrin remaining, and the conversion has been entire. The proportions of materials are, generally, to 200 bs. of starch, 4 lbs . of ordinary sulphuric acid of $60^{\circ}$ Baume and from 80 to 100 gallons of water. The conversion of the starch and grape sugar is hastened by the addition of a small quantity of nitric acid. The separation of the sulphuric acid from the sugar solution is a most important operation, for the color, purity, and flavor all depend upon success in this stage of the process. The acid is neutralized with baryta or lime, with either of which it forms an insoluble salt, deposited at the bottom of the neutralization vessels, and leaving


TROUVE'S MILITARY TELEGRAPH.-FIg. 3. a clear supernatant sirup. The baryta can be employed as a carbonate (witherite), and is, without doubt, the better neutralizing agent, sulphate of baryta being very insoluble. Lime, although ordinarily nsed, forms with the sulphuric acid a sulphate (gypsum) that is not perfectly insoluble in water. It can be employed as marble dust, chalk, or caustic lime. The neutralization is completed in the boiling pan while the sirup is still hot. For every pound of sulphuric acid so much pulverized marble is required as the varying strength of the acid may demand, about pound to pound. After the addition of the marble powder, and when the effervescence has subsided, the liquid must be tested with litmus paper, or, better, with tincture of litmus; if the sugar solution be neutralized when at $26^{\circ}$ Baumé density, the fol lowing evaporation will concentrate even the smallest quantity of sulphuric acid which niay have remained, and render another neutralization necessary. To insure perfect neutranother neutralization necessary. To insure perfect neutrain the proportion of 5 to 10 ozs . to every 10 lbs . of sulphuric acid. The evaporation and purification are similar to those employed for other sugars.

## NEW YORE ACADEMY OF SCIENCES.

 A meeting of the New York Academy of Sciences,formerlythe Lyceum of Natural History, was held recently in Professor Mayer's lecture room, at the Stevens Institute of Technology. Two communications were made by Professor A. M. Mayer and one by President Henry Morton. The first A. M. Mayer and one by President
paper was by Professor Mayer on

## crookes' radiometer,

and on some resultsobtained by the action of sound pulses on an apparatus constructed in a similar manner. Crookes was led to the construction of his delicate instrument in the following manner: He made a torsion balance consisting of a bar of pith suspended by a fine filament. One half the length of this bar was blackened. On exposing this apparalength of this bar was blackened. On exposing this appara-
tus to rays from different parts of the prismatic spectrum, he found that the torsion balance moved through spaces proporfound that the torsion balance moved through spaces propor-
tional to the thermometric effect produced by the same area of rays falling on a thermopile. Representing the motion of rays falling on a thermopile. Representing the motion
produced by the ultra-red rays by 100 , those of the other rays were as follows:
Extreme red.
Red..
Orange..
Orange.

> | 85 | Blue. ......... |
| :---: | :--- |
| .73 | Indigo....... |
| .66 | Violet....... |
| .57 | Ultra violet. |

Green..................... . 41
The difficulty of ascertaining facts in Nature, even by the most careful observers, is well illustrated here by the fact that Crookes overlooked the circumstance that he was here operating with a purely accidental spectrum, the proportion of whose parts depended entirely on the nature of his prism. Had he employed the normal or diffraction spectrum pro-
duced by the passage of light through finely ruled gitter duced by the passage of light through finely ruled gitter plates, his results would have been the same as those ob tained many years ago in this country by Dr. Draper.
Crookes found that the bar of the torsion balance was attracted when the apparatus contained air, and repelled when it was placed in a vacuum: also that the radiation
from a candle on blackened pith was $5 \frac{1}{2}$ times what it was on plain pith. From these observations to the construction on plain pith. From these observations to the construction
of the radiometer was but a short step. Two fine wires, at of the radiometer was but a short step. Two fine wires, at
right angles to each other, were provided with little vanes right angles to each other, were provided with little vanes
of mica blackened on one side, and the whole suspended on of mica blackened on one side, and the whole suspended on
a pivot and enclosed in a glass vessel, from which the air was exhausted by means of a Sprengel pump. When rays of light fall on this apparat.us, the differential action of the blackened and natural surfaces of the vanes gives rise to a continuous rotation. The rate of this rotation, and hence the intensity of the exciting cause, was obtained by means of a small electromagnet placed in the apparatus in such a
manner as to register the number of revolutions by making manner as to register the number of revolutions by making a series of dots on a slip of paper.
Professor Mayer then exhibited this very delicate instru ment to the meeting, and showed the increase in the velocity of rotation on bringing it nearer a source of light.
In order to measure the repulsion of a blackened surface n a vacuum, Crookes employed W. Ritchie's torsion balance, n a vacuum, Crookes employed
described in the " Transactions of the Royal Society" "of 1830. described in the "Transactions of the Royal Society" of 1830 .
This is so arranged that the repulsion of the blackened surThis is so arranged that the repulsion of the blackened sur-
face twists a fine glass thread, to which is attached a mirror projecting a beam of light on a screen. By means of a screw, the circumference of which is divided into $360^{\circ}$, the glass thread is turned back again until the beam occupies its original position. The amount of torsion is then read off on the screw. The extreme delicacy of this instrument may be appreciated from the fact that the $\frac{1}{100}$ of a grain produces a torsion through 10,000 degrees or about 28 rotations of the thread. As it is sensitive to $1^{\circ}$ of rotation, it is evident that we can thus weigh 10000 of $\frac{1}{100}=\frac{1}{1000000}$ of a grain!

A candle at a distance of 6 inches repels 2 square inches of surface of blackened pith with a force of 0.001772 grain, at 12 inches distance with a force of 0.000444 grain. Starting out with the latter figure, and remembering that the effects are as the reciprocals of the squares of the distances,
we should obtain at 6 inches a force of 0.001776 : which we should obtain at 6 inches a force of 0.001776 : which
differs from the result actually obtained by experiment by

After succeeding in constructing so perfect an instrument, it is not surprising that Crookes should be elated; but it is to be regretted that he should express himself as he did in the following extract from his paper: "A candle 12 inches off, acting on 2 square inches of surface, was found equal to 0.000444 grains; the sun, equaling 1,000 candles at 12 inches, gives a pressure of 0.44000 grain; that is equal to about 32 grains per square foot, to 2 cwt. per acre, to 57 tuns per square mile,or nearly $3,000.000,000$ tuns on the exposed sur-
face of the globe-sufficient to knock the earth out of its orbit if it came upon it suddenly." It is true he immediately orbit if it came upon it suddenly. It is trate he immediately
modifies this statement. but it is liable be quoted with modifies this statement, but it is liable to be quoted with-
out the following disclaimer: "It must be remembered that our earth is not a lamp-blackened body enclosed in a glass case, nor is its shape such as to give the maximum surface
with the minimum of weight."
Still more mischievous, however, is the pretention to " weigh a beam of light." That it is not light which causes the rotation in Crookes' radiometer has been conclusively proved by Schuster ("Proceedings of the Royal Society," April,1876). He made a radiometer having one arm a magnet. When a strong light fell on this apparatus, it overcame the directive force of the magnet, and caused it to rotate in the usual way. net outside to keep it stationary in spite of the strong light falling upon it, the bulb began to rotate in a direction opposite to that which the light would have imparted to the site to

