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AMATEUR TAXIDERMY.

A moderate knowledge of practical taxidermy necessitates two essential qualifications: first, a touch both gentle and delicate; second, some knowledge of natural history and anatomy. A badly prepared bird or animal is worthless as a specimen, and a ghastly object to behold. The last mentioned application will, we have no doubt, be peculiarly applicable to the result of our reader's first effort after he rises from the perusal of the lines below. We do not say this in order to discourage such attempt—far from it—but merely to insinuate, in advance, that the practice of the art is not half so easy as it appears from the simple description of the various processes. Therefore we hope that all who, having armed themselves with scalpel and forceps, are now sitting with the victim of Tabby's last raid on the canary cage in front of them, and this paper spread out in convenient position for reference, will blame, not our elucidation, but their own inexperience, if, in lieu of the life-like image existing in their mind's eye, a badly rumpled little knob of yellow feathers reward their toil. Skill is only to be gained by study and practice, and the path is sure to be thickly strewn with monstrosities in astonishing variety; but when once a certain degree of deftness is attained, the student will find that an occasional ramble through the woods, with a light shot gun for company, will be sure to produce enough interesting specimens to keep him amused, as well as instructed, during many of the long evenings between now and summer.

We should begin with a small chicken. Not that a stuffed chicken—unless of course, its interior be filled with bread crumbs, and its exterior be roasted—is an object of extraordinary beauty, or at all suggestive of anything in particular, but because it is easy to get, and it has a moderately tough skin. Besides, if we are economically inclined, the meat will make good soup, and need not be wasted. Don't begin with a canary, nor with a chippy or any other small bird. Stuff several chickens first, or any larger animals.

We will suppose, now, that the student is seated at his work bench. A defunct pullet elevates its rigid claws in the air before him. He has rolled up his sleeves, and is about to make his initial incision. Before he does so, let us look over his kit of tools. Our artist has sketched them all, on the table before the individual which, in the large engraving, he represents

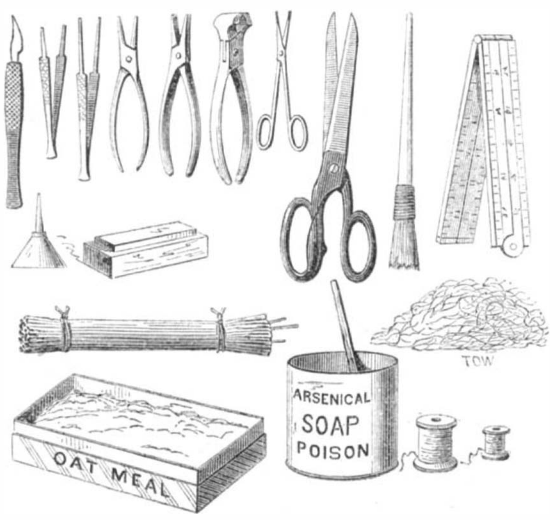

Fig. 2.—TAXIDERMICAL IMPLEMENTS.

at work, and in Fig. 2. First, there is the scalpel. This can be purchased for a small sum from any maker of surgeon's instruments. The blade is short and very sharp, while the handle (not jointed) is long enough to allow of a firm grasp. From the same maker, a couple of pair of surgeon's scissors should also be obtained, one quite small and sharp-pointed, the other of medium size; also two or three spring forceps of various dimensions. A small pair of pliers for clipping wire is required, some spools of cotton (Nos. 10, 30, and 100), a quantity of excelsior and tow, some cotton batting, a little prepared glue, a number of pieces of wire about fifteen inches long, and straight (size No. 20 or thereabouts), a box of dry oatmeal, and some arsenical soap. This last can generally be obtained of druggists, or, if not, can be

THE TAXIDERMIST AT WORK.

made of carbonate of potash, 3 ounces, white arsenic, white soap, and air-slaked lime, 1 ounce each, and powdered camphor, three sixteenths of an ounce. This is combined into a thick paste with water, and applied as below described, with a small paint brush. It should be marked as poison, and kept scrupulously out of the reach of children or pet animals.

If the bird has been shot, immediately afterwards all the holes made in its body, as well as the mouth, should be plugged with cotton, in order to prevent the escape of blood or liquids. Operations should not be begun for twenty-four hours, so that the body may have ample time to stiffen and the blood to coagulate. It is well during this period to inclose the bird, head downwards, in a cone of paper, so that the feathers will be held smooth. See initial letter.

The first process is skinning, and it is in this operation that delicacy and neatness is required. In commencing, the left hand is used to part the feathers, exposing the skin from the apex of the breast bone to the tail. With the scalpel held like a pen, a free incision is made between these points, as shown in Fig. 3, care being taken to divide the skin only, without cutting into the flesh. The skin is then pressed apart, and oatmeal dusted into the cut, in order to absorb any fluids which may escape. Careful lifting of the skin clear of the flesh follows, until the leg is reached, when the scalpel is again used to disarticulate the thigh joints. The bone of each thigh is then exposed for its whole length, by pushing back the skin, and the meat removed, when the bone is replaced, and the other thigh treated in similar manner.

The skin is next detached, to the wings, which are cut from the body at the joint next the same, and the bones scraped clear of meat. Then the neck is divided, so that the skin, with the head attached, can be peeled from the entire body clear to the root of the tail. The last is bent toward the back, with the left hand, the finger and thumb keeping down the detached parts of the skin on each side of the vent. A deep cut is then made across the latter until the back bone, near the oil gland at the root of the tail, is exposed. Sever the back bone at the joint. This detaches the body, which may be removed and thrown aside, while the root of the tail, with the oil gland, is left. Great care is needed in this operation, as, if not enough bone be left at its root, the tail will come out; but all fleshy matter should be neatly dissected away.

The neck now requires attention. This need not be split or in any wise cut. The skin is merely pulled over the flesh, as a glove is removed from the finger, until the skull is exposed and appears as in the sketch, Fig. 4. With the point of the knife, remove the ears; and on reaching the eyes, carefully separate the lids from the eyeballs, cutting neither. It requires very delicate and slow work at this point, so as not to injure the eyelids. Then scrape out the eye cavities, and cut away the flesh of the neck, removing, at the same time, a small portion of the base of the skull. Through the cavity thus made, extract the tongue and brains, and after cleaning away all fleshy matter, paint the eye orbits with arsenical soap, and stuff them tightly with cotton. Care should be taken not to detach the skin from the bill, as it is necessary to leave the skull in place. Finally, fill the interior of the skull with tow, after coating internally with the prepared soap.

Cotton, it should be understood, will not answer as a material for stuffing any portion of the body through which, subsequently, it may become necessary to pass needles or wires. It packs too hard, and therefore tow or excelsior must be employed.

The skinning operation being now completed, the stuffing is next proceeded with. To prepare for this, the bird, before being skinned, should have been measured, first as to its girth about the body, and second as to its length from root of tail to top of skull, following the shape of the form. From these data an artificial body of the right dimensions is constructed and inserted as follows: On a piece of straight wire, equal in length to the last measurement above mentioned, a bunch of excelsior is secured by repeated winding with stout thread. This bundle, which is represented in our Fig. 4, is molded to a shape resembling that of the bird's body, and its girth is regulated by the similar measurement already obtained from the bird itself. As will be seen, it is attached at the end of the wire, the long protruding portion of which

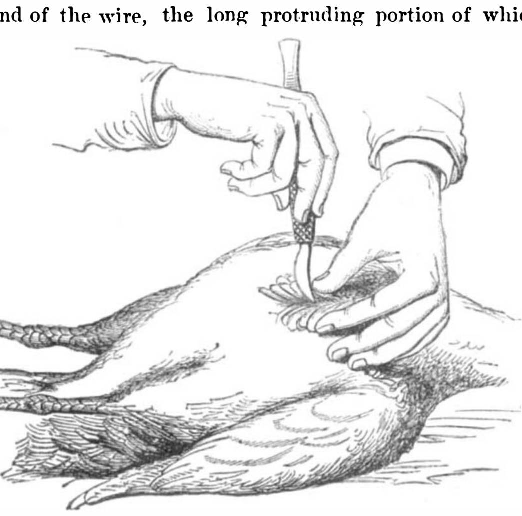

Fig 3.—SKINNING—THE FIRST INCISION.

serves as a foundation for the neck. The extremity of the wire is clipped by the pliers to a sharp point, and then forced diagonally upward through the skull, on top of which it is clinched flat. Cotton batting is then wound about the wire between skull and body, until sufficient thickness is obtained to fill the skin of the neck. The position of the various parts at this point is represented in Fig. 4. Painting the inside of the skin with arsenical soap follows, and then the skin is drawn back so as to envelope the false body, and a needle and thread is thrust through the nostrils to make a loop for convenience in handling.

The finest pair of forceps is employed to pull the eyelid skin into place, to arrange the feathers, and to pull up the cotton in the orbits so as to stuff the cavities out plumply. More cotton is next pushed down the throat until the same is entirely filled (Fig. 5). Two pieces of wire—quite stout for large bird—are then sharpened at one extremity. Taking the wire in one hand and guiding it with the other, the operator shoves it into the leg, from the ball of the foot up alongside the thigh bone, the skin being turned back for the

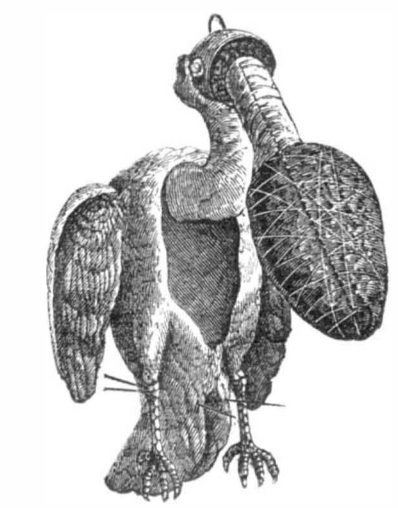

Fig. 4.—MODE OF ATTACHING THE FALSE BODY.

purpose. Cotton is then wound about both wire and bone, in order to fill the thigh out naturally, and the same process is repeated for the other side. The ends of the wire below are left protruding in order to support the bird on a perch, if such be desired. The upper ends are pushed clean through the artificial body, from below up, and clinched on the upper side. This secures the legs, which are afterwards bent in natural position (Fig. 6).

The bird can now be set up, that is, the wires stretching out below the claws can be wound about a perch or pushed through holes in a board and clinched on the under side. In the latter case, it will be necessary to spread the claws and fasten them with pins. For small birds, the cut in the breast need not be sewn up; a chicken or larger fowl will require

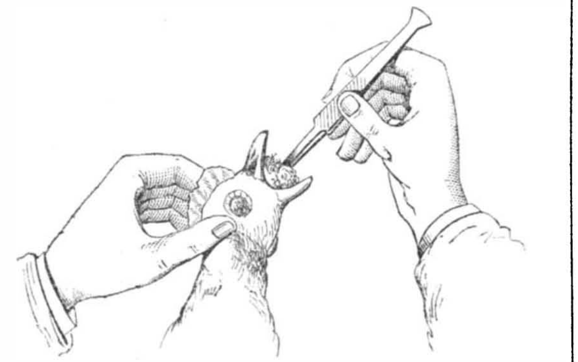

Fig. 5.—FILLING THE THROAT.

a few stitches to hold the edges together. If the tail feathers are to be spread, a wire is thrust across the body and through each feather, holding all in the proper position. The wings are then gathered closely in to the body, and two wires, one from each side, are pushed in diagonally from up, down, and through the skin of the second joint (Fig. 7). The wings are thus held, and the wires, as well as that through the tail, are left protruding for an inch or more. A touch of glue within

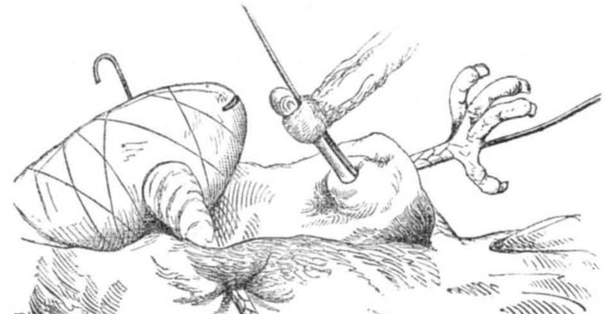

Fig. 6.—STUFFING THE LEGS.

the eyelids prepares the latter for the eyes. These must be purchased from taxidermists, but for small birds common black beads will answer. If plain glass beads can be obtained, by the aid of a little paint the student can easily imitate the eye of a chicken. After the eyes are inserted, a sharp needle is used to pull the lids around them and into place.

The operator must now, with a fine pair of forceps, carefully adjust the feathers, smoothing them down with a large camel's hair brush. This done, thread must be wound over the body very loosely, beginning at the head, and continuing until all the feathers are securely bound. The bird is then left to dry for a day or two, when the thread is removed, the ends of wire cut off close to the body, and the work is complete.

Stuffing animals requires less delicacy and care to avoid injuring the skin than with birds, but necessitates a closer knowledge of the form and natural position. The mode of skinning and stuffing is the same, except that the neck is cut down, as the head cannot, of course, be drawn through. This last is also the case with ducks, woodpeckers, and other slender-necked birds. In preparing deer's heads and antlers, the skull is best taken in, as it can be secured on a piece of wood, on which the neck can be built up. In skinning the head, the incision should be made on the back of the neck, and care should be taken completely to fill all cavities of the skull.

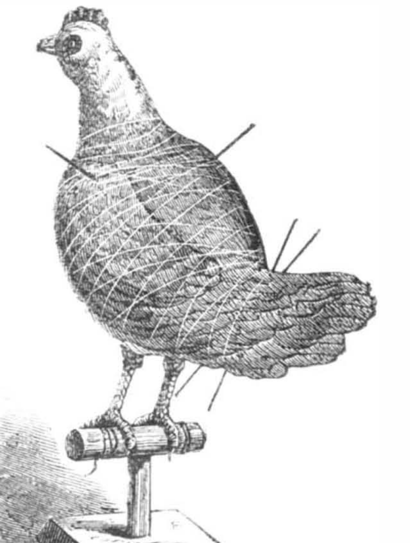

Fig. 7.—THE BIRD PREPARED FOR DRYING.

We should advise amateurs in this interesting art to endeavor to give an aspect of life to their productions, by grouping them or placing them in odd though natural positions. For instance, a chicken can be easily placed as in the act of picking up food or crowing—any position will be better than stiffly standing erect. Similarly animals can be represented attacking prey, fighting, or playing. A very fine group, now in the Central Park Museum, this city, representing an Arab mounted on a camel and attacked by lions, will exemplify our meaning. All the animals in this group are superbly prepared and placed, though, of course, such a work requires a skilled naturalist as well as taxidermist.

We are indebted to Messrs. Ulrich and Riedel, taxidermists, of No. 16 North William street, this city, for the practical suggestions above given.

Sir Charles Lyell.

