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IMPROVED POWER PUNCH AND SHEARING MACHINE.

We illustrate herewith a new power punch and shearing machine, manufactured by Messrs. Long, Allstatter & Co., of Hamilton, Ohio. The machine is adapted and arranged for the speedy attachment of tools for the accomplishment of all kinds of punching, shearing, and bending. The jaws are constructed to accommodate blocks which are interchangea ble for carrying from one to fifty punches, to make from one to five washers or nuts; or for carrying any peculiar shaped punches singly or in gangs. The hight of the punches may be adjusted to compensate for wear or grinding, and the punches and dies may be removed without disarranging the other parts. The machines are made on cores, and consequently are exceedingly rigid. All the bearings are adjustable to take up wear. The countershafts have separate caps easy of access for oiling.

The cam works in steel pintles with steel bearings at top and bottom. It extends through the face plate, which is securely locked and bolted to the jaws of the press, and has a bearing in it for the outer end of the cam shaft, thus securing a bearing on either side of the cam, which prevents the latter bending. A hand wheel is attached to raise and lower the slide for the purpose of arranging the punches when the machine is not running.

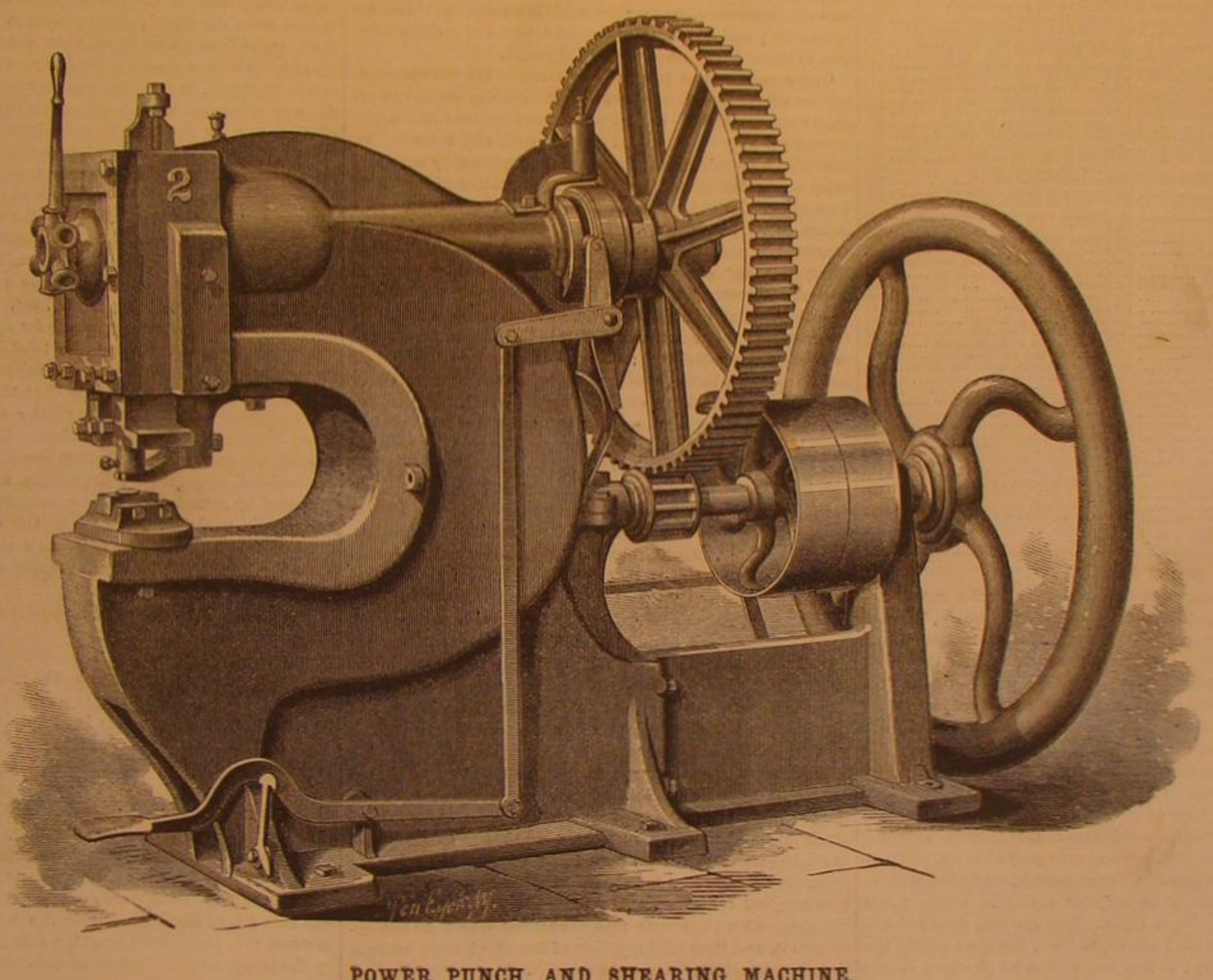
The illustration represents a medium machine. Its ordinary working capacity is to punch 1 inch diameter through 1 inch thickness, or to cut off ¾ by 5 inches flat or 1½ inches round iron. The speed, when the machine is fed by hand, is from 20 to 40 strokes; if fed automatically, 60 strokes, per minute. Safety feed tables are attached to all sizes of the machine, when desired, also an adjustable automatic stop, which is advantageous in boiler, plow, or other kindred work This device is simple, easily adjusted, sure in its operation, and may be used or not as the nature of the work may determine.

There is, besides, an improved pull-off, which consists of an iron lever which passes through a slot in the center of the press body. It is pivoted to the front, and arranged to be raised or lowered and fastened in place at the back by a loose pin. It can be changed instantly to accommodate any thickness of material. This is also constructed to work automatically, and to adjust itself to unequal surfaces, pressing hard on the material and holding it firmly until the punch passes through and is withdrawn entirely, when the jaws of the pull off are quickly raised out of the way. This method, it is claimed, prevents the machine from curving, and enables many kinds of work to be done with safety to the punches that could not be done with the ordinary pull-off. The pull-off is removed from the press by simply disengaging a loose pin.

The above manufacturers make a specialty of meeting the requirements of the trade in sizes, shapes, and the arrangement of tools for every variety of punching, shearing, and bending. They have, we are informed, accomplished the difficult task of punching all the holes in a hot horseshoe at one stroke of the puncher. The work is as accurate as if done by hand, the shoe is left perfectly true; and the holes all the same shape. As the eight punches penetrate at different angles, and are tapering, the novelty of the operation can be imagined.

The sizes of the machines range from a punch and shear weighing 500 lbs., capable of punching ½ x ½ of an inch, and to cut off ½ of an inch round iron, to the steam machine weighing 25,000 lbs., which will punch 2¼ inches diameter through 1½ inches thick, or cut off 4 inches square iron cold. The jaws vary in depth from 3 to 26 inches.

Letters patent for parts of these machines have been granted, and steps taken for securing recent improvements.



POWER PUNCH AND SHEARING MACHINE.

Glass Cement.

A cement to stop cracks in glass vessels, to resist moisture and heat, is made by dissolving caseine in a cold saturated solution of borax. With this solution, paste strips of hog's or bullock's bladder, softened in water, on the cracks of glass, and dry at a gentle heat. If the vessel is to be heated, coat the bladder on the outside, just before it has become quite dry, with a paste of a rather concentrated solution of soda and quicklime or plaster of Paris.

Bones.

When a new bone finds its way into the student's hands, he observes, says Professor Elwin, some peculiarity in shape or structure in which it differs from the bones he is already acquainted with; the question naturally occurs to him: Why does this bone assume one shape in one animal and in another is modified into a different form? He may look in vain in his books for an answer to his query. And yet it is points like these which, in my opinion, make up the true science of osteology. It is through careful, constant, and intelligent observation that these enigmas are to be solved. Observation, indoors and out; close attention to the habits of the animal in question, on the one hand, and careful consideration of its anatomical peculiarities, on the other.

Take the skull of a crocodile. What do we find? The orbits of the eyes, the nasal orifice, the passages leading to the auditory apparatus, all situated on a plane, along the upper flattened surface of the head. What, then, is the cause of this? Palpably, to allow the crocodile to remain submerged in the water, with its nose, eyes, and ears just above the surface to warn him of the approach of enemies or prey, and the rest of his carcass securely hidden beneath the waters.

Take another instance. Observe the habits of a mole. With what rapidity it burrows under ground, shoveling away the earth with its fore feet. Then look at its skeleton. We find just what we should have expected. The bones of its fore legs of astounding strength and breadth, furnished with deep grooves, which, together with its sternum or breast bone, which is furnished with a keel almost like that of the sternum of a bird, afford attachment to the powerful muscles. Its hind legs, being simply needed for locomotion, are of the normal size. So also with the birds. The size of the keel of the sternum varies in proportion to the powers of flight which each species requires, for it is to the broad surfaces of the sternum that the great wing muscles are attached. Take the skeleton of a humming bird, which spends its life almost upon the wing. We find there a keel of so vast a size that the remainder of the skeleton is reduced to insignificance in comparison.

In these researches, one is soon struck by the fact that, in the modifications in various bones, or sets of bones, in accordance with the habits of each animal, the original type is never departed from, only modified. See, for example, the paddle of a whale, more like the fin of a fish in general appearance; and yet the same set of bones which are found in the arm of a man are again found in an adapted form in the paddle of the whale. So, also, the foreleg of a horse preserves the same general plan. What is generally called his knee is in reality his wrist. It is there that we find the little group of bones which form the carpus. All below it answers to our hand—a hand consisting of one finger.

Take even a wider instance. Compare the arm of a man and the wing of a bird. Still greater adaptations have taken place, and yet the plan remains the same. We still find the clavicle or collar bone, the scapula or shoulder blade, the humerus, ulna, and radius, answering to the same bones of our arm, a small carpus or wrist, and finally the phalanges or fingers, simplified and lengthened and anchylosed to form but one series of bone, with the exception of a rudimentary thumb. It is not uncommon to find a rudimentary bone like this which, in some allied species, is fully developed. The leg of the horse again gives us a very striking example of this. There is, so to speak, only a single finger, but we find, one on each side of this little finger, two small bones, commonly known only as splint bones. These are the rudimentary traces of the same finger bones, which in the rhinoceros are fully developed.

Now osteology abounds in wonderful forms of structure like these. It is a study pregnant with pleasurable results, and is a really profitable study, and one in which each fresh student may do real solid work. It is all the little facts observed by naturalists, from time to time, all over the world, which, on being collected together, forms the nucleus of knowledge, for indeed all the scientific knowledge which we possess is little more than a nucleus, with which we are supplied.—*Science Gossip*

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VOLUME XXXIII., No. 10. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, SEPTEMBER 4, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

WHAT DO WE SEE?

Not a little comment has been provoked by the recent article entitled "The Trustworthiness of the Senses," in the course of which we expressed the belief that in health our senses are truth-telling and trustworthy, and that the cases commonly cited as illustrating sense deception, or deception by the senses, are really instances of mistaken judgment. The sense does not tell us a lie, but we infer what is not true through haste, carelessness, or lack of knowledge. Accustomed to associate certain conditions with certain appearances, for instance the presence of a gem when a particular play of light and color is perceived, we infer the existence of the familiar condition whenever the usually ascribed phenomenon is observed. We see the play of color, and pronounce its source a gem. On examination, we find that there is no gem, but merely an angular cavity in bright metal bathed in clear or colored light. The eye was deceived and reported a lie, men say: not so, say we; the eye reported the appearance correctly; it was not within its province to tell what caused the appearance. Our erroneous inference arose from lack of knowledge of the fact that that particular play of light could be produced in various ways other than the refractive action of a particular gem.

Such misleading inferences are frequently made by microscopists; bubbles are mistaken for solids, solids for cavities, transparent globules for opaque masses, and so on, the liability to error lessening with increase of experience and knowledge. A notable instance occurred but a little while ago. A mineralogist thought he had discovered what mineralogists have been so long looking for, the native place of the diamond. In a rock with which diamonds were associated, he observed under the microscope what he took to be diamonds. The observation was apparently confirmed by other microscopists; but another, more acute or more fortunate, was able to see that the supposed gems were merely minute cavities, once occupied by crystals but now empty, the original tenants and formers of the faceted spaces having been dissolved and washed away.

Shall we say that the eyes of the mistaken microscopists deceived them? Not at all. They saw truly all that was to be seen, a certain play of light. They inferred that it was caused by tiny diamonds, and erred, not knowing or forgetting that there were other ways in which such appearances could be produced.

Take a still more plausible instance of reputed sense deception. Cross the second finger over the forefinger and roll a small object in the angle between their tips. The object will seem to be double. Touch gives a false report, it is said. We say: No; it simply reports the contact of some objects with the inside of one finger and the outside of the other, a sensation commonly produced by two objects separated by the breadth of the fingers. After a little practice with the crossed fingers, we cease to make the wrong interpretation of their report, just as we have all learned to do in the case of thumb and finger. So familiar are we with the touch of objects indifferently between either side of the thumb and either side of the several fingers that we never mistake their combined report. The same is true with regard to our two hands; from long experience we instinctively combine the double sensation they give into a single perception. Not so, however, with hands and feet—at least among a boot-wearing people. We are not used to feeling objects with our fingers and toes together; consequently when an object is touched, say by the great toe and the forefinger, the double sensation gives a double perception, though the object be single. Very probably the education of savages is more complete than ours in that respect. Shall we say their senses are therefore more trustworthy?

Against the view we have illustrated so fully, several correspondents have taken exception. One says:

"Allow me to ask, is not our judgment the offspring of our senses? Yes; and the more acute the senses, and the more harmony there is in their working together, the more accurate the judgment. Blot out of existence the five senses, and you blot out the judgment which you make lie back of them, and seem to make independent of them."

To this we need only reply that the fullest dependence, not only of judgment, but of all the faculties of the mind, upon the senses, may be admitted, as far as their development is concerned, without affecting our position. Whatever their organic connection, perception and inference are distinct operations; and no theory of mental action can make a delusion of sense out of an error in judgment.

Our correspondent proceeds to describe the nervous connection of the several organs of sense with the brain, and organs that the senses cannot be trusted because the nerve connection may be deranged or destroyed, and a correct report of the sense's action prevented: a contingency carefully ruled out of the discussion by our specification of health as a condition of right action on the part of the senses. This is not so bad, however, as the course of another who pronounces our position absurd and foolish, and, in proof of his assertion that "everything goes to prove the trustworthiness of the senses," gives a series of examples, all but one of which belong to the domain not of sense but of sensibility; for example: that one man delights in the odor of roses while to another it is indifferent; that one man enjoys the tumult and clamor of a battle, another abhors it, another cannot bear it; that one man likes tobacco, which to another is disgusting. The single exception was this: that a distant church spire looked to him not more that a foot long; therefore his sense of sight was not to be trusted!

It is surprising how common is this twofold error, to suppose it a function of the eye to see size, and to accuse the eye of inefficiency or dishonesty because the apparent size of objects is variable. Our first-mentioned correspondent has in this connection a theory that is quite new to us. "I have said," he remarks, "that the organs of sense have brain nerves; I not only believe this, but I believe that they each have more than one brain nerve. The eye, for instance, has a brain nerve which enables the mind to recognize form, another which enables it to recognize color, another which enables it to recognize size, etc. And upon the acuteness of these nerves depends the power of mind to recognize the different qualities reflected through the eye."

The theory is simply enough, but unfortunately it is not supported by anatomy and is flatly contradicted by experience; particularly the experience of those persons who have taught us most with regard to what we see and how we learn to see it—men and women born blind with cataract or some other curable organic defect, and enabled to see in later life by a surgical operation. To speak mildly, it is hardly just to impose upon the eye so many functions which do not belong to it, and then hold it guilty of breach of trust because it does not perform them satisfactorily.

This brings us by a roundabout way to our original enquiry: What do we really see?

We use our eyes in determining the size, solidity, distance, and motion of objects. Can we say absolutely that we see them? We frequently pronounce an object hard or soft, hot or cold, at sight. Do we see hardness or heat? From varied experience we have learned to associate different degrees of density and temperature in many objects with certain visual aspects of those objects; these perceived, we infer the softness or hardness, the warmth or cold; and so closely united are the perception and inference that we are apt to say we see what we really infer.

In like manner we infer or estimate size, distance, solidity, speed of motion, and the rest. In all such cases, then, an act of judgment involves many elements, sight being supplemented by extravisual processes, the mastery of which was slowly gained in infancy, but so thoroughly gained that they now seem automatic. In reality we see only light in its various hues and shades; but whether the source of the light is near or far, solid or superficial, it is no business of the eye, primarily, to determine. Consequently, when we mistake a painted object on a flat surface for a solid object in open space, when we think a sheet of water is ten miles across one day and only three miles the next, when a hawk speeding through space seems motionless, when a pool of water is mistaken for a damp flagstone by gas light, in the infinite instances when things are not what they seem and the eye is charged with treachery, that useful organ is simply wrongly accused. Its duty is correctly done; but through inattention, haste, or ignorance, we misinterpret its report.

We are not asserting the perfection of the human eye as an optical instrument. It is far from perfect; but the untrustworthiness with which it is charged does not arise from its optical imperfection: so, in almost every instance, in the case of the other senses. If we are deceived by them, it is our fault, not theirs.

But it may be asked, what difference does it make whether we regard the senses or what lies back of them as a source of error, so long as liability to mistake is admitted?

This very great difference: The one view logically leads to the brooding apathy of the Indian mystic, the other to the questioning, testing creative activity of modern thought. To surrender ourselves to the belief that error is our normal condition is to lose our grip of reality and drift into dreamy speculation. Believing the senses honest and truth-telling, we must regard error as an evil to be corrected by caution, culture, and widening knowledge; where they fail through dullness or narrowness of range, we can strengthen and verify them by mechanical devices. Distrust them utterly, and hope is lost; trust them, and we may pursue our course with something of the confidence of the passengers of the Prairie Belle, with Jim Bludsoe at the wheel, when

> "They all had faith in his cussedness
> And knowed he would keep his word!"

THE CAUSE OF PROFUSE RAINS.

Every one knows that the heat of the sun raises water from the earth in the form of vapor, which becomes clouds, that float around, and at last discharge the water of which they consist; this simply is the cause of rain. But we ask the reader if he has ever considered that the amount of water evaporated by the sun depends on the latter's heat? If this were increased, more water would evaporate and more come down; and if it were diminished, less would evaporate and less would come down, and the amount of rain would diminish, as it is certain that the water which comes down as rain must have been previously raised by the heat of the sun; as the sun is sometimes obscured by spots, it must be supposed to give less heat, and therefore cannot raise so much water as vapor: and under these circumstances the sun cannot properly be the cause of extraordinarily heavy rains and inundations. This is the theory advocated in some quarters, but it cannot stand the scrutiny of reason.

Measurements show that the heat emitted by the sun is not regulated by the spots; while at the same time that spots appear, the faculæ, giving more heat, also make their appearance, and go far to compensate for the diminution of heat caused by the spots, so that the total heat emitted by the orb is, for all practical purposes, a tolerably constant quantity; and it must be remembered that the evaporation chiefly takes place from the surface of the ocean, which covers three fourths of the earth's surface. Three fourths of this evaporated water falls back into the ocean, and one fourth on the land, or perhaps a little more, as clouds appear to be attracted by mountains, and by preference discharge their contents on land; but in any case the ocean receives back, in the form of rain, more than half the water evaporated from the surface. The circumstances attending the condensation of the cloud vapors into rain are very complex; and this operation is subject to so many various conflicting influences that a regular distribution of rain would be a matter of surprise, if not a total impossibility, and therefore we see the greatest irregularity in the rainfall prevail. In some limited regions of the earth, however, there exists a regularity in this regard; but this is simply caused by the more uniform circumstances in which such exceptional localities are placed; and the causes of this regularity may be, and have been, clearly traced by those who make the investigation of this subject a special pursuit.

If the total amount of evaporation, over the whole surface of the earth, be a nearly constant quantity, the total amount of rain falling over its whole surface must also be regular, because what goes up must come down; and if we had rain gages distributed over the whole earth and ocean surface, this proposition would, no doubt, be verified. But, by the irregular distribution of rainfall, some localities may be liberally supplied at the expense of others; or at some periods of time, the rainfall may become concentrated into shorter periods. If, then, such larger rainfalls take place within the limits of the valleys which supply our rivers, an inundation is the consequence. It may be that the amount of rainfall in some inundated districts is not greater for the whole season than is usually the case, or, if it is, the rainfall of other localities, or on the ocean, may have been so much less; so that, in order to account for an inundation or a great rainfall, it is not necessary to suppose the total amount of water falling has been greater than usual.

These considerations show how unnecessary it is to look for cosmic causes in explanation of such comparatively trifling meteorological phenomena as an extra rainfall in some districts. Some philosophers have even gone so far as to attribute it to the jets of incandescent hydrogen, ejected in the form of protuberances (during solar storms) from the sun's surface to a hight of a hundred thousand miles toward the earth, which, cooling while approaching our atmosphere, form water. If we consider that, at a distance of three million miles from the sun, the gravity towards that body is nearly as great as is the gravity on the surface of the earth towards the earth, it is clear that this solar hydrogen has little chance to reach us. If it did, and if it combined with our atmosphere's oxygen to form water, a terrible fate would be in store for the earth; because, if all the oxygen in our atmosphere were exhausted to combine with hydrogen to form water, it would only form water enough to raise the surface of the ocean six feet, as is easily proved by calculation.

STEEL BRONZE AN AMERICAN INVENTION.

We recently described the so-called steel bronze, which, as material for ordnance, is at the present time being widely discussed by European military people. It is an ordinary bronze of 90 parts copper and 10 of tin, of which the gun is cast on a copper core of less diameter than the bore. The latter is then reamed out until about one quarter inch less in diameter than it is intended to be ultimately. The gun being firmly secured, a series of conical plugs of hard steel are forced through it by hydraulic pressure, compressing the metal about the bore and rendering it,as proved by extended experiment, stronger, harder, and much more elastic. General Uchatius of the Austrian Army, the reputed inventor of this process,has been experimenting upon it since September, 1873, but his claims as to origination are opposed by those of Colonel Rosset of the Italian, and Colonel Narroff of the Russian, army, both of whom state that they also separately conceived the idea of thus treating bronze guns as early as the year above mentioned.