The only plausible explanation hitherto offered of the instrument is the following: The vacuum of the Sprengel pump is not a perfect one ; but in the highly rarefied air contained in the bulb, the molecules have a much greater being vadtly swing than in their ordinary condition, there being vastly fewer in the same space. Hence the currents
set up by the very feeble heat of the rays of light are sufficient to produce a much moreintense action than could take cient to produce a much moreintense action than could
place in dense air. The blackened surfaces become heated place in dense air. The blackened surfaces become heated
more than the natural ones, and consequently repel more more than the natural ones, and consequently repel more
particles, the reaction of which causes motion; and the ap paratus being free to turn, the motion becomes one of rotation, which continues until the effects on the two surfaces becom equalized.
To show that the effect was due to heat, Professor Maye interposed a glass plate between the apparatus and the dif fused light from a window. The effect was to stop the rotation by cutting off the heat rays, while the light rays passed
through freely. Rotation was also produced by placing the hand near the radiometer.
an analogous apparatus for sound.
In the next place, Professor Mayer exhibited an apparatus coustructed by him to produce motion by means of sound pulses. Four glass resonators on cross arms were suspended by means of a string. On sounding an organ pipe in tune with the resonators, and bringing it opposite the mouth of one of them, the resonator was repelled and the apparatus ing from the fact that, so far from any current of air pro ceeding out of the mouth of the organ pipe, the air is actually sucked in, as may be rendered visible by means of smoke rom a cigar. The smoke is carried up the pipe even when he latter is closed at the top with cotton wool so as to smother the sound. On substituting disks of cardboard for
the resonators, they were drawn up to the mouth of the organ pipe with considerable force. When fine silica powder was placed in the resonators, it was thrown into violen motion on sounding the pipe.

## OBLITERATION OF SONOROUS SENSATIONS.

Professor Mayer next described some interesting experiments, the effect of which will be to modify our present theories of audition. He took an American clock ticking 4 beats a second and a watch ticking 5 . At a distance of everal feet from the ear, all the ticks of both could be plainly heard, even those which coincided. On gradually moving the watch away from the ear, a point was reached
where the fifth or coincident tick of the watch became inwhere the fifth or coincident tick of the watch became in-
audible. A watch beating 4 times a second was then substituted and set to gain 30 seconds an hour on the clock Coincidence then occurred every 2 minutes. Removing the watch 24 inches from the ear, its ticks became extinguished for 9 seconds at a time.
To determine the relative intensities of these ticks,numer ous experiments were made on still nights in the country and it was found that the ticks of the clock became inaudi be at a distance of 350 feet, and those of the watch at a dis tance of 20 feet. The ratio of the squares of these numbers makes the ticks of the clock about 300 times more intense than those of the watch. Standing at different distances from the clock, and holding a slender stick graduated to
inches and tenths against his zygomatic process, the experimenter slid a watch along the stick (taking care not to touch it) until its fifth tick disappeared. The relative intensities of clock and watch ticks at the same distance being known,
their intensities at the distances in these experiments were their intensities at the distances in these experiments were
obtained by the law of reciprocal squares. The slightest obtained by the law of reciprocal squares. The
noise or breeze renders the experiment impossible.
In the same way one musical sound may obliterate the sensation of one higher than itself. To obviate the objection that this might be due to a change of timbre, Professor Mayer caused one of the notes to sound periodically by opening and shutting the resonant box of a fork with the hand at regular intervals. Now on sounding another lower note, either from a fork or an organ pipe, continuously, its timbre could only be changed during the sounding intervals of the other note, and would be restored during the intervals of
silence, if the objection is just. No such effect, however, is observed. The actual result is that the sound of the fork becomes more and more feeble, and finally its sensation is entirely lost. If at this point the other sound is stopped, it is found that the fork is still vibrating and emitting a sound, which had been completely overpowered by the graver one of the pipe. The same takes place if a closed organ pipe of the same pitch is
Another very remarkable fact is that even a very intense sound cannotobliterate the sensation of one lower in pitch. When the ear ceases to perceive the lower sound, it is generally found, on stopping the higher one, that the lower fork has entirely ceased to vibrate. Numerous experiments have has entirely ceased to vibrate. Numerous experiments have
been made, through a range of four octaves and on a score of been made, through a range of four
ears, always with the same result.
If a sentence is read over and over in the same tone of voice and modulation, while an $\mathrm{Ut}_{s}$ pipe is sounding, it seems as if two persons were reading, one with a very grave
voice (consisting of all the vocal sounds below Ut ${ }^{\text {s }}$ ) and one with a high, squeaky, and nasal voice. The intermediate harmonies are obliterated. The fundamental tone of most notes is perceived as the strongest, because each harmonic is diminished by the sum of all below it, while the lowest is not affected by any of them. On sounding $U \mathrm{t}_{3}$ together with an $U t_{2}$ free reed pipe, the component $U t_{2}$ is perceived unaffected in intensity, while all the higher harmonics are obdeep residual sound of a New Yorli fire alarm bell is heard
distinctly through all the noises of the street higher than it is until it dies entirely away. It seems in these experiments as though we had a special sense for the lower sounds.
Professor Mayer stated that since these discoveries he has repeatedly witnessed in orchestral music the entire obliteration of all sounds from the violins by the deeper and more intense sounds of the wind instruments, while the bass viols hold their own. From the same cause the clarinets lose their peculiar quality and charm. The leader probably heard them all; but as the ears of the audience hold different. relation of distance to the several instruments, they are actual ly paying for his enjoyment instead of their own. His position ought therefore to be that of an average hearer. The laws of orchestration can only be arrived at by a quantitative de. termination of the intensities of all musical instruments. When quantitative analyses of the compound sounds in the different instruments shall have been made, the composer will be better able to command such qualities of sound as he desires to bring out. It is evident that instruments to be used in orchestras must be differently constructed from those designed for solos or quartetts, and that they must have their peculiarities of timbre exaggerated.
Professor Mayer concluded by stating that he is at present engaged in determining the intensity of sounds either existing alone or as components of compound notes.
The meeting then adjourned to President Morton's lect ure rom to listen to a communication on some fluorescent bodies. FLUORESCENCE
Professor Morton began by stating that the property of lengthening the wave length of light rays, to which fluores cence was due, was one inherent in a great range of bodies Fluorescence is produced when light rays of one kind are converted into another having a longer wave; when the rays are lengthened so much as to exceed the limits of the spectrum, they are converted into heat. A number of fluor easing substances were then exhibited, producing effects of ndescribable beauty.
Fluorescine, a substance having little color of its own, fluoresced with a rich bright green when illuminated with the electric light passing through blue or violet glass.
Eocene, the tetrabromide of fluorescine, which has natur ally a delicate pink color in solution, became dark green under the same conditions. In this, as in the other solutions shown, the Huorescence produced a very noticeable opacity.
Purpurine,one of the coloring substances made from mad der, became very opaque orange yellow. The tinctorial power of this and some of the other substances shown is perfectly marvelous. As much as will lie on the point of a penknife, dissolved in a gallon of water, had to be diluted again with three or four times as much water to produce a good effect. Fluorescence enables us here to distinguish with perfect certainty between the natural product and ar tificial purpurine. A piece of a dressing gown dyed with madder, having passed the last stage of its usefulness, had been employed for a long time as a rag to wipe up things in the laboratory. A bit of thiswas treated to extract the purpurine,and its fluorescence was shown to be perfectly distinct and characteristic. By thus analyzing a garment dyed with rtificial preparations, we would be enabled to decide with certainty that it could not have been manufactured before the date of the invention of the artificial dyestuffs.
Chlorophyll, made by steeping exhausted tea leaves in alcohol, is a liquid of a very deep green, so deep indeed as to appear almost black. It fluoresced with a magnificent to appear
crimson.
A solution of bisulpho-bichlor-anthracenic acid, which is perfectly colorless, fluoresced with a purplish blue.
A dish of nitrate of uranium crystals fluoresced with a lu minous yellow color.
An extremely beautiful effect was produced by illuminat ing a screen on which a large wreath encircling the mono gram of the Stevens Institute of Technology was painted by means of different fluorescing substances.
President Morton concluded by exhibiting some absorp tion bands, and pointing out how they serve to distinguish the substances by which they are produced.