We regret to announce the death of Sir Charles Lyell, a veteran scientist whose labors in the field of geology have gained for him universal renown. He was a native of Scotland, and was born in 1797; and he graduated at Exeter College, Oxford, where Dr. Buckland (afterward Dean of Westminster, and father of our contemporary, Mr. Frank Buckland) was Professor of Geology. The personal influence of Dr. Buckland, one of the most successful teachers who ever imparted a charm to an abstruse science, probably turned Lyell's attention to geology, he having commenced, on leaving the university, the study of law. In his twenty-ninth year he published his first paper, "On the Recent Formations in Forfarshire, Dorsetshire, and Hampshire." His fame as a writer was rapidly achieved, the scientific world at once recognizing his patient and laborious research, and his masterly and lucid method of exposition. His "Elements of Geology" and "The Principles of Geology" are his two most valuable works, and are known as accurate and exhaustive text books; while his more recent volume, "The Antiquity of Man," is perhaps the most important contribution yet made to that branch which connects his favorite science with the whole problem of the Universe and its origin.

Sir Charles traveled much in this country and Canada in 1841, and a very interesting book on our geology was published by him soon afterwards, called "Travels in North America," a second volume being the result of subsequent investigations made in 1845. During his first visit, he gave a course of lectures on geology in Boston, Mass. He served twice as President of the Geological Society of England, and departed this life full of honors and distinctions bestowed upon him by learned societies in all parts of the world.

New York Science and Art Association.

This institution, at its last regular meeting, elected for President, S. Irenæus Prime, D. D.; Vice Presidents, E. P. Rogers, D. D., Howard Crosby, LL. D., Professor D. G. Eaton, Henry Day, W. P. Titus.

Its course of lectures this winter has been very brilliant, and every one of them attended by crowded assemblies. The Association gives the lectures freely to the public, its only object being the diffusion of useful knowledge. To this end it invites learned and able men to discourse to the people on topics of commanding interest, and the multitudes desirous of being instructed show that these efforts are appreciated.

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NEW YORK, SATURDAY, MARCH 13, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE NEW RULE OF THE PATENT OFFICE.

Contrary to the uniform and long-established practice of the Office, the Commissioner has recently promulgated a rule that hereafter no rejected and abandoned application shall be a competent reference on which to reject an application for a patent. A person may now hunt among the models of rejected applications, to which free access is allowed; and if he finds anything that has never been patented, or described in a printed publication, or gone into public use, he may—if he can bring his conscience to the sticking point for making the necessary affidavit—obtain a patent therefor which will be good and valid against all the world for seventeen years. It is true that an affirmation, showing that he had derived his knowledge of the invention in the manner just supposed, would defeat his action for infringement; but such proof can rarely be obtained.

The patent law denies a patent unless, among other requirements, the thing patented was "not known or used by others in this country" prior to its invention by the applicant; and after the patent is obtained, it may be defeated by showing that the patentee "was not the original and first inventor or discoverer of any material and substantial part of the thing patented." A quarter of a century ago, Judge Cranch had decided that an invention was completed and reduced to practice when, by means of models, drawings, and other descriptions, it was set forth in such terms that a person skilled in that particular art could reproduce the invention so described. When this was done, therefore, in an application for a patent, the invention was *known* in this country, and no other person could afterwards be *the original and first inventor thereof.*

The rule embodied in this decision has governed the action of the Patent Office ever since, until the recent change. A rejected application was therefore regarded as just as good a reference on which to reject a new application as a patent itself would have been. The importance of preserving and arranging the files, models, and drawings of all rejected applications was therefore manifest.

The business of the Office has grown up chiefly under the rule above referred to, and the education of the practitioners therein has been shaped accordingly. The change of the rule, without any corresponding change of the statute, naturally created no little surprise and aroused a feeling of disapproval in our minds.

But upon reviewing the action of the Federal courts on this subject for several years past, we find that they have been gradually drifting away from the rule laid down by Judge Cranch, and the views of the inferior courts in this respect have finally been sanctioned and confirmed by those of the Supreme Court of the United States. We are far from being the advocates of what Mr. Jefferson used to denominate judge-made laws. We believe that the proper duty of the judiciary is to give effect to the statute, according to its fair intent and meaning—leaving to the legislative department the duty of correcting whatever may be thought amiss in the law as it exists. When the courts overstep this rule and undertake, by construction, to change the statute into what they think it should be, they launch forth upon a sea of uncertainty, and find themselves the authors of unnecessary difficulties for which there is no adequate compensation. Different judges will have different views of expediency. No one can tell into what shape prevailing doubts will finally crystalize. The most intelligent members of the profession find themselves incapable of giving reliable opinions, and property in patents becomes to a needless extent a gambling contrivance. To us it has always seemed as though the ruling of Judge Cranch, above referred to, was in substantial accordance with the statute, and that, if thought erroneous, an act of Congress was the proper remedy, especially after it had been so long recognized and acquiesced in by the Office.

But the ultimate decision of the courts is the rule to be observed in administering these and all other laws. Whatever may be our individual opinions, the great court of last resort must be regarded as being endowed with judicial infallibility so far as our own subsequent actions are concerned. The rule of the Patent Office should be made to harmonize therewith, and the Commissioner was bound by his duty to act accordingly. This he seems to have done by the establishment of the rule we have been considering, and to which the conduct of all interested parties must be made to conform.

This rule will to a great extent dispense with the necessity of preserving the files, models, or drawings of abandoned applications, or at all events of leaving them open to public inspection. Until the applications are abandoned, the previous rules of the Office preserved them in secret. After their abandonment, they can hardly be needed for any commendable purpose, and perhaps their preservation might be discontinued altogether, to the great relief and convenience of the Office. With this matter, however, we do not intend to meddle at present.

PISCICULTURAL PROGRESS.

That fish culture is evidently destined to become as much a settled pursuit as stock raising, we believe its past progress, as well as its prospects for the future, leaves no reasonable doubt. The success which has attended the efforts of the public-spirited gentlemen, who, for several years, have devoted their time and studies to the industry, is certainly very flattering, and an abundance of the finest and most delicate of game fish, in almost every stream and brook suitable for their development, appears now to be dependent mainly on the degree to which individuals will interest themselves in procuring the necessary spawn. This, through the new transporting apparatus, which we illustrated last week, is reduced to so simple and easy a proceeding, that the means for populating otherwise waste waters is to be obtained merely for the asking, or at most attended with an expense intrinsically trivial, and entirely inconsiderable in comparison with the benefits to be gained.

We took occasion recently to speak of the landlocked salmon as an excellent fish for stocking streams. There is another species which is worthy of equal commendation, and which is, besides, especially suitable for streams preserved for sporting purposes. We allude to the grayling, the natural habitat of which is in streams in Michigan, flowing into the Lake. This fish has, during the past year, been successfully hatched in New York State. It is not so good eating as trout, but is not at all inferior as a sporting fish. It is easily kept in good condition, and does not require so much food as the trout, and it is in season while the trout is not. The grayling spawns in April and the trout in November.

Mr. Seth Green, however, adheres to the belief that trout is the only fish with which to restock worn-out streams, and he states that in no event can grayling and trout be reared in the same waters.

Mr. R. B. Roosevelt, President of the American Fish Culturists' Association, at the recent annual meeting of that body, briefly recounted progress during the past year, in his opening address. Shad have been put on the Pacific coast, and captured in Sacramento river where they have never before been taken. So, also, bodies of water previously destitute of fish have been well filled with salmon trout, white fish, and various varieties of bass. Experiments are in progress with relation to the sturgeon, and it is believed that this valuable and large fish may be successfully artificially hatched

NATURE'S EFFORTS.

"If Nature put not forth her power, about the opening of the flower, who is it that could live an hour?"

So argues one of Tennyson's "Two Voices," anent the "stirring of the blood" which makes youth ambitious of great deeds. As poetry it is admirable, it lying in the province of poetry to personify all things, Nature not excepted. As prose, it would be less commendable; as Science, utterly intolerable. Yet men who think themselves scientific not unfrequently indulge in expressions in the same strain, which, if they mean anything, mean that the aggregate of phenomena to which we apply the term Nature is capable of willing and choosing, and of adapting special means to special ends—a palpable absurdity. Curiously, too, such language is often indulged in by those who deny the implied divinity of Nature, and recognize no controlling intelligence behind the veil.

An instance occurred the other evening: A more than usually thoughtful physician was speaking about the large family of small children, left orphans by a consumptive patient just dead; he said: "That is the usual way; those least worthy of perpetuation—those who have least to transmit to their offspring—multiply the most. Men know that they are slowly dying of an incurable disease, and that their children are almost certain to inherit ill balanced bodies and untimely death; yet they multiply to the last, just as plants when struggling under unfavorable conditions invariably run to seed. It seems," he continued, "as though Nature, conscious of impending defeat, threw all her available force in the direction of seed, to increase the chances of perpetuating the stock."

We have little faith in the theory which ascribes infinite perfection to Nature; in most cases, things are as they are simply because they could not be much worse and exist; still we should shrink from an interpretation of the facts of life imputing, like our friend's theory, infinite foolishness to Nature. The under dog in the fight may be an object of pity. From a human or humane point of view, he may be a proper subject for assistance. But to expect Nature to interfere in his behalf would be as unreasonable as to expect her to make a special effort now and then to help water to run up hill. If the fittest survive—and that is the natural order—the least fit must go down and stay down.

But do not the frailer sort seem to multiply excessively, as our medical friend asserted? To a great extent they do; but that does not necessitate his interpretation of the fact. That simply involves the same fallacy which a prominent sanitarian exemplified in his explanation of the fact that, in the poorer districts of great cities and in other places, as in rural Russia, where ignorance and poverty abound, the birth rate is relatively excessive. It shows an effort of Nature, he said, to make up for the unsanitary condition of such places, and the consequent waste of life in them: in other words, the death rate being excessive, the birth rate has to be correspondingly great to enable Nature to keep her seed up in the matter of population. Of the folly which Nature would exhibit in thus choosing the worst possible ground for fighting her assumed battle with death, he said nothing.

It was easy for a more logical and sensible observer to turn the tables entirely by calling attention to the fact that the excessive death rate, observed under such conditions, is the consequence and not the cause of the excessive birthrate. A high birth rate implies rapid child-bearing, exhausted mothers, ill-cared-for children, and many deaths in infancy—the invariable source of a relatively large death rate; and the same unthrift and ignorance, which result in poverty and overcrowding in unwholesome tenements, are very apt to manifest themselves also in improvident child-bearing with its fatal consequences.

As in this, so in all other similar cases, the moment men begin to indulge in the seductive habit of attributing intention, purpose, design, or what not, to the drift of phenomena, that moment they turn their eyes from their real connection and delude themselves with vain imaginings.

RUBBER TIPPED PENCILS.

On July 23d, 1867, James B. Blair obtained a patent for a rubber head for lead pencils, claiming, as a new article of manufacture, "an elastic erasible pencil head." The patent was acquired by "The Rubber Tip Pencil Company," who pretended that the patent gave to them the exclusive right to make rubber heads for lead pencils and under threat of legal proceedings against all who proposed to make such articles, they prevented competition, obtained a large business, and soon grew wealthy. A few stationers, however, ventured to dispute the broad claims of the Tip Company, and a suit finally came to the United States Circuit Court for trial. The defendants alleged that the rubber head claimed by the plaintiffs was simply a bit of rubber with a hole in it, on which a patent could not be sustained. The court took the same view, and decided that the patent was invalid. An appeal was then taken to the United States Supreme Court, as will be seen from our report on another page. The Supreme Court affirms the previous decision, thus completely rubbing out the absurd claims of the erasible pencil head Tip Company.

WASTE LAND AND FOREST CULTURE.

After a century spent in spoiling our woodlands, we are, as a people, slowly awakening to the fact that the chief end of man is not to cut down trees. We are beginning to learn also that, so far from being incompatible with forests, permanent civilization is impossible without them, that the tree slayer's ambition to bring the whole land under tillage would result, if successful, in making tillage a waste of labor through climatic disturbances. Alternations of drouth and deluge, blighting heats and blasting colds, have ever been the penalty for general forest destruction; and many a land once fertile is now a desert for this cause alone. Indeed woodlands are to climate what the balance wheel is to machinery, the great conservator and regulator, without which all other conditions are wasted.

There is probably not a periodical in the country which has not had more or less to say about the waste of our woodlands. The general opinion seems to be that we can recover the advantages we have squandered only by the creation of great forest reserves, with a general commission of forestry to see to their protection. Had we a strongly centralized government, it might be easy enough to carry out such a scheme successfully. As things are, we very much doubt its feasibility, except perhaps in regions like the Adirondack Wilderness, where the soil is unfit for anything else, and where such precautions are very little needed. Within our personal recollection, large areas in Clinton and Essex counties have been twice stripped of timber by lumbermen and charcoal burners; yet to-day the same hills are covered with a thrifty third growth. Where the difficulties of transportation are so great, there is little danger that the natural wood growth will fail to keep pace with the wood cutters. It is only where land has been cleared and brought under tillage, or laid waste by repeated fires, that special effort is required for the restoration of the forests. The fears that have been expressed in regard to such irreclaimable wildernesses as those of Northern New York are therefore quite gratuitous.

Besides, it is a general distribution of woodlands, not local forests, however extensive, that the country chiefly needs. The farms of Central New York are benefited by groves in their immediate neighborhood far more than by the forests of Essex and Franklin counties. Still more do the farmers of the West require frequent spaces of woodland, to break the storms of the prairies, to regulate the rainfall and temper the climate, and to meet the local demand for wood. Great forest reserves in Michigan or Wisconsin would help them comparatively little. They should look rather to local measures for the cultivation of trees; and the most that they should ask of government is a law authorizing townships to compel the gradual conversion of unused land into woodland. In every part of the country, there are tracts of land held by individuals or by corporations for speculative purposes. Very largely such landholders are non residents, who count on being enriched through other men's efforts. While A, B, and C are clearing their farms and establishing schools, churches, and other conditions of civilization, a market is made for the lands of D, who contributes nothing to the advancement of the new society, yet gains in the end perhaps more than the actual settlers. It would be no injustice to him to make him do his part towards the building-up of the community through whose labor he is made rich; and there is no way in which this could be more surely accomplished than by compelling him to plant a portion, say one tenth, of his idle land to trees every year. There would be no injustice in this, for the growth of the timber would add year by year to the value of his investment, while the resident community would be benefited by securing a local supply of fuel and lumber with all the climatic advantages of abundant woodland. The settler can ill afford to wait twenty or fifty years for the maturing of a crop; the speculator on the other hand, who is simply holding the land for its "unearned increment," can well afford to have a legitimate increment in timber growth slowly swelling the value of his investment. The necessity of planting might limit his purchases, but it would scarcely limit his profits in the end.

In all the older States, there are vast areas of waste land owned by railway companies and other corporations, much of it of little value for plow land or pasturage, yet well suited for the growth of wood. The railway companies are in the habit of sending to the remotest parts of the country for ties, when, by the exercise of a little forethought, they might grow them more cheaply at home. It would be to their advantage in the end, as well as a benefit to the community at large, if they were compelled by law to do so.