The results which have been reached in testing guns of steel bronze, some of which have withstood the firing of 3,000 rounds without any diminution of accuracy of fire or deterioration in any other respect, prove the invention to be of more than ordinary importance. This fact is certainly well recognized by the Austrian government, which, as already stated in a previous article, has ordered a large number of batteries to be made of the improved metal. Consequently it is all the more gratifying to Americans to learn that the so-called steel bronze is neither an Austrian, an Italian, nor a Russian invention, but one created by Samuel B. Dean, of Boston, Mass.,and patented by him in this country and in England in 1869. Mr. Dean's claim is, "as a new manufacture, a bronze gun in which the metal immediately surrounding the bore is put in the condition by the process of condensation set forth," which process we need not here recapitulate, since it is identically the same as that described in the first paragraph of this article, and now asserted to be theirs by Uchatius, Rosset, and Narroff.

It appears further, and the fact may not be so gratifying to Americans as that just mentioned,that Mr. Dean patented his invention in Austria in 1869. Three years later a general in the Austrian army comes out with precisely the same idea, and is backed up in its ownership by Austrian authorities, who reward his alleged discovery by permitting him to sell out rights for certain countries, other than the great powers of Europe.

Colonel Laidley of the U. S. Ordnance, to whose suggestion we are indebted for reference to Mr. Dean's patent,states that the records of the U. S. Ordnance Office show that an order was given in July, 1870, for a number of these guns, but that,through lack of funds,the same was countermanded. We agree with the above named officer in the hope that the next Congress will make a suitable appropriation for the introduction of Mr. Dean's invention into our service.

DEATH IN THE NURSING BOTTLE.

In a city like ours where the death rate at the present season averages seven to eight hundred per week, mostly children, every humane person feels the necessity of increased vigilance to combat every evil which tends to increase "the slaughter of the innocents." High temperature is one of the causes which we are powerless to combat. Dirty streets and filthy houses we must leave to the Board of Health. Poverty of the parents, which prevents their providing suitable food and medicine for their little ones, is another cause of our great infantile mortality, against which we can and ought to do something. But ignorance is another cause, too often overlooked, against which we are not powerless if we organize for action. The daily papers warn old and young against the dangers of unripe fruit and stale watermelons; but people will indulge, and we must allow the American citizen, however young, to exercise his inalienable right to take his own life in this way.

But there is another prolific source of infant mortality to which we wish now to direct special attention, namely, the patent nursing bottle. It consists of a rubber tube, one end of which is held in the child's mouth; the other end, passing through a cork, is attached to a glass rod which descends to the bottom of a bottle of so-called milk. We might write a column on the dangers that reside in the milk, unless special care has been taken to obtain it fresh or by suitably diluting pure condensed milk. But this danger is well known, and our business at present is with the bottle, or rather its dirty tube, which should never be used more than once, then thrown away and a new one bought.

Even when new, these white tubes, impregnated as they are with oxide of zinc, are not unobjectionable; far worse are they when saturated with sour milk, germs of putrefaction, decay, and disease. Some of these child-murdering Yankee inventions have reached Berlin, and have called forth the following from a practising physician of that city:

"The supposed advantage of these bottles consists in this, that they can be placed beside the infant in bed, while other bottles must be held in the hand all the time. What sensible mother or nurse would leave a child with a bottle without watching it? The danger of the bottle consists in this, that it is absolutely impossible to cleanse it. When sucked on, little particles of milk become attached to the tube and cork; these curdle and soon turn sour. If some of this deposit be placed under a microscope, we see innumerable bacteria, organic beings which indicate decomposition and decay. At every meal the child draws in thousands of these germs. The decomposing process acts upon what it finds in the mouth, œsophagus, and stomach; and the result is diarrhea, *cholera infantum*, etc. I will here expressly remark that the usual method of placing the apparatus in water, or merely rinsing it out with a stream of water, is in no way sufficient. Some dealers sell a suitable little wire brush with the bottle, but even this does not answer the purpose, for the apparatus is not clean by a long way after drawing the brush through it several times; and who will take the trouble to clean it so thoroughly 8 or 10 times a day? How much time it would require! Another disadvantage is that the bottle is airtight, and a partial vacuum is formed, which renders sucking so difficult as to exhaust the child, and it stops before its hunger is satisfied. Hence, parents, ye who are compelled to feed your children with a bottle, throw away this apparatus, which can only bring destruction upon your children, and either select a bottle with glass mouthpiece, which is filled from below, or take a large rubber mouthpiece, which is perforated by a small hole and can be drawn directly over the neck of the glass bottle. This large mouthpiece or nipple can readily be turned inside out and thoroughly cleaned and rubbed with dry salt."

CLOUDS AS STORM SIGNALS.

It is commonly believed that the barometer is an infallible indicator of weather changes. Practical meteorologists know that its merits fall far short of its popular reputation,though as an indicator of variations of atmospheric pressure it is the main dependence of isolated observers—especially mariners and travelers—in estimating the probabilities of wind and weather.

In his newly published work on storms, Blasius questions even this limited usefulness of the barometer, and insists that observers, particularly navigators, will find a far better guide and counsellor for safety in the forms of the clouds, which not only foretel approaching storms much earlier than the barometer, but show at the same time the observer's position in regard to them, and how their dangers can be best escaped.

Mr. Blasius enters the field of meteorological discussion with a theory of his own,and boldly pronounces the accepted theories of storm-formation incorrect, because based on a part only of the facts involved. Both the leading theories of storm development and movement—the rotary or cyclone, and the inblowing or centripetal—are misleading, he claims, for two reasons: first, in that they make an exceptional form, the tornado, the type of all storms; second, because they are based on partial observation even of that. Observations of the same storm are thus made to support two directly contrary theories, the error of both consisting in the taking of part of the storm, and each a different part, as representative of the whole, and holding that the action of storms is of the same nature at its beginning and throughout its entire course.

From the unequal distribution of the temperature of the air, and the varying effect of the sun's heat upon it, there arise, first, currents caused by a tendency to re-establish, in a perpendicular direction from the earth's surface, both upward and downward, an equilibrium which has been disturbed; second, currents caused by a tendency to re-establish, in a horizontal direction from the equator to the poles and from the poles to the equator, an equilibrium which has been disturbed. From the movements and conflicts of these currents, modified by the configuration of the ground in certain cases, storms arise; and according to Mr. Blasius, every sort of storm has its representative cloud formation, which gives timely notice of approaching danger.

In accordance with these views storms are divided into the following classes: (1) Local or vertical storms produced by the rushing in or inblowing of the atmosphere to re establish in a vertical direction an equilibrium which has been disturbed. In our latitude, the summer shower is an example of this sort of storm. Its characteristic cloud is the *cumulus*.

(2) Progressive or lateral storms in which the equilibrium is re-established in a lateral direction. These storms are of two kinds: (a) Equatorial or northerly winter storms, produced by a warm current displacing a cool one to supply a deficiency toward the pole; temperature, changing from cool to warm; characteristic cloud, *stratus*. (b) Polar or southerly summer storms, produced by a cool current displacing a warm one to supply a deficiency toward the equator; temperature, changing from warm to cool; characteristic cloud, *cumulo-stratus*.

(3) Diagonal storms—tornadoes, hailstorms, sand storms, waterspouts, etc.—produced by an atmospheric effort to re-establish the equilibrium of a polar storm which has been disturbed in the plane of meeting by a peculiar configuration of the ground: direction, the diagonal of the forces of the two opposing currents transversely through the polar storm; characteristic cloud, *conus*, heretofore known simply as the tornado cloud.

It is in the first described storms that the barometer is chiefly of use as a predicter, especially in the torrid zone, where they attain very great dimensions. In the temperate zones they are of less importance, and cannot be long foreseen by the clouds.

In the next class, the barometer is of less advantage, the clouds indicating the approach of such storms from half a day to a whole day before the meteorological instruments begin to show any change. These storms generally come from the northeast, and report themselves in advance by means of hazy stripes of stratus cloud above the southern horizon.

Of still less use is the barometer in foretelling the polar, southeast, and southwest storms of summer; for in those which are most violent and destructive, the worst is over before the barometer begins to fall. It is from these that tornadoes originate. They do not send their warning clouds so far in advance as the northeast storms, but, on the other hand, they do not extend over so large a territory, and travel much more slowly, especially when about to become destructive. Their cloud sign is a long bank of round black clouds along the northern or northwestern horizon. If rightly interpreted, these not only indicate the approach of the storm early enough for safety, but also tell which way to sail to avoid them. They can generally be seen from one to eight hours before the middle of the storm arrives; and the more violent the storm, the slower its approach.

The loco-progressive or diagonal storm is an offspring of the foregoing, but differs totally from the other kinds of storms in origin, motion, and appearance. Its area is the smallest and its effects the greatest of all. It arises at the culmination of the southeast storm, that is, where the polar current balances the equatorial, and the region of conflict has become nearly or quite stationary. If any local advantage is given to either current by the configuration of the ground at this stage, a whirl or eddy may be produced and a rotary storm generated, traveling in the diagonal of the forces of the two currents through the region of calm between them, its course delineated by a long black bank of cloud. Its first sign is a rotating disk of cloud,darker than ordinary, formed by the sudden and profuse condensation of the moisture contained in the air of the equatorial current, which is suddenly thrown into higher and colder regions.

The art of cloud-reading, Mr. Blasius is good enough to say, is easily learned. The best time to begin the study is in midwinter, when the irregularities of the earth's surface are partially obliterated by the snow, and when the horizontal air currents which produce the progressive storms and their registering clouds are less disturbed by upward currents. "The experience gained in the repeated forward and backward oscillations of these currents will prepare the student for the more complicated influences and effects which the vertically rising currents, the originators of local storms, bring into consideration as the season advances. A year's observation will acquaint him with the cycle of phenomena and make him a reliable weather prophet, at least for every-day purposes"—presuming, of course, that he has taken pains beforehand to learn the significance of elementary cloud changes, as indicators of the direction and character of aerial currents and conflicts.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW EMERALD GREEN.

Any pigment which approaches in beauty the fearfully poisonous Paris green certainly deserves attention. One of these is said to be an hydrated oxide of chromium, prepared in a peculiar manner and known as Guignet's green. We doubt the statement that it is not poisonous; but it is, at all events, far more harmless than Paris green, or any other arsenical color. It is prepared on a large scale by fusing together, on the hearth of a suitably constructed flame furnace, at a dark red heat, 3 parts boracic acid to 1 part bichromate of potash. The mass swells up, much oxygen gas is evolved, and the substance is finally converted into a beautiful green double salt, a borate of chromium and potash. By repeated washing with boiling water, it is decomposed with hydrated oxide of chromium and a soluble borate of potash. After suitable washing and very fine grinding, this oxide of chromium has a most beautiful shade of color, covers well,stands the air and light, and is only attacked by boiling concentrated acids. On a small scale, this green pigment may be prepared in a porcelain crucible.

VANILLA AS A WASTE PRODUCT IN THE MANUFACTURE OF PAPER.

We take the following interesting suggestion from a recent number of *Dingler's Journal*: In the preparation of wood pulp for paper, fine wood is treated to a solution of caustic soda under high pressure in iron boilers. After the operation the solution contains the soda salts of resinic acid, humic acid, and carbonic acid, and some other resinous bodies. In this solution the soda salt of vanilla must also be present, if it has not been destroyed by the high pressure and temperature. The presence of this body is indicated by the intense vanilla odor which always appears on treating the above liquor with acids and allowing it to stand a few days. The writer above referred to has not yet succeeded in obtaining crystals of vanillin, and hence does not describe his process in full. If any of our readers possess sufficient quantities of this lye to experiment upon, we have strong hopes that their labors will be rewarded with better success than those of our German friend, and that America will one day boast of a vanillin factory.

ALUMINUM.

According to Winkler there are at present four aluminum manufactories, which produce about 35 cwt. per annum. Of this quantity 20 cwt. goes to France and 15 to England. Aluminum is also made in Berlin. The price for a number of years has been $12 to $15 per lb. It is not probable that it will be produced cheaper than that. This fact, with its unchangeability and lightness, being 3 times lighter than copper, 4 times lighter than silver, and 7 or 8 times lighter than gold, render it excellently adapted to coin, especially as it is easily coined.

Kansas City Industrial and Agricultural Fair.

It is intended to hold a fair at Kansas City, Mo., to be open from September 13 to September 18, both inclusive. An unusual interest is being taken in this meeting, as the Kansas State Fair will not be held this year, and the exposition at Kansas City will be the only one held in Missouri, west of St. Louis. Liberal awards of diplomas and gold, and silver, and bronze medals for merit in all classes of articles will be made; and proper arrangements for the care of machinery, etc., have been perfected. Further particulars will be found in our advertising columns.

A NEW GUNBOAT.

Messrs. J. and G. Rennie, of Greenwich, England, have recently launched a gunboat, the Bermejo, built for the Argentine Republic. She is intended to carry a 26¼ tun, 11 inch Armstrong 600-pounder gun, and is after the Arrow and Bonetta type, now being constructed for the British navy by the same firm. She is of the following dimensions: Length, 105 feet; beam, 30 feet; and depth, 10 feet 6 inches, having a draft of water of about 7 feet 6 inches when loaded, with an intended speed of about nine knots per hour. There are two pairs of inverted compound twin screw engines, each driving a separate screw under the quarter. They are expected to give out, when at full working, an indicated power of about 400 horses. She is also fitted with a steam steering apparatus, enabling the gunner to point the gun by means of the rudder, without the necessity for separate means of training. The rudder is unusually large. A small temporary forecastle is to be fitted forward to enable the vessel to proceed with more comfort and safety to her destination, the River Plata.

The gun platform is movable, as in the British gunboats, and lifts and lowers by means of screws worked by a small engine for that purpose; the same engine is used to work a pair of hydraulic pumps, which will supply power to load and ram the gun.

NEW GUNBOAT THE BERMEJO.

Compass Variations on Iron Ships.

It is now believed that some of the sudden and hitherto unaccountable changes in the deviation of the compasses of iron ships—which are often unsuspected until alleged as the only conceivable cause of the vessels running ashore—are the effects of an unequal and varying distribution of heat over the iron hull. Sudden slight changes of compass deviation, not exceeding five degrees, have been noticed on board iron ships on our American coast, and these are now attributed to changes in the hull, occasioned by the vessel's passing from warm to cold water, and the reverse. The warm temperature of the Gulf Stream, taken in connection with the cold counter current, may account for many of the suspected compass errors on iron ships, and the devising of a remedy for this would be an excellent subject for study on the part of an enterprising inventor.

DRIVING PORTABLE TOOLS.

We illustrate herewith a mode of working portable tools for drilling, boring, sawing, polishing, etc., designed and patented by Mr. John Paterson Smith, of Glasgow, Scotland. As the arrangement will, says *Engineering*, probably at once remind our readers of hair-brushing by machinery, as the plans really consist in adaptations of the mode of driving a rotary brush, used by the hair-cutting fraternity, to the varied requirements of the workshop.

Fig. 1 of our engraving is a perspective view, showing one method of operating with a portable tool. In this figure, *e* is an overhead shaft, driven from the prime mover by the belt, *f*, and pulley, *g*. The shaft, *e*, is carried on bearings, *h h*, and has planed on it a groove or key way, *i*, running its whole length. The pulley, *j*, is bored out for the shaft, and fitted with a key or feather to suit the key bed just mentioned, and it is, moreover, so mounted as to be easily moved or shifted along the shaft to any portion between the bearings, *h h*; this pulley, *j*, has formed in its periphery a V groove to receive the elastic or other endless band, *k*, which conveys the motion to the grooved pulley, *c*, of the portable tool. Z represents the work to be operated upon, held in the vise, *m*, attached to the workman's bench, *n*. The hands, *o o*, of the operator grasp the handles on the movable tool, and guide and direct it when in operation, as shown.

Fig. 2 is a longitudinal vertical section of a tool suitable for drilling, boring, widening, or other purposes, similar to the modification delineated in Fig. 1. In Fig. 2, *a* is the center spindle, having one end formed as a socket to receive the drill or other tool, *b*, and on this spindle, *a*, is fixed the V grooved pulley, *c*, for receiving the driving band or power transmitter. Two tubular or loose handles, *d d*, are also mounted on the spindle, so that the latter rotates within them.

Fig. 3 is a side elevation, and Fig. 4 a sectional elevation of means for fixing drilling, boring, or other cutters in holders, when tools are arranged to be operated as portable hand tools. In these figures, *a* is the cutter holder, having one end formed to enter the socket of the portable tool spindle, while the other end is taper or cone-shaped, with a slit, *b*, to receive the small steel cutter, *d*, and the bridge of the taper thimble, *c*. The taper thimble, *c*, is bored out to fit the cone, and has a bridge at the wide end to pass up the slit. The steel cutter bears on this bridge; and the harder the cutter is pressed on the work, the more firmly the taper thimble compresses the slit cone and causes the slit cone to grip the cutter.

Fig. 5 is a sectional elevation of a bevel gear tool suitable for operating in a horizontal, vertical, or angular direction. In this view, *a* is the central spindle, having one end formed as a socket to receive the tool, *b*. The V-grooved pulley, *c*, runs loose on a stud handle, *d*, fixed in the frame, *e*, which latter is also bored out to receive the central spindle, *a*, and back center screw, *h*. The grooved pulley, *c*, has fixed on it a bevel tooth pinion, *f*, which gears into and actuates the wheel, *g*, on the center spindle, *a*. The adjusting screw, *h*, is fixed into framing, *e*, by cotter, *i*, and the box screw back center nut, *j*, is arranged in the usual way.

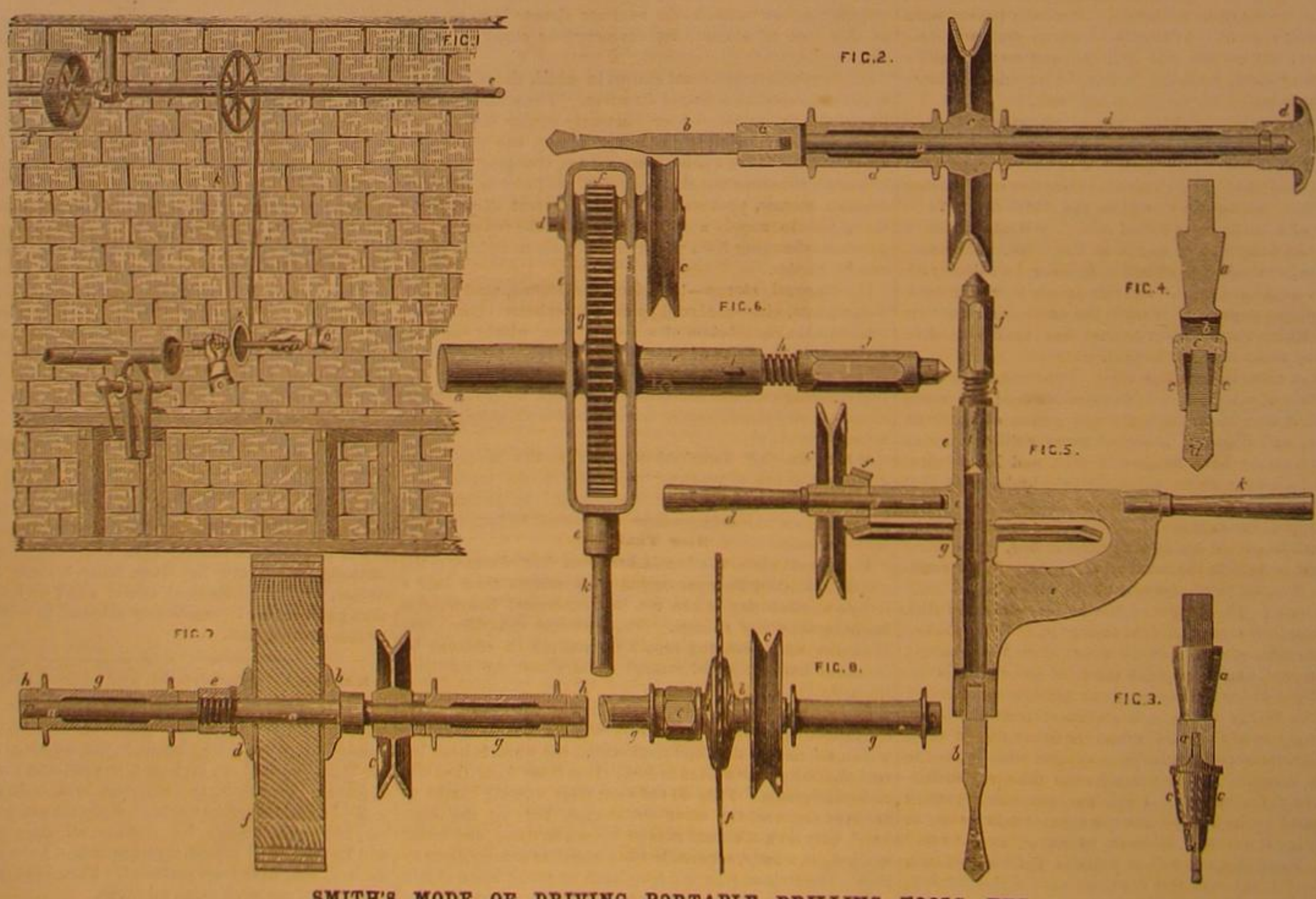
Fig. 6 is a plan of a single spur-geared boring, drilling, widening, or other tool, specially useful where the work to be done is of a heavier class than is suitable for the modification represented in Fig. 2. In this case, *a* is a central spindle having one end formed as a socket to receive the cutter, *b*. The V grooved pulley, *c*, is fixed on a counter spindle, *d*, running in bearings in the frame, *e*, which is also bored out to receive the center spindle, *a*, and back center screw, *h*. The counter spindle, *d*, has keyed on it a tooth pinion, *f*, which gears into a wheel, *g*, fixed on the center spindle, *a*. The adjusting screw, *k*, is fixed into the frame, *e*, by the cotter, *i*, and the box screw back center nut, *j*, is of an ordinary kind; *k* is a handle fixed in the revolving frame, *e*, by means of which the driving pulley, *c*, and spur pinion, *f*, are carried round the periphery of the spur wheel, *g*, thus giving means for tightening up the driving band.