## ASTRONOMICAL NOTES.

Observatory of Vassar College.
The computations and some of the observations in the The computations and some of the observations in the
following notes are from students in the astronomical de following notes are from students in the astronomical de
partment. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned.

Positions of Planets for July, 1876 .
Mercury.
On July 1, Mercury rises at 3 h .33 m . A. M., and sets at 5 h , 56 m . P. M. On July 31, Mercury rises at 4 h .29 m . A. M., and sets at $7 \mathrm{~h} .6 \mathrm{~m} . \mathrm{P}$. M.
Mercury is atits greatest elongation west of the sun on the 8th, and can then be best seen. It should be looked for before sunrise, a little south of the point of sunrise.

Venus.
On July 1 Venus rises at 6 h .13 m . A. M., and sets at 8 h . 30 m . P. M. On the 31st, Venus rises at 3h. 21m. A. M., and sets at 5 h .20 m. P. M.
Venus is becoming less and less conspicuous, and will
probably not be noticed after the first week of July, probably not be noticed after the first week of July, being too nearly in range with the sun. After the middle of the month Venus should be looked for in the morning, as is has passed to the west of the sun.

## Mars.

Mars is now very small, and will not be noticed by ordinary observers. It will he very near Venus on the 5 th, and
may possibly be seen just after sunset some $45^{\circ}$ farther
north than Venus. Mars rises on the 31st at 5 h .16 m . A.M., and sets at 7h. 31m. P. M.; it cannot at that time be seen at all.

## Jupiter.

On July 1, Jupiter rises at 3 h .45 m . P. M., and sets at 1 h . 35 m . the next morning. On July 31, Jupiter rises at 1h. 47 m . A. M., and sets at 11 h .35 m . P. M.
Jupiter is so well situated in the first half of the month that observers who have small telescopes(say with two inch object glasses) can very well observe the many changes in the relative positions of its four moons. As the first satellite, or the one nearest to Jupiter, makes a revolution around the p'anet in less than ten days, it goes through all the changes, passing from east to west behind the planet, and in front of the planet from west to east (as seen in a telescope), becoming invisible by transit, by occultation, and by eclipse changes of position between $7 \mathrm{~h}, 30 \mathrm{~m} . \mathrm{P}, \mathrm{M}$, and midnight on July $7,8,9,14,15,16,22,23,24,30$, and 31 .
On July 10 the third satellite (which is the largest, but third in the order of dists.nce) will not be seen until near $10 \mathrm{P} . \mathrm{M}$. (Washington time), being in front of the planet on the 28 th it will disappear at 10 h .14 m . by going into the shadow of the planet. Young observers may learn much of this system of bodies by watching their movements, and may determine periods for themselves.

## Saturn.

On July 1, Saturn rises at 10 h .35 m . P. M., and sets at 9 h . 21 m . the next morning. On July 31, Saturn rises at 8 h . 34 m . P. M., and sets at 7 h .16 m . next morning.
Saturn can be recognized on July 10 by its nearness to the moon; and by reference to the American Nautical Almanac it will be found that the moon occults (hides by seeming to pass over it) the planet Saturn on August 6, and again on September 2.

## Uranus.

Uranus is too nearly in range with the sun to be seen. It sets at 9 h .41 m . P. M., on July 1, and at 7 h .48 m. P. M. on the 31st.

## Sun Spots.

We are evidently passing through a minimum period of sun spots; as from May 26 to the present date, June 19, a period of 23 days, with a telescope whose object glass measures two and a half inches, no spots have been found.

## NEW BOOKS AND PUBLICATIONS.

Trow's new York City Directory, Vol. XC., for the year ending May 1, 1377 . H. Wilson, Compiler. Price $\$ 5$. Ncw York
The Trow City Directory Company, 11 University Place.
Wilson's Businkss Directory, 1876-7. Price \$2.50. New York eity: The Trow Clty Dis everybody wants to consult them, yet few wish to buy them. In fact, there seems to be a kind of popular dea that directortes are only magnitled sign
posts, to be used as freely as the signs on the street corners. This is one posts, to be used as freely as the signs on the street corners. This is one
disadvantage with which directory publishers are ohliged to contend, and her mertt the two volumes above named are the oldest and best known works of thetr class,
and possess a degree of accuracy which none other in this, or any other ctty, to our knowledge, possesses. In the city directory, there are 241,16 names, and there are seven Items (business, number, etc.) to each name;
yet we are told there is but one error to every 8,400 items. The number of names above glven shows an increase over last year of 7,196 , and also prove
that the population of New York is stcadly growing, notwithstanding the assertion to the contrary by some despondent croakers. Allowing that each of the family that is given-the increase since last year is 35,980 souls hea of the family that is given-the increase since last year is 35,980 souls. No
only for the counting room and business man is a directory useful, but in erence is very conventent.
Theory of Simultaneous Ignitions. By Brevet Brigadier Gene talion Press.
This is a treatise on the best method of securing the simultaneous ignition theory is mathematically demonstrated at length, and a portable machine requiring only about four horse power, is described, which will supply an masneto-electric current ample to meet nearly any demand in submarine
blasting on the most extensive scale. The paper has already been referred to in these columns, in our abstract of essays read at the last session of the American Academy of Sclences
Pocket Book of Useful Formule and Memoranda for Civil New York city : E. \& F. N. Spon, 446 Broome street.
This is the elghteenth edition of the most convenient engineer's pocket ag very much less information; but its contents and Nystrom in containsuggestions and formule with which every engineer tlls up the leaves of his private note book. It is of the right size, and contains just the facts will be convenient to the engineer when called to examine machinery, and to make rough calculations; and not knowing exactly what
the requirements are, he feels safer if he has his rules and tables handy. A Treatise on United States Patents. Edited by h. \& C. Howson. Philadelpha, Pa.: Porter \& Coates.
This is a neatly bound book of 160 pages, and contains more information
of value to patentees than any work of its size that has come to our knowledge. It not only defines the nature and scone of patents, but it states what constitutes an invention, and tells the reader to whom patents are granted,
how an acquired interest may be lost, etc. But the most important feature of the book is its cit
Supreme Court on in constderable value to the owncrs and workers of patents, as such informareports.
Hints to Young Engineers upon Entering the Profession.
By Joseph W. Wilson, A. I. C. E. New York city: E. \& F. N . By Joseph W. Wilson, A.
The author, in this itttle pamphlet of 22 duodecimo pages, has combined a gineering student requires at the threshold of his profession. It is written in a pleasant half amusing style, does not about in moral reflections, and, altogether, is an agreeable and sensible little work. More of the same kind Our Roadways. By "Viator." New York city : E. \& F. n. Spon, 446 Broome street.