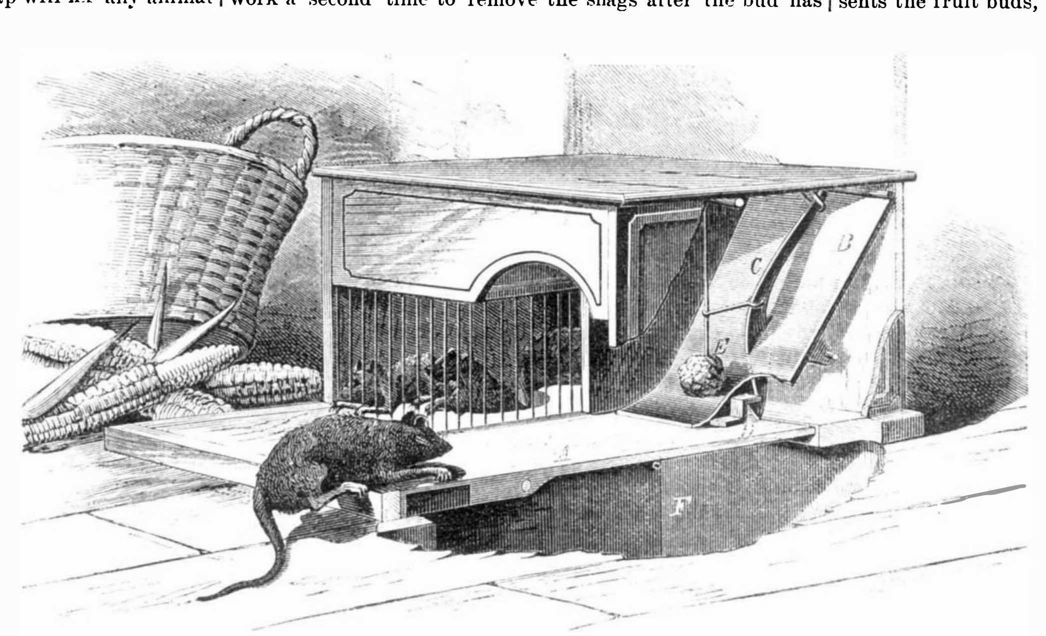
So too in mining regions, as in Pennsylvania, where miles and miles of mountainous country have been stripped of timber and scourged by fire until nothing remains but blackness and desolation. With their abundant riches underground, the great coal companies can afford to neglect the land above; but the State at large cannot long afford to let them do it. Such waste of woodland has brought ruin to every country that has permitted it; and if the owners of the soil will not restore its natural covering through enlightened self-interest, the inhabitants of the State will have to interfere in self-defence.

Fall of a Meteoric Stone.

The *Times* has already made mention of a brilliant meteor that was seen at Iowa City and other points in Central Iowa, on the evening of February 12, at half past ten o'clock. Its course was from southeast toward the northwest. It was apparently about half the diameter of the moon, and accompanied by a beautiful train. The color and vividness were about like that of molten iron. While in view it was seen to separate into many fragments, and, after about three minutes, the reports of three explosions were distinctly heard. One of the fragments seems to have fallen about three miles south of the village of West Liberty. An observer near that point says: "For fully a minute the heavens were lighted by the fierce glare of the swiftly descending fire ball; and when it struck, the earth shook as from an earthquake for miles around, and the noise of the concussion was heard by the people of Grinnell, 95 miles away. The fiery ball, striking *terra firma* in a large open field, frightened residents in the vicinity half out of their wits. It sank fifteen feet into the ground, and left a hole of that depth and ten feet in diameter. For hours it continued to spit forth flame, crackle, sputter, smoke, and occasionally discharge loud cannon-like reports, to the infinite terror of the people in that vicinity. None dared approach while this miniature volcano continued in action; but with the cessation of life, hundreds gathered around to investigate the wonder."—*Dubuque Times, February* 19.

IMPROVED ANIMAL TRAP.

The moment we looked at the model of this invention, we thought about pirates. Not that we mean to insinuate that there is any bond of connection between buccaneers and rat traps—romance forbid such base comparisons! But when we saw an apparatus in which the unsuspecting animal is beguiled to walk along a treacherous pathway, which suddenly turns a sommersault and deposits him, before he has any time to remonstrate, in some unknown region beneath, we were reminded of the polite requests, on the part of the big whiskered gentry, which resulted in their captives promenading to the end of a plank, from which they failed to return. The inventor says that this trap will fix any animal in exactly that way, any animal, moreover, from a mouse to a buffalo. Although a mouse might stand such treatment and not need subsequent repairs, we doubt if a buffalo would. In fact, we think that the average buffalo, after gloriously coasting down the end of a plank into a yawning chasm, would experience such a general disorganization as to render him of no further utility whatever as a buffalo. Still he would be caught, and that is exactly the object of the trap, to the representation of which, as applied to rats, we devote the annexed illustration.

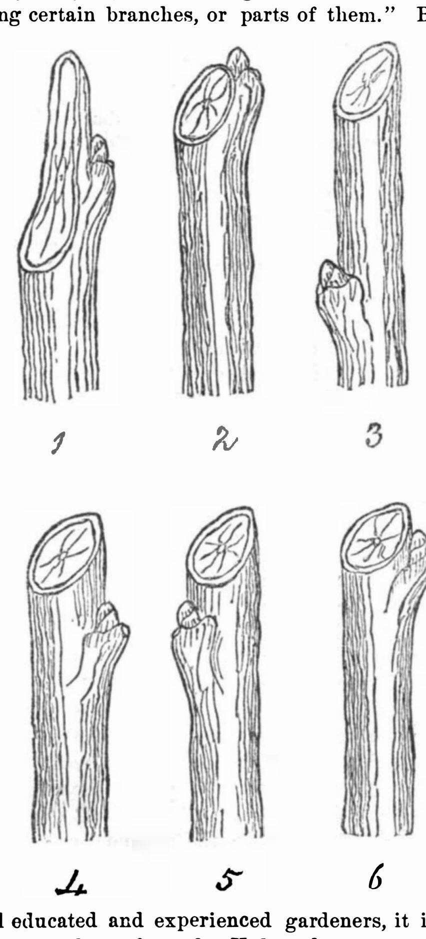


DILDINE'S ANIMAL TRAP.

The deluded rodent, shown on the left, takes the high road leading to destruction *via* the pivoted platform, A. In cheerful anticipation of a feast, he proceeds to the inner extremity of said platform and tackles the banquet, and probably places his paws on the swinging piece, B. Either touching the bait, E, or meddling with the swinging piece is, on his part, an unfortunate mistake, as the effect is to push back the curved catch, C, and so release the lower extremity of the latter from a lug, D, by which said catch supports the end of the platform. The victim's weight then overbalances the lead on the opposite extremity, and he immediately loses interest in the bait and devotes his mind to jabbing his claws into the platform with the vain hope of making his abrupt departure look as if it were less involuntary. Eventually he finds himself in darkness beneath, from which he may, at his convenience, emerge into the cage like apartment above, and regale himself by watching his relatives served in the same manner, or he may find profitable food for thought in speculating over the neat arrangement of the counterpoise or weighted end of the platform, which, after the victim is deposited, brings the latter back to a level position, when the catch again engages with the supporting lug, and the trap is ready for new prey. We doubt, however, if his conclusions would accord with ours, namely, that the trap is a very ingenious and useful little device; he might receive the further information, that it was patented August 25, 1874, and that State, county, and township rights are for sale, with disgust, and undoubtedly he would anathematize Mr. John Dildine, of Limestoneville, Montour county, Pa., who is the inventor to be addressed for further particulars.

THE MANIPULATION OF PRUNING.

Lindley truly says: "Pruning is the art of scientifically removing certain branches, or parts of them." But except



by well educated and experienced gardeners, it is seldom, if ever, properly performed. Unless the operator thoroughly understands the principles upon which it is based, and the proper mode of operation, it is better to let Nature take her own course, as less loss will then be incurred and less injury done. By ignorant men the simple operation of cutting off a shoot is almost always done in an injurious way. Some make a long "slivering cut," as in Fig. 1. Here the cut is begun too low down and is carried up too high, exposing the back of the bud to the weather and either killing it outright or causing it to make a feeble or weakly growth. Others, as in Fig. 4, cut "to the quick," producing the same evil effects. To avoid this, some make "snag cuts"—beginning the cut on the same side of the shoot as that on which the bud is placed, and thence sloping upwards from it, as in Figs. 3, 4, and 5. This necessitates going over the work a second time to remove the snags after the bud has made a growth, as the young growth cannot cover the dead snag.

The proper cut is shown in Fig. 6. It is called the "clean cut," and is made by cutting at an angle of 45°, beginning at the back of the bud, and finishing slightly above it. When pruned in this way the wound readily and rapidly heals, and commences to be covered with new wood as soon as the young bud pushes into growth. Pruning should always be done with a keen-edged knife, holding the shoot in the left hand, and making one sharp, quick draw. The knife is a far better instrument with which to perform the operation than pruning shears and scissors, as these necessarily bruise the bark, at least on one side. Shears or scissors may do for rose bushes and common shrubs; but for grape vines, fruit trees, and greenhouse plants, the knife is the only proper instrument. Many persons advocate fall and winter pruning, but we think it will be seen, by referring to our engraving, that the exposure of the bud, after pruning, to the drying cold winds, the severe frost, and the effects of sleet and snow, cannot but be injurious, and will either kill or greatly weaken it. Such has been our own observation. Hence, we recommend that the operation be delayed until the middle of February, and performed between that time and the middle of March.

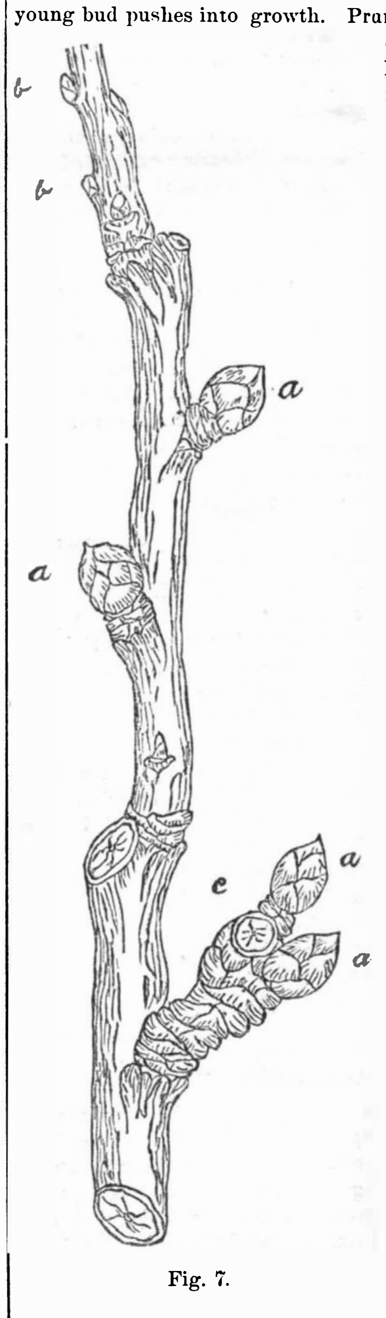


Fig. 7.

The apple, pear, plum, and cherry, as a general rule, bear only on two-year-old wood, or on spurs from older wood. The young wood should, therefore, be shortened back but little—say one third, or not more than one half—as otherwise it will expend its strength only in forming new wood. We have seen numerous instances in which, because of the ignorance of the pruner, a pear tree, for instance, has had a top as thick as a broom, and borne scarcely any fruit, because the young wood had been cut back, year after year, to three or four buds. The tree should always be encouraged to commence bearing as soon as possible after planting; as this has a tendency to prevent excessive growth, and as it is then comparatively easy of control, and will not require much pruning. The object of the pruning is to prevent the head becoming too thick, and to induce the formation of fruit spurs. The Morello cherry bears its fruit chiefly on last year's wood, and should therefore never be pruned back severely. As a rule, all cherries should be but sparingly pruned, as the use of the knife has a tendency to cause them to gum. Fig. 7 represents the growth of the wood of an apple tree, showing a bearing spur on the three-year-old wood, the blossom buds on the two-year-old wood, and the leaf buds on the last year's growth. In this, *a a a a* represents the fruit buds, *b b b* the leaf buds, and *c* the scar from the fruit borne the last year. When, in the course of time, the spurs of any of these trees become too long, they must be shortened back to the eyes near their base. They will then throw out a new set of spurs.

The peach and the nectarine bear their fruit on the last year's wood. Hence all the pruning they require is to cut back this wood about one third of its length, thinning out all superabundant wood, but retaining enough in the center of the head to prevent the mass of the fruit being borne towards the ends of the branches, in which case the branches may break or split with the weight, to the great injury of the tree. As the trees are thrifty growers, a little consideration will direct us how to obtain a symmetrical and balanced fruitful head.

Of all the fruits cultivated by man, none has been so twisted about, so tortured, by systems of training, pruning, and feeding, as the grape vine. Were it not possessed of a constitutional vigor and a power of recuperation common to few, if any, other plants, it would long since have disappeared from cultivation. The books that have been written about it would make a small library. Each author inveighs against every other system of training or pruning, and declares his mode the only correct one, and it alone the one which should be universally adopted. Each forgets that the vine grows and produces fruit in almost every soil and climate, whether on the rocky sides of mountains where the thermometer goes down to zero, or upon the alluvial savannahs of Demarara, and subject to its equatorial heats.

While the vine produces its fruit on the new growth of the current season, the main requisite for its successful cultivation is the formation of moderate-sized, healthy, well ripened wood of the previous year—such as will furnish one or more strong eyes for the new year's growth. All the systems of training and feeding that have been invented have this object in view, and all the various modes of pruning resolve themselves into the procuring of two eyes or shoots—one for the production of wood for future use and the other for the immediate production of fruit. This is best brought about by the spur method, in which a shoot from a strong cane has been pruned back so as to produce two shoots, only one of which was allowed to produce fruit the last season, as shown in Fig. 8. Here the upper shoot was the fruit bearer, and the lower one not allowed to bear. Now we cut back the upper one on the line *a*, and the lower one on line, *d*. From the bud on the lower shoot will come a fruit-bearing shoot for the current season, and the bud, *b*, will make a growth shoot to produce fruit the next year. The present lower shoot will then be cut away, as the upper one has now been—and so on year after year. If the bud, *b*, should be developed at *c*, instead of in its present position, it will make no difference, as in all probability a bud will be developed on the upper side, next year, from which to get a growth shoot, the one beyond it making a fruiting shoot.

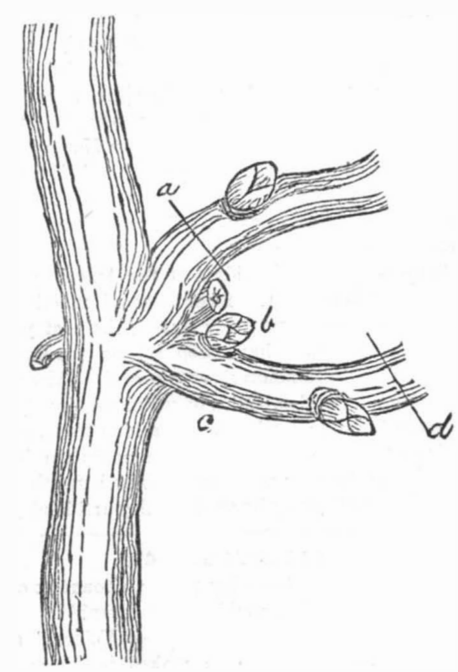


Fig. 8.