Fig. 7 is a section of a grinding or polishing tool, arranged to be worked in the same way as the drills already described. In this figure, *a* is the center spindle, on which are fixed the disk or collar, *b*, and V-grooved pulley, *c*. The disk, *d*, is free to slide longitudinally on the spindle, *a*, and to adjust closer to disk, *b*, by screwing up the nut, *e*. The cylindrical grinder or polisher, *f*, is held between the two collars, *b* and *d*. On the spindle, *a*, two loose guiding handles, *g g*, are mounted, so that the spindle rotates within them; the collars, *h h*, keep the handles in position on the spindle.

Fig. 8 is a front elevation of a sawing or cutting tool, also driven in the same way. Here *a* is the center spindle, on which the tubular bush, *b*, with enlarged collar, *b'*, for fixing saw, freely revolves. The V-grooved pulley, *c*, is keyed on the tubular bush, *b*. The collar or disk, *d*, is free to slide on the tubular bush, *b*, and the saw or cutter, *f*, is held between the collars, *b'* and *d*, by screwing up the nut, *e*. The guiding handles, *g g*, may either be fixed to or free to rotate on the spindle, *a*.

We need merely add that there is a variety of light work for which tools so driven might be advantageously employed.

A POUND of copperas dissolved in a pailful of soft soap, and, when thinned with water, applied to onions, is good to keep off the maggot and to promote the growth of the onions.



SMITH'S MODE OF DRIVING PORTABLE DRILLING TOOLS, ETC.

American Grape Vines in France.

Mr. C. V. Riley, State Entomologist of Missouri, has lately returned from France, where he has been on a tour of inspection among the grape-growing regions. He was every where received and treated like a prince, dinners were given in his honor, and every possible attention shown to him in public and in private.

The particular reason for these civilities is the fact that Mr. Riley was the first to call the attention of the French to the fact that a simple remedy for all their troubles in connection with the grape vine disease was the substitution of certain species of American vines, by him named. These, he affirmed, would yield good wine in France and be free from the pest.

Some of the wine growers tried the experiment, which was continued the next year and that following; and the success has become so well established that extensive orders have now been sent to this country for vines. In fact it is believed the demand from France will be so great that our nurserymen will be unable to fill the orders for exportation this season. Mr. Riley saw plantations of American vines flourishing in France, where the native vines had been utterly destroyed.

A NEW CIRCULAR COMPASS.

M. Emile Duchemin substitutes for the ordinary compass needle two concentric circles, A B, in the annexed engraving, connected by a crosspiece, C, of aluminum or other metal. The maximum of magnetization starts from the N. and S. poles, and decreases to the neutral points, n n, as is indicated by the dark shading on the circles in the illustration.

This compass is said to be much more sensitive than the needle, to be less affected by rolling of the ship, and to be much less sluggish than the liquid compass. These facts were adduced by recent French naval tests of the instrument in comparison with compasses of the usual construction.

Centennial Notes.

About $3,500,000 have been subscribed toward the building fund, leaving a deficit yet to be made up, according to the reduced estimates, of $2,000,000. This is exclusive of the cost of Memorial Hall ($1,500,000), which is guaranteed by Philadelphia and the State of Pennsylvania, over and above their subscription. The latter amounts to $2,575,000 out of the $3,500,000, leaving $925,000 as representing the total received from the balance of the Union thus far.

France wants special laws enacted by Congress in order to protect her exhibitors from piracy of their inventions by the "grasping Yankees." The French say that they passed such enactments for the benefit of contributors to the 1867 show and that now we should go and do likewise. If we remember rightly, the French laws did not prevent sundry grasps of American inventions at the 1867 Exposition, and exhibition of the same in French shop windows, for sale, while the owners waited and sought for redress which they never got. We have no illiberal policy which prevents foreigners taking advantage of our patent laws, and thus securing full protection for their ideas with as much facility as our own citizens; and such laws we think will be found to answer every purpose of preventing piracy, without any additional legislative tinkering.

The Director General of the Centennial has issued the following rules for the information and guidance of exhibitors.

The space granted to an exhibitor within the building is available floor space, exclusive of the intermediate passages between the exhibits.

There will be no charge for space, but all platforms, counters, ornamental partitions, show cases, and appurtenances must be erected at the expense of the exhibitor; but they must not exceed the following hights without special permission from the Chief of Bureau:

Show cases and partitions: Fifteen feet above the floor.

Counters: Two feet ten inches above the floor, on the side next the passage way.

Platforms: One foot above the floor.

Exhibitors have the privilege of placing railings of approved design around the space allotted to them, of the uniform hight of two feet six inches above the floor level. The floor space granted includes the area embraced by the railing.

Each column within the building will be lettered and numbered, the letters designating the lines of columns, lengthwise, from east to west, and the numbers the lines, crosswise from north to south. Each exhibitor will have his location defined with reference to the nearest column, and the official directory of the building will give the position according to this system.

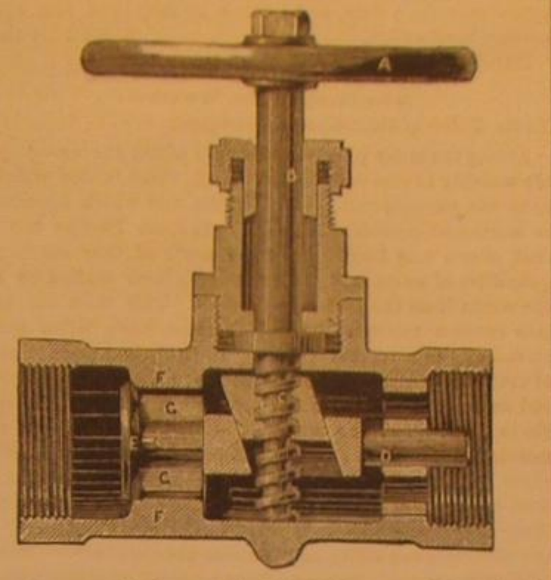
Exhibitors having space granted in close proximity to the columns or outer wall of the building will be furnished from the Bureau of installation with drawings showing the form of the columns, the water spouts, and the available wall space. Cards stating the exhibitor's name, class of objects, catalogue number, place of manufacture, and price will be affixed to goods under such regulations as the commission may prescribe.

All products arriving at the doors of the building by rail, wagon, or otherwise, will be received by the Bureau of Transportation and delivered on the space granted.

All exhibits must be arranged, completely and finally in position, not later than May 1, 1875.

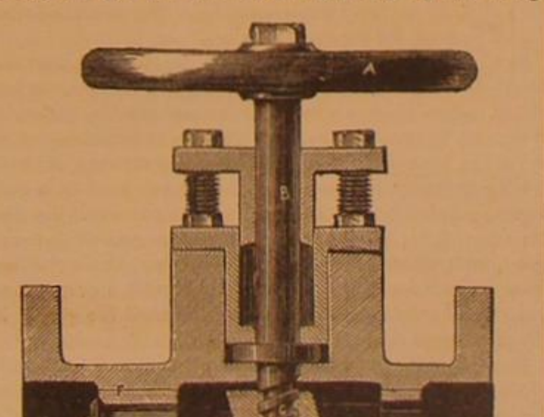
WHITTON'S STOP VALVE.

We publish herewith sectional views of two forms of a



stop valve recently invented by Mr. Whitton, and introduced by Messrs. Low and Duff, of Dundee, Scotland. Its chief characteristic is its powerful closing and opening movement, obtained by a combination of the screw and the wedge. This gives it a ready control over the supply of steam or water under great pressure, and especially adapts it for use as a throttle for a locomotive or as a water hydrant valve.

In Fig. 1, the spindle, B, has a square thread, C, cut upon it, upon which slides a wedge block, moving in an inclined slot in the valve spindle, O, by which arrangement it will be readily understood that the disk, E, is powerfully controlled by the wedge, which is again acted upon equally and uniformly by the action of the screw. It will be seen that the stuffing box and gland, through which the spindle, B, passes, are both screwed into the socket of the valve. In Fig. 2, however, the stuffing box arrangement is improved, the box being driven in tight and screwed down, and the gland being



adjusted by studs. The seat of the valve, being put in separately, can be easily repaired. The bottom of the screwed spindle is also recessed into the bottom of the valve, giving lateral support to the spindle.

A New Textile Industry.

The government of India has been encouraging of late the culture of China grass (tschu-ma) or inner bark of the *Böhmeria nivea*, which yields a very beautiful fiber, some three times as strong as hemp, and as soft as flax, while possessing a luster equal to that of silk. Although the properties of this fiber have long been known there has been an absence of proper machinery for its preparation, and until quite lately it has been supposed that only the green stem could be operated upon. Since it has been discovered that the dry stems may be treated by ordinary flax and hemp machinery, producing a fiber but little inferior to that obtained from the green plant, their utilization bids fair to constitute an important addition to existing textile industries.

Although the vegetable is indigenous to China, India, Japan, and has been successfully cultivated in Martinique, Jamaica, Trinidad, Algeria, Queensland, and Mauritius, and to a limited extent on some portions of our continent, we are not aware of any extended efforts being made towards its acclimatization in the United States. It is said that the plant adapts itself to climatic conditions with considerable facility, and hence it may be inferred that systematic culture in southern states would be attended with favorable results.

THE CATALEPTIC ROOSTER.

There is a curious experiment which any one who is the possessor of a rooster can try for himself with success, and which has never been positively explained. It is an ancient one, in fact it is two hundred years and over old, since it was commented upon by Kircher in 1646. Still it is none the less curious, and almost as much a subject of speculation now as it was when first observed. It is performed thus: Select a dark colored table with a smooth top; place it so that a narrow streak of sunlight will fall across the surface. The sun light is not absolutely material to success, but we have found the desired result to be more quickly obtained when it is present. Then set the rooster on the table, and hold his head down so that his beak comes in contact with the wood. Now, with a piece of chalk and in the sunlight, draw a line straight from the bird's beak, as represented in our engraving. Move the chalk very slowly, and by the time the line is a couple of feet in length the rooster will fall into a cataleptic or trance-like condition; and although the hands are removed from his body, he will remain perfectly rigid for a minute or two. It is said that a black line on a white surface will produce the same effect. Hens may be similarly treated, but it takes much longer to get them into the trance state, it being necessary to hold the head down several minutes before they come under the influence.

This phenomenon is termed hypnotism, or the result of a curious sleep-producing property incident to the fixation of the attention upon some bright object. It is by some considered a partial paralyzation of the brain. The same can be done upon human beings. The person should fix his eyes steadfastly on any glittering object, say a disk of silver paper, fastened on a black surface and brought within ten inches of his face, for about twenty or thirty minutes. A state of torpor supervenes, during which, if the limbs be gently raised, they will rigidly remain as placed. Surgical operations have been performed under these conditions without causing suffering to the patient.

A Method of Increasing the Solubility of Salicylic Acid.

The solubility of salicylic acid is enormously increased by the addition of borax to the water, so that as much as ten parts of the acid can be dissolved in 100 parts of water, if eight parts of borax be present. This discovery we owe to Dr. H. Bose, assistant in the Surgical Clinic at Berlin, who has contributed a paper of much interest to the *Berliner Klinische Woch nschrift* (No. 28, July 12), to which we are indebted for the following details. The solution should be made by first dissolving the borax with the aid of heat, and then gradually adding the salicylic acid to the boiling fluid. Since commercial samples of both these drugs are not chemically pure, a small amount separates, and requires to be filtered off on cooling. The filtrate is a clear yellowish or light brown fluid, according to its concentration. The proof that the addition of borax does not convert more than a part of the salicylic acid into salicylate of soda—a salt devoid of antiseptic properties—is easily shown; for if we dissolve 6 9 parts of the acid in 100 parts of boiling water, and then add 2 89 parts of bicorbonate of soda, the carbonic acid in the latter is set free, while the soda combines with the salicylic acid, and on cooling there is such an abundant deposition of the excessive acid that the whole liquid becomes nearly solid, owing to the formation of crystals. Now, if the whole be reheated until the acid is completely dissolved, and then 3 58 parts of boracic acid added, no deposit of any kind occurs on cooling. The most suitable strength in which the above solution can be used for direct application to wounds is, according to Dr. Bose's experience, one which contains from 2½ to 5 per cent of salicylic acid, and 2 to 4 per cent of borax. Solutions containing more than 5 per cent of acid are too irritating, and give rise to a very abundant capillary hemorrhage if applied to the surface of a fresh wound. Dr. Bose speaks highly of the result obtained with the boro-salicylic dressing in a number of cases of removal of small tumors. The operations were all performed without the spray, and only the sponges and forceps used were cleansed antiseptically with the above solution. The wound was thoroughly washed with the same liquid, and then a thick layer of salicylic wadding, also soaked with it, was laid on its apposed edges, so as to reach several finger's breadths beyond them and fixed by means of a bandage; catgut was used to tie any vessels requiring ligature. In those cases where the edges of the wound could not be accurately brought together, Dr. Bose put in catgut sutures, and then filled the spaces between the edges with the salicylic solution by means of a small syringe, and applied the wadding over all. The greater number of the cases thus treated healed by first intention, without the formation of a drop of pus.

Dr. Bose concludes his paper by stating that he has as yet no experience of the value of the boro salicylic acid solution in dressing large wounds, and that he has not found it invariably successful in the case of small ones.—*Medical Times and Gazette.*

Correspondence.

Death by Strychnin.

To the Editor of the Scientific American:

On Saturday, July 24, Dr. J. O. Hill, of Ithaca, New York, in a hurry to go out, took thoughtlessly a drink of water from a graduated glass, in which he had previously dissolved some strychnin. He walked a quarter of a mile, and then felt dizzy, and this and an exhausted feeling seem to have been the first effects of the poison. These increased, and they seem to have enfeebled his mind somewhat, but not seriously. At the end of about a half mile walk, his lower extremities had become so affected that he could not move. It is not know what the exact form of this action of the poison was; but as seen by me a few moments later, it is probable that it was possibly numbness, and certainly spasm of the extremities, with quivering of the muscles on every attempt to use them; with congestion, or its opposite, anemia, of the brain, such as a ghastly pale face would show. In 5 or 8 minutes later, I saw him. His condition was that of constant spasms of the lower limbs, with occasional spasms of the arms; and in every half minute or minute, a spasmodic convulsion of the greater part of the involuntary muscles would take place. His mind was clear when no convulsions were on; but it was affected, but not suspended, during the convulsions. A death-like paleness preceded each general convulsion, with a stoppage of the pulse at the wrist, which soon took definite shape. In the brief intervals between the spasms or convulsions, he was able to speak, and to describe his case accurately. His vision was clear. He was cool and accurate in verbal expressions, but had that excitement that underlies danger. Being of a hopeful and mirthful turn of mind, he at this moment had no fear of death; for he wished still to take the railroad train, and said: "I shall be over this soon." If I am correct, and I think I am, his case shows that, beginning with a serious impression on the brain, the poison begins its fatal action on the extremities, the hands and feet, and by degrees proceeds up the extremities of the body to the trunk. When he spoke to me, this had reached the hips, pelvis, and shoulders, as was evidenced by his pointing to these parts and saying: "I am sick; it is cramps here," that is, on the circumference of bowels and ribs, and in the hips and shoulders. A few minutes later, he evidently felt that the poison was invading the involuntary muscles of the heart and lungs, as a sorrowful and alarmed expression evidently showed. A convulsion came on, and was followed by his clear statement: "What I fear is that a clonic spasm of the heart and lungs will take place, and I shall go, go soon in it." And after the next general convulsion, he said: "Doctor, you know what I fear," meaning the clonic spasm of heart and lungs.

Next the tetanic or clonic spasm was evidenced by his saying: "My jaws are becoming locked." The word "clonic," used by the dying doctor, means an irregular spasm. It is also used, probably without authority, as he used it, for violent closing or locking spasm, suddenly coming on. Very soon after, he was unable to swallow camphor and water I offered to him, and the teeth were locked as in tetanus, though not so rigidly. Then follow the fifth and sixth general spasm or violent convulsion within twelve to fifteen minutes, during the brief intervals of which he spoke: "I am gone," "it is over," "raise me up," "lift me up," and he turned purple or livid in the face; the clonic or closing tetanic spasm of the heart and lungs took place, and he who, forty-five moments before, had taken, into an empty stomach, a drink of water with the poison in it, was dead.

The action of the poison was, as I have said, first on the brain and voluntary muscles, then on the ganglia of the voluntary muscles; and it ended in death as soon as the involuntary muscles of breathing became involved, the breast being the last involuntary muscular organ that stopped. The spasms evidently were very painful, but not remarkably so. His mind was clear, so much so that he saw and spoke of what was best to do, and what was being done for and about him. Had not the celerity and the certainty of the progress of the poison been known (being absorbed by one in violent exercise, in water or solution, on an empty stomach), we might have well thought that such a self-possessed, strong, well reasoning, and conscious man was not at the gate of death.

Thinking that these facts are of interest to the medical profession, I have sent them to you.

S. J. PARKER, M.D.

Weighted Silks.

To the Editor of the Scientific American:

I noticed in your issue of July 10, an article headed "Weighted Silks." It states that the increase is by means of salts of iron and astringents, and salts of tin and cyanide; and that it cannot be too widely known that, by this adulteration, silk is rendered very inflammable, and, under certain circumstances, spontaneously so. I admit that silk in the process of dyeing, and where heavily weighted, receives all of the material named. Iron is the base; cyanide of potassium forms with the iron Prussian blue, giving the blue ground; it is then given a bath of tannin, which is precipitated with tin salts, fixing the tan insolubly on the silk. The result of all this is: Silk being, like hide, an animal gelatin, having an affinity for tan, becomes leather, and is about as inflammable.

I enclose a skein of black silk; one half of the weight is silk, the other half iron, cyanide, tin salts, and astringents, used as I have named. It is true the weighting of silks is carried to the extent of ruining the fabric. Although the goods thus weighted appear firm and solid, they will not wear. This weighing process adds bulk, so that the weighted silk will make two yards, where the unweighted would only make one. The silks will not last like those our mothers wore; to redye them is out of the question; but they have a decent appearance for a time, and I think no lady need fear spontaneous combustion.

A SILK DYER.

Pittsfield, Mass.

The Recent Wet Weather.

To the Editor of the Scientific American:

Among the many probable causes to which the exceptionable weather of this year is attributed, there is one which I have not yet seen mentioned in print, and which appears to be worthy of consideration. Advices from Europe tell us that, over a very large area of the north of that continent, quantities of ashes have fallen, having been wafted on the the winds from the Iceland volcanoes. This does not take into account the quantity which must have fallen unobserved on the intervening seas. To lift this immense mass of material to so great a hight requires an immense force, and an amount of the gaseous products of combustion terrible to think of. The question it would present to the meteorologist is: What effect would be produced on the atmosphere by this body of gas? Or if, as seems reasonable, there is an atmosphere of hydrogen above our atmosphere of combined oxygen and nitrogen, what would be the effect on it, and the resulting effect on the lower atmosphere?

Many years ago, Professor Epsy claimed that the atmospheric disturbances caused by large fires produced rains; but so far as I know, he did not assign a reason. If fire is wanted to bring rain, here is an amount of fire and heat to which the heat of the fires of Chicago and Boston combined would be nothing, and an amount of matter raised high into the air that would make many such cities.

Louisville, Ky. N. B. G.

Useful Recipes for the Shop, the Household, and the Farm.

The best remedy for currant and gooseberry worms is powdered white hellebore, obtainable at any druggist's. Put the powder in a common tin cup, tying a piece of very fine muslin over the mouth. Fasten the apparatus to the end of a short stick, and dust the powder through the muslin lightly upon the bushes. Do not work on a windy day, and stand to windward during the operation, as, if taken into the nostrils, the hellebore excites violent sneezing. The same material is a good remedy for cucumber beetles.

Sawdust can be converted into a liquid wood, and afterwards into a solid, flexible, and almost indestructible mass, which, when incorporated with animal matter, rolled, and dried, can be used for the most delicate impressions, as well as for the formation of solid and durable articles, in the following manner: Immerse the dust of any kind of wood in diluted sulphuric acid, sufficiently strong to affect the fibers, for some days; the finer parts are then passed through a sieve, well stirred, and allowed to settle. Drain the liquid from the sediment, and mix the latter with a proportionate quantity of animal offal, similar to that used for glue. Roll the mass, pack it in molds, and allow it to dry.

The following table for boiling fruit in cans will doubtless prove useful, as the present is the time for putting up such preserves for winter. The first figure after the name of the fruit refers to time of boiling in minutes, the second to ounces of sugar to the quart: Cherries, 5, 6; raspberries, 6, 4; blackberries, 6, 6; gooseberries, 8, 8; currants, 6, 8; grapes, 10, 8; plums, 10, 8; peaches (whole), 15, 4; peaches (halves), 8, 4; pears (whole), 30, 8; crab apples, 25, 8; quinces (sliced), 15, 10; tomatoes, 30, none; beans and peas, three to four hours.

The following soluble glass is best adapted for coating brick and stone: Dry carbonate of potassium, 10 parts; powdered quartz, 15 parts; charcoal, 1 part. Sand, free from alumina and iron, may replace the quartz. Fuse together and dissolve in boiling water of 5 or 6 times the weight. Filter.

Handsome ornaments can be made by mounting fern leaves on glass. The leaves must first be dyed or colored. They are then arranged on the mirror according to fancy. A butterfly or two may be added. Then a sheet of clear glass of the same size is placed on top, and the two sheets secured together at the edges and placed in a frame.

Photography of Children.

W. A. Nicholas, Australia, says; As nearly all children are photographed in white dresses, and the faces are a great deal tanned through exposure to the sun, I have found a useful help in a simple wax match. If I have been unable to get full exposure through the restlessness of the little sitter in dull weather, by lighting a match and holding it just under the face only, so as to make that part of the plate hot during development, it is astonishing the increase of detail I get. There is no danger of the plate cracking through uneven expansion.

PRACTICAL MECHANISM.