## expect much deference pald to their opinions. The present pamphlet has some useful information on pavementsin general, but appearsto be strongly

 some useful Information on pavementsing general, but appearstdevoted to the interests of an English wood- paving concern. The Clerk of Works' Vade Mecum. By George Gordon HosBroome Street.
A useful volume of practical suggestions for the architect charged with
the supervision of a bullding. It is of course mainly in accordance with English practice and customs, which detract from its practical usefulness to our archittec
some beneft.

## decisions of the courts.


 The ananuage of the claim may be frrst consfdercd. It ts as follows:
What T claim as my invention, and desire to scecure by letters patent








Unces. this branch of the case, the contention has been whether freen wa
Ue inventor, or Bron Mudge the nerson who under the direction o









































 complainants.
United States Circuit Court-mistrict of Massachue setts.
. harlow el al.

 In a sheep-she ring device where power is employed to operate the cut-
ters. 1 tis immaterial what kind of power is employed when the two separate
devices are operated in the same way to produce substantially the same ef-
fect.




## zecent Amcrican and foreigu zatents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

Carl Wiegand, New York city.-This consists of a doll head that is molded of sections made of interior layers of paper or paste-
board and outer layers of muslin, that are joined by a paste of uitable consistence.
mproved painters' scaffold chair,
John R. Crockett, Flatonia, Tex.-The invention consists of a ower by a suspension rope that is carried over suitable friction pulleys of the chair frame.
improved beam scale.
Jacob J. Hopper, New York city.-This is an improved beam scale for weigh masters, ice wagons, and other purposes, by which the beam for each weighing. It consists of a beam scale, in which the beam is made of $U$ shape, with the suspension fulcrum at th upper shorter leg, the weight being hung below the fulcrum and sliding along the lower extended leg.
improved shoe last.
Robert Taylor, New York city.-This consists of an oblique joint that the heel can be detached from the ball portion and taken ou readily. The last can thus be removed from the shoe without the heel is often torn, and the shank is fyequently broken.

GREASE CONDENSER FOR PURIFYING EXHAUST STEAM.
Samuel N. Hartwell, Wollaston Hights, Mass.-This invention consists of a grease condenser, into which the exhaust steam is conveyed by an entrance pipe, and brought into contact with a chanically purifled by the impact of the oil globules with said fluid or material.
improved process of preserving food
Kennard Knott, Chicago, IIl.-No efficient and economical method of preserving fresh meat, on shipboard, has been heretofore deised and come into use. The patentee has, however, discovered perature and moisture to which a ship's cargo is ordinarily subjected. The meat to be preserved is first deprived of its animal heat in a temperature considerably above the freezing point, and then
subjected to a temperature below that point, until it is frozen ubjected to a temperature below that point, until it is frozen sealed, both these operations of packing and sealing being performed in the same temperature to which the meat was last subjected. The meat case is placed in the center of the outer case, made sufficiently large to leave a considerable space between them on all sides. This space is filled with densely packed, fine, wheaten fieur and the cover of the outer case then applied and
secured. The flour, is a most excellent non-conductor, and, after ecured. The flour, is a most excellent non-conductor, and, afte in condition to be utilized in making bread, etc., the same as if it had been packed separately from the meat.

## improved glove fastening

Frank G. Farnham, Hawley, Pa.-This relates to the hasp-staple and spring-key contrivance for fastening gloves on which a pata cam-shaped arrangement whereby the key is maintained in the position for keeping the fastening intact; also of a device to make the pivot of a couple of points of the foundation plate of the staple, and a simple method of fastening the two prongs of the spring key together at the open end. There is also a stretching plate at-
tached to the inside of the glove ,by the rivets which attach the tached t
staples.
mprovid method of making ich.
Bernard Hoppenyan, Hancock, Mich.-This inventor suggests a novel plan for making ice in solid blocks. During very cold weaher he sprinkles water on sheets of paper prepared with resin and are used as partitions, and the ice is thus formed and packed in between them.
mprovel) car truck box
John M. Brosius, Richmond, Va.-This invention consists in exJonding out the lower end of the upper section of the axle box and naking this extension detachable so as to furnish convenient acess to the space within and allow the brass to be replaced. An inlined spout is also applied to one side of the box, and an excision made in the side face of the brass, to allow the lubricant to be poured into the box, so as easily to reach the packing. Shouldered
standards are also employed in the corners of the box to support the brass above the bottom and allow ample space for the packing. There are other improvements, all calculated to render the box betteradapted to its purpose.

## imploved burial case.

Joseph B. Morray and Robert J. Morray, New Burnside, Ill., executors of James B. Morray, deceased.-The top portion of this
burial case is formed of glass and the lower part of cement, the burial case is formed of glass and the lower part of cement, the joints, also flanges and bolts. The case is particularly designed for use within a monumental cement case, and the body of $t$ deceased can be seen through the glass top of the inner case. mi'ROVED POCKETBOOK FASTENINGS
Louis Prahar, New York city.-Two inventions. The first conthe flange at its rear ond, and a latch provided a notch formed ear end to fit into the said notch to pivot the said latch in place. The object of the second device is to lessen the cost of manufac ner not liable to get out of order. The rear part of the baseplate has a recess to receive an arm on the upper plate. The flange of the base plate also has an arm which passes through a short slot formed in the first arm, and thus hinges the two plates together.

IMPROVED ADDING PENCIL.
John J. White, Philadelphia, Pa.-In this adding pencil a pointer made to turn a grooved revolving cylinder, and move an index along a scale on the case containing the cylinder. This records thereon the number to be added by pressing the pointer upward in the casea distance corresponding to the number to be added to the record. The invention includes several novel and ingenious devices.
mproved life boat
James F. Cosgro, Santa Clara, Cal.-This consists of decks con-
rived in half-circular form, and fitted so that they can be readily trived in half-circular form, and fitted so that they can be readily
closed over the cabins of the boat, to protect the occupants from closed over the cabins of the boat, to protect the occupants from
storms and the boat from filling. There is also a hollow keel, of sheet metal, which fills with water and materially assists in keeping the boat upright.
improved brick kiln
Jerome Bronkar, Zanesville, $O$.-This invention consists in the mprovement of brick kilns by a peculiar mode of combining furoperation of the kiln can be regulated and controlled better than as commonly arranged.

IMPROVED PORTFOLIO.
John Quenzer, New York city, and Charles Quenzer, Brooklyn, N. Y.-This portfolio is so constructed as to enable school children and may be opened out for use as a writing desk without its being necessary to remove the books and other articles.