In a single article we can only give a few hints, or a general outline of how the operation of pruning should be performed.—*The American Garden.*

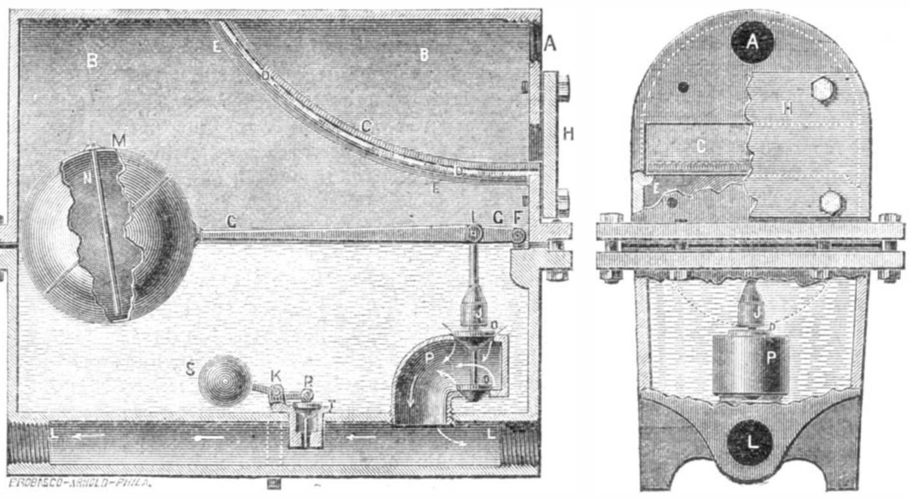
NON-FREEZING FLOAT STEAM TRAP.

Every practical engineer is familiar with the requirements of a perfect steam trap, which are as follows: It must liberate the water of condensation from steam heating surfaces, under all pressures and at all temperatures, draining one foot or a thousand feet of pipe with equal facility, without being regulated or adjusted; it must allow no steam to escape; it must be frost-proof; and it must be so arranged that it may be readily cleaned without disturbing the machinery.

The device now under consideration, patented September 29, 1874, by Mr. W. H. Jenkins, of Philadelphia, Pa., was used at the late Exhibition of the Franklin Institute; and it drained, we are informed, the principal portion of the main steam pipes for supplying power to drive the machinery. It is stated by the inventor that it possesses economy, efficiency, and convenience, which are attained by the construction hereafter described.

It is constructed on the float principle. Steam enters the trap at A, and, with the water of condensation in the pipes, will pass through the filter, C, leaving there the scale and dirt. When sufficient water collects in the case to raise the float, M, the lever, G G, fulcrumed at F, and the valves, O O, connected to the lever, G, at I, are also raised, allowing the water to pass into the outlet, L. As long as the water runs into the trap, the valves, O O, will remain open; but if the supply stops, they will close, until the water again reaches a point enabling it to raise the float, M. In the upper part of the case, B, the lugs or flanges, E E, support the perforated wrought iron sheet, D D, upon which rests a filter of fine wire gauze. This is so arranged that, by removing the bonnet or plate, H, the filter may be taken out and cleaned without disconnecting the pipes, or otherwise disturbing the machine. The float, M, has an opening at the top; and by means of the tube, N, this opening is transferred to within an eighth of an inch of the bottom. The float, being thus subjected to the same pressure within as without, cannot collapse, which permits its being made of very thin material, and thus renders it more buoyant, and the inventor states that it cannot become water-logged; since, if a quantity of water collect in it, the variation of pressure ordinarily occurring would at once remove it through the tube. The float being spun together, and made entirely without the use of solder, is not affected by heat. The balanced valves, O O, and the counterbalanced valve, R, and their seats, P and T, respectively, are made of the best brass, and so arranged that they can be ground in without the trap being removed, or the lower half of the case disconnected from the pipes. The valves, O O, being nearly balanced in upward and downward pressure, a large outlet can be operated by a small float, this being a decided point of advantage in this trap. The counterbalanced valve, R, is connected to a lever fulcrumed at K, and extending to the iron ball, S. When there is no pressure within the trap, the weight of the ball, S, will keep the valve open. When steam is turned on, the air in the pipes and case will pass out through the port of the valve, R. When the pressure increases to 3 lbs. per square inch, the valve will close and remain so until the pressure is removed, when it will open by its own action, allowing the water and steam to pass out, leaving the case dry and hot, and thereby rendering it impossible for any water to freeze in the trap. In order to set the trap in operation, connect the pipe to be drained with the inlet, A. Attach to either end of the outlet, L (plugging up the other end), the waste pipe. The inventor assures us that, when properly connected, the trap requires no attention except cleaning at long intervals, as there is no chance for affecting its action from without, thus securing it from being tampered with. It is manufactured in three sizes, No. 0 to drain up to 2,000 feet of one inch pipe, No. 1 for 4,000 feet one inch pipe, and No. 2 to drain up to 20,000 feet of one inch pipe.

For further particulars, address Messrs. Jenkins & Kern, 228 Church street, Philadelphia, Pa.



JENKINS' AUTOMATIC STEAM TRAP.

House Drainage.

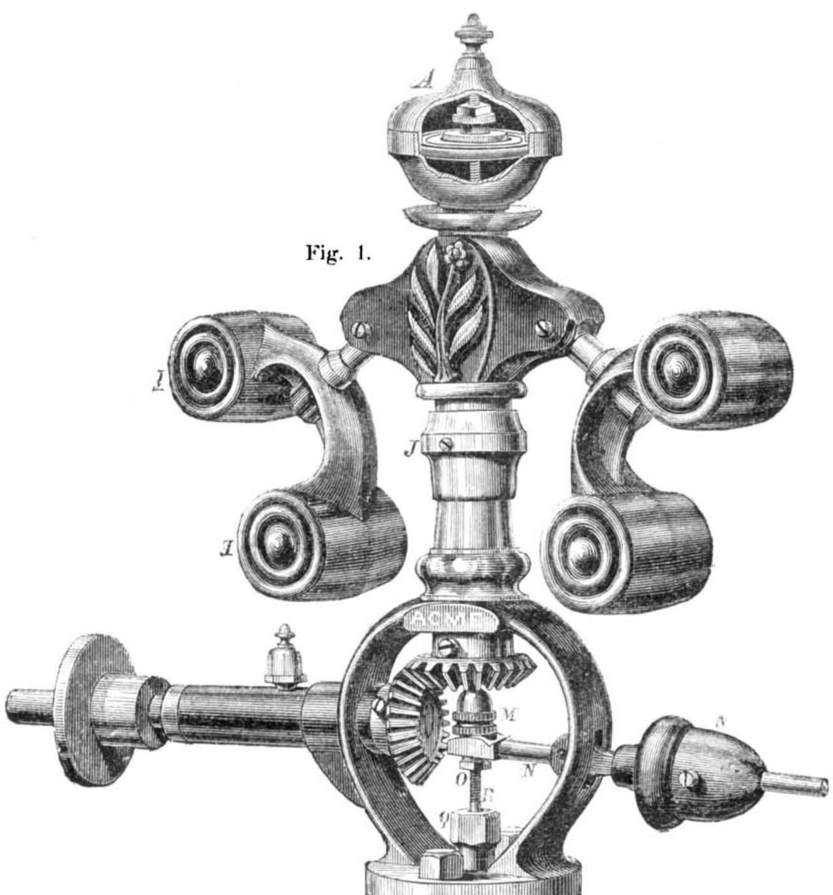
At the Sanitary Conference recently held at Birmingham, Eng., Mr. Walton read a paper on the objects of the Artisans', Laborers', and General Dwellings Company, one of its essential purposes being the erection of low-rented houses in which every attention is paid to insure the best sanitary arrangements.

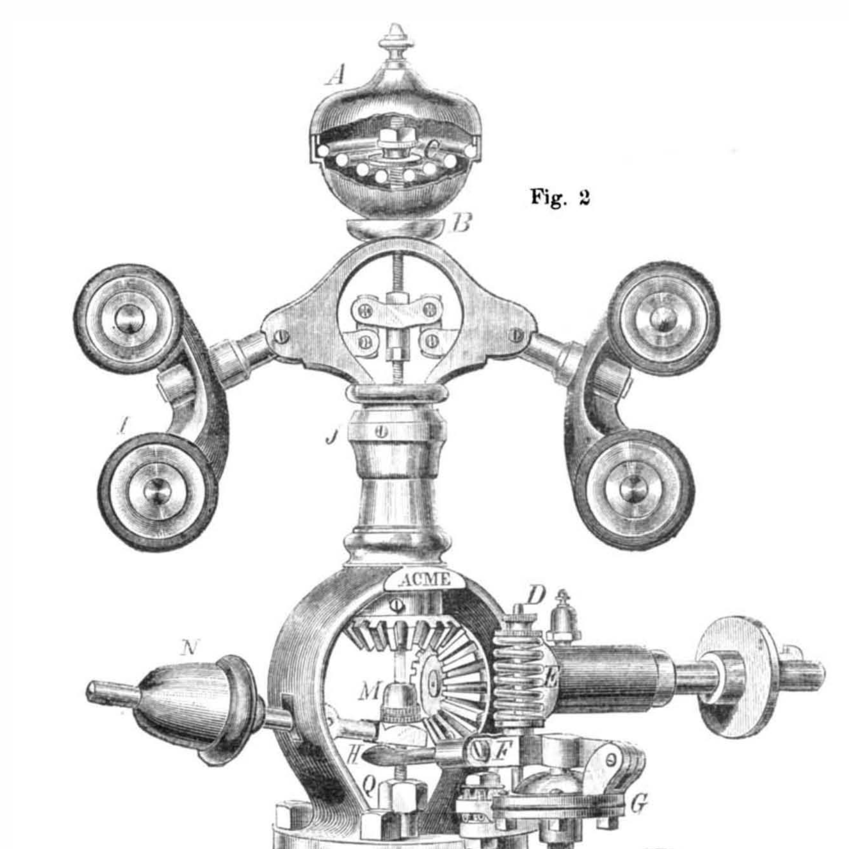
In making the drainage of their houses, the company invariably, and as a fixed rule, avoid carrying the drains under any portions of the houses. Instead of this a drain is arranged at the backs of two rows of houses, running lengthwise in the gardens, and into the main drain. The drain pipes are lead from the backs of the houses instead of beneath them and hence into the street, as is generally done in all after modes of house drainage. This plan they have carried out in the houses they have built at Liverpool, Birmingham, Salford, etc., and they are adopting it near London at the Shaftesbury estate, where they have already erected 800 and are constructing 400 more houses. It has been found that wherever this plan has been adopted, the death rate in these houses, compared with that of a similar number of ordinarily drained houses, has been much less.

IMPROVED SAFETY GOVERNOR.

The illustration, Fig. 1, shows the above named governor with a number of improvements, which have recently been added, and are partly explained as follows:

Fig. 1 shows the governor and stop or throttle valve combined; the advantage of which will be apparent, as it obviates the necessity of the usual clumsy throttle separate from the governor. The stop valve and actuating parts are so constructed as by no possibility to interfere with the govern-





LYNDE'S ACME SAFETY GOVERNOR AND STOP VALVE COMBINED ing valve, and can be reground if necessary with as much precision and in the same manner as when first made. The governing valve is a new device; and it is claimed that, being steam balanced, a much larger valve than heretofore can be used, thus increasing largely the capacity of the governor. The need of this increased capacity of valve will be appreciated by many who have been compelled to purchase a much larger governor than seemed necessary to admit sufficient steam to the engine cylinder. The proprietor states that a size smaller may always be ordered, of the Acme governor, than has heretofore been used, when calculating the size of governor wanted.

Fig. 2 shows the Acme governor (the parts being in about the position they take when running) with the auxiliary attachment, whereby the variable pressure in the engine cylinder is used to assist in regulating the engine: thus reducing the variation of speed, between light and heavy loads, to a minimum.

It is well known that a governor, set to run an engine at a certain speed when light, cannot run it at same speed when full load is put on, without alteration; the engine must go a little slower (from three to ten per cent, according to the governor used) to allow the governor to open its valve. This difficulty is met by the contrivance (lately patented) named above; it has been well tested and is quite novel, the load itself assisting to let on steam to carry it. With this arrangement the engine will run less than one per cent slower, fully loaded, than when light; it takes no power to run it, and needs no oiling, etc.

This instrument is constructed on the same principle as a steam damper regulator, the lever F being held and regulated by a spiral spring, E; its office and operation are as follows: The siphon pipe is attached to the steam chest; and when the valve, K, is open, the pressure in the steam chest will be exerted under a disk of rubber, G, on which stands a piston, having a center point pressing against the lever, F, which is set by the nut and spring, D, so that, when the engine is not loaded, it will have no effect on the governor; but as soon as an increased pressure is felt in the cylinder and chest by the addition of load, the lever, F, is forced up against the lever, H, thus helping to open the governor valve to supply the steam for the increase of load, without perceptible change of speed. Of course as the load changes, the pressure in the chest varies also; and the practicability of this arrangement must be apparent. But it is only necessary where exact speed is required, or where the desire is to do the work with the least possible pressure in the boiler.

For full particulars, circular, and explanatory diagrams, address J. D. Lynde, 405 North Eighth street, Philadelphia, Pa.

PRACTICAL MECHANISM.

NUMBER XIX.

BY JOSHUA ROSE.

THE CRANK.

The crank is a mechanical device, generally employed to convert a reciprocating into a rotative movement, and has proved the most simple and effective mechanical arrangement yet devised for that purpose. It delivers all the power it receives, save and except the usual allowance for the friction due to its movement, which friction varies according to the amount of power or load which the crank transmits. The crank has, it is true, two points in its movement at which it does not transmit power, and (if an engine crank) depends upon the momentum of the fly wheel to carry it forward. But at these points the piston does not receive any steam, hence there is no loss of the power applied. It is true, also, that the power applied to the crank pin is always at a considerable angle to the direction in which the pin itself moves; and this, together with the difference in the distance moved by the crank and that moved by the piston, during a revolution of the engine, gave rise to the common error that there was power lost by the employment of the crank. That such is not the case may be demonstrated by the following propositions:

Let us suppose that we have an engine whose cylinder area is 50 square inches, and its length or stroke 12 inches; the crank, therefore, is 6 inches from center to center. If the pressure of the steam on the piston be taken at 1 lb. per square inch, and is constant throughout the stroke, the total steam pressure on the piston will be 50 lbs.; and as the piston moves up and down the cylinder while the crank performs a revolution, it is self-evident that the amount of power applied by the steam to the piston will be equal to 50 lbs. moving 2 feet. Now, suppose there is attached to the crank shaft a pulley 7·639 inches in diameter, to the periphery of which one end of a rope is attached, the other end suspending a weight of 50 lbs. The circumference of such a pulley being 2 feet, it is apparent that each revolution of the crank will raise the 50 lbs. weight 2 feet, which is the exact amount of power applied by the steam to the piston (allowing nothing for friction), since the element of time will be equal in both cases. The radius of a pulley of the above given diameter is 3·819 inches, which must, therefore, represent the average leverage of the crank: that is to say, a crank, whose length is 6 inches from the center of the shaft upon which it revolves to the center of its crank pin, would (in order to lift the weight as described) require to act all round the stroke at a leverage equal to 3·819 inches, or always in full power, since that is the duty performed by the pulley.