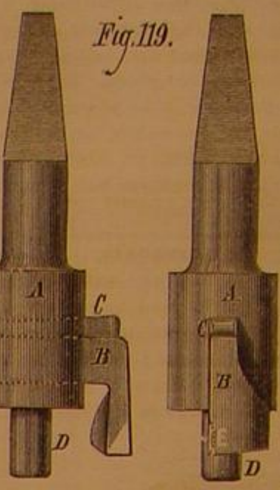
BY JOSHUA ROSE.

NUMBER XXX.

CUTTERS.

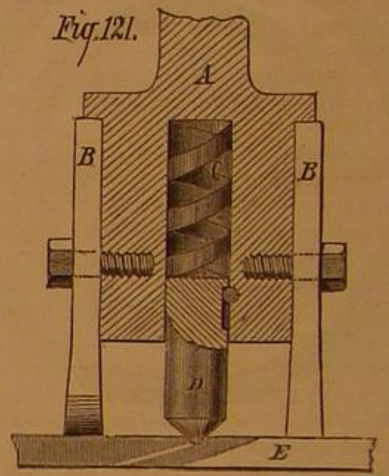
Cutters are steel bits, usually held in either a stock or bar, being fitted and keyed to the same; by this means, cutters of various shapes and sizes may be made to fit one stock or bar, thus obviating the necessity of having a multiplicity of these tools. Of cutter stocks, which are usually employed to cut out holes of comparatively large diameter, as in the case of tube plates for boilers, there are two kinds, the simplest and easiest to be made being that shown in Fig. 119.

Fig. 119.



A is the stock, through which runs a slot or keyway into which the cutter, B, fits, being locked by the key, C. D is a pin to steady the tool while it is in operation. Holes of the size of the pin, D, are first drilled in the work, into which the pin fits. To obviate the necessity of drilling these holes, some modern drill stocks have, in place of the pin, D, a conical-ended pin which acts as a center, and which fits into a center punch mark made in the center of the hole to be cut in the work. Most of these devices are patented, and the principle upon which

Fig. 121.

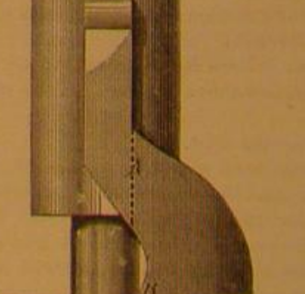


they act will be understood from Fig. 121, A being the stock to which the cutters, B B, are bolted with one or more screws. C is a spiral spring working in a hole in the stock to receive it. Into the outer end of this hole fits, at a working fit, the center, D, which is prevented from being forced out (from the pressure of the spring, C) by the pin working in the recess, as shown. E is the plate to be cut out, from which it will be observed that the center, D, is forced into the center punch mark in the plate by the spring, C, and thus serves as a guide to steady the cutters and cause them to revolve in a true circle, so that the necessity of first drilling a hole, as requirred in the employment of the form of stock shown in Fig. 119, is obviated. The cutters are broadest at the cutting end, which is necessary to give the point clearance in the groove. They are also, at the taper part (that is to say, the part projecting below the stock), made thinner behind than at the cutting edge, which is done to give the sides clearance. It is obvious that, with suitable cutters, various sized holes may be cut with one stock.

In cutting out holes of a large diameter in sheet iron, a stock and cutter such as shown in Fig. 120 is generally employed; but the great distance of the cutting from the cutting edge, that is to say, the extreme length of the cutter, renders it very liable to spring, in which case these, and other tools having a slight body and broad cutting edge, are almost sure to break, unless some provision is made so that the tool, in springing, will recede from and not advance into the cut. To accomplish this end, we must shape the cutter as shown in Fig. 120, which will, at the very least, double the efficiency of the tool.

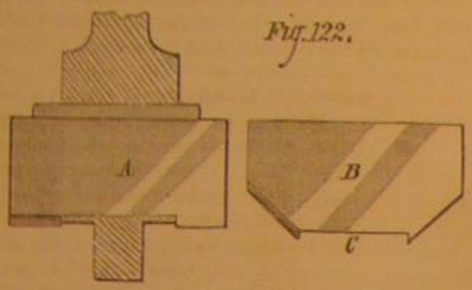
In Fig. 120 the cutting edge, B, stands in the rear of the line, A, or fulcrum from which the springing takes place; hence, when the tool springs, it will recede from the work, C. To avoid springing and for very large holes, the cutter may be a short tool, held by a stout crossbar carried by the stock; but in any event the cutter should be made as shown above.

Fig. 120.



Cutters of a standard size, and intended to fit the pin stock, shown in Fig. 119, should be recessed as shown in Fig., 122, A being a facing or recessing cutter, shown in the stock, and B a countersink cutter out of the stock, the recess being shown at C. In making these cutters they should be first fitted to the stock, and then turned up in the lathe, using the stock as a mandrel, the ends being then backed off to form the cutting edges. Those slight in substance should be tempered to a light straw at the cutting edge, and left softer at the back part. Those above five

Fig. 122.



sixteenths of an inch in thickness may be hardened right out, and not tempered at all.

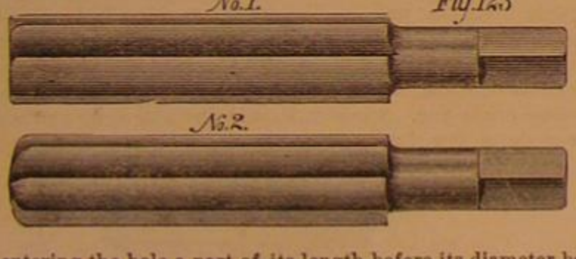
Here it may be as well to describe a process for tempering cutters, which, as several very expert workmen have assured me, gives superior results. It is to heat the cutter to a cherry red heat, and quench it in the water until it is cold, and to then reheat it until water dropped upon it will dry off in slight bubbles. If, however, the reheating is rapidly performed, there will be no need to drop any water on it, since that which adheres to it after quenching will be sufficient. I have no doubt but that for stout cutters, or even for slight ones which perform a light duty, this method is preferable to all others: but for light cutters performing a heavy duty, I should judge that it would leave them too hard for their strength, and therefore liable to break.

Cutters for boring bars should be, if intended to be of standard size, recessed to fit the bar, as shown in Fig. 122, the bar having a flat place filed around and beyond the edges of the hole, to form a broader bearing for the cutter to fit upon. But if the cutter is intended to vary the size of hole, it must be left plain, so that it may be moved inwards or outwards to accommodate the size of bore required. All cutters and bits should be used at a cutting speed of about 15 feet per minute, and with oil or soapy water for work in wrought iron or steel; and for use on those metals, the cutters, etc., may be given a little front rake by grinding away the metal of the front face, as shown by the dotted line in Fig. 119, at E.

REAMERS.

Reamers are cutting tools usually employed to finish holes requiring to be very true and smooth, and may be employed in a machine or lathe, or by hand. As reamers are generally of a standard size, but little metal should be left to be cut out by the reamer, so that they will not, from excessive duty, become rapidly worn and hence reduced in size. Fig. 123 represents reamers for hand use, No. 1 being a taper reamer to be introduced first, and No. 2 a finishing one to make the hole parallel. It is obvious that the taper one, by

Fig. 123



entering the hole a part of its length before its diameter becomes large enough to perform any cutting duty, is steadied during the operation. To steady the finishing reamer, it is usually made slightly taper at its cutting end for a length about equal to its diameter. To illustrate the indispensability of this tool, we will take the case of fitting an eccentric rod double eye to a link or quadrant. The faces of the latter are planed, and the hole is bored as true and parallel as possible. The double eye may be planed, milled, or slotted, and the holes in the eyes are bored as true as it is practicable to get them; nevertheless, when the double eye is fitted to the quadrant, it will be found that the holes in the eye and that through the quadrant are not true one with the other. Theory would say that they must come true, but practice proves that they never do; hence they are fitted together, and the reamer is applied to true them out and make them parallel. The reason for this want of truth is this: If the holes in the double eye are bored before the inside faces are cut out, the latter operation varies the *form* of the whole double eye, in consequence of freeing the tension which always exists on the outer surface of either forgings or castings, as has already been explained in former remarks. If, on the other hand the faces of the double eye are turned out first, then boring the hole will have the same effect; hence the use of the reamer cannot be dispensed with for holes requiring to be practically true.

Reamers should be made as follows: Forge them of the very best steel, and to within one sixteenth inch of the finished size; then turn them up, taking care to properly centerdrill and square the ends, and to rough them out all over before finishing any one part, bearing in mind that the diameter is sure to be a trifle increased by the process of hardening. Then cut out the flutes in a milling machine; the number of flutes should increase with the diameter of the reamer, but a good proportion is five flutes to a reamer of an inch diameter. Let the flutes be deep and roomy, so as to allow the cuttings free egress and the oil free ingress. An odd number of flutes is better than an even one, since they render the reamer less likely to follow any variation from roundness in the hole. Nor need the flutes be the same distance apart, a slight variation tending to steady the reamer when in operation. The form of flute is not arbitrary; Fig. 124*a* shows, however, the forms usually employed, either of

Fig. 124*a*.

which will answer excellently for hand reamers, the only difference being that No. 2 is rather more difficult to sharpen (without softening it) on an emery wheel, while No. 1 is the most difficult to sharpen when it is softened, in consequence of the file being liable to slip out of the groove and take off the cutting edge.

After the flutes are cut, the rake is given to the cutting edges by easing off or filing away the metal behind the cutting edges, A, towards the point, B; but this should be done by drawfiling to a very slight degree near the cutting edges, otherwise the reamer will be liable to wabble when cutting. In forms 1 and 2, the amount of the rake at the point, B, need not be more than the thickness of a piece of thin writing paper; but in No. 3, while near the cutting edge it may be very slight indeed, it must at the point, B, be considerable; hence (save for rough work requiring an excess of cutting duty) form No. 3 is not so desirable as the others.

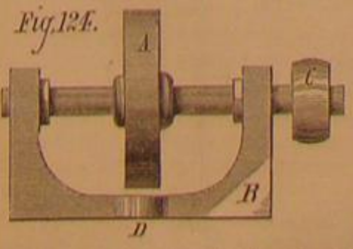
The best method of hardening such reamers, and in fact all others, is to heat them in molten lead, and to quench them endwise in water; because, when heated in lead, the outside will become sufficiently heated before the inside metal is red hot; and so, when the tool is quenched, the inside or central metal will remain sufficiently soft to permit of the tool being straightened should it warp in the hardening. The straightening should be performed by slightly warming the reamer and laying it upon a block of lead with the rounded side upwards; then place a rod of copper or brass in the uppermost flute, and strike the copper with a hammer. The use of the copper is to prevent damage to the tool by the hammer. The object of dipping the tool endwise is to prevent the reamer from warping in hardening. If great care is not taken in the hardening process, reamers and all tools having grooves or flutes in them are very apt to crack along the bottom of the flutes, which cracking is due to the unequal contraction of the metal in being rapidly cooled by quenching. Those having deep flutes, or sharp corners at the bottoms of the flutes, are the most liable to flaw in hardening, so that, in this respect, the flute shown in No. 1 is far preferable. To obviate the liability to flaw, the water in which the quenching is performed may be made sufficiently warm to be just bearable to the hand; and if it is also made a little saline, its hardening value will not have been impaired by the warming.

For light work, the hand reamer should be, if above ⅜ inch in diameter, tempered to a light straw color. For sizes less than that, and for heavy duty, a deep brown will prove the most serviceable, being less likely to cause the tool to break. The whole value of a reamer depends upon its being true or straight, and it is therefore necessary to exercise great care in the re-sharpening, as well as in its manufacture.

Many attempts have at various times been made to produce adjustable hand reamers, that is to say, those formed of cutters held in a stock and adjustable as to diameter, the object being to make one reamer serve for several sizes of holes, and to render the manufacture less expensive by having to simply remove the cutters to grind them when dull, and to renew them when worn out. The difficulties in the way of producing such a tool are that, in the smaller sizes, there is not sufficient strength to permit of their being made in pieces, and that, in requiring to set the diameter of the tool, a slight deviation as to size is very apt to occur. They are also liable to wear out of truth.

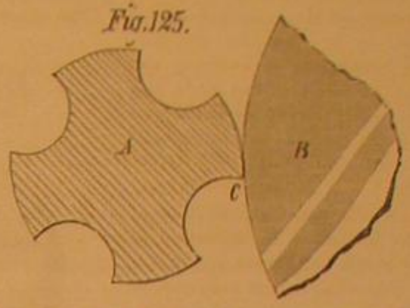
The best and truest method of making long fluted reamers is the one instituted in the Grant Locomotive Works, of Paterson, N. J. It consists in turning the reamer from one sixty-fourth to one thirty-second inch too large in diameter; then, after cutting out the flutes and hardening, the straightening and backing off is performed as follows: Upon the top of the slide rest, in the position usually occupied by the tool post or clamp, there is fastened a small head carrying an emery wheel of say eight inches diameter, upon a spindle having a small pulley attached, speeded to run about 2,000 revolutions per minute. An overhead countershaft is provided to drive the same, the appearance of the device being as in Fig. 124. The belt is arranged to drive the emery wheel in a direction opposite to that in which the lathe runs.

Fig. 124.



A is the emery wheel, B the head carrying the spindle, and C the pulley, D being a lug to bolt the appliance to the top of the slide rest of the lathe. The reamer is, after being hardened, driven in the lathe at a fast speed; the revolving emery wheel is then brought into contact with it and traversed along the length, thus serving as a cutting tool to true the reamer to a dead true and, by proper adjustment, to the requisite diameter. The backing off is performed thus: The lathe is stopped in such a position that the emery wheel will make contact with the reamer just behind the cutting edge, as shown in Fig. 125, A being a section of the reamer, and B a section of the emery wheel, C being a cutting edge of the reamer. The position being adjusted, the lathe is locked, so that it cannot move, by locking the back gear or in any other convenient manner. The revolving emery wheel is then brought into contact with the reamer, and traversed from end to end of its length of flute, thus performing the backing off, the reamer being turned a little fur-

Fig. 125.



ther round and the grinding operation repeated until the backing off is completed upon that flute; the other flutes are then similarly treated, the whole process producing a true and sharp reamer, unequaled by any other method of manufacture. It is obvious that, by adjustment of the back head of the lathe, any desired degree of taper may be given to the reamer. The journals of the hardened spindles for lathes may be, and in fact are, in many cases, made true and round by the application of the same device.

Professor Winlock.

Joseph Winlock was born February 6, 1826, in Shelby county, Kentucky. Graduating in 1845, at Shelby College, he afterwards held the professorship of mathematics and astronomy in that institution until 1852. The remainder of his life was passed chiefly at Cambridge, Mass.; but he spent some months at the United States Naval Observatory at Washington, and for more than a year was at the head of the mathematical department of the United States Naval Academy at Annapolis. He was twice made superintendent of the *American Ephemeris*, finally quitting this office in 1866 to take the post of Phillips Professor of Astronomy at Harvard University, and in that capacity to serve as Director of the Observatory. He held this office at the time of his death, June 11, 1875. His last illness was short, and did not appear dangerous until a few hours before its termination.

Professor Winlock was an excellent mathematician and astronomer, and had a remarkably retentive memory, not only for facts relating to his branch of science, but for the sources of information concerning those facts. The originality of of his mind, however, was chiefly shown in his suggestions for the improvement of astronomical instruments. These inventions were singularly simple and effective. Four among them deserve special notice in this place.

(1) The mounting of large meridian circles in such a manner as to allow the piers to be shortened, so that the graduated circles are wholly above the piers, and the steadiness of the whole instrument is increased. The theoretical advantage of this arrangement cannot here be discussed; it has been tested by five years' experience at Harvard College Observatory with very gratifying results; it has been adopted in other observatories, and will probably come into general use.

(2) The application of a diagonal eyepiece, moved by a rack and pinion, to any large telescope, in such a manner as to dispense with the customary finder, and to enable the principal object glass to be used in finding faint objects which are to be examined with the spectroscope or otherwise. This invention has also been for some years in use in Harvard College Observatory.

(3) A method of registering spectroscopic observations by marking lines upon a silver plate without requiring the removal of the eye from the spectroscope, or the use of artificial light. Professor Winlock registered in this manner his observations of the solar eclipse of December, 1870, which he observed in Spain.

(4) The use of a lens of long focus and of a plane mirror in making photographs of the sun. Apparatus of this kind was brought into daily use in July, 1870, at Harvard College Observatory. Priority in this invention is claimed by some other astronomers; but it does not appear that any one actually used the combination of the mirror with the lens of long focus until some years after Professor Winlock. It should also be noticed that in 1869 Professor Winlock first photographed the solar corona without enlarging the image by an eyepiece.

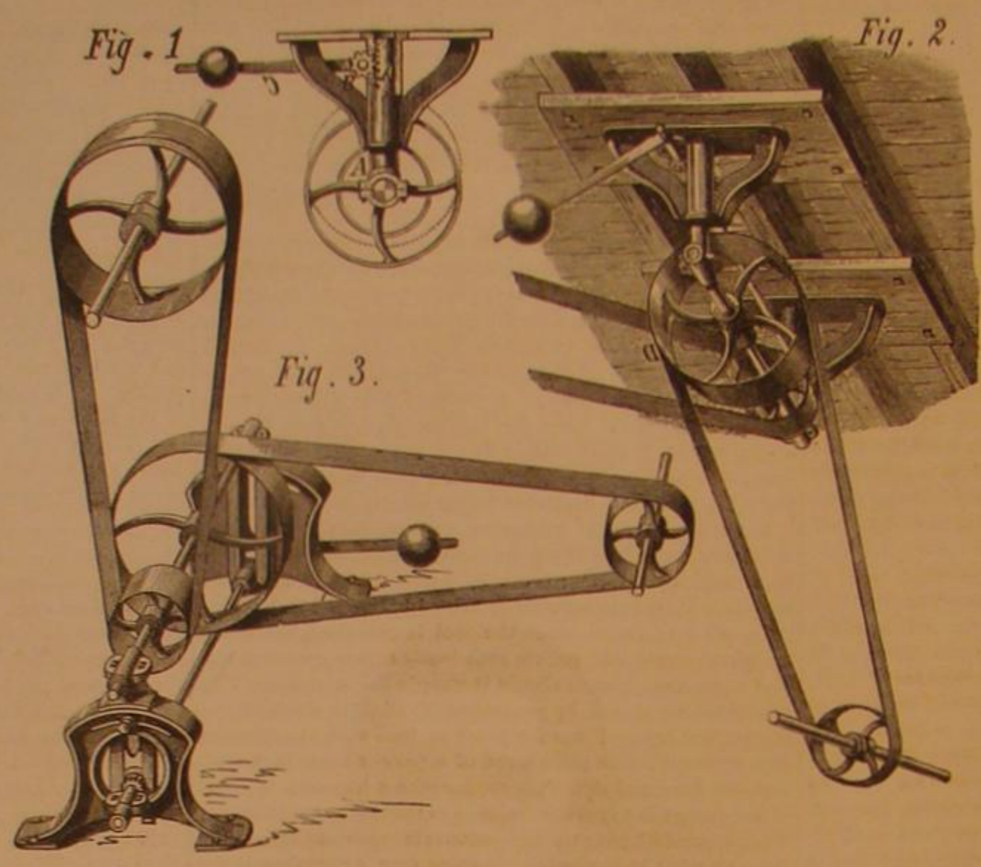
During his connection with the Observatory, Professor Winlock greatly increased its instrumental equipment, and also its pecuniary resources, by the aid of contributions from neighboring friends of Science. In particular, the system adopted for furnishing electric signals from one of the clocks at the Observatory, to various points in Boston and elsewhere, has been profitable alike to the Observatory and to the public. It illustrates Professor Winlock's practical good sense, that, instead of introducing new clocks, controlled by that at the Observatory, at the places where the signals are received, he provided simple telegraphic apparatus for the reception of the signals every two seconds: a method much cheaper than the other, and in practice equally satisfactory.

In private life, Professor Winlock's amiable though reserved character greatly endeared him to his friends.—*A. S., in the American Journal of Science and Arts.*

COMBINED BELT TIGHTENER AND COUNTERSHAFT HANGER.

The annexed engravings represent a device for the transmission of motion in a prompt and uniform manner, and with safety. The invention also obviates the use of loose pulleys and the consequent changing of belts.

The construction will be understood from the sectional view, Fig. 1, which shows a countershaft supported in a bearing upon a standard, A, which slides in guides. Engaging with rack teeth upon said standard is a pinion, B, with which is connected the weighted lever, C. The effect of this arrangement is to raise the countershaft, the standards, A, entering the ways as far as possible; but when the lever is elevated, the countershaft will be moved down, and the belt pulley will take the position indicated by the dotted lines in Fig. 1. It will be obvious from Fig. 2 that a belt, passing over the pulley, D, may be slacked or tightened at pleasure through the means above described. When the belt is held taut by the weighted lever, keeping the countershaft raised, then necessarily motion will be transmitted; but as soon as the countershaft is caused to descend, then the belt will hang loosely, revolving with the pulley, D, but not with the driven pulley. In the opposite case, represented in Fig. 3, the raising of the countershaft, which is under the driven pulley, determines the slacking of the belt; and the latter remains stationary upon said driven pulley, and hangs loose from the driver. The belt in all cases remains in place relatively upon the pulley. As indicated in Fig. 3, the standards which support the countershaft are made radially adjustable so as to be placed in proper line of direction between the driving and driven pulleys. The counterposed lever may be governed by a cord and pulley or any suitable device. The abolition of loose pulleys is an advantage of importance, since the dangers peculiar to such machinery, as well as the difficulty always encountered in oiling the same, are well known.