IMPROVED CAMP LOUNGE.
Anson Tottingham, Pittsfield, Mass.-This is a knock-down trame
with a canvas web stretched from head to ent hights, to elevate the head for a pillow. The web is fastened to the cross bars by two straps attached to the canvas.
improved foot measure.
Francis B. Smith, New York city.-This consists of a vertically adjustable heel rest, in combination with a foot plate, in which is a sliding measureand tape measure to take the measures of the
foot, the said elevating heel rest being to adjust the foot more nearly in the position it occupies in the shoe. Tapes for taking the transverse measure are connected to turning studs to enable them to be shifted readily to measure over any part of the foot. The studs have a detachable pin, to be employed for fastening a sheet of paper under the sole of the foot, to be used as a record o to the last.

William E. Thomas, Ford's Store, Md.-This device includes a formed of a bent metal rod, and constituting a fixed attachment rod, in desk; and the pen safe isan open-ended tube, hinged to said its ends for the insertion or removal of a pen. The rack receive and supports the pen while the owner or occupant of the desk frequently requires it for use; but at other times, as when leaving
his desk at the end of the day, it is placed in the tube for safety. IMPROVED ENVELOPE
Lewis P. Hays, Donegal, Pa.-This inventor makes a margin on the right hand of the envelope to recelve the stamp and enable it者 be cancelled by penciling without injury to the letter, the wo thicknesses of paper forming the margin being pasted together them. The extended margin is also designed to facilitate the open ing of the letter by tearing off the end.

IMPROVED ASPERSORIUM.
Rev. James J. Dunn, Meadville, Pa.-This is an improved asperorium or sprinkler, for holy water in Catholic churches, which may also be applied to bottles containing holy water. The sprinkeeparate vessel for the same. It consists of a reservoir, which is attached to the handle of the aspersorium, and provided with a neck, tube, and perforated head for sprinkling.

MPROVED BOOT TREE
James H. Sampson, Paris, Canada.-This consists of a lever and with the front piece ond wedge piece, to be used in combination contrived for treeing the ankle or center and foot piece.

## NEW TEXTILE MACHINERY.

IMPROVED HOSE GOODS.
Henry G. Hubbard, Middletown,Conn., assignor to Russell Manfacturing Company, of same place.-This consists in an improved hose goods, of three or more plies, in which one or more of the
inner plies are without warp threads. This is claimed to give the woof threads of all the plies to resist the expansion strain upon the tos.
mPROVED CLOTH-NAPPING MACHINE.
Marciene $\mathbf{H}$. Whitcomb, Holyoke, Mass.-This is a machine for napping cloth, combining on one frame the wire or card napper and the teasel cylinder. The object is to have the strength of the wire or card clothing for breaking or tearing up the fibers of cient, and to have the teasels for finishing the nap, for which they are superior to the card

## NEW AGRICULTURAL INVENTIONS

## IMPROVED CHURN

Alonzo L. Starkey, Elwood, Ind., assignor to himself and George M. Oversheimer, of same place.-The novel feature consists of two sets of paddles revolving in opposite directions, the faces of one set belng the ined so as to gather the hus producing conficting ents.
IMPROVED COMBINED HARROW AND CULTIVATOR.
Harlin Butner, Duncan's Bridge, Mo.-This machine is adapted for cultivating corn or other crops planted in rows or drills. It is
so constructed as to loosen and pulverise the soil and destroy the grass and weeds, and at the same time to open a furrow between the rows to drain off the water.
improved reaper and harvester
William Clawater, Liberty Pole, Wis.-The object of this invention is to furnish reapers and harvesters so constructed that they the fild, making a right-hand cut, and drawn back, making a left hand cut, without detaching the horses.
improved fence-building machine.
Thomas J. Tally, Rockfort, Texas.-This is a portable machine tus, with an attachment for mak ing the holes and driving in the posts, also a boring attachment for deep holes, and wire drums for

MPROVED CHEESE VA
Solomon Howe and Andrew Hill, Wegatchie, N. Y.-This consists in a lever and roller attached to the legs and front end of a cheese vat for raising and lowering the end by turning the lever, so as to bring the rollens down and ift the vaing off, and other purposes
improved ditching machine.
Charles Skinner and William B. McClure, Eau Claire, Wis.-This nvention consists of a kind of adjustable scoop at the forward part
of the framework of a two-wheeled truck, to be drawn along for cutting the ditch. It has an endless elevator at the rear of the scoop to receive the slice of earth and raise it up to a platform on which there is a kind of moldboard so arranged as to shoot the
slice off obliquely upon the bank at one end of the ditch. The maslice off obliquely upon the bank at one end of the ditch. The mahine is worked by a rope and capstan.

IMPROVED GRAIN BAG
Henry Redden, New York city, assignor to himself and John E Walsh, of same place.-In order to secure the mouths of grain and other bags in such a way that the mouths cannot gape or leak, and
which will avoid the necessity of sewing every time they are filled, which will avoid the necessity of sewing every time they are filled,
this inventor proposes a novel combination of strings with the mouth of the bag and with a funnel-shaped tube

MPROVED MOTH TRAP.
John R. Stephens, Lone Star, Miss.-The moths pass through en into a lighted box of the cap. They are thus caged and removed with the box for being killed.

IMPROVED COMBINED FORK AND RAKE
Ernest L. Gebhardt, Milford, Pa.-The mechanical construction
of this device is such that it may be readily adjusted for hay fork, a manure fork, and a rake. It is strong and serviceable in either capacity.

IMPROVED FERTILIZER.
Alexander W. Rowland, Wilson, N. C.-Thisinvention consists of an improved chemical fertilizer, designed to be used in the place fushels), rich surface earth ( 20 bushels), stable manure ( 20 bushels),
bus sulphate of magnesia ( 5 lbs.$)$, sulphate of ammonia ( 30 lbs.$)$, nitrate
of soda ( 40 lbs .), ground plaster ( 75 lbs .), pure dissolved bone ( 118 of soda ( 40 lbs .), ground plaster ( 75 lbs. ), pure dissolved bone (118
lbs.), prepared in the manner set forth in the specification and in or ibs.), prepared in the manner set forth in the speciscation and in or
about the proportionsindicated, the amount thus prescribed being about the proportionsindicated, the an
applicable to about five acres of land.

IMPROVED HARVESTER
Andrew T. Nord, Fremont, Nebraska.-The object of this inven tion is to provide a new and improved construction of harvester,
designed to adapt the implement to a more general and extended use. It consists in the peculiar construction of the framework and adjustments of the operating mechanism whereby the machine is adapted to be used either as a header for cutting off the heads of the grain, or as a harvester for cutting off both heads and stalks and for these difierent uses is readily convertible at will.
IMPROVED CORN AND COTTON CUTTER AND SCRAPEI.
Isaac F. Harrison, Rodney, Miss.-This invention is an improvement in implementsdesigned for scraping or cutting away the side blade adapted to be applied to an ordinary plow and to be adjusted in position to cutaway more or less of the ridge, and to be detached when re
purposes.
improved huller and cleaner.
Jacob F. Gibson, Bryansville, Pa.-This invention consists in ro tating a shaft provided with rows of triturators, shaped like saw has a reciprocating or movable botom as well as a siliding grate also in providing the huller spout with a fan that throws a cros blast to complete the cleaning of the grain as it is discharged and

IMPROVED PJ.OW
william I. Gossett and James P. Stark, Liberty, Tenn.-A bulltongue plow is here adapted for use as a turn plow in gravelly may be projected, and by suitable devices, may be held in any po sition into which they may be adjusted
improved bush-Cutting implement
Oliver Pickering, Needham, Mass.-This is an implement for cutbushes without cutting them. It may be used as a hoe or as a scythe, and will allow the knives to be readily removed and sharpened, when required
improved device for freding salt to cattle
Mathias Winterscheid and Bernard Schultes, Mendota, Ill.-This invention consists of a table with stationary top receptacle for the salt, and a conical revolving salt distributor that is adjustable to greater or less distance from the bottom rim of the receptacle, and provided with radial feed channels.
mproved farm gate.
Andrew J. Grady, Pecatonica, Ill.-The bars are pivoted to end posts, to allow them to swing up and down. A latch is pivoted a one end to the lowest rail of the gate, while the other end works in notches on the post. This latch is provided with a side stud on
which works a lever, thus enabling the gate to be raised in fron and unlatched simultaneously by lifting the free end of the lever In order that the gate may be held at varying hight, the top strap is pivoted to the upper end of the posts, and to a stud working in is pis of the second rail. The bottom strap is attached to an eye
slota
that slides on a pintle, the two straps being connected by the piv that slides
oted bar.