In order to ascertain, in as practical a way as possible, by calculation and demonstration, the average leverage of a crank, we may divide the circle described by the crank pin into as many divisions as there are inches in its revolution; and then, after measuring the leverage of the crank when it is in each position, we add the whole of them together and divide their sum total by the number of divisions or points at which such leverages were taken. The quotient will then be the average leverage of the whole; and if the result of such a calculation, applied to a crank of the above given dimensions, gives us 3·819 inches, it will demonstrate, if we make no allowance for friction, that the crank delivers all the power it receives.

It will suffice, however, to take nine of such crank positions (instead of one at every inch of movement); this will give a result sufficiently correct for the purpose of illustration, as shown in Fig. 56, which is drawn to one quarter of the full size. *a a* represents the circle described by the center of the crank pin. The digits, from 0 to 9, on each side of the above circle, are equidistant points, denoting the positions of the crank at which its leverage is taken; and the lines descending from each digit represent, in each case, the center line of the connecting rod when the crank is at that position. Hence the digits, from 0 to 9, on the parallel line, I, denote the positions, in each case, of the crosshead end of the connecting rod.

It is obvious that, whether the crank stands (at corresponding points) on the right or left half of the circle, the leverage will be the same; so that, if we ascertain the leverage of the crank at points 0, 1, 2, 3, and 4, on the left hand side of the illustration, and points 5, 6, 7, and 8, on the right hand half of the circle, it will be the same as taking the whole nine points on one side of the circle, and will make the lines of the illustration much clearer. The leverage of the crank in any one position is the length that a line, struck at a right angle to the center line of the connecting rod, passing through the center of the crank shaft, will be. When, therefore, the crank is at point, 1, the center line of the connecting rod being denoted by the line, 1 1, the line, *a*, represents the leverage of the crank, and so on through the whole of the positions. Proceeding, then, to demonstrate from the illustration, we have:

Position of crank No.		Leverage inches		inches
0	line			
1	*a*	3-8	=	·375
2	*b*	23-32	=	·72
3	*c*	1 1-32	=	1·031
4	*d*	1 5-16	=	1·312
5	*e*	1 1-2	=	1·50
6	*f*	1 1-2 bare	=	1·49
7	*g*	1 3-16	=	1·187
8	*h*	11-16 bare	=	·687
				8·302

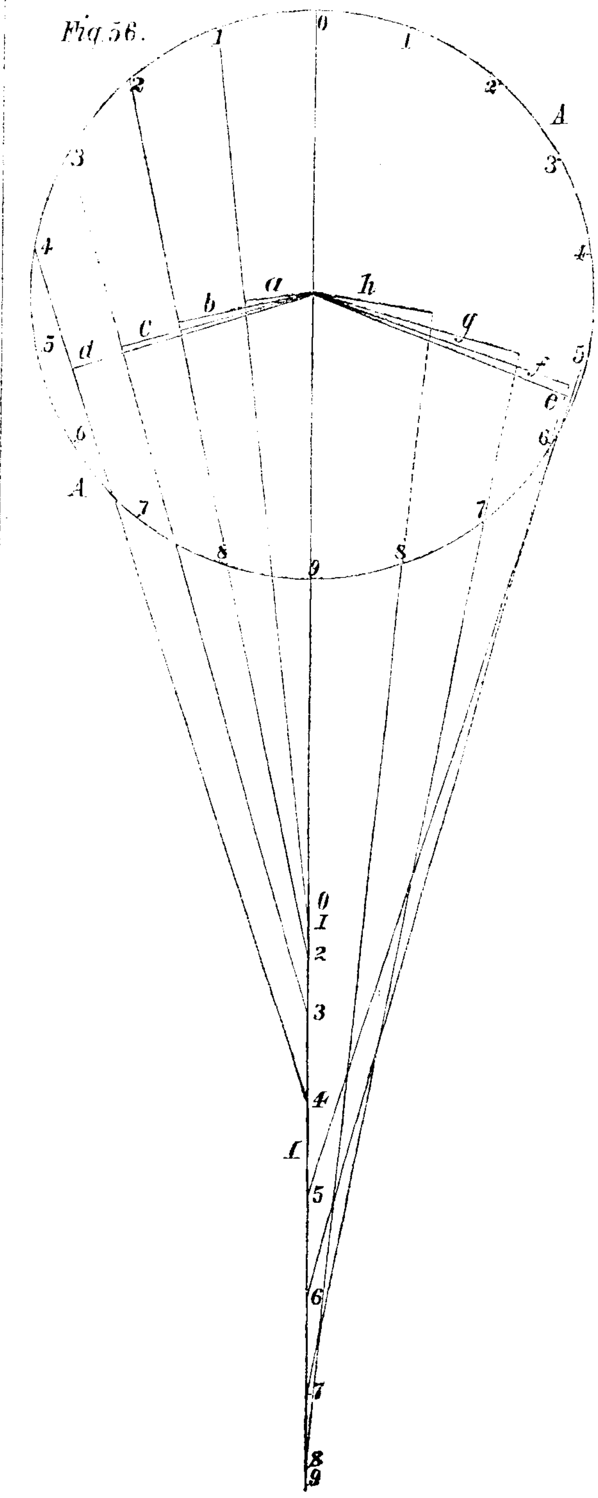
Here, then, we have 8·302 inches as the sum of the leverages of nine positions. Dividing this by 9, it gives us 0·922 inch as the average leverage, in the experimental illustration. Since, however, the illustration is only one quarter the full size of the supposed engine (to which the hypothetical pulley and weight were attached), we must multiply this 0·922 by 4, which gives us 3·688 inches as the average (calculated) leverage of the crank. To be absolutely correct, this should be 3·819 inches; and were the leverages taken at a greater number of points, our answer would be more nearly accurate, because we have one dead point in a total of 9: whereas, did we measure the leverage at 40 points of the stroke there would be but one dead point in the total of 40; then again, each crank movement commenced at the minimum of leverage, and only attained the maximum on the completion of the movement, which latter does not, therefore, represent the average leverage of the crank during the movement, but merely the actual leverage of the crank on arriving at each position. Hence, the greater the number of points at which the leverage is taken, the more nearly correct will the result obtained be.

To recapitulate, then, the proposition of the pulley and weight proved that, in order to deliver all the power placed by the steam on the piston, a crank 6 inches from center to center would require to give, by calculation, an average leverage all round the revolution of 3·819 inches, whereas the illustration and the accompanying figures demonstrate, by calculation, that the crank would develop very nearly tha amount, the slight discrepancy arising from the fact that we have not, in our example, taken a sufficient number of positions of the crank to obtain a perfectly correct result.

It is certainly an objection to the employment of the crank, as a means of converting a reciprocating into a rotary motion, that its leverage, and therefore its power, is so variable; this is, however, rectified to a great degree by the action of the fly wheel, which, acting as a reservoir of power, gives back to the crank, when the latter is at and near its dead centers, part of the power which it received from the crank while it was at or near its full leverage or power.

The points of full power are not, it will be observed, on exactly opposite sides of the diameter of the circle of the crank travel, so that a straight line passing through the center of the crank shaft cannot intersect both the points of full power.

The illustration and its accompanying table of movements shows the crank in that case to be at full power between positions 5 and 6; if, however, the connecting rod were longer in proportion to the length of the crank, its point of full power would come nearer to a horizontal line, drawn through the center of the crank shaft and at a right angle to the center line of the cylinder, the rule being that, the longer the connecting rod proportionately is, the nearer will its point of full power be to that point at which the crank stands midway between the two dead centers; and as a consequence, the more regular will the variation of the leverage of the crank be, that is to say (referring to the illustration), the leverages of points 1, 2, 3, and 4 would be greater, and the leverages of points 5, 6, 7, and 8 would be less, and hence the one series of positions would more nearly equal in leverage to the other series



Let us now consider the crank movement and leverage in relation to the piston movement; and we find, on referring to the diagram, that, while the crank moves from position 0 to position 1, the crank has gained three eighths of an inch of leverage, while the piston has only moved about one sixteenth of an inch, using, therefore, but very little steam, and so on, as per the following table:

Crank movement No.	Leverage gained inch	Piston movement inch
0 to 1	3-8	1-16
1 " 2	11-32	3-16
2 " 3	5-16	5-16
3 " 4	9-32	7-16
4 " 5	3-16	17-32
5 " 6	0	17-32
	Leverage lost	
6 " 7	5-16	1-2
7 " 8	1-2	11-32
8 " 9	11-16	3-32

which shows that, when the crank has moved from position 0 to position 2, which is two ninths of its stroke, it has gained very nearly one half of its full leverage (that is $\frac{3}{8}+\frac{11}{32}=\frac{23}{32}$ or nearly $\frac{3}{4}$ inch), while the piston has moved one twelfth only of its stroke (that is $\frac{1}{16}+\frac{3}{16}=\frac{1}{4}$ inch, the total stroke being three inches). Again when the crank has moved to position 3, which is one third of its stroke, it has gained a little over two thirds of its leverage (that is $\frac{3}{8}+\frac{11}{32}+\frac{5}{16}=\frac{33}{32}$, which is over two thirds of one and one half inches), while the piston has only moved a little over one fifth of its stroke. At both positions, Nos. 5 and 6, the crank remains as nearly as possible at its full length of lever, while at position 7 it has moved seven ninths of its stroke, remaining still a lever equal to over seven tenths of its full length, the piston having moved over seventeen twentieths of its stroke. Even at position 8, the crank is at a leverage approximating to one half its full length, although when in that position it has moved eight ninths of its entire stroke. Thus we find that the reason, that a crank is equal, all round its revolution, to a lever of more than one half its length from the center of the crank pin to the center of the crank shaft, is because it moves so quickly into its leverage and retains the same so long, and, furthermore,that the piston movement, and therefore the consumption of steam in the cylinder, during that part of the crank movement in which the crank is at a leverage of less than one half its length, is comparatively very small indeed.

It will be further observed that, as the momentum of the fly wheel causes the crank to travel at (nearly) an equal speed during all parts of the revolution, the piston is traveling much faster at one than at another part of the stroke. For instance, suppose the crank to make a revolution in a second, it will move from each of the divisions (in the diagram) to the next division in the one-eighteenth of a second. The piston, then, while the crank was moving from point 5 to point 6, traveled at the rate of (referring to the table of piston movements) one and one half inches in one eighteenth of a second; while on the other hand, the crank moved from point 1 on one side of the dead center to point 1 on the other side of the dead center,that is two divisions,the piston moved one eighth of an inch only, and had (since the crank moved two divisions)two eighteenths or one ninth of a second to do it in; so that the reversal of the direction of the movement of the piston is not so sudden as it would at first sight appear to be, or as to cause any violent shock, or entail any appreciable loss of power.

The difference between the amount of power transmitted to the piston and that delivered by the crank shaft may be appreciated when it is stated that in large engines it is computed at nearly two pounds per square inch of the piston area, and in small engines to from ten to fifteen per cent of the total mean pressure on the piston throughout the stroke; to which must be added the amount of friction due to the load which the engine may be driving, the allowance made for this latter being about seven per cent. This difference is accountable for in the power required to operate the slide valve and other working parts of the engine,although there is no doubt that the strain placed by the blocks upon the guide bars when the crank is at and near its points of full power is also very great, in consequence of the angle at which the center line of the connecting rod stands to the faces of the guide bars.

Not so much power is consumed in moving the connecting rod as might, at first sight, appear, because the movement of the crank pin end, which is the heaviest end of the rod, is circular, and it is only at the very center of the crosshead bearing of the rod that its movement is a purely reciprocating one. The movement of the rod as a whole is, as stated, a circular one at the crank pin end, and an oval one between the crank pin and crosshead, which oval becomes longer and narrower as the point on the rod, at which the movement is considered, is located nearer to the crosshead journal.

But little expenditure of power is involved in reversing the motion of the piston, piston rod,crosshead, and guide blocks, because whatever amount of power is required to move them in the first half of the stroke, during which their speed is accelerated,is delivered back by them in the effort to arrest their movement which takes place during the last half of the stroke; hence we find that there is no foundation for any supposition of a loss of power due to the movement of a crank as applied to an engine.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for March, 1875.

Mercury.

Mercury has been seen after sunset in the twilight from February 1 to the present time (February 18), and will probably be visible for some few more evenings.

After March 10, it should be looked for in the early morning before sunrise, and on March 28 it should be readily seen, as it is then at its greatest elongation west of the sun.

March 1, Mercury rises at 6h. 23m. A. M., and sets at 5h. 53m. P. M. On the 31st, Mercury rises 4h. 54m. A. M., and sets 3h. 56m. P. M.

Venus.

Venus, although past its greatest brilliancy, is still a beautiful object in the morning. It rises at 4h. 18m. A. M. on March 1, and sets at 1h. 56m. P. M. It passes the meridian about 9 A. M., and to good eyes is still visible at that time.

On the 31st,Venus rises at 4h. 10m. A. M., and sets at 2h. 40m. P. M. On the 27th, Venus is so near Saturn that the latter can be easily found.

Mars.

Mars can be seen in the early morning hours. It rises on March 1 at 1h. 15m. A. M., and sets at 10h. 33m. A. M., being far south in declination, and above our horizon only a little more than nine hours. On the 31st, Mars rises at 0h. 25m. A. M., and sets at 9h. 27m. A. M.

Jupiter.

On March 1, Jupiter rises at 10 in the evening,and sets the next morning at 8h. 42m. On the 31st, Jupiter rises at 7h. 47m. P. M., and sets at 6h 37m. the next morning. As Jupiter comes into better and better position, the varying phenomena which its satellites present should be carefully noted.

Between 10 P. M. of March 18 and 2 A. M. of the 19th, the third satellite and its shadow and the first satellite and its shadow may be seen projected on the disk of Jupiter.

Saturn.

Saturn rises at 5h. 52m. A. M. on the 1st, and sets at 3h 54m. P. M. On the 31st, Saturn rises at 4h. 2m. A. M., and sets at 2h. 12m. P. M.

According to the *American Nautical Almanac*, Venus and Saturn are in conjunction (have the same right ascension) on the 27th, Venus being 1° 16' north of Saturn. As Venus is well known to every one, this position will enable observers to recognize Saturn.

Uranus.

Uranus rises on March 1 at 3h. 14m. P. M., and sets at 5h. 28m. the next morning. On the 31st, Uranus rises at 1h. 12m. A. M., and sets at 3h. 28m. the next morning. Seen through a telescope, Uranus presents the appearance of a small full moon, bluish white in color. Its satellites are seen as exceedingly minute points of light.

Neptune.

Neptune rises and sets so nearly with the sun that it cannot be seen.

Sun Spots.