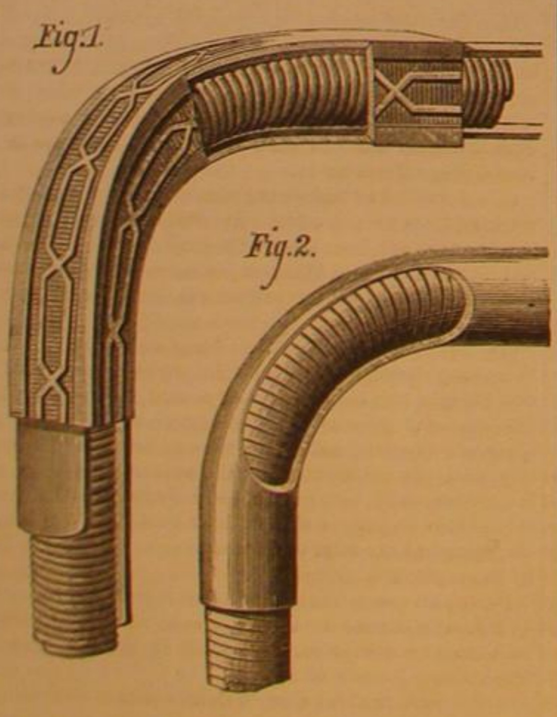
SQUIRE'S COMBINED BELT TIGHTENER AND COUNTERSHAFT HANGER

By the present device, the power hitherto used in turning a loose pulley is economized, as well as the wear incident thereto.

Patented May 4, 1875. For further information address the inventor, Mr. John J. Squire, or Branch, Crookes & Co., 114 and 116 Vine street, St. Louis, Mo.

NEW METHOD OF BENDING PIPES.

The usual mode of bending pipes to a true curve is to fill the heavy tubes with rosin and the light ones with lead, and, fastening them in a vise, to give the required curve by suitable lever pressure, subsequently hammering the metal into proper shape. This last operation is both difficult and tedious, and, even when performed by a skillful workman, does not leave the metal perfectly smooth nor free from dents, while the section of the pipe can never be left, by handwork, perfectly circular.



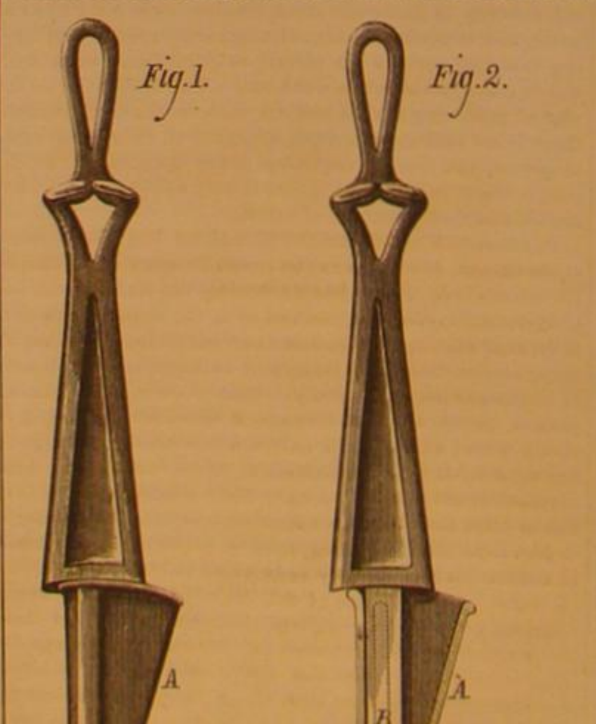
A new mode of bending copper and brass pipe is now the subject of patents pending in this country, in Canada, and in England. It consists, as shown in the engraving, Fig. 1, of the use of a spiral spring of ordinary square wire, which serves as a flexible mandrel, supporting the tube at all points during the bending process. After the curve is made, the spring, by turning it slightly in the direction of its coil, is compressed and thus easily drawn out

Any size of pipe, we are informed, can thus be bent and, as proved by several samples submitted to us, with perfect accuracy. The curve is true, the section a circle; no hammering whatever is needed, and there is no excessive crowding together of the metal on the inside, nor stretching of the same on the outside, of the curve. For square pipe, such as is used for gas fixtures, etc., the spring is reinforced by two strips of metal, as shown in Fig. 2, which are easily inserted and removed, and which serve to maintain the rectangular section of the tube.

The invention is one of considerable merit, and will doubtless soon find a widespread employment among coppersmiths, since its tendency is eminently labor-saving. For further particulars address the inventor, Mr. Morris L. Orum, care J. Snowden Bell, 702 Chesnut street, Philadelphia, Pa.

IMPROVED NAIL EXTRACTOR.

The object of the invention illustrated herewith is to provide a convenient means of extracting nails from wood work, without mutilating the latter or destroying the nail. The device is made in two parts. The lower boot-shaped portion, A, is hollow, and has formed on its inner side two vertical channels indicated by the dotted lines in Fig. 2. The upper portion consists of a handle and a downward extension, B, the lower extremity of which forms the movable jaw, the stationary jaw being cast on the portion, A. On the sides of part, B, are projections, C, which are inserted on the channels of portion, A, the malleable metal of which the latter is composed being previously heated and expanded to allow of the entrance. After the metal has cooled and contracted, it becomes of course impossible to detach the portions of the



implement, although their free motion within and upon each other is unimpaired. The forward projection of part A, serves as a fulcrum for the lever after the jaws have grasped the nail, as shown in Fig. 2. In order to confine the movable jaw to its work, an angular projection is made on one side of the bar, B, which enters a suitable recess in part A. The handle slides over the curved top of the lower portion; and when the bar, B, comes in contact with the latter, a leverage of the entire length of the device is gained, which speedily, it is claimed, draws out the most deeply imbedded nails.

Patented April 20, 1875. For further particulars address M. D. Converse, 68 Park Place, New York city.

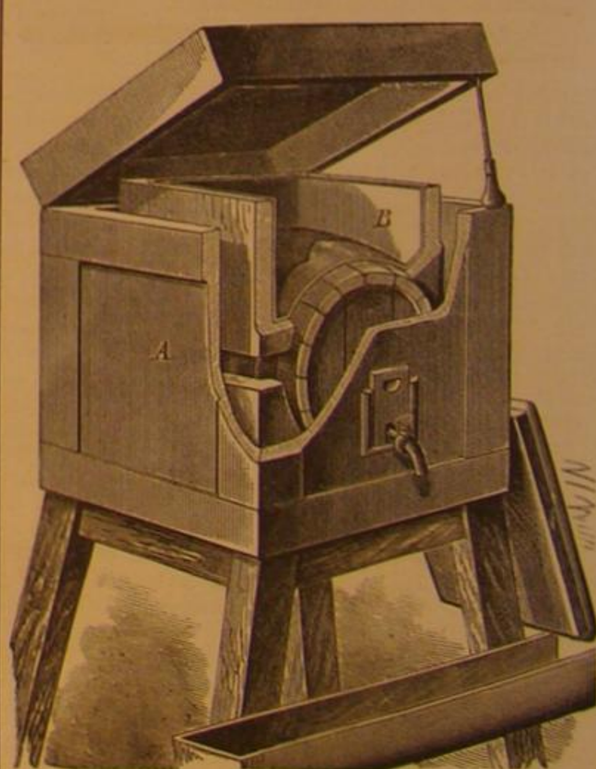
Value of Road Dust.

During a dry season, every country resident should secure several barrels of road dust. Those who keep poultry may secure by its use a valuable fertilizer, nearly as strong as guano, with none of its disagreeable odor. Place an inch or two of road dust in the bottom of a barrel; then, as the poultry house is regularly cleaned, deposit a layer an inch thick of the cleanings, and so on, alternately layers of each till the barrel is full. The thinner each layer is, the more perfect will be the intermixture of the ingredients. If the soil of which the road dust is made is clayey, the layers of each may be of equal thickness; if sandy, the dust should be at least twice as thick as the layer of droppings. Old barrels of any kind may be used for this purpose, but if previously soaked with crude petroleum or coated with gas tar, they will last many years. If the contents are pounded on a floor into fine powder before applying, the fertilizer may be sown from a drill. Road dust is one of the most perfect deodorizers of vaults—converting their contents also into rich manure. Place a barrel or box of it in the closet, with a small dipper, and throw down a pint into the vault each time it is occupied, and there will be no offensive odor whatever. This is simpler, cheaper, and better than a water closet, and never freezes or gets out of order. Mixing the road dust with equal bulk of coal ashes is an improvement, making the fertilizer more friable.—*Country Gentleman.*

BOHART'S BEER COOLER.

The annexed engraving represents a simple and inexpensive form of beer cooler, designed to receive the keg, which contains the liquid and from which it is drawn off for use. The advantages offered are that the cooling is effected with a small amount of ice and in as thorough a manner as may be desired, while the keg may be easily inserted and removed from the receptacle.

The device consists of an outer casing or box, A, provided with a hinged cover and supported by legs at a convenient hight Within and on the bottom are placed the skids, upon which the keg is set. Above the keg, and resting on its upper side, is a box, B, lined with sheets of zinc or other inoxidizable metal, which is curved so as to fit closely to the shape of the keg. The box, B, is packed full of ice and salt, and closed by a tightly-fitting cover. In the side of the box,



A, an aperture is made large enough readily to admit the faucet. A slide is provided, notched at its lower edge, which tightly closes the hole at the point of passage of the faucet pipe. The quantity of ice may be regulated according to the degree of coldness to which the beer is to be reduced, and, being placed directly upon the keg, is situated so as to exert its greatest cooling effect upon the liquid within.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr John N. Bohart, Denison, Grayson county, Texas.

EL BARON DE HUGHES.

Under this title we find in a recent number of *La Ilustracion Española*, a handsome illustrated paper published at Madrid, a finely executed portrait and a flattering notice of our ingenious countryman, Mr. E. D. Hughes, of Kentucky. The Spanish government has lately adopted the Hughes printing telegraph instruments, and their successful working gives so much satisfaction that the king has conferred a titulary nobility upon the inventor. "The Baron of Hughes" is the new name of our fellow citizen.

By the help of photography we have reproduced the portrait of the baron, and present it herewith, together with some of the good words given by R. de Morines, the writer in *La Ilustracion*.

"Our readers will have learned from the city papers that the Spanish goverment has, at last, decided to adopt for service on its long telegraph lines, the printing instrument invented by Sir Hughes.

"The nature of our publication and the limited space at our disposal will not permit us to give a full description of the system to which we refer. We are obliged to omit details, and simply say that the principle upon which it is founded is the isochronous or movement in unison, of type wheels, obtained by means of a vibrating plate which serves as a regulator. Our readers must suppose one of the said type wheels to be located in the station at Madrid and the other at Paris; that the two revolve in unison; and that at the beginning of their movements, the letter A, for example, in both instruments, stands directly in front of a hammer, which, on the passage of the electric current through the bobbin of an electro-magnet, strikes upon a ribbon of paper, interposed between the hammer and the type wheel. If, at this instant, the operator at Madrid presses with his finger the key which establishes contact with the battery, the electric current will pass over the line, through the magnet bobbin, and into the earth; the plate will move and give motion to the hammer, which, by pressing the paper against the letter A, effects an impression thereof on the paper, provided the type has been suitably inked.

As the velocity of the electric current may be considered unlimited over a distance relatively very small, the same letter will, at the same time, be printed in Paris, if, as before stated, the letter A, in both instruments, stands at the same instant in front of the printing hammers. If instead of A the letter D stands in said position, then that letter will be printed, and so on.

"Such in brief is the principle of the system so ingeniously worked out by Sir Hughes. Its chief advantages are rapidity and correctness in transmission, the delivery of the message in ordinary print, and the great distance over which the messages may be directly transmitted.

"The genius of the inventor, his perseverance under all difficulties, twenty years of study and experiment, a hundred thousand dollars in money spent in realizing the first imperfect but still useful apparatus, the endurance, without dismay, of all the hardships and mischances that beset every man of talent who seeks to raise himself above the common level—these have crowned, with a most happy conclusion, a discovery which has yielded to its author glory, honors, and fortune.

"Sir Don Edward David Hughes, whose portrait we herewith publish, was born in 1831, in Louisville, Ky., one of the States of North America. From a very early age, he devoted himself to the study of the physical, mathematical, and mechanical sciences. At the age of 19 years he was professor of physics in the College of Kentucky, and in the same year (1850) began his studies upon the instrument which today bears his name.

"In 1855 the American Telegraph Company first adopted the Hughes system. In 1861 it was adopted in France, and, successively, in Italy and England in 1862, Russia 1865, Prussia 1866, Austria, Hungary, and Turkey 1867, Holland 1868, Bavaria and Wurtemburg 1869, Switzerland and Belgium 1870, Peru 1871, Buenos Ayres 1872, the English Submarine Company 1873, the Argentine Confederation 1874, Spain 1875.

"We give thanks for the example and zeal of the Government Ministers, and the worthy Director General of Telegraphs, in that, having overcome all obstacles, administrative and routine, they have introduced into our country so useful an improvement, at a time when it is so much needed by the daily increasing necessities of the telegraphic service. We tender our congratulations to them and the public, who will very soon begin to experience the advantages of this wonderful invention.

"Sir Hughes is a member of almost all the scientific academies of Europe. He received the great gold medal at the Universal Exposition at Paris in 1867. He is knight commander and holds the grand cross of the order of San Miguel and of the Iron Crown. He has been decorated with the cross of the Legion of Honor, of Medjidie, of Santa Anna, of San Mauricio, and San Lazaro, etc. The Spanish government has decorated him with the commandery of Carlos III. The greater part of the sovereigns of Europe have honored him by their personal visits.

"As we have already stated, Sir Hughes has had the good fortune to realize in life that which few men of his stamp ever enjoy, namely, the pleasure of being useful to humanity, and of receiving honors, glory, and a considerable fortune. Nevertheless, Sir Hughes, like all men of real merit, is modest and simple, qualities which enhance his native worth and attract the sympathies of all who have the happiness of knowing or dealing with him.

"Taking advantage of his presence among us, we publish his portrait, and through the columns of our periodical we give him a welcome."

A California Tree for the Centennial.

Some time ago we mentioned the fact that Mr. Vivian was preparing a large piece of one of the Tulare county big trees to exhibit at the Centennial next year. The piece of timber selected will be sixteen feet long, and twenty-one feet in diameter at one end and nineteen feet at the other. The heart of this will be taken out, leaving only about one foot of the body of the tree attached to the shell or bark. This outside shell will then be divided into eight equa' parts, each of which will weigh four thousand pounds without the bark. It is necessary to divide it into this number of parts in order to allow it to pass through the numerous tunnels between here and Philadelphia. The eight parts will weigh about thirty thousand pounds, and will require two cars for their transportation. One solid foot of this tree weighs seventy-two pounds, being ten pounds heavier than so much water. This timber was taken out of the General Lee, a tree two hundred and seventy-five feet high, and which, had it been sawn into lumber, would have produced a sufficient quantity to have built a very respectable young town or a large ship. It contained more than two hundred thousand feet of lumber, besides, probably, about two hundred cords of wood. The General Grant, a much larger tree than the General Lee, and the largest in the world, growing in the same grove, is left standing, probably for the benefit of future.—*Visalia (Cal.) Delta.*

EDWARD DAVID HUGHES.
INVENTOR OF THE HUGHES PRINTING TELEGRAPH.

Progress of Telegraphy.---One Wire for Many Instruments.

The *Golos* announces the arrival at St. Petersburgh of M. La Cour, assistant-director of the Copenhagen Physical Observatory, in order to submit to the telegraphic conference a new invention in telegraphy. That invention gives the possibility of transmitting despatches between two telegraphic stations through one wire only, and by means of many instruments, so that transmission by one instrument cannot impede the action of the other. M. La Cour, while engaged some years ago in investigating the passage of electric currents through conducting media, found that electricity is transmitted from place to place by undulations analogous to those of sound. In consequence of this discovery, he hit upon an arrangement of electro-magnets and tuning forks, by means of which a particular current passing through a tuning fork pitched to a certain note does not become merged in or confounded with other currents which, after passage through differently pitched tuning forks, are simultaneously transmitted along the same wire. This, of course, renders it possible to send many messages at a time through a single wire. —*The Telegraphic Journal.*

THE CENTER OF OUR POPULATION.—It has traveled westward, keeping curiously near the 39th parallel of latitude, never getting more than 20 miles north, nor two miles south of it. In the 80 years it has traveled only 400 miles, and is still found nearly 50 miles eastward of Cincinnati.

Salicylic and Benzoic Acids.

Professor Salkowsky of Berlin has recently made some experiments which are not so favorable to salicylic acid as those previously reported. The *Industrie Blätter* gives the following *resumé* of his experiments: Salicylic acid, in concentrated aqueous solution, puts off decay but is not able to prevent it. Salicylic acid does not possess any deodorizing properties, although it has been supposed to. Decomposing liquids when mixed with salicylic acid solution retain their odor unchanged. In fact it is difficult to see how it could deodorize, for this action can only be effected in one of three ways: first, by destroying the volatile substances that rise from the liquid; permanganate of potash, chloride of lime, and sulphurous acid deodorize in this way. Second, by absorbing these substances, as does charcoal, and to a less degree other porous bodies, like peat and plaster of Paris; to this class also belong those substances which precipitate aluminous matters. Third, by concealing the foul odor, as does carbolic acid. Salicylic acid does not possess strong chemical affinities, nor form precipitates, nor yet possess an odor of its own. The action of salicylic acid is not due to its splitting up into carbolic acid and carbonic acid, as Kolbe originally supposed. The untenableness of of this supposition is evident from the fact that salicylic acid acts when much less concentrated than carbolic acid. Besides, it is easily extracted from the mixture by means of ether, and no carbolic acid can be detected in it.

Benzoic acid possesses much stronger antiseptic properties than salicylic acid. According to the author's experiments, if fresh meat, either finely chopped or in larger pieces, be kept in a concentrated aqueous solution, no decomposition sets it at all for more than 3 months. The liquid remains perfectly clear and retains the odor of benzoic acid. Kolbe found benzoic acid less active than salicylic acid. "I thought at first," says he, "that the difference could lie in the different sources of the acids employed. Benzoic acid made from gum benzoin has a strong aromatic odor, which is due to a minute quantity of some other admixture which has not yet been studied. Benzoic acid prepared from the urine of cattle and horses has also an odor, but not so intense and rather different from the former. Now it was supposable that this minute admixture had an effect upon its antiseptic properties, but some of the latter acid, labeled *acidum benzoicum ex urina*, was just as active as the former kind."

As regards the practical use of salicylic acid externally, the fact that it does not entirely prevent decay is of little consequence, for, other things being equal, people always prefer that which offers perfect protection against decomposition. Benzoic acid is decidedly cheaper* than salicylic, which is a strong point in its favor. Whether in its employment it possesses disadvantages over salicylic acid, or advantages over carbolic acid, can only be learned by clinical experience.

Both acids are alike unsuited for internal use as antiseptics or antizymotics, because when taken into the blood they are converted into the soda salts. It is evident that here the use of neutral substances is far preferable, such as pass unchanged through the system; in fact this is the principal condition of their effectiveness. As a type of these we may mention phenol (carbolic acid) and substitution products of phenol, all of which exert, to greater or less degree, a strong antiseptic action, such as thymol. The ether of phenol is also an antiseptic.

The Spiritual Scientist.

Most of the organs of the spiritualists in this country are filled with insipid ghost matter, very tiresome and useless to all whose brains have not been softened by the spirit craze. The *Spiritual Scientist*, a neatly printed weekly periodical, is an exception. Its editorial columns exhibit talent, while its conductors, with a boldness quite remarkable for a spirit paper, actually condemn, as unworthy of true believers, the printing and circulation of the unauthenticated trashy stuff delivered by common mediums. To its cotemporary the *Banner of Light*, it administers a severe rebuke for its agency in this matter, and alleges that for the past ten or twelve years that journal has poured out a weekly stream of pretended spirit communications, of which not more than two in a hundred had any evidence of being genuine, or contained anything beyond childish nonsense, the merest babbings of infancy. It thinks the time has now come to substitute the intelligent speech of adolescence, which it accordingly undertakes to do in its next article.

Subject: The American Association for the Advancement of Science, now in session at Detroit.

Disgraceful behavior of the Association and of individual members thereof, towards spiritual science, are charged on the following specifications:

"If," says the *Scientist*, "these learned children would simply confess their ignorance of spiritual facts, laws, and philosophy, we could have nothing to complain of. But what the whole spiritualistic press and all intelligent spritualists so indignantly denounce is the fact that scientific men, like Davy, Faraday, Tyndall, and Huxley, pronounce upon these matters without being possessed of any data upon which to form an opinion. Worse, they sometimes have deliberately lied about observed phenomena, to avoid making

*Benzoic acid sells for 25 cents per ounce, artificial salicylic acid 50 cents per ounce, in New York city.

a favorable report. If any of them feels aggrieved at our language, let him say so, and we will prove its literal accuracy."

"The helpless creatures are only human moles. As they burrow in their 'dim galleries,' what can they know of the inner world, which their predecessors only discovered at the moment when communication was interrupted between them and their fellow grubbers?"

"See what will happen at this Detroit meeting: Their Entomological Club will have heated debate upon trapdoor spiders, and acrimoniously discuss whether the male *mygale avicularia* has a darker shade of brown than the female on the upper segment of the body, and more ciliæ to the square inch; after which, as an appetizer for dinner (champagne and fixings on the lake), mention will be made of that Dismal Swamp louse, which (see Trans. 1874) the surveyors found always pointing its nose to the north, whichsoever way they might lay it down. Professor Hilgard will enquire, across the room, of Professor Dawson, whether the Myriapoda with two antennæ, so highly esteemed by the scolopen'ra tribes of India, are more nutritious than the date palm. Professor Youmans will propose to the Club the election to honorary membership of the "correspondent of the Department of Agriculture" whose discovery of mortality among bots, upon the application of a decoction of tansy he had appropriately noticed at page 384, Vol. VII, No. 39 of *Popular Science Monthly*. Professor E. B. Elliot will show that he was right and Professor H. E. Davis wrong in the number of young *lepidoptera* which, when placed end to end, will measure a mile,—the true figures being 0174 x $b-y542\frac{1}{2}$ = A's².

"The anthropological subsection will no doubt give prominence to a discussion upon measles as a religious element among the Andamanese; and an adjournment could hardly be reached without a fight over the old puzzle, whether it is probable that the American stovepipe represents the form of the prayer cylinder of the lacustrians. If Professor Buchanan, who has forgotten more about anthropology than any of them ever knew, should attempt to crowd upon them the complete study of man in all his relations, he will be coughed down and the floor granted to somebody who has a speech ready upon the reticulated button hole of the Bengalese Rajpoot's coat. And yet they are not happy.