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

## MPROVED MILLSTONE DRESSER.

Augustine Defor, Etna, Minn.-This is a contrivance for working the pick by a crank mechanism, and feeding it along at the same time in the line of the crack being made by the pick. There is
also a device for shifting the pick along from crack to crack, and one for adjusting the pick handle to regulate the force of the blows.

IMPROVED WATCHMEN'S TIME RECORDER
Augustus A. Cone, Staunton, Va.-This invention consists of train, of a forked spring and rod that govern a sliding cylinder which communicates by a side aperature with the mouths of a which communicates by a side aperature with the mouths of an
entrance and exit tube. Through this a ball, thrown in by the watchman at the proper time, is conveyed to a receptacle in the
clock case. The device may be attached to any clock at small

## cost.

improved dumping box.
Joel w. Hiatt, Iowa Falls, Iowa.-The box is rocked from its Joel W. Hiatt, Iowa Falls, Iowa.-The box is rocked from its
horizontal to a dumping position, for discharging the coal by a a rack. Suitable stop springs lock on pins of the box to retain the same in horizontal position for filling.

Edward Brast and John Boger, Powhatan, Ohio.-This invention proposes to connect the buckets and arms of a water wheel cen trally by a yoke, angle plate, and double angle block. This affords a strong construction.
improved flue cap
Henry McMillen and William L. Rydman, Lima, Ohio.-This in vention consists of a plaster of Paris fiue cap, provided with loopshaped wire springs to retain it in the flue thimble. The ends o the wire composing each spring are fixed in a block of wood em-
bedded in the plaster of Paris, while the point of the loop bend outward and rests against the inner surface of the thimble, wher it is held firmly in place by the wire being coiled on each side o the bend. A flange around the cap rests against the outer surfac of the wall.
improved grinding mill.
Lewis B. McDonald, Wytheville, Va.-This invention is an im provement in the class of mills whose burrs or grinding staves ar placed vertical upon horizontal shafts. The mill is adapted fo grinding shelled corn or corn in the ear, for cracking or grinding
wheat and other grains, and also for crushing and grinding plaste and canes. The improvements relate particularly to the construc tion of the breaking or crushing devices, in connection with vert cal burrs; to the manner of securing the conical crusher to th runner; to the means of adjusting the bed stave, and at the same time preventing
brating the shoe.
improved mill feeder.
John D. Mines, Moffatt's Creek, Va.-The funnel, by which the grain is discharged immediately into the eye of the runner, passes contact with the balance iron of the stone. The holder is made adjustable on the balance iron, to enable the funnel to be set at a greater or less inclination to the axis of the runner. The improvement also relates to connecting the funn
rotating it by means of a knuckle joint.

MPROVED PRINTING PRESS.
Edward T. Dockum, New York city, assignor to himself and Thomas Dockum, of same place.-Thisinvention consists in a leve bent at right angles, pivoted to the frame by a single bolt, and upon its upper end to receive the set screws for adjusting the

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vilie Spining Ring Co.. Whitinsville, Mase.
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J. P. H. will find full particulars of th malleable glass on p. 402, vol. 32 , and p. 20, vol. 33
$-H$. L. C. will find a good recipe for paste black ing on p. 139, vol. 31.-L. H. W. Will find directions ing on p. 139, vol. 31.-L. H. W. Will ind direction 31. -D. M. K. can mend his rubber foot ball by the
method described on $p$. 203, vol. $30 .-$ R. A. B. can prescrve natural tlowers by the process describe on p. 204, vol. 28.-T. J. should waterproof his
horse covers by the process described on p. 347 horse covers by the process described on $p$. 347,
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lice headquarters. -M. will find a description of lice headquarters.-M. will find a description of
the glacier theory on p. 90 , vol. 31.-I. S. can nicke J. R. McN. can make purple and red ink byusin the recipes given on p. 315, vol. 33.-F. O. X. will and directions for kalsomining outdoor work on p. 133, vol. 34. For crystallizing with alum, see $p$
127,vol. 26.-R. A. I.will find directions for mountng chromos on p. 91, vol. 31. -L. will find recipe for colored fires on p. 165, vol. 24.-L. W.S. wil
fnd directions for casc-hardening set screws on and directions for case-hardening set screws on
p. 202, vol. 31.-J. H. D. will find directions for skeletonizing leaves on p. 155, vol. 31.-C. W.
should use aquarium cement in the joints of his shonks. See p. 80, vol. 31.-T. O' B. Will find a re-
cipe for hair dye on p. 138 , vol. $27 .-$ R. S. P. will find a recipe for a silver-plating fluid on p. 269 , vol. 31.-C. H. P. should know that a circle con taims a larger area than cilan to its circumference, in any other
sime form.-W. W. B. will find an account of the inventions of the past century on pp. 330, 336352 ,
vol. 34.-F. W. F. can remove grease spots from ol. 34.-F. W. F. can remove grease sposs from
clothing by using rectified spirits of naphtha.-S. R. S. Will find a description of the Solvay soda
process on p. 404 , vol $34-$ B. $X$ will find direcprocess on p. 404, vol. 34.-B. X. Will for manifold
tions for making transfer paper for mand writing on p. 363, vol. 31.-T. \& B. will find direc tions for lining casks with a waterproof, taste less compound on p. 11, vol. 34. This also an-
swers H. C. B.-W. A. W. will find an answer to is query as to friction of water in pipes on $p$ 250, vol. 34.-R. V. L. D. will find directions fo
building a shell boat in the ScIENTIFIC American building a shell boat in the SCIENTIFIC American
Supplement, vol. 1.-J. B. O. C. and others will find a recipe for mucilage on p. 202, vol. 31.-W. B. will find a recipe for aquarium cement on $p$. 80,
vol. 31.-C. E. W. will find a recipe for Babbitt metal on p. 122, vol. 28.-L. R. can clean his dirty oil by the method described on p. 409, vol. 34.-F R. W. can mold rubber in his iron joint by the
process described on p. 283, vol. 29.-R. G. B. will process described on p. 2ak, voll directions for making a telescope on p. 11, ol. 1,SCIENTIFIC AMERICAN SUPPLEMENT.- F . 380 ,
will find directions for bleaching hair on p. vol. 24.-E.G. E., W. J. M., R.J. W., J. K. B., R. S,, and others wn cosk us to recommena books on in-
dustrial and scientific subjects. should address the dustrial and scientific subjects. should address the
booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.
(1) T. L. F. says: 1. Please give me a plain mode of calculating port openings, exhaust, etc.,
of small steam cylinders. A. The ports should of small steam cylinders. A. The ports should
be so proportioned that the velocity of the steam will not exceed 100 ieet per second. Hence, if you multiply the area of the piston in square inches by the piston speed in feet per minute, and divide by 6,000 , the quotient will be the minimum portarea. 2. Is Mr. David Shive's way of calculating the horse mation. You have not, in your instance, applied it properly. 3. I am using a small engine for driving 8 or 10 lathes, and occasionally a small circular saw, for about 2 or 3 hours. I have to drive a
large fan. Myboiler is 8 feet high and of 30 inches grate surface; cylinder is 15 inches long and of $51 / 6$ inches bore; engine runs at 130 revolutions pe or 80 lbs. steam. After throwing the fan off, we have far more power than is required, running full speed with 25 or 30 lbs. steam. Would it not pay to build a small cylinder, say 5 by 6 inches, running at 200 revolutions, to use when not using the fan? A. Your engine seems to be performing
very well, and we scarcely think the proposed ssential
(2) A. B. C. asks: What are the proper obtain a vacuum of 24 inches under the following oonditions? Small engine, say from 8 inches diameter by 10 inches stroke; slide valve cutting off a ${ }^{7}$ in to 34 of the stroke. Steam pressure in boiler 75 to 80 lbs ., and piston speed 300 feet per minute.
Heat of injection water $60^{\circ}$. Air pump to be Heat of injection water $60^{\circ}$. Air pump to worked with crank on forward end of shaft What should be the size of injection pipe? A You should proportion the apparatus so that the amount of injection water will be from 22 to 20 imes the volume of the condensed steam.
(3) C. U. E. says: From the following you
will see that friction decreases with the diameter will see that friction decreases with the diameter
of shaft. See p. 283, vol.34. R=pressure on journal, and $c=$ coefficient of friction. Then friction of shaft=2 $r$; and the of shaft $=2 \pi r$, and the mechanical effect lost by
friction is $A=c \mathrm{R} 2 \pi r$; now if the shaft makes $n$ pended per second is equal to $\mathrm{L}=2 \pi c \mathrm{R} r \frac{n}{60}=$ $\frac{\pi n c \mathrm{Rr}}{30}=0 \cdot 105 n c \mathrm{Rr}$. Therefore the friction ncreases with pressure, number of revolutions, a. According to the query, the
velocity was to remain constant, so that, as the di ameter of the journal was increased, the number of revolutions was to be diminished in prope
proportion; and the mechanical effect lost byfricproportion; and the mecha
(4) A. L. B. says: 1. I am building a small nches. How large a fly wheel should I have? A From $21 / 3$ to 3 inches in diameter. 2. Which is the simplest way of constructing a feed pump for the
boiler? A. A plunger pump would probably b ooiler? A. A plunger pump would probably be the simplest. 3. The boiler is 3 inches in diame arge enough to keep the engine on a steady run? A. No. It is rather too small.
(5) W. F. W. asks: Why is it that saw fil fre in small quantities, will tlash like powdo A. Because they are suddenly heated and con-