The record is from January 24 to February 18 inclusive. During this time, on account of cold weather and clouds, only nine photographs have been taken. In the picture of the 24th are two spots of medium size, near the end of their passage across the disk. From this time until February 16 photographs and observations with the telescope show that spots were remarkably few and small. To day (February 18), the preceding day having been cloudy, the photograph shows a very large spot just within the eastern limb. At present the spot appears narrow but of unusual length, and, if it follows the ordinary changes in passing across the disk, must be visible to the naked eye when it reaches the middle of the passage.

Correspondence.

Can Ants Talk?

To the Editor of the Scientific American:

The following may perhaps answer the above question:

During a ramble over the mountains last spring, I was attracted by a low, shrill, squeak close by, when, upon looking in the direction of the sound, I saw on the ground, evidently hastening from me, a large insect of the ant species, about ¾ of an inch in length, its hinder part of a bright red color, and covered with hair. I saw nothing peculiar in its shape, it being similar, as nearly as I could tell, to a common ant, only much larger. Struck by the novelty of the sound, I stopped it with my stick, and tantalized it for some minutes, during the whole of which time it emitted its scream, which I can describe in no other way than that it was similar to the sound which one would make when calling the attention of a bird in its cage, and that it was sufficiently loud to have been heard at a distance of 40 or 50 feet. I finally secured the insect and have kept it ever since, preserved in alcohol.

From the above it can be seen that the vocal power of the ant is sometimes far from inaudible; for in proportion to its size, I should estimate that the cry of my ant would exceed the bellow of a bull, or the roar of a lion.

Salt Lake city, Utah. H. L. A. C.

New Telegraph Alphabet.

To the Editor of the Scientific American:

The ordinary Morse telegraph alphabet, consisting of dots, dashes, and spaces, answers very well when a register is used, and the signals are recorded on paper; but since the sounder instrument has almost entirely superseded the register, this alphabet is defective, as the sound of a dash is very much like the sound of a dot with a succeeding space. This fact suggested to my mind the idea of forming an alphabet which would consist entirely of dots and spaces, and thus lessen the liability to mistakes in transmitting messages by sound. I selected an article in a newspaper, ascertained how many times each letter occurred in it, and arranged them in tabular form, placing the letter which occurred most frequently, first, thus:

E	154 times	G	25 times
N	112 "	F	23 "
T	108 "	Y	22 "
A	99 "	P	20 "
I	82 "	B	17 "
S	69 "	M	17 "
R	69 "	W	16 "
L	57 "	V	14 "
C	52 "	K	5 "
O	52 "	J	3 "
D	51 "	X	1 "
H	49 "	Q	0 "
U	40 "	Z	0 "

The alphabet was then formed by denoting the first letter in the table by the simplest character possible, that is a single dot; the second one is denoted by two dots, the third one by dot, space, and dot, thus:

E	.	G	... .
N	..	F	.... .
T	. .	Y	......
A	...	P	. .....
I	. ..	B	.. ....
S	.. .	M	... ...
R	. ...	W	.... ..
L	. ...	V	....
C	.. .	K	. ....
O	.. .	J	. ...
D	.....	X	.. ....
H	....	Q	. . ....
U	. .	Z	....

Addison, Mich. JOHN MILLIS.

Utilization of Exhaust Steam.

To the Editor of the Scientific American:

Some mechanics hold that exhaust steam cannot be practically used for heating purposes on account of the back pressure on the engine, which has sometimes resulted in producing greater loss than profit, both mechanically and economically.

Mr. James F. Smith, of this city, a practical engineer, has recently overcome this obstacle by making the heating pipes of the full area of the exhaust. At the end of the building so heated, it is necessary to exhaust upwards, and work down with the drips. It will, of course, require larger piping, and the pipes should be laid with sufficient descent to carry off the waste water. A child can be easily regulate the throttle for each room; and the rough and unsightly crates now in use can be dispensed with. B.

Orange, N. J.

New Safety Elevator.

We have lately examined, at the shops of the Holske Machine Company, in this city, No. 279 Cherry street, the working operation of their new elevator, for warehouses, stores, offices, and other purposes. One of the distinctive features of the improvement is a novel clutch, by the shifting of which, by the usual cord, the motion of the rope drums is changed, and the elevator made to ascend or descend, as may be desired. Another improvement relates to a safety clamp attached to the elevator platform, so arranged that, in case the lifting ropes should break, the platform instantly locks itself between its guides, and cannot fall. As a practical trial, we saw two men mount the platform and sever the lifting rope while they were upon it; but the platform barely settled four inches before it was solidly locked fast.

Another point of improvement is an additional safety device, for locking the main gears in case the driving belt fails or breaks. The device for this purpose is simple but effective. Altogether the improvements appear to be admirably adapted for practical use, and contain every appliance for safe and reliable operation which the best experience can suggest. All elevators are of course more or less alike. They consist of a platform on which the goods or passengers are to ride, wire lifting ropes to raise and lower the same,winding drums to operate the ropes, and steam power to perform the work. These things being equal, that will be the best elevator which likewise supplies the most effective devices for ensuring safety and preventing accident. In these respects it will probably be difficult to find anything superior to the improvements above described.

Sleeplessness.

To take a hearty meal just before retiring is, of course, injurious, because it is very likely to disturb one's rest and produce nightmare. However, a little food at this time, if one is hungry,is decidedly beneficial; it prevents the gnawing of an empty stomach, with its attendant restlessness and unpleasant dreams, to say nothing of probable headache, or of nervous and other derangements, the next morning. One should no more lie down at night hungry than he should lie down after a very full dinner, the consequence of either being disturbing and harmful. A cracker or two, a bit of bread and butter or cake, a little fruit—something to relieve the sense of vacuity, and so restore the tone of the system—is all that is necessary.

We have known persons,habitual sufferers from restlessness at night, to experience material benefit, even though they were not hungry, by a very light luncheon before bedtime. In place of tossing about for two or three hours as formerly,they would soon grow drowsy, fall asleep, and not wake more than once or twice until sunrise. This mode of treating insomnia has recently been recommended by several distinguished physicians, and the prescription has generally been attended with happy results.—*Scribner's Magazine*

Good Words for the "Science Record."

The following words, from three of our friends in remote places, who have just received the SCIENCE RECORD, express the sentiments of many others, which we refrain from printing on account of our limited space:

"Received SCIENCE RECORDS today; they are a splendid reward for a little work."—*Martyn F. Gilbert, Racine, Wis.*

"The SCIENCE RECORD came to hand this morning; upon examination I find that it far exceeds my expectations, and would be a valuable addition to any man's library."—*Jas. D. Hollister, Salisbury, N. C.*

"Many thanks for the SCIENCE RECORD; it is well worthy of going to any trouble to get. I hope I may be able to get you more new subscribers."—*Francis Carroll, Manager, N. O. Gas Works.*

Any person having paid for a volume, or being entitled to one for obtaining new subscribers to this paper, and not having received it, will please notify the publishers at once, as copies have been mailed to all the names upon our order books.

The SCIENCE RECORD for the years 1872, 3,4, 5,—four volumes—will be mailed on receipt of $8, or a single copy of either year for $2.50.

DR. FOTHERGILL says in the *Popular Science Monthly* that the intellect is more than normally brilliant when the person is affected with the first stages of pulmonary consumption or with chronic gout.

THE Suez canal has earned a profit equivalent to seven per cent on its cost, during the year ending in September last.

IMPROVED RAILWAY AXLE BOX.

Hot boxes are one of the many annoyances with which railway mechanics have to contend, railway owners to pay for, and railway passengers to anathematize. Dust will get into brasses, and friction inevitably follows. Then the parts get hotter and hotter, and finally oil and waste burst into flame; the train is delayed, sometimes for hours, and in the end rushes on to its destination with ruined brasses and badly cut journals, looking (after nightfall), to the astonished denizens of way stations, more like a rapid torchlight procession than anything else. The usual means for avoiding the difficulty are: Care in closely fitting brass and journal, the use of alloys, for the former, least liable to cut, and of various lubricating materials claimed to perform their office more effectually than oil. An invention which, like the one which is herewith illustrated, aims at the root of the evil, by preventing altogether the entrance of dust and providing a means to keep the brass cool, has, we believe, hitherto been absent, or, if it existed, no tidings of its success have ever reached us. The present device has, therefore, the merit of novelty and also of being a long step in the right direction. It appears to be practical, and we think that railway mechanics will not hesitate to give the new axle box a fair trial.

It comprises two distinct inventions, the first for keeping out dust, the second for maintaining the brass cool. To gain the former end, the box must be perfectly tight next the wheel, sufficiently so to prevent the leakage of oil, and yet it must allow the axle abundant play in its lateral and other movements. By referring to the sectional view, Fig. 2, the manner in which these ends are accomplished will be seen. A is the back of the box, cast in one piece with the body. A metal guard and bolts secure to the inner side a bellows joint, B, which is stamped out of leather and hence has no seam. The outer portion of this joint is similarly attached to a gun metal ring, C, shown enlarged above. On the axle a ring, D, is shrunk; and just outside of this, another ring, E, of iron, containing spiral springs which tend to push it outward, is placed. The springs serve to take up any wear of the rings. The bellows joint slips directly over these, so that the ring, C, bears against the ring, E. Outside of the ring, C, and also bearing against it, another iron ring, F, is secured rigidly to the axle. It will be seen, therefore, that the leather forms a screen between axle and box, and, as it is attached to both and is flexible, it forms no obstacle to the lateral play of the former. The two rings, E and F, bearing directly against the ring, C, revolve, of course, with the axle; and as the ring, F, is slightly tapered, its natural effect, owing to the centrifugal force due to the revolution, is, it is claimed, to throw the oil away from the joint, and thus to prevent leakage.

This arrangement, the inventor states, can be applied to any railway box at a cost not exceeding fifty cents. He claims that it allows of filling the box to a sufficient depth with oil alone, and thus doing away with packing entirely, so that the axle runs directly in the liquid. A large saving is thus effected, not merely by obviating waste of oil, but also in packing and the time and labor involved in inserting and removing the same.

The apparatus for cooling the journal consists in the peculiar construction of the brass, and in a water receptacle with suitable connecting pipes secured above and outside the box. The brass, shown at G in the sectional cut, is cast with a core, so as to leave within it longitudinal and horizontal channels on each side of the brass. These connect with short tubes on the outer end of the brass; and to the tubes, the flexible rubber pipes, H, which lead to the water reservoir, I (shown in the perspective view, Fig. 1), are attached. It is claimed that, by this device, the brass can never become heated higher than the boiling point of water, even if the lubricating material should be neglected. The reservoir is a simple box of tin, provided with a screw cap, opening to allow of its ready replenishment. It is attached to the box by a simple thumbscrew, so that if broken it may be easily detached. Its cost, the inventor says, need not be over ten cents, while the brasses, he further adds, are no more expensive than those ordinarily employed. In winter the water can be mixed with alcohol or glycerin to prevent freezing.

As an additional precaution against dust, a piece of leather, J, Fig. 2, is attached to the rear of the box by clamps.

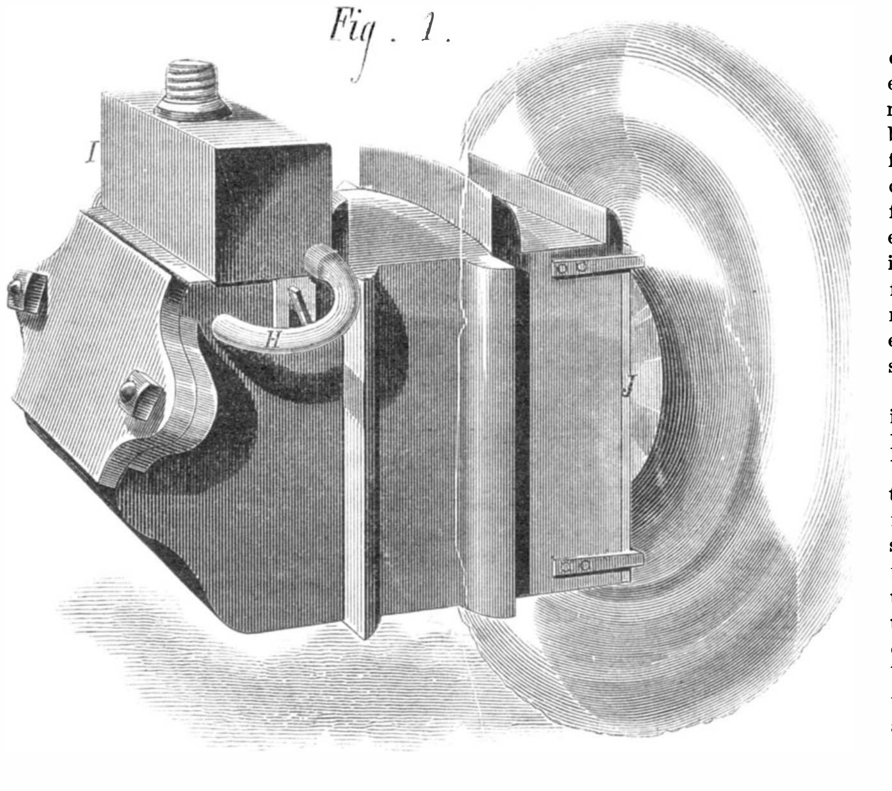
The entire device is quite simple, and, as we have already stated, can be readily applied to trucks already in use. If its use in addition yields even a portion of the many important advantages claimed, its economical value will be quickly appreciated.

Patented through the Scientific American Patent Agency, in the United States, Canada, England, and other countries. For further particulars address the patentee, Mr. C. A. Hussey, care of the Mercantile Agency, 335 Broadway, New York city.

A Boy's Idea of Heads.

The *Young American* brings up a "boy's composition" on heads as follows:

"Heads are of different shapes and sizes. They are full of notions. Large heads do not always hold the most. Some persons can tell just what a person is by the shape of his head. High heads are the best kind. Very knowing people are called long-headed. A man that won't stop for anything or anybody is called hot-headed. If he isn't quite so bright, they call him soft-headed; if he won't be coaxed nor turned, they call him pig-headed. Animals have large heads. The heads of fools slant back. Our heads are all covered with hair, except bald heads. There are other kinds of heads besides our heads. There are barrel heads, heads of sermons

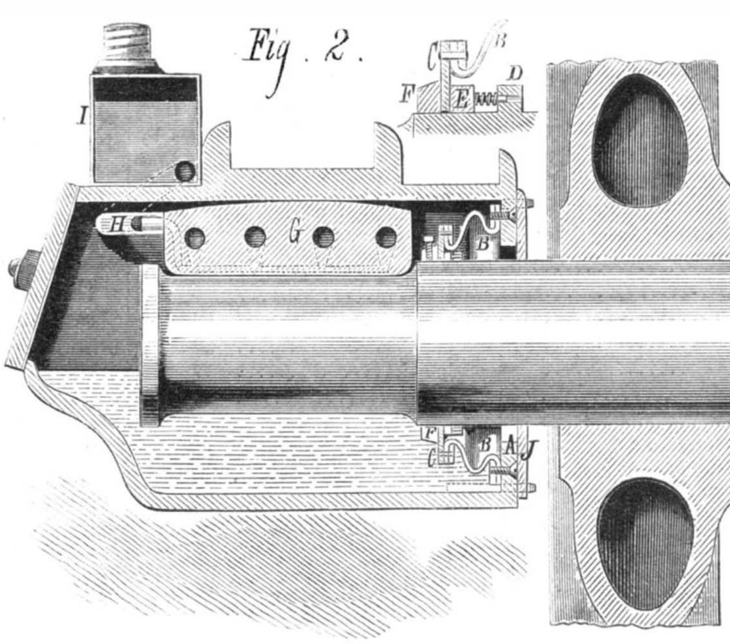


HUSSEY'S RAILWAY AXLE BOX.