"Have we done any injustice to the American and British Associations—for they are both alike? Consult the printed volumes of *Transactions*, in which may be found a record of some of the very papers above enumerated, and others about orange peel oil, fat women, hyena's dens, and the blastoderms of birds' eggs.

It is their own affair whether they study this or that science, and prefer to use the few hours they have on earth in discovering the nature of the respiratory organs of the shark or any other ignoble tomfoolery, to studying the spiritual part of Man and his intermundane communications, attractions, and perils."

[For the Scientific American.]

THE HEATING SURFACE OF BOILERS.

The questions sent to us in regard to boilers continue to multiply, and we imagine that we have received inquiries on all the points connected with the subject. We propose, therefore, to devote some space to answering these questions more in detail than is possible in our correspondence column; and after disposing of the topic indicated by the title of this article, we will give some directions in regard to setting boilers, proportioning them for engines of given size, etc.

There is some difference of opinion among engineers in regard to what parts of a boiler are to be considered in estimating its heating surface; but in the rules which are appended, the methods most commonly employed are adopted.

(*a*) Cylindrical boilers: These, forming the simplest class of boilers, consist of plain cylinders, sometimes with and sometimes without steam drums. The heating surface of such a boiler is half the surface of the shell, or it is equal to 1·5708 × the diameter of the boiler × the length. It is to be observed that, in this and in the rules that follow, all dimensions are to be taken in feet; so that, in applying the rule, any proportions that are expressed in inches are to be divided by 12, before making the calculation. Thus: Suppose that a given boiler has a diameter of 36 inches and a length of 20 feet; its heating surface is the product of 1·5708, 3, and 20, or about 94¼ square feet.

(*b*) Cylindrical flue boilers: A boiler of this class is a cylinder with two large flues. Its heating surface is half the surface of the shell, increased by the sum of the interior surfaces of the flues, or 1·5708 × diameter of boiler × length + 6·2832 × interior diameter of flues × length.

For the sake of illustrating this rule, suppose that a flue boiler has a diameter of 48 inches or 4 feet, and a length of 22 feet, and that the interior diameter of each flue is 15 inches, or 1¼ feet. Then the heating surface is equal to the product of 1·5708, 4, and 22, or nearly 138¼ square feet, increased by the product of 6·2832, 1·25, and 22, or about 172¾ square feet, making the total heating surface 311 square feet.

(*c*) Cylindrical tubular boilers: As the name implies, these boilers are cylinders containing a number of tubes. To find the heating surface of such a boiler, take half the surface of the shell and add it to the interior surface of the tubes. Expressing this rule in a similar manner to the foregoing, it may be said that the heating surface of a cylindrical tubular boiler is equal to 1·5708 × diameter of boiler × length + 3·1416 × number of tubes × interior diameter of a tube × length.

Example: A cylindrical tubular boiler has a diameter of 42 inches or 3½ feet, is 16 feet long, and contains 40 tubes, each having an interior diameter of 3⅞ inches, or 0·323 feet. What is its heating surface?

Answer: The product of 1·5708 × 3·5 × 16 is nearly 88 square feet.

The product of 3·1416 × 40 × 0·323 × 16 is about 649 square feet.

So that the whole heating surface is 737 square feet.

When the dimensions of a tubular boiler are given, the outside diameter of the tubes is usually stated, so that twice the thickness must be subtracted to obtain the diameter to be used in the calculation. The thickness of tubes by different makers varies somewhat, but those given below are average values, and can generally be used without serious error. The table gives dimensions of standard sizes of tubes, as well as a column of heating surface, which will greatly facilitate calculations.

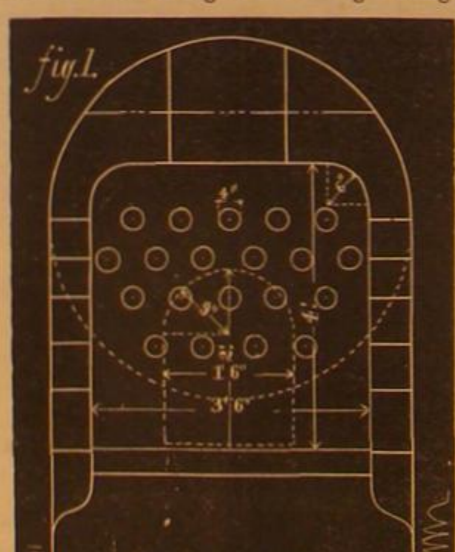
Outside diameter in inches.	Thickness in inches.	Internal diameter in inches	Internal diameter in feet.	Heating surface in in square feet, per foot of length.
1·25	0·072	1·106	0·0922	0·3273
1·5	0·083	1·334	0·1112	0·3926
1·75	0·095	1·560	0·1300	0·4589
2·	0·095	1·810	0·1508	0·5236
2·25	0·095	2·060	0·1717	0·5890
2·5	0·109	2·282	0·1902	0·6545
2·75	0·109	2·532	0·2110	0·7200
3·	0·109	2·782	0·2318	0·7853
3·25	0·120	3·010	0·2508	0·8508
3·5	0·120	3·260	0·2717	0·9163
3·75	0·120	3·510	0·2925	0·9817
4·	0·134	3·732	0·3110	1·0472
4·5	0·134	4·232	0·3527	1·1790
5·	0·148	4·704	0·3920	1·3680
6·	0·165	5·770	0·4808	1·5708
7·	0·165	6·770	0·5642	1·8326
8·	0·165	7·770	0·6475	2·0944
9·	0·180	8·640	0·7200	2·3562
10·	0·203	9·594	0·7995	2·5347

To illustrate the use of the table, suppose it is required to find the heating surface of the tubes in a boiler which contains 60 tubes, each 3 inches outside diameter and 12 feet long. The total length of tubes in the boiler is 12 times 60, or 720 feet, so that the heating surface is 720 times 0·7853, or about 565 square feet.

(*d*). Locomotive and vertical boilers: In this class, the furnaces are contained within the boilers. The heating surface of such a boiler is all the surface in the furnace increased by the interior surface of the tubes.

Locomotive boilers: The furnaces of boilers of this class do not all have the same form of cross section, so that the rule for determining the heating surface cannot be, generally, expressed precisely in detail. It may be said, however, that the heating surface of a locomotive boiler is equal to the length of the line bounding the cross section of the furnace × the length of the furnace + 2 × the area of the cross section of the furnace — the area of the furnace door — the number of tubes × 0·7854 × (the interior diameter of a tube)² + the number of tubes × the length of the tubes × the heating surface of a tube per running foot.

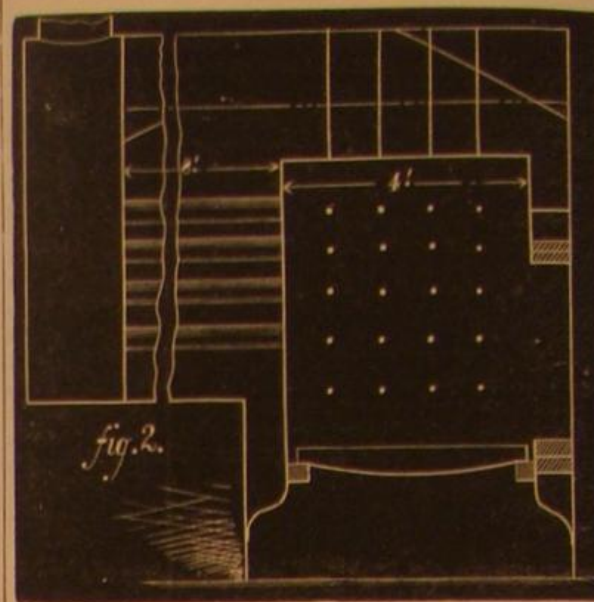
As an example of the use of this rule, suppose it is required to determine the heating surface of a boiler having the dimensions noted in Figs. 1 and 2—Fig. 1 being a cross



section of the boiler at the furnace, showing also the furnace door in dotted outline, and Fig. 2 being a longitudinal section. The length of the line bounding the cross section of the furnace is the sum of 3·5 × 2 + 2·5 + 1 multiplied by 1·5708, or about 11·07 feet. The area of the sides and top of the furnace is 4 times 11·07, or 44·28 square feet. The area of the cross section of the furnace is the sum of the products of 3·5 × 3·5 + 0·5 × 2·5 + 0·5 × 0·7854, or about 13·89 square feet. The cross section of the tubes is the product of 20 × 0·7854 × (0·311)², or about 1·52 square feet. The area of the furnace door is the sum of the products of 1·5 × 1·25 + 0·3927 × (1·5)², or about 2·76 square feet. The interior surface of the tubes is the product of 20 × 8 × 1·0472, or about 167·55 square feet. Hence the heating surface of the boiler is 44·28 + 2 × 13·89 — 1·52 — 2·76 + 167·55, or about 235¼ square feet. This example shows the general method to be employed for locomotive boilers, and the dimensions that are to be taken.

2. Vertical boilers: The furnaces of these boilers are ordinarily cylindrical, so that the rule for the heating surface is as follows: 3·1416 × diameter of furnace × hight of furnace + 0·7854 × (diameter of furnace)²—number of tubes × 0·7854 × (interior diameter of a tube)² + number of tubes × length of tubes × heating surface of a tube per running foot.

Example: Required the heating surface of a vertical boiler, having the following dimensions: Diameter of furnace 24 inches, hight of furnace, 18 inches, 40 tubes, each 2 inches outside diameter, 6 feet long. The heating surface is the sum of the products of 3·1416 × 2 × 1·5 + 0·7854 × 2² + 40 × 6 × 0·5236 = 138·23, diminished by 40 × 0·7854 × (0·1508)² = 0·72, or 137·51 square feet.



These rules might be extended, so as to include sectional and marine boilers, together with some special forms which are occasionally used: but it is believed that they are sufficiently comprehensive to apply to nearly all boilers employed in this country for stationary and portable engines. The simple manner in which they are expressed, and the illustrative examples accompanying them, will doubtless be appreciated by the reader.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The meeting this year is a light one in point of attendance; but the lack in this respect is in a measure compensated for by the absence of ponderously technical papers and the substitution of essays having a more practical bearing upon the scientific questions of the day. While a cardinal object of this association is the interchange of ideas of all kinds among its learned members, the nature of such interchanges should, we think, be subordinated to considerations of public instruction and benefit, and hence dissertations on abstruse points and technicalities unintelligible to all save those versed in the particular branch of Science involved, might well be reserved for dissemination through narrower channels, leaving a clear field for the discussion of subjects within the general public comprehension. It is impossible to publish such papers in their entirety, and equally impossible to prepare fairly intelligible abstracts. We give below a *resumé* of the essays thus far read.

Professor Lovering described an acoustic method of measuring the velocity of electricity. He stated that a wire from Cambridge to San Francisco, thence back through Canada to Massachusetts, about 7,200 miles in all, transmitted a message in two thirds of a second, and that some of this time was wasted through thirteen repeaters. The system proposed consisted in utilizing the vibrations of tuning forks, which may indicate intervals of one ten-thousandth of a second, or even less.

Professor Farquharson read an account of recent

EXPLORATIONS AMONG INDIAN MOUNDS,

which resulted in the discovery of thirty skeletons, several copper implements, and a pulley or spindle wheel of terra cotta. In one skeleton two of the neck bones were found anchylosed, giving evidence of a disease rare at the present time among adults, and from which they only survive by very careful treatment.

Professor E. B. Andrews compared the Ohio and Virginia sides of

THE GREAT ALLEGHANY COAL FIELD.

On the Kanawha there are 3,100 feet of productive coal measures below the horizon of the Pittsburgh coal. The remarkable belt of coal seams found on the Kanawha, between Charleston and Kanawha, on Coal river, on the Guyandotte, and on the upper waters of the Twelve Pole, and on the Tag and Louisa forks of the Big Sandy, is the finest belt of bituminous coal in the United States. The professor traced the probable direction of the great West Virginia geosynclinal trough, and expressed the opinion that it had a connection with the ancient ocean to the southwest by the way of Tennessee.

Professor J. S. Newberry gave descriptions of some newly discovered

ANCIENT FISHES

found in the Devonian and carboniferous rocks of Ohio Among these was the entire bony structure of the *dinichthys Terellii*, the hugest of all the old armor-plated ganoids. The dorsal shield weighed 30 pounds. Drawings of another species of *dinichthys* were shown, in which the maxillaries and mandibles were set with teeth instead of being sharp-edged. Professor Newberry explained that the *dipnoans* of Africa and South America, the *lepidosiren* and *protopterus*, were descended from these ancient plated ganoids, and were the last remnants of a group of fishes which in the Devonian age not only ruled the seas, but were the most powerful and highly organized of living beings. Many other interesting specimens were exhibited by Professor Newberry, all of which will be described in the reports of the geological survey of Ohio.

NEW YORK GEOLOGY.

Professor James Hall read a paper on the geology of the Catskill Mountains, and stated that explorations have proved that the range is composed of several nearly parallel synclinal axes, and the culmination portion, at Lookout and Roundtop, is caused by the slight convergence and junction of three of these synclinals, which are so closely crowded together.

Professor Cope defended the

THEORY OF EVOLUTION

by reference to North American tertiary mammals, commenting on the fact that the human skeleton contains so many characteristics of earlier forms; he said that the quadrumana, and afterwards man, had won their way to pre-eminence rather by development of mind than by that of the physical system. It was not so much a case of the survival of the fittest as of the survival of the most intelligent.

There was a debate on the question of:

ARE POTATO BUGS POISONOUS?

Professors A. R. Grote and A. Kayser maintained the negative, and stated that they had boiled down the bugs, producing a colorless liquid, offensive in smell, but clear and alkaline. Other bugs were digested in alcohol. The distilled liquid administered to frogs produced no effect either when introduced into the blood or into the stomach. The tincture killed the frog when injected, but this was due to its acid properties. It was concluded that the bug is not poisonous, and the evil effects noted on burning the insect were probably due to the presence of Paris green.

Professor C. V. Riley replied to the effect that he felt assured of genuine poisoning from the bug, in cases which he had examined. Professor Cope related further experiments on frogs, and said that the frog liquid administered to the reptiles made them very sick. The most plausible suggestion offered during the debate was that the frog poison is probably volatile, and in the process of making decoctions and tinctures, the poison, when heated, escaped into the air.

A PROPOSED INSECT COMMISSION.

A memorial was submitted to the meeting and approved, which addresses Congress with relation to the establishment of a national insect commission. The document states that the damage done by the noxious insects in the United States amounts to $300,000,000 per annum. The subscribers propose either the reorganization of the Department of Agriculture, under the control of the highest scientific authories, or the appointment of a commission of five persons, to wit: Three entomologists, one chemist, and one botanist, eminent in their respective branches of science, to be chosen by the Council of the National Academy of Science, and approved by the Secretary of the Treasury, with salaries adequate for the responsible work. The duty of this commission would be to investigate the causes which affect injuriously agricultural interests, and to suggest the best means of diminishing the losses.

The results of such investigations should be embodied in brief reports, containing practical instructions and made accessible at a small price; or the results should be made useful, by personal education, to every farmer in the country.

LOCUSTS AS FOOD.

Professor Riley believes that grasshoppers make a good article of diet. He says that he fried them and roasted them, and that they have a pleasant, nutty flavor. They are equally good eating, either boiled or stewed. We congratulate the professor, both on his gastronomic discovery and on his courage. His name bids fair to be linked by posterity with that of the man who first ate an oyster.

More about insects, a branch of creation which seems peculiarly interesting to the assembled scientists this year, is found in the papers of Professor W. J. Beal and Thomas Meehan. The former discussed

CARNIVOROUS PLANTS;

and after detailing past discoveries, said that the *Martynia* of our vegetable gardens catches immense numbers of insects, one plant of small size destroying 7,200 of its prey. The hairs seem to have small glands at the ends, which secrete a sticky substance. The insect is soon killed and sucked dry.

Professor Meehan disputed several assumptions relative to the

INSECT FERTILIZATION OF PLANTS.

He concluded that the great bulk of colored flowering plants are self-fertilizers; that only to a limited extent do insects aid fertilization that self-fertilizers are every way as healthy and vigorous, and are immensely more productive than those dependent on insect aid, and that, when plants are so dependent, they are the most fitted to engage in the struggle for life.

Professor Gillman gave a description of his explorations on the upper lakes, during which he found a large number of

ANCIENT HUMAN RELICS.

Many of the skulls were perforated at the highest point, the holes measuring between ½ and ¼ an inch. Several mounds opened gave evidence of the cremation of the bodies inhumed.

Professor Cope read a fine essay on the

DISTRIBUTION OF BATRACHIA AND REPTILIA IN NORTH AMERICA.

He said that the characteristics of these families are such as to make them especially useful in the inquiry as to the actual relations between the structures of animals and the physical nature of the regions which they inhabit. The natural divisions of the batrachian and reptilian *fauna* in America were stated to be six, namely, two east of the plains, the northern or eastern, the southern or austro-riparian; the central, extending from the eastern boundary of the plains to the Sierra Nevada; the Pacific, west of that range; the Sonoran, including New Mexico, Arizona, and a portion of Northern Mexico. Lastly, the Lower California region, embracing the peninsula of that name. The eastern and austro-riparian regions embrace all of the *batrachia* (especially salamanders) and the turtles; the Sonoran embraces nearly all of the lizard; the Pacific region includes a nearly equal percentage of all the divisions excepting the tortoises. The relations of these distributions to physical peculiarities are as follows: First, as to temperature: The two Southern regions of North America are the austro-riparian and Sonoran. These regions include nearly all the North American genera, and three fourths of the species. In Central America and Mexico, it is the central plateau and the high mountains which support the North American forms, while the South American genera and species are distributed along the Sierra Caliente of the east and west coasts. Thus it is evident that temperature has a controlling influence in the distribution of reptilian life on the North American continent, and that conditions of humidity are effective in determining the distribution of *batrachia*, and to a less degree of *reptilia*.

The following officers were elected for the next meeting, which is to be held at Buffalo, N. Y.: President, William B. Rogers, of Boston, Mass.; General Secretary, Thomas C. Mendenhall, of Columbus, Ohio; Vice President of Section A, Charles A. Young, of Hanover, N. H.; Vice-President of Section B, Edward S. Morse, of Salem, Mass.; Secretary of Section A, Arthur W. Wright, of New Haven, Conn.; Secretary of Section B, Albert H. Tuttle, of Columbus, Ohio; Treasurer, Thomas T. Bouve, of Boston, Mass.; Permanent Secretary, Professor Putnam

Abstracts of other papers read will appear in our next issue.

The Death of Donaldson the Aeronaut.

About the middle of July last, Mr. Washington A. Donaldson, the well known aeronaut, in company with a Mr. Grimwood, a newspaper reporter, started on a balloon ascension from Chicago. The trip was intended to be one of the many which constituted a part of the attractions of Mr. P. T. Barnum's traveling show; and accordingly, after an afternoon performance of the circus, Donaldson and his companion ascended amid the usual cheering of the multitude. All accounts agree to the statement that the balloon and its appurtenances looked dangerously weak. The globe itself was of cotton, and old and weatherbeaten, while the netting showed frequent marks of half-made repairs. Shortly after the balloon had departed, a violent storm arose, the track of which intersected that of the air ship, as indicated by the direction in which the latter was swiftly borne over Lake Michigan.

No tidings of the aeronauts were obtained until after the lapse of several days, when the captains of arriving vessels reported sighting the balloon, close to the surface of the lake and apparently dragging its car in the water. Reports of a similar nature followed, not unmixed, however, with conflicting stories of the safe landing of the travelers; but the latter on investigation proved untrue.

As the public is familiar with Mr. P. T. Barnum's ingenuity in converting all sorts of phenomenal circumstances into useful advertisements for his show, a very large number of persons, ourselves included, suspected that the disappearance of Donaldson was intentional, and that, in due time after the excitement had abated, he would return with some marvelous yarn, eminently attractive to the curious and gullible. The recent discovery of the body of Grimwood on the shore of the lake leaves no question, however, but that the daring aeronaut is actually lost, and that at last, after surviving voyages in paper balloons, and in balloons filled with hot air, after indulging in his taste for blood-curdling gymnastics on the trapeze while above the clouds, *ad libitum*, he at length has fallen a victim to the dangers which he had grown to despise.

In a certain sense, Mr. Donaldson's death is a loss to Science; for although his proclivities tended more toward the sensational, and his achievements were accomplished more by sheer rashness and pluck than through any desire for scientific investigation, still he possessed many qualities which eminently fitted him to be a pioneer in a branch of knowledge regarding which so much remains to be practically discovered. He had considerable inventive ability, and courage enough to attempt tasks before which the majority of men would shrink; and these qualities, coupled with an extended experience, gave fair promise that in the future his efforts might result in useful data toward the solution of the problem of aerial navigation.

DECISIONS OF THE COURTS.

United States Circuit Court.---Northern District of New York

PATENT BARREL HEAD LININGS.—GEORGE A. REED *vs.* LOUIS REED AND GEORGE FOLTS.

[In equity.—Before Wallace J.—October, 1874.]

The claim of letters patent for an "Improvement in Head Linings for Barrels," granted to George A. Reed, May 11, 1873, namely: "As a new article of manufacture, barrel head linings prepared in the manner specified, when bundled as shown and described"—is invalid.

As both head linings and hoops had been made by machinery, and were articles of trade, and as hoops had also been crimped by machinery, the patentee merely produced an article which was the result of more mechanical skill and care in its manufacture than that previously sold and used; but this result did not involve the faculty of invention.

Although the crimpled machine-made head linings are an improvement upon the article used prior to their introduction, and, as such, have secured the approval of the trade and become a valuable commodity of manufacture and sale, the improvement is not the proper subject of a patent.

The sole merit of bundling the head linings is that it renders the commodity more attractive to purchasers, and more convenient for the purposes of sale. There is nothing in this result that is patentable.

[*James A. Allen*, for complainant.
John Van Voorhis, for defendants.]

NEW BOOKS AND PUBLICATIONS.

MANUAL OF QUALITATIVE CHEMICAL ANALYSIS. By C. Remigius Fresenius, Director of the Chemical Laboratory at Wiesbaden, and Professor of Chemistry, Natural Philosophy, and Technology at the Wiesbaden Agricultural Institute. Translated into the New System and Edited by Samuel W. Johnson, M.A., Professor of Theoretical and Agricultural Chemistry in the Sheffield Scientific School of Yale College, New Haven, Conn. Price $4.50. New York city: John Wiley & Son, 15 Astor Place.