Why is it that, if you multiply all of the numer assexcept 8 and 0 by a multiplier produced by mul iplying the figure 9 by 2 , all the figures in th $9 \times 3$, the answer will be all 3 s , and so on ? Thus:

| 12345679 | 12345679 | 12345679 |
| :---: | :---: | :---: |
| 98765432 | 88419753 | 12345679 |
| 12345679 | 24691358 | 98765432 |
| 222222222 | 3333 | 9998 |

A. It is determined by experiment. Thus, it hav-
ing been found that $111,111,111+9=12,345,679$, the rest follows.
Please give me a good composition for imit tion marble, that can be shaped into mor imitagetting hard? A, See p. 165, vol. 27.
(6) W. C. F. says: I am manufacturing a class of work that may be cast in a chill, an work; but when thus cast the pieces cannot be drilled. By what process can I anneal the cast-
ings so they may be drilled? A. Make them re ings so they may be drilled? A. Make them red (7) a $A$,
(7) A. A. A. says: I am about to construct a magneto-electrical machine like that representI have a permanent magnet which measures from the two ends to the bend 13 inches, and between the two ends $11 / 2$ inches, and from the outside across the two ends $31 / 8$ inches, and it will lift more and thickness the ends of the know what length should have, so as to correspond with the perma ber of wire. A. Make the iron cores for the ber of wire. A. Make the iron cores for the
electro-magnet about $1 / 2$ inch long and $1 / 3$ or $5 / 8$ in diameter. Use 150 or 200 feet of No. 23 coppe
wire in each coil. Cover the iron with paper wire in each coil.
(8) L. K. Y. asks: Will you please tell me how I can make a Britannia dip? Silver platers use a dip by the above name. Before putting a piece of Britannia metal in the silver solution
they dip the piece in the Britannia dip. A. Britnnia metal should be rinsed in a fresh solution o once to the silvering solution.
(9) M. R. says : I have so changed the solu eems to have some of the characteristics of fric tional and induced electricity, direct from the ead pencil in contact with a piece of carbon, and putting them in circuit (the pencil connected with the positive poic) heat is produced in the lead suf
ficient to inflame an ordinary friction match. I this an unusual degree of heat to be produced direct from a battery of this number of cups or of thedensity form ? A. No.
(10; B. S. S. says: Please give me a recipe for coating wooden troughs for batteries, that
will withstand the alkali. A. The following much used in batteries: In 12 parts benzole dis 20 parts powdered shellac, heating the mixture autiously over fire. Apply with a brush.
(11) P. F. W. asks: 1. Can an engine with 4 footdrive whecl make 60 miles an hour? A
It is vossible. 2. Can an engine with a 5 . t is oossible. 2. Can an engine with a 5 foot
wheel make 75 miles an hour? A. Yes, so far as the size of the wheel is concerned. 3. What is the ascertained or supposed maximum of speed attainable by 4, 5, and 6 foot drive wheel engines,
respectively? A. The ascertained maximum is respectively? A. The ascertained maximum is
about 60 miles an hour. The supposed is an unabout 60 miles an