—and some ministers used to have fifteen heads to one sermon; pin heads; heads of cattle, as the farmer calls his cows and oxen; head winds; drum heads; cabbage heads; at loggerheads; come to a head, like a boil; heads of chapters; head him off; head of the family; and go ahead—but first be sure you are right."

Recording Votes by Electricity.

A clerk employed in the French government telegraph office (M. Jacquin) has conceived a system for recording votes by electricity. It is thus described: "Before every deputy two ivory buttons are placed, like the buttons of electric bells. If the deputy wishes to vote 'Yes,' he presses the button on his right; if he wishes to vote 'No,' he presses the button on his left. The voter establishes by this means an electric communication, which is transmitted to an apparatus close to the



president and his secretaries. Every time the electric current acts thus it opens the door to a ball, and the ball falls through a tube into the ballot box. The balls are made of glass or ivory, and are strictly identical in weight. The two ballot boxes are then weighed, and the number of balls indicated by the weight. Finally, by turning a handle, all the balls which have not been used are let out, and they give the number of members who have abstained or were absent when the vote was taken. Nothing can be more simple. The inventor has offered to set up his apparatus in the Versailles assembly for the sum of $12,000."

Mr. Thomas Hall, of Boston, Mass., calls our attention to the patent granted in this country, in 1850, to Albert N. Henderson, of Buffalo, N.Y., for an electrical vote recorder. Henderson's plan was to have a couple of keys on each member's desk, by pressing which the members could instantly print in colors "aye" or "no" on a list sheet at the Speaker's desk It was a simpler plan than that of Jacquin.

The Institute of Mining Engineers.

This society held a meeting at New Haven, Conn., on February 24 and 25, Professor R. R. Raymond being the President. Various interesting papers were presented.

Professor Raymond introduced the subject of

IRON AND STEEL,

with special reference to the decarbonization of spiegel iron by annealing. He exhibited a specimen, the outside of which had been rendered malleable.

An able paper was presented by Mr. Henry M. Howe, of Boston, Mass., on

BLAST FURNACE ECONOMY.

The waste of fuel is mainly due to the reduction of carbonic acid. The proper remedy lies in using lower furnaces with narrower throats, so that the charge may be heated more rapidly on entering the furnace, and that the carbonic acid produced by the reduction of the ore may be formed nearer the tunnel head, and may be exposed for less time and to less fuel before it escapes from the furnace. The waste of fuel is, in all cases, attributable to, first, th reduction of carbonic acid; and second, to the escaping gases carrying off unnecessary sensible heat. A paper on the

METALLURGY OF QUICKSILVER

in North Carolina was read by Professor J. Eggleston, of the School of Mines of New York. The ore is found as cinnabar and native mercury, in dirt washed into the valleys from the decomposition of the cinnabar and serpentine rock. Cinnabar ore is put in the furnace in pieces the size of an egg; ore containing native mercury is made into adobes, the size of a brick, or a half larger. The processes are roasting and precipitation with lime in a retort. Roasting is done in a retort without lime and in shaft furnaces which are intermittent and continuous.

Professor Blake, of New Haven, read a paper on

PROVISIONS FOR THE COMFORT OF MINERS

The Hassard colliery, in Belgium, was especially referred to. A comfortable home has been established for the miners near the mouth of the shaft, capable of lodging comfortably 200 men. The success and beneficial results of this experiment may, to a great degree, be regarded as a model for such undertakings, and worthy the attention of our colliers and metallurgical establishments.

Professor Eggleston said that the material comfort of miners is not the only thing that receives attention. Provision is made for their intellectual and moral welfare. At one of the works in Hanover, where a large number of men are employed, the whole question of amusement and instruction is solved better than anywhere else. In England and France sickness is better provided for than in Germany. The children of the miners at this place in Germany are instructed in schools provided for this purpose. The ordinary lager beer garden is provided; also a ball room and theater. The music and acting are carried on by the workmen themselves. The hospital system in England is gratuitous. In France a certain portion of the wages of the workmen goes to a hospital fund. Fines for disorderly conduct go to this fund, which is managed by the workmen. These plans have worked admirably. In this country, difficulties arise from the lack of concerted action on the subject, and from the large number of nationalities to contend with, which is not the case in Europe. A paper on

THE NEWBURYPORT MINES,

by Professor Richards, of the Massachusetts School of Technology, was presented by Professor T. Sterry Hunt, of the same institution. It appears that the first ore discovered here was in the form of loose masses in the drift, but subsequent explorations showed that the source of the ore is a vein having a northeast course, cutting the ancient crystaline soda of the region. Two shafts have been sunk upon it, each of which has now reached a depth of about forty feet. In one, the ore-bearing portion of the vein was six feet in breadth, and in the other, about seven inches. Further explorations are required to determine the breadth of the lodes in these shafts. The ore is a galena, carrying silver, with some copper, yielding, on assay, both gold and silver. Small portions of copper pyrites, zinc blende and native silver have also been found. The treatment of Baulbach, of Newark, of about four tuns of the loose ore found in the soil, gave thirty-eight per cent of lead, together with $58.76 of silver, and $4.85 of gold, to the tun of ore. Assays of the borings from a portion of the lode showed over fifty per cent of lead, containing silver and some gold, giving to the base bullion a value of about $300 to the tun.

THE Congress of Mexico offers a reward of $20,000 to the first mine that produces 500 flasks of quicksilver. The metal is extremely scarce, a fact said to be due to the lack of proper enterprise in procuring it, rather than to any deficiency in its presence.

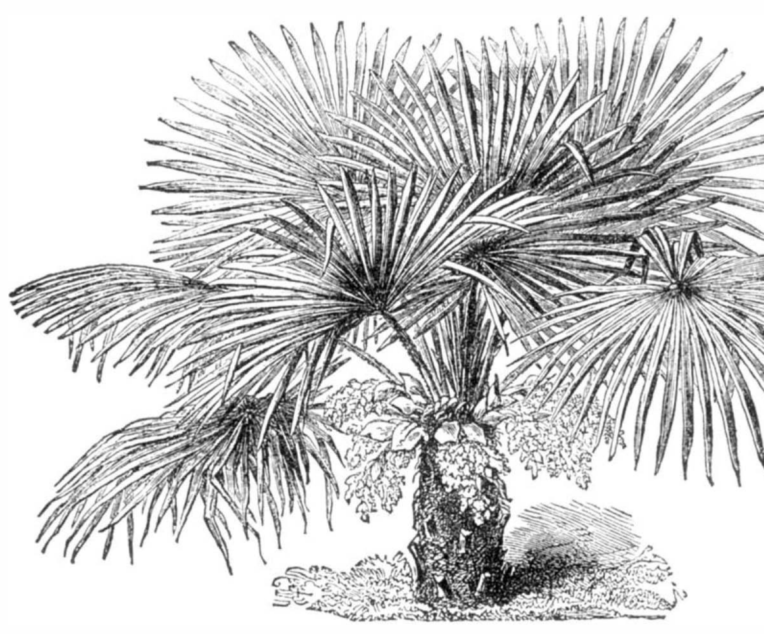
TWO REMARKABLE PLANTS.

During the frosts of winter, which have this year been so severe and so prolonged, the eye finds unusual pleasure in contemplating the inhabitants of the greenhouse and the hot house; and the vegetation of the tropics appears more than ever beautiful when the weather has bound our soil in an iron chain. Of all the classes of plants which the art of the gardener, aided by artificial heat, can cultivate in our northern climate, the palms exhibit the greatest variety of graceful foliage; and we publish herewith an engraving of the male species of the hardy palm, an ornamental kind exhibiting a remarkable difference between the two genders.

The male kind is known by its large thick trunk which, near the ground, branches out into strong vigorous boughs, thickly covered with spiky foliage of a deep yellow color; these spikelets at first grow out straight from the branches and then incline sharply downwards. It bears innumerable little flowers, growing closely together, of a beautiful deep orange color tipped with yellow. The female is comparatively small, with much thinner branches, the greenish yellow leaves of which grow straighter than those of the male sort, describing no curve or angle till much further from the stem. Its numerous small flowers, of a pale yellow hue, also grow at greater intervals apart. It blooms from April to May, and the seeds ripen from February until April the following season, thus requiring an entire year for complete fruition. As regards display, the preference must be given to the male trees, which may well be pronounced exceedingly ornamental. It is a moot point whether the males or females are most numerous; but certain circumstances would indicate that the males are.

Our second specimen is even a greater curiosity. It comes from Costa Rica, and has a large scarlet spathe, and a twisted spadix, which, when elevated, as they are, on a tall peduncle, have a peculiar aspect, and have gained for this species the name of flamingo plant.

The accompanying illustration has been prepared from a photographic representation of one of the finest specimens of this plant to be found in Europe, and it is also one of the best varieties of this truly beautiful species. The compost in which it has thriven so well consists of peat, charcoal, broken crocks, and moss. The pot is half filled with drainage. The temperature it has all along been grown in is intermediate between that of a stove and a greenhouse. We are indebted to *The Garden* for the two engravings.



THE MALE HARDY PALM.

THE FLAMINGO PLANT—(ANTHURIUM SCHERZERANIUM).

Aniline Colors without Arsenic.

Coupier, of Paris, was the first to succeed in producing fuchsin by the action, at a suitable temperature, of hydrochloric acid and iron in small quantities on pure aniline and nitrotoluol.

Recently, the Gesellschaft für Anilin Fabrikation, of Berlin, have erected new works, where no arsenic acid is used in the preparation of colors. Not only fuchsin (rubin), but all the colors derived from it which are manufactured by this company, are warranted to be produced without the employment of arsenic, and to be entirely free from this poisonous reagent.

The Berlin company are working Coupier's process with several important modifications, and produce from 450 to 675 lbs. of fuchsin per day. Some specimens of fuchsin and other colors manufactured by this company appear to be products of unrivaled beauty, purity, and strength. The fuchsin is stated to be not only purer, but stronger than that made by the aid of arsenic acid, and is the pure hydrochlorate of rosaniline. The rosaniline base, from its great purity, is admirably adapted for the preparation of aniline blue, and is now being very largely used by other manufacturers of aniline colors.

Being free from arsenic, these dyes are not only fitted for coloring sweetmeats, liqueurs, sirups, and pharmaceutical preparations of every description, but may be used in many other industrial purposes where poisonous colors would be more or less dangerous, as in the staining of paper, paper-hangings, toys, etc.

It is to be desired that other manufacturers of these dyes will adopt the new method, and relinquish the old arsenic acid process, which, apart from the inconveniences it has caused both manufacturers and consumers, has led to many lamentable accidents.—*Chemical News.*

Autogenous Soldering.

The term autogenous in connection with the process of soldering is strictly applicable to those instances only where the pieces to be joined are united by means of the same kind of metal, and more strictly still in those cases only where the joint is made by melting the surface or edges of the pieces to be united. In shop parlance this is known as "burning," an operation requiring no little skill, but, when satisfactorily accomplished, affording a better joint than can be obtained by the use of alloys, and indeed in some cases the only joint that is practically useful. The term autogenous is, however, applied to a process of soldering in which metals are united by melting the lead or other alloys along the seams by means of the flame of hydrogen, or of that obtained by the combustion of a mixture of hydrogen and common air. The correct or incorrect application of the term is of little moment, as the use of the expression "burning" has become so general and well understood amongst mechanics that its use in connection with the operation of joining metals is scarcely likely to be misunderstood.

The first and most important use of burning is in the construction of vessels for holding acid or corrosive liquids, which would attack one of the ingredients of ordinary solders; as for instance the leaden vessels, tanks, and chambers employed at chemical works. In vessels subjected to considerable changes of temperature, alloys are frequently of little use in constructing joints, owing to the difference in the amount of their expansion and that of the metals to which they are attached; and in other cases they set up a galvanic action, which more or less speedily destroys the more oxidizable metal. Autogenous soldering is also employed for the sake of appearance in pewterer's and plumber's work—especially in the former, in which, if solder where employed, the joints of angles and the seams would become too apparent to the eye. Burning is also resorted to to remedy defects in castings, and in various jobs in which solder is either inapplicable or objectionable.

The simplest method of burning is that adopted in the manufacture of leaden tubs, tanks, and other vessels, the success of the operation depending more upon the quantity and state of the materials than upon the skill of the workmen. Thus if a round or square tank is required, a piece of the sheet lead sufficient in size to form the sides and ends of the tank, or the hoop, if a round one, is bent into shape, the overlapping ends being secured by a few touches of solder or a few nails, driven from the inside, so as to keep the overlapping edges perfectly close. On the outside of the joint a piece of stout brown paper is pasted, so as to cover the whole of the joint. The hoop, or parts to be joined, are then turned downwards on to the casting floor, and molding sand of good quality packed over the joint to about five or six inches in depth, a piece of wood about three quarters of an inch thick being placed over the junction of the edges, while the sand is being rammed together. This wood is to form the runner or channel for the molten metal, and must be slightly longer than the joint to be made, so that it can be drawn out lengthways. The sand being tolerably firm, cut down to the wood with a trowel, forming a sort of V-shaped groove along nearly the whole length of the intended joint, leaving a few inches of the wood buried at one end, which is also to be completely stopped. When the wood is drawn out, which is the next operation, the other end of the runner is to be stopped up to a greater or lesser hight according to the thickness of the metal; about an inch is usually sufficient. It will be understood that we have here, as it were, a broad-mouthed ditch in the sand, stopped at one end, and with a bar one inch deep at the other; and at the bottom are the overlapping edges of the lead that is to be joined. A quantity of lead is then melted in a furnace, and brought to heat sufficient to melt the two edges of the metal to be joined.

Everything being in readiness, a small quantity of rosin is dusted along the intended joint at the bottom of the runner, and a bar formed to catch the overflow of metal. The latter is then poured in steadily but quickly, giving it as much fall as possible, and keeping up the supply till, by means of a trying stick, it is known that the cold metal of the edges has been melted. The overflow end is then stopped up, and more metal poured in, the molten lead being kept ready to fill up as shrinkage shows itself. When set, the sand is removed, and the runner or the remains of the metal poured on the joint is cut off with a chise and mallet, and the surface flushed with a scratch brush or wire card. The paper that was pasted over the outside will have fallen off, and will be seen to have left a smooth surface, in which no trace of a join is visible.