This book fills a place in our scientific literature that has for some time been vacant. Nearly all our manuals of analytical science have long been antiquated; and although several small treatises have been issued, in which the latest results of contemporary research have been recognized and the new nomenclature has been employed, the authoritative text book of Dr. Fresenius, to whom, more than to any other master, the progress of this science to its present nearly absolute perfection is due, was in danger of becoming obsolete. Professor Johnson deserves the thanks of the scientific world for the labor and care he has given to the publication of this important work, which now receives as it were a new life. No book on the subject which we have yet seen approaches this in perspicuity and excellence of method. It deals with each subject in a strictly scientific manner, accompanying the student from test to test, and noting down the results and the inferences therefrom with a certainty that amounts to demonstration. We commend it to all students of chemistry, not only for its accuracy and completeness, but for the inductive reasoning employed throughout, which is the very foundation of all scientific investigation.

THE PRIMER OF POLITICAL ECONOMY, in Sixteen Definitions and Forty Propositions. By A. B. Mason and John J. Lalor. Price 75 cents. Chicago, Ill.: Jansen, McClurg, & Co.

Although the authors of this excellent treatise are careful to assert that it is only a primer, we are bound to state that the most elementary truths contained in it are little known to many who claim to be well versed in the science, and especially to have some panacea for the widespread poverty and distress which has reigned in our manufacturing interests for nearly two years. The writers have no fear in placing before the world many unpalatable facts, and in deducing from them a policy which will restore prosperity to our trades. Every ignorant person in the country is now talking tariff and currency; and a little common sense, as embodied in these incontrovertible propositions, is especially welcome at the present time.

NOTES ON BUILDING CONSTRUCTION, Arranged to Meet the Requirements of the Syllabus of the Science and Art Department of the Committee of Council on Education, South Kensington, England. Part I, First Stage or Elementary Course. London, Oxford, and Cambridge, England: Rivingtons. Philadelphia, Pa.: J. B. Lippincott & Co., 717 & 719 Market street.

The author of this work (who modestly conceals his name) states that these notes are compiled for the use of students of building science; but the book is really a valuable text book on the art of practical architecture, treating the subject with thoroughness, and leaving nothing unsaid that could inform the pupil as to the best possible practice. It is well arranged and edited.

UTILITY OF THE SLIDE RULE, a Treatise on Instrumental Arithmetic. By Arnold Jillson. New York city: A. J. Bicknell & Co., 27 Warren street.

The use of ready reckoners saves an immense amount of labor in all trades; and by far the most compendious reckoner is the engineer's slide rule. A little slip of wood with brass mounting, easily carried in the pocket, it gives a means for effecting all kinds of mensuration of surfaces and solids, gaging, weighing metals and other materials, calculating powers of engines and capacities of appliances for transmission of force, and even for reckoning compound interest. Mr. Jillson has written a valuable little book, which fully describes all the uses of this instrument; and he has, moreover, applied the slide rule to many novel purposes, especially in the textile manufactures We commend this pocket volume to all our readers.

A SUMMER IN NORWAY, with Notes on the Industries, Habits, and Customs of the People, etc. By John Dean Caton, LL.D., Ex-Chief Justice of the Supreme Court of the State of Illinois. Price $2.50. To be had of all booksellers. Chicago, Ill.: Jansen, McClurg, & Co.

This book is a readable account of a holiday spent in a country which is, in many respects, one of the most interesting in the world. It is generally well written, and the author appears to be observant and accurate; and no doubt the slight touches of egotism with which the volume abounds are almost inseparable from a book of travels, which is nearly sure to be more or less of a personal history.

DESIGNS FOR MONUMENTS. By W. B. Franke, Architect. New York city: A. J. Bicknell & Co., 27 Warren street.

This book contains forty folio plates, showing over one hundred designs for cemetery monuments in all forms and styles. Many of the ideas embodied in the drawings are strikingly original and in good taste; while the variety exhibited enables any one to find a memorial suited to his purpose and his means. The details are all fully elaborated, making the plates serve as working drawings. It is a handsome volume, and does credit to the publishers.

CATALOGUE OF RAILWAY, MACHINISTS', AND MANUFACTURERS' SUPPLIES. By H. A. Rogers. New York city: H. A. Rogers, 19 John street.

This is a very handsome volume of 272 pages, on which is represented nearly every article that can possibly be needed in an engine or machine shop The engravings are admirably executed; and the book, although but a trade catalogue, gives much valuable information as to many branches of the mechanical arts.

THE WATCHMAKER, JEWELER, AND SILVERSMITH, a Monthly Journal devoted to the Interests of Watchmakers, Jewelers, Silversmiths, Opticians, and Kindred Trades. Subscription, $1.25 (gold) a year. London, England: 8 Cross street, Hatton Garden.

A readable, well arranged periodical containing much varied information on the trades to which it is specially addressed.

LASALLE'S POCKET MAP OF THE COMSTOCK LODE. Mounted in Pocket Book Form. Price $2.50. San Francisco, Cal.: Le Count Brothers, 417 Montgomery street. New York city: F. F. Taylor, 16 Broad street.

A neatly executed map of the remarkable district of Washoe, Nevada, in which the intricacy of the mines and their immense capacity are forcibly shown. Some valuable explanatory statistics are added to the volume.

THE SILVER AND LEAD DISCOVERIES IN NEWBURYPORT, MASS., AND ITS VICINITY. With a Map. By Charles J. Brockway. Price 50 cents. Boston, Mass.: A. Williams & Co., 283 Washington street.

This is an historical account of the Massachusetts silver, gold, and lead ores, of which we heard so much a few months since. There does not, at present, seem to be great probability of Mr. Brockway's estimates o wealth being realized.

THE WOOL CARDER'S VADE MECUM, a Handbook of the Woolen Industry. By W. C. Bramwell. Terre Haute, Ind.: Express Printing Company.

An excellent practical treatise, containing much valuable information and some useful tables.

PURCELL'S RAILROAD POCKET BOOK. Price 25 cents. Louisville Ky.: Saxton Publishing Company.

A set of well compiled distance tables.

Recent American and Foreign Patents.

Improved Sulky Harrow.

Daniel F. Shaw, Hamilton, Mo.—This improved harrow may be readily adjusted to make a wide or a narrow cut, and to work as a diamond harrow or as a double-A harrow. It may also be readily raised from the ground to clear it of weeds, grass, stubble, etc., and for convenience in passing from place to place.

Improved Machine for Making Barrel Heads.

William W. Trevor, Lockport, N. Y., assignor to himself and Francis N. Trevor, same place.—This invention relates to machinery for circling barrel heads by revolving clamps and a circular saw, the clamps being contrived to move the pieces to be sawn up to the saw, and turn them around one revolution, and then move away at the same time that they open to discharge the finished head; and it consists of the apparatus for gearing the shaft of the clamps with the saw arbor to turn it thereby; also the apparatus for closing and opening the clamps; also mechanism for starting, stopping, and allowing the clamps to rest for changing the work; and also mechanism for causing the clamps to turn a little more than a revolution at each operation in combination with an automatic stop, to insure the cutting of the complete circle.

Improved Tower Clock.

Charles Fasoldt, Albany, N. Y.—The invention consists mainly in the separation of the band-moving mechanism and its actuating power from that of the clock train, and its connection with an unlocking wheel of the main arbor by an intermittingly operated planetary motion device, actuated at certain intervals by the band driving weight, that transmits also motion to the hands on any suitable number of dials above or below the clock.

Improved Galvanic Battery.

Jerome Kidder, New York city.—This invention relates to an improved galvanic battery, with a series of cells in which the fluid is quickly and easily distributed to and emptied from all the cells, and also the action of the same on the elements in an instant interrupted and established, the same being guided reliably and securely to their proper positions in the cells. The invention also relates to a battery casing with a number of longitudinal and lateral partitions forming the cells and with outer higher walls. A longitudinal end reservoir, with horizontal gutter flange and corner spout, assists the filling and emptying of the cells, while a detachable top guide frame with corresponding subdivisions guides the vertically moving elements, applied to a common supporting plate to their respective cells.

Improved Fishing and Similar Floats.

William T. Quinn, Paterson, N. J., assignor of two thirds his right to Will Hague and John Hague, same place.—This is a float contrived to run deep in the water, and have considerable side draft. There is a rod along one side, to which a cord for drawing the float is attached by a ring, so that it will shift from end to end of the rod freely, according to which end of the float the draft is to be applied. This enables the float to be run out readily from the shore, and then be drawn forward and backward at the limit of the line, as a means of carrying fishing lines or running out the float to persons in distress, or to operate a decoy duck.

Improved Ice Velocipede.

Charles M. Day, Elizabeth, N. J.—This invention consists of a screw propeller, combined with a chair or other conveyance for running on the ice, and so arranged that the edges of the vanes or blades run in contact with the ice to impel the carriage, the screw being turned by foot, hand, steam, or other power. Springs support the weight of the carriage, so that the same does not come upon the propeller blades.

Improved Cultivator.

William Weaver, Greenwich, N.Y.—The frame is diamond-shaped, with its obtuse angle cut off. The point of draft attachment may be adjusted higher or lower, as may be required. By suitable arrangements, in digging potatoes, the forward plow will open the hill, hoes will turn the soil over, leaving the potatoes upon the top of the ground, and the rear plow, running a little deeper than the forward plow, will raise any potatoes that may be left by said plow. The hoes may be adjusted wider apart or closer together, according to the distance apart of the rows to be operated upon.

Improved Water Wheel.

Harvey W. Hawley, Walton, N. Y.—This water wheel may be used either in horizontal or vertical position, utilizing nearly the whole head of water, and allowing the adjustment of the buckets to different angles to the wheel, if desired. The invention consists of a water wheel with central web and solid or detachable buckets extending to equal distance and suitable angles therefrom.

Improved Sheet Iron Barrel.

Charles M. Wyvell, Scottsville, N. Y.—This barrell is formed in two parts, having their adjacent edges notched to each other, and secured by the hoops and locking strips. With this construction, the barrel, when empty, can be readily taken apart and nested for storage or transportation, and can be put together when required for use.

Improved Filter.

Henry F. Scherr, St. Louis, Mo.—This invention consists of a filter, composed of a lower reservoir for the filtered water, an upper receptacle with the filtering tube for receiving the water to be filtered, and of an intermediate filtering pan attached to the filtering tube to compel the water to pass first it down, and then in upward, direction through the filtering material.

Improved Anvil.

Edwin Hodgdon, Springdale, Me., assignor to himself and Ansel J. Cheney, same place.—This invention consists in a rotary swage or anvil having a number of working faces, which is supported and seated upon a recessed block having its top portions properly conformed to said anvil in shape. To enable the anvil to be raised from the base block, and rotated for the purpose of changing the working face, it is pivoted to and between parallel vertically movable bars.

Improved Document Envelope.

John Pritchard, Maysville, Mo.—This invention consists of an interior fold, open at the sides and closed at the ends, that is applied to an outer inclosing wrapper by being firmly attached at one side and connected by an adjustable band at the other side. It expands and contracts with the thickness of the papers.

Improved Bee Hive.

Hiram Penoyer, Anna, Ill.—Two separate and detachable frame sections are hung into the central chamber from top frames, a sufficient space being provided between the sections for the passage of the air. Each section may be taken out separately, and thereby the swarming of the bees prevented by replacing the full section with an empty one.

Improved Fire Escape.

Andrew J. Culbertson, San Andreas, Cal.—By pulling upon a cord, a lever is operated to push the device from its seat above the window and allow it to drop down to the window sill, where it will be stopped by a ratchet wheel and pawl, and held until the person or persons to descend have taken their places upon the platform. The pawl is then turned back from the ratchet wheel and the device is allowed to descend, the rapidity of descent being regulated and controlled by a brake and hand screw.

Improved Bench Plane.

Charles Bridges, Lowell, Mass.—Devices are provided whereby a plane iron is instantly placed in the stock and guided exactly into its place, being also readily adjusted to any thickness of shavings by the screw bolt. The cutter edge can be squared to the throat or face of the plane by moving a screw slightly to the right or left in the recess of the partition, which is made wide enough for this purpose. The arm piece attached to the handle is adjusted in such a manner that, when the handle is slid forward on the plane stock, the wedge pieces and bottom ribs bind rigidly on the ends of the arm piece, define the position of the handle, and seat the rear part of the handle exactly on the circular rear partition of the stock. The thumb piece of the lengthened screw bolt is then turned up, and thereby the handle securely locked to the plane iron and stock, so that no detaching during use is possible. The invention is an improvement or device of the same *inventor*, patented December 8, 1874.

Improved Furnace Grate.

Samuel J. La Rue, Russell, Mo.—By vibrating a lever a shaft is rocked, and the grate bars are made to receive a swinging and slightly upward motion, which has the effect of clearing the coal or other fuel from ashes, and renovating the fire. Air cells in the tops of all the grate bars allow the air to circulate over the bars transversely and increase the combustion.

Improved Cutter Head.

Simon P. Randolph, Tehama, Cal.—This is an improved matching cutter for rabbeting machines, by which work may be accomplished without requiring frequent sharpening for keeping the grooves and tongues in proper size. The knives, which make a clean cut without splintering the edge, are curved at the forward end, and made with two lips, for cutting the groove part of the matching boards. The forward curve of the cutter causes the cutting edge to strike the wood square and avoid scraping.

Improved Wash Bowl.

Henry M. Weaver, Mansfield, Ohio.—This is a detachable valve plug, which is fitted into the waste pipe, and provided with sieves attached to its stem, to be raised by a fulcrumed lever and connecting rod from the side of the bowl for emptying the same.

Improved Farm Gate.

Amos Callahan, Maryville, Tenn.—This invention consists in combining adjustable diagonal bars with a grate for the purpose of supporting its front end, and thus preventing or taking up sag, or adapting it to pass over an inclined or uneven surface.

Improved Bias Gage.

John A. Hamilton, Chippewa Falls, Wis.—This is a marking and cutting rule, to which is attached another rule or gage parallel to it, so as to be shifted, and having one end beveled, so that, when placed parallel with the edge of the goods to be cut into bias strips, it will gage the principal rule to the proper bias for cutting the cloth. The width of the strips is gaged by the distance of one rule from another.

Improved Brake Shoe.

William Robinson, Jr., Wilmington, Del., assignor to himself and Samuel Harris, same place.—The brake shoe is provided with a recess at the upper end, and with a slot at the lower end, which serve to connect the interchangeable and detachable sole part by a top hook, locking into recess, and by a perforated lug passing through the lower slot. The ear is firmly secured to the shoe by a suitable key.

Improved Oiler.

George F. Dutton, Farmington Falls, Me., assignor to Eliza C. Dutton, of same place.—This is an oiler having a chamber above the reservoir, in which is a glass tube which screws into the opening at the top of the reservoir, and which forms a tightly packed joint at the top of the chamber. The chamber is rigidly attached to the discharge nozzle, and is screwed on to the collar of the reservoir.

Improved Road Scraper.

Jacob W. Wilson, Summerford, assignor to himself and Addison Shanklin, London, Ohio.—This invention relates to that class of rotary road scrapers in which the scraper box and the handles are connected and disconnected for revolving the scraper by manipulating the handles. The latter are attached to the draft yoke eccentrically to the connection of the yoke with the scraper, in such manner that the scraper is detached by swinging the handles upward, and connected by swinging them downward. The invention consists of a guard hook, in combination with the connecting devices, to prevent disconnection by the downward movement of the handles.

Improved Marking Board for Pin Pools.

George H. Decker, Belleville, N. J.—This relates to such an improvement in marking boards for pin pool that the numbered balls may be taken out without the annoyance of dropping the same on opening the slide gates or hinged caps at present in use. The invention consists in recessing the marking board for the round or otherwise shaped plugs that contain the balls securely in concave recesses.

Improved Car Coupling.

John A. Acton, Jackson C. H., Ohio.—The invention consists of a drawhead with a crooked pin bar, that swings in a longitudinal top slot of the same, and is keyed at the rear end to a lateral shaft with ratchet wheel and pawl, and provided at the front end with the pivoted coupling pin. The release of the pin-controlling ratchet, either from the sides or top of the car, drops the pin through the link, which completes the coupling operation.

Improved Compound for Flavoring and Preserving Tobacco.

George E. Sterry, New York city.—This is an improved compound for sweetening, flavoring, and preserving tobacco, formed of powdered salt and licorice root.

Improved Hot Air Furnace.

Thomas Langstrath, Germantown, Phila., Pa.—The smoke pipe leads out of the top of the combustion chamber into a horizontal pipe, going through the furnace from front to rear, and on the latter side receiving a dust pipe, leading up from the ash pit, to carry off the dust when the ashes are shaken down. At the front of the horizontal pipe is a damper, to be opened to let in air to check the draft without opening the furnace door and letting cold air in directly on the hot plates.

Apparatus for Separating Gold from Sand, etc.

Thomas W. Irvin, Eureka, Cal., assignor of one half his right to Alex. Gilmore, A. Dolan, E. Brown, and Maurice F. Moloney.—This invention consists of suitable apparatus for drying and separating the sand, and conveying the same by an elevator to a system of connected channels and conductors, in which the heavier gold particles are separated from the sand by the current of an exhausting fan, and the current of air and its force is changed and regulated by adjustable valves, while additional chambers or receptacles collect the finer mixture of gold dust and sand for transmission to the amalgamator.

Improved Toy.

George F. Morse, New York city, assignor to himself and Joseph F. Tobin, of same place.—This is a recessed ball, mounted with a bell forming a part of the spherical shape of the same, and sounded by a spring clapper or other device within.

Improved Revolving Horse Rake.

John H. Randolph, Jr., of Bayou Goula, La.—This is an improved sulky rake, designed especially for pulling pea vines for hay, and leaving them in bunches to dry. By the provision of detachable stop blocks any pitch of the rake teeth may be given, and the stops can also be thickened to the required point by applying one or more additional pieces thereto. There are also improved devices for holding and tipping the rake head.

Improved Apple Corer and Slicer.

Charles E. Kimball, New York city.—The invention consists of quartering blades radiating from a common center, in which is a revolving shaft carrying a couple of bow-shaped knives, which, being turned after the quartering blades have been pressed into the apple, will cut out the core, after which the quartering blades, being driven down through the apple, will finally separate the cored quarters.

Improved Boiling Pot.

W. H. Hennaman, and W. F. Shaw, Jr., 19 S. Chester street, Baltimore, Md.—The invention consists in a sectional boiler having opposite flange grooves, sliding plate, and a cover hinged to the top of a vertical partition.

Improved Warming Apparatus.

John F. Reilly, Washington, D. C.—The invention consists in an overflow pipe and a longitudinal steam pipe between cover and pan, together with a steam coil extending under the warming plate and provided with discharge outlets.

Improved Crank Motion.

Charles E. Whipple, North Charlestown, N. H.—This invention consists of a connecting rod connected to the crank pin by a slotted hole, and extended beyond it and connected to another crank, which is pivoted eccentrically to the axis of an idle wheel, on which it is mounted, and is carried around with the connecting rod. By this arrangement, when the main crank pin is on the centers the connecting rod ceases to pull or push on it on account of the slot, but continues to pull or push on the auxiliary crank, which, not being on the center, carries the rod laterally against the main crank pin, and thus carries it past the center.

Improved Hook Bale Tie.

William Greet, Mooresville, Ala.—One end of the ball band is passed into a hole on a separate locking piece, back through another aperture, and then is doubled over. The other end is bent to form a loop, pushes through a hole in the locking piece, and is secured by a pivoted hook on the latter.

Improved Earth Auger.

Joseph E. Hall, Paxton, Ill.—The door is attached by points at the lower end and the stud screws at the upper end of the edges, engaging with the sockets and notches respectively, in the barrel, the edges being fitted inside of the edges of the barrel, and fastened by a screw. The lip is hinged to the under side of the bottom of the barrel in the clearance, where it does not obstruct the turning of the auger, and it is contrived to drop down on the bit when the auger is raised, and convert the auger into a sand bucket by closing the throat. The bit is attached by a dovetail-shaped shank on it, and a corresponding socket in the auger bottom, for readily detaching it.

Improved Miter Box.

Peter Johnson, Wauconda, and Nicholas H. Johnson, Blackberry, Ill.—The table is supported on pivoted base arms that may be folded to the under side of the table after use. A sliding spring-cushioned sleeve supports, on branch arms with end sleeves sliding on pillars of a revolving base plate, a saw guide frame, which extends downward below the supporting disk, and carries in forked guide ends the saw for cutting the miter.

Improved Tyre Tightener.

Henry A. R. Horton and Amos P. Hayes, McKinney, Tex., assignors of one half their right to John H. Owen.—The joint is composed of two nuts connected together by a bolt with right and left threads. In the center of the bolt there is an enlarged piace of octagon shape. The bolt, when screwed entirely up, enters into holes made in the ends of the fellies. In one end of the tyre a tongue is cut, and in the other end there is a slot into which this tongue fits. The miter joint, formed by tongue and slot, is intended to prevent the ends of the tyre from springing apart laterally. The joint is covered underneath by a clip made so as to fit up to the edges of the tyre. The ends of the fellies are cut into blunt wedge shape, and covered by thimbles, and the nuts are so shaped that the thimbles fit into them exactly.

Improved Clothes Wringer.

William T. Bunnell and Anson G. Ronan, Ottawa, Can., said Ronan assignor to said Bunnell.—When a handle roller is forced down, spring cams bear upon friction rolls and force the upper rubber roller downward in contact with the lower rubber roller, and in doing that the crabs in which the lower roll revolves are made to clasp the tub or vessel, while the handle roller serves as a guide to conduct the clothes between the rollers.

Improved Milk Cooler.

Owel H. Willard, Randolph, N. Y.—The invention consists of milk pans and vats constructed with bottoms with diagonal pitch or inclination toward the lowest corner, at which the tightly-sealing milk outlet is arranged, that may be readily detached for allowing the separation of pan and vat for cleaning purposes.

Improved Cistern Cover.