## nown quantity (12) G. S.

(12) G. S. N. asks: I have a $2 \times 6$ inches cylinder engine, with fiy wheel 15 inches in diam
eter and $2 y / 2$ inches face, making 150 to 200 revolutions per minute, with steam at 50 lbs. The cone on my lathe has four changes of speed, being 6 596,414 , and $33 / 4$ inches in diameter. What size of Wheel should I use on a shaft to drive my lathe a
the proper number of revolutions? A. Let the countershaft of the lathe make 180 revolution per minute.
(18) G. W. F. asks : 1. What is the meas re of a gage as applied to saws? A: A gage, ac cording to Stubs' standard, is no particular part
of an inch. Gages from No. 1 to No. 26 vary from
 the gage of a 22 inch shingle saw? A. About No.
11 at center and 14 to 16 at the rim. 3. What should it cut per revolution, running at $1,700 \mathrm{revo}$ lutions per minute? A. About $1 / 4$ of an inch 0
more, according to the hardness of timber What width of belt will be required to run it A. About 6 inches. 5. What size of saw pulley be safely run at 2,000 revolutions per minute if thick at center? A. Yes.-J. E. E., of Pa. (14) A. B. says: I have a pump on a tug
boat worked with crank and fly wheel. Bore of steam cylinder is 4 inches, stroke 6 inches; bore 85 lbs. to the square inch. What would be best for a plunger? I have been using rubber, but it
mixture of 3 partscopper, 1 part tin, and 1 par
(15) L. W. R. says: 1. I am trying to elec of Britannia metal and gold mony, with two 2 quart Smee batteries; but th solution soon gets out of order and will not work Deposition takes place very slowly, and some times will only go on a part of the work, and th metal win then scale ofr the work. A. Rinse th sa,and transferat once to the plating solution. The latter seems to contain too much cyanide. Th free cyanide should be equal to about half the is apt to dissoive silver solution. When it is more, objects. 2. What ought the strength of gold an siver solutions to be, according to the hydrom er, for plating Britannia metal as above de of silver to the gallon is a good working strength 3. Will gold and silver coin do to make the solutions, and also for anodes? A. Coin is sometime , bout is better to use pure metals.
(16) W. H. S. asks: How will brass pack
agrings do in an engine? A. Do not use them Cast iron piston ringsare the best.
(17) E. H. S. asks: 1. Is it possible to send our or more messages over the same wire with out confounding the signals? A. Yes. 2. How
are the receiving and transmitting instruments constructed? A. Several ways have been de vised, but we believe the details of the system now used by theWestern Union company have no
been published. A description of Gray's harm been published. A descopto of p. 92, No. b, SCI entific American Suppiement, vol. 1 1. Can you explain why the blood gives off only parts of the body as are needed by them, as fo instance, lime to the bones, phosphorus to the brain, etc.? A. It is generally believed that eac organic substance in the body has the power of
assimilation of its own kind of matter only. assimilation of its own kind of matter only.
Would an excessive drain upon any organ of the body in a healthy person cause an appetite for he hich would contain a large percentage o likely.
(18) I. A. asks: 1. How are the positive and negative wires fastened in a Leclanche bat astened by wire leading from the zinc may be baked in with the carbon, or it may be secured to the carbon with a clamp. 2. Why does the bi chromate of potassa solution in a battery tur the chemical reaction exhausts the solution. 3. have a battery trough made of wood, with 8 cells in it. The cells are 5 inches high and 4 inche long, by 2 inches wide. I propose to make 16 por ous plates of yellow ocher, powdered charcoal,
and fine sand; they are to be 5 inches high, 2 inches wide, and $1 / 2$ inch thick. I shall place them two in each cell, so that there will be a space of 1 inch n each side to receive coke and manganese, an I shall have the zinc in between the plates, and have the plates cemented fast to the partitions. The zinc plates are to be 5 inches high, 2 inche wide, and $1 / 4$ inch thick. Whit work? A. Th ily. You had better get the regular porous cell from some dealer in electrical apparatus. You can have them made of any desired shape.
(19) F. A. asks: 1. Through how lor g carbonic acid vacuum tube would a $1 / 4$ inch spar
from an induction coil pass? A. Try the expert ment if you have the opportunity. 2. How fa rom the tube could the time of night be see by a watch? A. Try it for yourself. 3. What
length of platinum wire, No. 36 or 40 , would three Probably about a foot.
(20) J. D. O. says: Enclosed find specimen using it in making an induction coil, for medical purposes. What size and what length of wir would be the best for making the primary or inner coil? A. About 100 feet of No. 20 will do. 2 What should be the length of the induction coil?
A. Five or six inches. 3. Is the wire to be wound A. Five or thread upon a spool, and are both coils to be wound in the same manner? A. Yes, butit do notmatter whether the direction of winding is the way of both coils. 4. What do you think p. 344, vol. 33 ? Would it be practically advan tageous in my case for such a comparativel manlating Ma. No. 5. Is there any necessity fo nsulating material to separate the inner an quantity, intensity, etc., between an electro-mag net of given length (say 3 inches) composed of 4 layers of insulated wire, with another magne wice as long composed of the same length o wire, the number of layers being of course near
y one half? The size of the wire and the battery y one half? The size of the wire and the battery
power of course is the same in both instances. Would not No. 1 exceed in intensity, and No. pplicabl to magnets No. 1 w trongest,provided the current were notsufficient

Minerals, etc.-Specimens have been $\mathbf{r} t$ ceived from the following correspondents, and examined, with the results stated:
J. H. P. - Nos. 1,2, and 3 are differentvarieties o mica schist. No. 4 is a chlorite schist. Not valu The red is granite containing a potassa felspa Both contain a small percentage of iron, but not
sufficient for extraction.-G. B. L. - It does not contain fertlizers, and is valuable for building contain fertilizers, and is valuable for building
purposes.--R. W. C.-It is sulphuret of iron.-I. H M.'s and G.C. R.'s specimens have not been re
W. G. asks: Will some one oblige by giv-
ing me correct directions for netting a hammock? I have justinished one, but it will not hang prop-erly.-A. H. H. asks: How can I make red, blue purple, and black ink for printing with rubber stamps? How can I make indelible ink for the
same purpose?-W. F. asks: What is the composition of the flesh-colored enamel used by artif cial leg makers?-E. T. Q. says: Would S. C. bo good enough to give a demonstration of his method of inscribing a regular polygon, published in COMMUNICATIONS RECEIVED. The Editor of the SCIENTIFIC American ac-
knowledges, with much pleasure, the receipt of original papers and contributionsupon the follow-
ing subjects:
On Oil of Bitter Almonds. By H. P. On Raising Tomatoes. By H. M. On the Cotton Gin. By R. J. McC.
On the Western Tannin Plant. By G E. B. On the Western Tannin Plant. By G E. B.
On Spontaneous Combustion. By A. H. On Social Pressure. By J. J. On a Locomotive Blast Pipe. By I.H. D. Also inquiries and answers from the following : H. H.-B. R. H.-G. E. O.-K. T.-G. N.-B. W. M.-
C. S. M.-J. H. B. - E. E.-G. L. R. - D. G. D.

HINTS TO CORRESPONDENTS. Correspondents whose inquiries fail to appear may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.
Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials as it would fill half of our paper to print them all, but we generally take pleasure in answering briefly by mail, if the writer's address is given. Hundreds of inquiries analogous to the following are sent: "Who makes malleable glass? Who
 What is the value of maynetite or magnetic irro re? What is the cost of a yacht of 25 tuns, and of one of 100 tuns, burden? Who sells acid chromate of lime? Who uses cattle hair, for making cloth? Who sells fower pot making machines? Who sells or lets out lime light apparatus for tableaux?" All such personal inquiries are printed, as will be observed, in the column of "Business that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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index of inventions
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Bedstead, sofa, W. Lewls.
Bedstead, sofa, W. Lewls.
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Bone black, revivifying, J. Gandolfo
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DESIGNS PATENTED.
9,324.-Glassware.-T. B. Atterbury, Pittsburgh, Pa.
,325.-Carriace Sters.-E. A. Cooper,Lancaster,N. Y.

phia, Pa.
$9.328-$ Fog Curs.-C. L. Mercer, Washington, D. C.
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