Sebastian Haffter, Highland, Ill.—The invention consists of a flanged cast iron well cover, provided with supporting standards for the pump stock or pump chain tube, a hinged lid, and filtering basket below the lid. The cover admits ready access to the cistern for repairs, and allows the taking out of the pump stock or casing without removing the well cover.

Improved Metallic Truss Bridge.

James Valleley, Canton, Ohio.—The stay or brace pieces are formed of a wrought metal plate having its end portions in different but parallel planes, and joined by a middle portion, which is inclined at about an angle of forty-five degrees thereto. The said end portions constitute what may be termed the feet of the braces, and are perforated to receive the bolts by which they are secured in the arch. One foot is bolted to the upper and the other to the under plate of the chord, the length of the inclined middle part determining the distance between the plates.

Improved Clothes Pin.

Uriah D. Mihills, Fond Du Lac, Wis.—The notch of a block is passed over the clothes line, and a key is forced down, clamping the line between its edge and the side of the notch in the block.

Improved Gang Plow.

Eugene P. Pulliam, Palmyra, Mo.—This invention includes simple devices which enable the altitude of all the beams to be simultaneously regulated.

Improved Shoe Fastener.

George P. Reeves, Helena, Montana Ter., assignor to himself and Charles Rumley, of same place.—This consists of a lacer applied by prongs to the leather or other material, and provided with a central concavity and surrounding ridge, open toward a hook-shaped part, which is turned back far enough to prevent the catching of the dress or other objects thereon.

Pure Water.

From the days of the old Romans down to the present time, political economists have sought for an abundant supply of pure water as the first great nee l of any great city. The question, today, when railroads and manufactures concentrate humanity at so many points, is of more importance than when settlements were made merely where nature has provided a full supply of the true water of life. Our great cities are all seeking an additional water supply, and in many the water now received is expensive and unsatisfactory in quality from the immense waste and sad deterioration consequent on a faulty system of piping. Many different materials have been used for the conveyance of water long distances. The old Roman aqueducts brought water of only the purity of ordinary streams, open to sun, air, dust, and like minor evils, a style not feasible in this day or country. The first American aqueduct of which we have cognizance, that at Portsmouth, N. H., in operation in 1790, brought water through heavy pine logs, and so continued up to a year or two since. Lead has proved dangerous for piping, and lined with tin has been found enormously expensive for a doubtful result; while plain cast and wrought iron rust and corrode; iron lined with cement, glass or porcelain, has been found impracticable, on account of a lack of elasticity; and galvanized iron, which it was hoped would solve the problem, has been found seriously affected by the various salts and alkalis held in solution by the water conveyed therein.

Again, the dependence of a city or large town on a single main of great size has been a cause of disaster from any defect therein, and the future water supply will be doubtless through a number of smaller mains, each independent of the other, thereby precluding any possibility of a general failure. The National Tube Works Company of Boston, Mass., and McKeesport, Penn., seem to have solved the problem as to a perfect pipe, furnishing a seamless lap-welded wrought iron pipe, of from one half to fourteen inches diameter, coated inside and out with an indestructible elastic enamel, and capable of withstanding a pressure of 1,000 pounds to the square inch. The coating resists all known corrosives, and is elastic enough for all working purposes, while all the connections are made by a sleeve joint that prevents any leakage.—*Boston Daily Globe*.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

A. J. B. can harden screw plates and dies by the process given on p. 75, vol. 28.—A. K. will find that imitation pearls are described on p. 250, vol. 30.—R. F. will find a recipe for liquid glue on p. 250, vol. 30.—R. K. W. will find a description of a good cheap telescope on p. 298, vol. 30.—F. J. will find a recipe for a cement for millstones on p. 251, vol. 31.—L. H. R. will find rules for proportioning safety valves on p. 330, vol. 32.—S. H. D. will find a rule for ascertaining the horse power of an engine on p. 33, vol. 33.—B. J. F. will find rules for ascertaining the required pressure of water in pipes on pp. 73 to 79, *Science Record* for 1873.

(1) H. E. says: 1. I have tried the recipe for indelible ink, and cannot dissolve the prussiate of potash. I tried to dissolve it in benzine, to mix it with printer's ink; but it will not dissolve. I also tried alcohol: it would not mix with the ink. What is the matter? A. What recipe do you refer to? Yellow prussiate of potash is soluble in water. 2. Is there anything that will make printer's ink indelible? A. Carbonaceous substances, such as asphalt, with proper solvents, have been used for this purpose.

(2) F. A. asks: 1. By what process can I make a good nickel solution for nickel plating? A. Use a strong solution of the cyanide or double sulphate of nickel and ammonia, obtained by dissolving the salts in hot water until the solvent is nearly saturated. 2. What is the proper quantity of cyanide of potassium? You mention 1¼ ozs. to 1 gallon. Would it not make a very weak solution? A. Use water 1 gallon, cyanide of potassium 12 ozs., cyanide of silver 1½ ozs.

(3) Y. P. asks: How long must I leave a pistol cylinder in a gold solution, so that the coating will last a year? A. About 24 hours will give a good deposit. It is not necessary to disturb it until finished. 2. Will an old watch case do to make the solution? A. Yes. A gold solution made with a battery is a good one for the purpose.

(4) F. H. J. asks: 1. Would a 1½ inches achromatic object glass, of 30 inches focus, and a plano-convex lens, of ½ inch diameter and 1 inch focus, answer in constructing a telescope as described on p. 7 of vol. 30? A. The 1½ inches objective is rather small for 30 inches focus. The plano-convex lens of ½ inch diameter and 1 inch focus for an eyepiece will not answer very well. The eyepiece should consist of two lenses, both plano-convex and with the flat side to the eye, one of, say, 1 inch focus near the eye, and one of 2 inches focus at the distance of 3 inches from the first. 2. Which is the best for an eyepiece, a plano-convex or a double convex lens? A. Plano-convex lenses are better than biconvex. 3. How can I make a terrestrial eyepiece and a celestial eyepiece? A. A celestial eyepiece consists of one set, that is, two such lenses; a terrestrial eyepiece consists of two such sets. A celestial eyepiece shows inverted images. The additional pair of lenses in the terrestrial eyepiece reverts the inverted image to its natural position. 4. Would the above telescope, if fitted properly, be powerful enough to see Jupiter's moons and Saturn's belts? A. If a good one it may do to see the satellites of Jupiter, but not Saturn's belts. 5. What work on the telescope would you recommend, for an amateur without a teacher? A. There are many books on the microscope, but few or none on the telescope alone. In some of the larger treatises on physics, such as Silliman's, Ganot's, etc., you may obtain some special information on various points.

(5) H. L. G. says: The following question involves the principle of the hydrostatic paradox, that the pressure of fluids is according to the hight and surface pressed upon, and not according to the quantity pressing. This is evident in case of water; but does it hold also in the case of air pressing upon itself under the same circumstances, either with or without forcing? Of course it would require a vacuum opposite to make the test. A. Yes.

(6) S. M. L. asks: What is the best material for belts to which slats three quarters of an inch in width are to be fastened, the belts to run over rollers three and five inches in diameter, the larger being the driving roller? A. Try a flat chain.

1. What is compressed air? A. It is air, the volume of which has been considerably decreased by pressure. 2. Is it as elastic as steam, or more so? A. It is more elastic at low temperatures. 3. If compressed air be confined, would it lose its elasticity? A. No.

Would a wheel that would start itself on an axle and keep on continually revolving, moved only by an eccentric weight of its own, be considered perpetual motion? A. Yes.

(7) L. W. says: I am coppering cast and malleable iron by dipping in a solution of sulphate of copper; but the copper does not attach itself as permanently to the malleable iron as to the other. What is the remedy? A. Clean the surface well by dipping in dilute oil of vitriol, and scouring with sand.

(8) D. B. T. says: I have long had a theory that the absorption of air by water decreases its cohesion to an extent unthought of by our best scientists. It is a well known fact that water absorbs about four per cent of air under one atmosphere's pressure, and that the absorption goes on in the same ratio with every increase of pressure. It is easy to conceive of a condition of things when the air under an enormous pressure would penetrate the intermolecular spaces of the water, to an extent sufficient to dissociate its elements and probably form a new combination and produce a new gas. A. There is no doubt that the addition of air to the water of a steam boiler, and even to the steam itself, is effective in increasing pressure. This was verified by Professor Rogers of Philadelphia, Pa., who even made it a matter for a patent, and constructed an engine which illustrated the difference of admitting and excluding air. But that air, under great pressure, would be able to penetrate the intermolecular space of the water, so as to dissociate its elements and form a new combination or gas, is a totally unsupported hypothesis; and we fear that your drawings for a generator and engine to work this gas, if it exists, have been labor wasted.

(9) S. A. R. asks: What is the best material used for filling fireproof safes? A. Plaster of Paris and alum, usually.

(10) C. H. M. says: Your correspondent I. S.M. asks for a rule to find the size of hole in which a thread is to be cut, and at the same time gives the following: Deduct from diameter of the screw 1½ times the pitch. Is not the following rule more accurate? As most of the threads used in this country are cut on a 60° angle, by taking the cosine of ½ the angle, that is, 0·8660, and multiplying it by the pitch, then doubling the result, and deducting it from the diameter of the screw, you will have the proper size for the hole. To illustrate the above rule: Let pitch be 0·10″, diameter of the screw 1″; then 0·1″×0·8660×2=0·1732; 1″−0·1732=0·8268. By I. S. M.'s rule: 1−0·15=·8500, giving a difference in size of hole of 0·0232. A. Below are the rules for proportioning the American standard screw, which is flattened at top and bottom. D= outside diameter of screw. d=diameter of hole in the nut. p=pitch of screw. n=number of threads per inch. (All dimensions in inches.) $p=\sqrt{\frac{16D+10}{16\cdot64}}-2\cdot909$. $n=\frac{1}{p}$. $d=D-1\cdot299\times p=D-\frac{1\cdot299}{n}$. If the thread is not flattened at top and bottom, $d=D-1\cdot732\times p$. For a screw, not flattened at top and bottom, with any angle, a, of thread, $d=D-\text{cotangent}\frac{a}{2}\times p$.

(11) W. F. R. asks: Which will last longest in an upright boiler, cast or wrought iron grates? A. Cast iron, generally.

(12) E P. says: In an article entitled "Work for Arctic Explorers," you make the following statement: "In longitude 112° W. of Greenwich, the explorers will have arrived between the north pole and the magnetic pole." I do not understand how this can agree with a previous statement: "When 40° E. of Greenwich is reached, the north pole will lie between the explorers and the magnetic pole." Has the magnetic pole magnitude, or was there a mistake in printing one of the above mentioned numbers? A. The magnetic pole in question has very considerable magnitude: it covers an area of many square miles. This, however, is not the sole cause of the paradoxical compass bearings mentioned in our article. You are doubtless aware that there is another north magnetic pole on the Siberian side of the geographical pole; and the lines of magnetic direction are still further complicated by magnetic conditions which have not yet been fully made out. The statements of our article on this point were founded as stated therein on the compass directions laid down on a provisional map constructed, for the expedition lately sailed, by the hydrographer of the British Admiralty, showing the magnetic conditions which may be expected in all unexplored polar regions if the distribution of terrestrial magnetism based on the knowledge acquired up to the present time, and elaborated by Gauss, Sabine, and others, turns out to be correct. If the compass bearings of any point could be predicted from its geographical position, or its position from its compass bearing from a known point such a map would be unnecessary, and the difficulties of arctic exploration would be greatly lessened; they are seriously complicated when the voyager has to rely so largely on the guidance of an instrument, the behavior of which he is unable to predict with any certainty. The provisional maps supplied to the British expedition will doubtless prove of great assistance, though they lay down merely what is probable.

(13) F. R. B. says: I have an achromatic microscope, powers from 20 to 100 diameters. I would like to construct with it an astronomical telescope. What sized object glass would it require, and of what focus? Should it be achromatic? A. Object glasses for astronomical telescopes must be achromatic, and may be had of all sizes and focal length, varying from 2½ to 3 inches in diameter and 3 or 4 feet focus to those of 27 inches diameter and 30, 40, or more feet focus.

(14) G. W. P. says: 1. I require from a magnetic engine as much power as a man would exert by opening and closing his thumb and forefinger 60 times a minute. Can I get this much from two Léclanché cells? A. Yes. 2. How many, and what sized, magnets should I use? A. Make your magnets so that the weight of the wire and the iron are equal, and determine the size by experiment. Two magnets are sufficient. 3. Can I gain more power by using more battery, or by less battery and more magnets? A. Make the cores thin and the poles thicker and use more battery.

(15) A. S. asks: Can a lamp wick be lit by electricity? A. Not unless surrounded with gas.

(16) L. J. S. says: D. L. B. asks if a solid bar of steel or iron would sink in the ocean in the deepest part, or float when the amount of water displaced equaled in weight the bar of iron. I wish to say that the weight of a body, specific or otherwise, depends on its density. As water is only slightly compressible, how could it be made as dense as iron? If it were so compressible that it could be made as dense as iron, it would be no longer water but a solid. The pressure of water has nothing to do with bodies floating and sinking in it. A. We would be glad to know your reasons for this conclusion.

Would it expand the air beyond its present limits to lesser the gravity of the earth? Suppose, for instance, that the material of which the earth is composed were several times lighter, would not the air be much more rarefied and reach much beyond its present hight? A. Yes.

(17) F. W. H. asks: Is it practicable to make a machine to run by a weight or spring, that will take the place of a Grove battery in plating small articles, such as watch cases, spoons, etc.? A. No.

(18) W. E. D. asks: 1. In an exhausted Léclanché battery, which needs replenishing, the oxide of manganese or the gas carbon? A. The manganese. 2. Will not a sheet of lead or copper answer as well as carbon to put in the porous cell, to make the positive pole of the battery? A. No. 3. Is there any metal that will take the place of zinc or platinum for making the negative pole of a battery? A. Nothing so good as zinc. Platinum forms the positive pole. Iron can be used in place of zinc, but it is not so good. 4. Will not a porous cell made of common stoneware (unglazed) answer as well as the ones we buy? A. Yes. 5. Cannot the above cells be made at any pottery, and should they be glazed or unglazed? A. If glazed they will not be porous. 6. What kind of pitch or resin is used to seal Léclanché batteries, and is it necessary to seal them? Will they not work as well if left unsealed? A. Shoemaker's wax will do. The sealing is done to prevent evaporation. They will work if not sealed, though not for so long a time.

(19) W. P. asks: What is the smallest magnet I can use, and what are the amount and size of wire required for it, to move a small latch of a door? A. A magnet 1 inch long will answer with 200 feet of No. 20 wire.

(20) F. W. R. says: In your article on the instability of the earth's surface, you state that the coast of Texas was rising at a comparatively rapid rate. This statement is certainly a very erroneous one, and I draw this conclusion from these facts: In 1841 I landed first in Texas, on Galveston Island. The place was but little elevated above the waters of the bay, but the street called Strand was above the ordinary tides; and was only overflowed after winds from certain quarters. It has been filled up to a hight of several feet, and is now barely above high tides. Salt water was reached at a depth of four or five feet, and is, I think, still found at that depth. The tide reaches the town of Houston and marks about a similar point on the wharf. I have often heard it said that our coast was rising; but so far as my appreciation of it goes, the rise must be very slight during the last thirty-four years. A. You must consider that the coast of Texas along the Gulf of Mexico is between 300 and 400 miles long, and that the northeastern portion, adjoining Louisiana, is of the nature of the latter State. It has not been asserted that Houston is rising; but 300 miles southwest of that place, near the mouth of the Rio Grande, it adjoins Mexico; and the condition is very different there, as the strata partake more of the volcanic nature prevailing in Mexico. It has been repeatedly stated, by those who visited that region 40 years ago and recently, that it is rising. It is a very common occurrence that a coast line descends or is stationary in one part, while, at a distance of 300, 200, or even 100 miles, a gradual rising takes place.

(21) S. K. L. says: A friend and I had a dispute as regards the ground wire of a telegraph. He says the ground current takes a direct line from one point in the earth to the other. I say it takes the course of the line wire. Which is right? A. It takes the course of a direct wire having no resistance.

(22) W. M. D. says: I wish to construct an electro-magnet and get as much force as possible with a given amount of material. Will 200 feet of No. 20 wire wound on 4 soft iron cores of U shape, each weighing ¼ lb. and each having 50 feet of wire, be as effective as 200 feet of No. 20 wire wound on 1 core weighing 1 lb. or as much as all the 4 small ones put together, the battery to be the same for the large one that is used for all 4 of the others at one time? A. Yes.

(23) F. R. says: I have a plating shop, and find great trouble with batteries. I was thinking of getting a friction battery to do gold, silver, and nickel plating with. How could I make a cheap one, to go by steam? A. You can buy magneto-electric machines for the purpose. You could hardly make one without great labor and expense

(24) I. H. R. asks: Can you tell me how to make an electro-magnet that will work very slowly? A. We cannot.

(25) W. R. B. says: Is there any method in use of blowing a church organ by the use of a heavy weight acting through a system of clockwork? A. Yes. A weight of 7,000 lbs. with a fall of 30 feet, and proper gears, will drive the bellows of an ordinary church organ for half an hour.

(26) C. E. J. says: 1. I have made an induction coil, 12 inches long and 6 inches in diameter, in the following manner: I took a piece of hard rubber tubing, 1¼ inches in diameter and 13 inches long; I put in 7 inch heads, ⅛ inch thick, of dry varnished walnut. I wound 4 layers of No. 16 cotton-covered copper wire for the primary coil, I then wrapped around the primary coil two thicknesses of manilla paper, thoroughly saturated in white paraffin, to insulate it from the secondary coil; my secondary coil was composed of between 7 or 8 miles of fine insulated green silk-covered copper wire, part being No. 30 and part No. 35 relay wire; and between each layer of wire, I wrap a sheet of paraffined paper. My core consisted of a number of small iron wires soldered together and slipped inside of the rubber tubing; my condenser consisted of 24 sheets of 12 inches square tin foil, each sheet separated by a sheet of paraffined paper, the alternate sheets of foil being connected together. I have connected the condenser with the coil in three different ways, with about equal results; the longest spark that I ever got out of it was ⅛ of a inch. Please tell me the defects of this machine. A. For full particulars regarding the construction of induction coils, see page 115, vol. 33. The principal faults in your machine consist in the soldering of the wires forming the core, and in the construction of your condensers. The bundle of wires forming the core should neither be soldered together, nor surrounded with a metallic substance. One side of the condenser should be connected to each side of the break piece in the primary circuit, the object being to furnish a reservoir for the extra currents to flow into when the primary circuit is interrupted, and thus prevent the spark. You should use a Bunsen battery instead of a Smee. 2. If made properly, how long a spark ought it to give? A. The length of your spark will depend upon the size of your battery.

(27) G. E. G. says: 1. Is it practicable to allow for the expansion of shafting of 2⅜ inches diameter and 220 feet long, running at 82 revolutions, when the temperature is from 65° to 70°, there being on the line two sets of bevel gears containing 30 and 36 teeth of 3¼ inches pitch, running shafting at right angles? A. Yes. 2. What should be the angle of gears containing 30 and 36 teeth, of 3¼ inches pitch? A. About 40°.

(28) C. H. says: A friend claims that four persons, holding their breath, may lift, with one finger each, a fifth person from the floor, he also holding his breath. I have tried it without success, but my friend says that he has seen it done at various times. What do you know about this experiment? A. We have told all we know about this matter (and it is very little) several times before. We have never seen the feat performed, but we have heard about it so often that we are inclined to think it may be true. As we have remarked before, however, it is certain that the person who is lifted does not lose any weight by holding his breath, neither do the lifters gain any strength by the process.

(29) W. J. B. asks: In heating a room, would it require more fuel to do it by ordinary steam, or to take ordinary steam and superheat it? In other words, would it be more expensive to continue to generate ordinary steam for a given number of hours, and use this for heating a room, or to convert ordinary steam into superheated steam, estimating the cost of the superheated steam from the time you began to superheat it, and not counting the cost of generating it in the first place? A. The second plan would be the most economical.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Paris Green, and on the Keely Motor. By G. W. P.
On Repairing Bells. By C. S.
On Bee Culture. By E. C.
On Draft of Vehicles. By M. W. W.
On Large and Small Axles. By F. W. D.

Also inquiries and answers from the following:

A. J. K.—N. B.—E. T. H.—B. W.—W. B. P.—N. K.—R. H. B.—F. J. W.—J. C. T.—H. T.—J. K.—T. W.—J. D.—B. L.—W. P.—N. K.—O. P. R.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The 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 only are given, are thrown into the waste basket, 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 sells telescope lenses? Who makes machinery for grinding lenses? Whose is the best vertical boiler? Who makes a good flocking machine? Who sells the best plow for use on heavy lands?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,554.—CHA . — Hooper *et al.*, Portland, Me.
8,555, 8,556.—INKSTANDS.—C. Kitschelt, New York city.
8,557.—CLOCK CASES.—W. F. Muller, New York city.
8,558.—STOVE KNOB.—J. F. Quimby, Troy, N. Y.
8,559.—TYPE.—J. K. Rogers, Brookline, Mass.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA August 7, 1875.

5,039.—J. G. Eberhard, Akron, Ohio, U. S. Hame. August 7, 1875.
5,040.—M. McCall *et al.*, Buffalo, N. Y., U. S. Cutting attachment to lead pencils. August 7, 1875.
5,041.—A. B. Drake, Painesville, Ohio, U. S. Fence post base. August 7, 1875.
5,042.—W. H. Lotz, Chicago, Ill., U. S. Hot air furnace. August 7, 1875.
5,043.—J. Kedey, New York city, U. S. Securing knob roses to doors. August 7, 1875.
5,044.—J. L. O'Connor *et al.*, Monroe Village, Wis., U. S. Pruning shears. August 7, 1875.
5,045.—A. Berry, Waterloo, P. Q. Churn. August 7, 1875.
5,046.—J. Buel, Chattanooga, Tenn., U. S. Safety stirrup. August 7, 1875.
5,047.—S. P. Littlefield, Lynn, Mass., U. S. Station indicator for railway carriages. August 7, 1875.
5,048.—H. A. Schandevyl, East Saugus, Mass., U. S. Corset. August 7, 1875.

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