It will be seen that the secret of success lies in having a good bed of sand, plenty of hot metal, and careful attention to the shrinkage. The bottom of the tub or tank is put in by a similar process. The hoop or sides, when the tank is not too deep, being completely sunk in a hole in the castingshop, is filled up with sand inside and out. The sand is then removed from the inside to a depth equal to the thickness required in the bottom of the tank, and smoothed over well with the trowel. The sand outside the tank must be rammed hard, and a bay left all round to take the overflow. As before, rosin is sprinkled over the edge of the metal, and the melting furnace brought close to the work. When the metal is as hot as possible, two or more men take a ladleful and pour along the edge; and when the latter is melted, the molten metal is poured in until it is up to and running over the level of the outside sand all round. The dross is then skimmed off and the metal left to cool, as it shrinks equally all over and requires no further attention. It is obvious that, instead of making the bottom by pouring on molten metal, a piece of the required size can be cut out of thinner sheet lead, and placed on the top of the inside sand; but we believe the majority of experienced workmen prefer the first mentioned method of burning in a bottom. If the article is of considerable size, however, it is necessary to have more than one workman, as the metal must be poured on as quickly as possible.

This method of lead burning is, it will be seen, considerably troublesome, and is rarely used except when the lead is too thick to be melted conveniently by means of the blowpipe or the oxyhydrogen flame. The latter is, however, always used when possible by those who can accomplish the operation, which requires a much greater degree of skill than the process of lead burning we have described above. The edges to be joined should be scraped clean, and be dusted with rosin. A piece of lead is then laid along the intended joint, and the flame brought to bear upon it. In many cases the skillful lead burner omits the strip of lead, and obtains a joint by fusing the two edges to be united; but it is only the skillful workman who can accomplish this, as,especially in thin lead, the edges as they approach fusion are apt to run away from one another instead of coalescing. It is always best to use the covering strip of lead, because it is easy to remove superfluous metal from the joint, and failure in the other process involves loss of time. In either case it is only by practice that the amateur or tyro can hope to succeed.

Similar processes are applicable in the case of the other metals. Thus brass may be burned together, by placing the parts to be joined in a sand mold, and pouring a quantity of molten brass on them, afterwards reducing the parts by means of the file, etc., to proper dimensions. The *sine qua non* is plenty of molten metal,made a trifle hotter than usual. Pewter is generally burned by the blowpipe or a very hot copper bit. In angles and where it is bent over sharp corners and in seams, one edge is allowed to stand over the surface of the other, and a strip of the same metal is then laid along the intended junction. The joint is then burned, as mentioned, by melting the surfaces and edges by means of a blowpipe or the hot soldering iron, and the superfluous metal is filed off, leaving the joint, if at an angle, looking as if it had been made out of the solid. The principle of the process is the same whatever be the mode in which it is performed; and when hot metal is used as the sole agent of heat, it is necessary to have plenty of it, and to see that the parts to be joined are clean. It is scarcely necessary to say that the autogenous method is the only proper method of remedying defects in castings, and, notwithstanding the trouble attached to it, should always be attempted with all metals for which it is applicable, and all articles in which it is possible. We do not suppose that trifling defects in iron castings will be remedied by this means, though there is no very great difficulty in accomplishing it, as flanges are often burned on to pipes and wheels; but with the more costly or easily worked metals, the practice of this process would be attended with advantage.—*English Mechanic.*

The Earth---Its Heat and Contraction.

Professor P. M. Duncan, F.R.S., recently delivered at the Royal Institution a course of lectures upon "The Grander Phenomena of Physical Geography." He pointed out that there is strong evidence that the earth is a solid body now cooling, because the deeper man can get in mines or in borings the hotter is the temperature, and if the temperature continues to increase at depths to which man cannot reach, in the same ratio that it does at depths which he can reach, a temperature of 3,680° would be found at a depth of 45 miles. At this temperature granites and lavas fuse. Assuming, then, the earth to be a hot body now cooling, as it cools the rocks must contract; moreover, those rocks which are rich in silica will not contract so rapidly on cooling as others, consequently herein is a source of change of shape of the earth. It is well known that surface changes are going on, that some large areas of land are in course of slow upheaval, while others are slowly sinking, and that at one geological period there was a great upheaval of the larger portion of the continent of North America. The globe, therefore, is cooling unequally. The radiation from some parts is greater than at others, so in this there is a further source of disturbance. Sir William Thomson has calculated that every year 92 horse power of work—for heat means work—is got rid of from every 247 acres of the surface of the globe. The dissipation of energy and the contraction of rocks not being uniform, the effect of these disturbing causes is to produce horizontal thrusts, which form mountain ranges by crumpling up the earth, for mountains are formed by this crumpling action, and not usually by direct volcanic or other upheaval. The changes produced by the contraction are slow, and there is every reason to believe that our present sea floors and our present continents are extremely old, geographically speaking, so far as their present forms are concerned. He said that the upper part of Snowdon consists of sea sand, fossil sea fishes, and volcanic ashes, all mixed together; in fact it appears to have been at one time in the same condition that the Bay of Naples is in at present, that is is to say,volcanic ashes fell into it and sometimes buried fish. The lower part of Snowdon consists of vast streams of old lava. At some geological period the crumpling action already mentioned took place below the Bay of Snowdon; consequently the bottom of the bay was elevated and became the top of the highest mountain in Wales. Rain,and rivers, and atmospheric changes then played upon it during the course of long ages, sculpturing out the beautiful mountain scenery which characterizes the Snowdon range.

Beef Steak Electricity.

The six Christmas lectures for juvenile listeners at the Royal Institution, were delivered by Dr. J. H. Gladstone, F.R.S. He chose for his subject "The Voltaic Battery." Most of the experiments and teachings were of course too elementary to interest the readers of these pages, but one of the experiments revealed a fact not generally known. He said that in daily life weak electrical currents are at work where their presence is often little suspected; for instance, supposing a person at dinner to have a silver fork in one hand and a finger upon the steel part of a knife held in the other, it follows that, when he plunges the knife and fork into a beef steak,two dissimilar metals are thereby placed in a moist conducting substance, consequently a voltaic circuit is formed and an electric current flows through the body of the individual between the knife and fork. To prove that this was really the case, he connected a reflecting galvanometer with the knife and fork by means of wires; he then proceeded to cut a beef steak, and the current thus generated deflected the needle of the galvanometer, so that the spot of light which it reflected was seen traveling along the screen by all the observers.

Steam Boat Poetry.

At a meeting of the Institution of Engineers and Shipbuilders in Scotland, held in Glasgow, on Wednesday, December 4, 1867, Mr. J. A. Napier, F.R.S., submitted the following verses, written by Wm. Muir, saddler, Kirkintilloch, March, 1803, "on seeing the new-invented Steamboat pass through the great Canal, dragging two vessels behind it fully loaded."

THE STEAM BARGE, OR NAUTICAL NOVELTY

When first by labor Forth and Clyde
Were taught o'er Scotia's hills to ride
In a Canal long, deep, and wide,
Naebody thocht
That winders without win' or tide
Would e'er be wrocht.

To gar them true that boats would sail
Thro' fields o' Corn or beds o' Kail,
An' turn o'er Glens their rudder's tail,
Like weathercooks,
Was doctrine that would needed bail
Wi' common folks

They ca'd it nonsense, till at last
They saw boats travel east and wast,
Wi' sails and streamers at their mast,
Syne, without jeering,
They were convinced the blustering blast
Was worth the hearing.

For mony a year, wi' little clatter,
An' naething said about the matter,
The horses hauled them through the water
Frae Forth to Clyde;
Or the reverse, wi' weary splatter,
And sweaty hide.

Then wi believed, poor silly bodies,
Wha' naething ken o' learned studies,
That horses' hoofs and hempen woodies
Best still to draw them;
An' cursing callins clad in dudies,
To swear and ca' them.

But little think wi what's in noddles,
Whar science sits an' gapes and gudles,
Syne darklins forth frae drumly puddles
Brings things to view
That the weak penetration fuddles,
O' me an' you.

For lately we have seen a lighter,
An' in her doup a fanner's flighter,
May old boat-haulers a' gae dight her,
Black sooty vent
Than half a dozen horse she's wighter
By ten per cent.

Wi' something that the learned ca' steam,
That drives at heughs the wa'ken' beam
O' huge engines to draw coal seam
Or carry hutches,
She in her breast swells sic a feum
As has few matches.

By it she through the water plashes,
An' out the stream behint her dashes,
At sic a rate baith frogs and fishes
Are forced to scud,
Like ducks and drakes amang the rashes,
To shun the mud.

When first I saw her in a tether
Draw twa sloops after ane anither,
Regardless o' the win' an' weather
Athwart her bearin',
I thought frae h—ll she had come hither
A privateering;

An' that the pair she had in tow
Were prizes, struck me, sae I vow:
I cried when fixed to their prow
I saw her cable—
"In Satan's furnace now they'll bow
Amang the rabble."

It was sae odd to see her pulling,
An' win' an' weather baith unwilling,
Yet d—l may care she onward sculling,
Defy'd them baith,
As constant as a mill that fullin'
Gude English claith.

Can o'er, thought I, a flame o' reek,
Or boiling water's cauldron smeek,
Tho' it war keepit for a week,
Perform sic wonders,
As quite surprises maist the folks
O gazing hunders?

But facts wi canna well dispute them
Altho' wi little ken about them;
When prejudice inclines to doubt them,
Wi' a' her might,
Plain demonstration deep can root them,
An' set us right.

Or lang gae now wi' whirligigs,
An' steam engines will plough our rigs,
An' gang about on easy legs,
Wi' nought to pain us,
But flit in tethers, needlessna
That us'd to hain us.

Braw news indeed for man and beast,
They'll then hae nought to do but rest,
An' on their former labors feast,
Wi' cheerful hearts,
When thus they see warm steam insist
To play their parts.

[The boat referred to, we presume, was the Charlotte Dundas, built by William Symington, a native of Falkirk, for whom the honor of first applying steam to navigation is claimed.]

NEW BOOKS AND PUBLICATIONS.

BETON COIGNET: A Description of the Material and its Uses in France and America. Published by John C. Goodridge, Jr., New York and Long Island Coignet Stone Company, Third Avenue, near Third Street, Brooklyn, N. Y.

Engineers, builders, and architects will find in this pamphlet complete information regarding one of the most successful artificial stones now manufactured. The work comprises a large number of valuable reports upon practical tests of the material, prepared by well known experts, and also the specifications of the ten patents under which it is made. A profusion of excellent engravings of completed structures, in which the béton Coignet is used, embellish the text. An advertisement of the pamphlet will be found on another page.

THE PROGRESSIVE SHIP BUILDER. By John W. Griffiths, Editor of the Nautical Magazine, etc. etc. Illustrated. Published by the Author, New York, P. O. Box 5125.

This is the first volume of an extended treatise upon ship-building, which inasmuch as it embodies the results of the author's experience of fifty-two years in the art, cannot but be of great practical value. Certainly, a work which aims to circulate broader ideas regarding a calling which (though on of the noblest, and at the same time one which our great seaboard, it migh be thought, would render one of the first to the country in industrial importance) has of late assumed proportions far too inconsiderable deserves an honest welcome. The book is written in clear and plain language, and is copiously illustrated. It will doubtless prove a useful contribution to literature on the subject.

THE MICROSCOPE AND ITS REVELATIONS. By William B. Carpenter, M.D., LL.D., F.R.S., &c. Illustrated with twenty-five plates and 449 wood engravings. Fifth Edition. Lindsay & Blakiston, Philadelphia, Pa.

This is a thoroughly revised edition of probably the best, certainly the most exhaustive, work on microscopy extant. The book is eminently practical; and for this reason, perhaps above all others, we can heartily commend it to students—while the very distinguished position of its author in the scientific world is an ample guarantee that nothing, in the already wide though constantly widening field through which he aims to conduct the reader, has been omitted or slighted. His endeavor clearly is throughout to make the student investigate for himself, or, to quote from the preface, "being satisfied that there is a large quantity of valuable microscope power at present running to waste," he hopes to direct this power to more systematic labors. The original work included chapters on the principles and construction of the microscope, accessory apparatus, management of the instrument, collecting and mounting of objects, and elaborate description of microscopic forms of life. These general topics in the volume before us have been brought down to the latest dates, and descriptions have been added of the newest inventions as well as discoveries in the science. The publishers deserve much credit for the excellent appearance of the very numerous illustrations, as well as of the book in general. Price $5.50. For sale in this city by D. Van Nostrand.

We have recently received an exceptionally handsome chromo calender from Messrs. Schumacher & Ettlinger, of Nos. 13 & 15 Murray Street, in this city. The work, which is a neat flower design representing a fan, is executed in gold and a variety of brilliant colors, making it a very attractiv show card.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

THE RUBBER TIP PENCIL COMPANY, APPELLANT, *vs.* SAMUEL E. HOWAR HENRY SANGER, MICHAEL SNOW, AND RICHARD BUTLER.

[Appeal from the circuit court of the United States for the southern district of New York.—October term, 1874.]

On the 23d of July, 1867, James B. Blair, claiming to be the original and first inventor or discoverer of "a new and useful rubber head for lead pencils," received a patent for his invention. He claimed "as a new article of manufacture an elastic erasible pencil head made substantially in manner as described." The "nature of his invention," he said, was "to be found in a new and useful or improved rubber or erasive head for lead pencils, etc., and consists in making the said head of any convenient external form, and forming a socket longitudinally in the same to receive one end of a lead pencil or a tenon extending from it." *This socket is to be cylindrical or of any other proper shape. Usually, the inventor says, he made it so as to extend part way through the head, but, if desirable, it might be extended entirely through. It must be within one end, but any particular location at the end is not made essential. This clearly is no more than providing that the piece of rubber to be used must have an opening leading from one end into or through it. This opening may be of any form and of any extent longitudinally. The form, therefore, of the inside cavity is no more the subject of the patent than the external shape. Any piece of rubber with a hole in it is all that is required thus far to meet the calls of the specifications, and thus far there is nothing new, therefore in the invention. *The small opening in the piece of rubber not limited in form or shape was not patentable, neither was the elasticity of the rubber. What, therefore, is left for this patentee but the idea that if a pencil is inserted into a cavity in a piece of rubber smaller than itself the rubber will attach itself to pencil, and, when so attached, become convenient for use as an eraser?

An idea of itself is not patenta le, but a new device by which it may made practically useful is. The idea of this patentee was a good one, but his device to give it effect, though useful, was not new. Consequently he took nothing by his patent.

The decree of the circuit court is affirmed.

[*John S. Washburn*, for appellant.
F. H. Betts and *S. W. Kellogg*, for appellees.]

Mr. Chief Justice Waite delivered the opinion of the court.

United States Circuit Court.---Northern District of Illinois.

JOHN M. TURNBULL *et al. vs.* THE WEIR PLOW COMPANY.

[In equity.—Before Drummond, J.]

This was a bill for an injunction to restrain the alleged infringement of letters patent for an Improvement in Cultivators, granted to Thomas McQuinston, October 18, 1859, and reissued May 16, 1871, and for an account.

McQuinston having in the year 1860 assigned away the exclusive right under his patent in and for the counties of Warren and Henderson, in the State of Illinois, and having, on the 18th day of November, 1870, and prior to the recording of such first deed, executed a second assignment, conveying to another party "all my [his] right, title, and interest in and to the said letters patent in the following described territory" (in which was included the State of Illinois), * * * "as fully and entirely as the same would have been held and enjoyed by me [him] if this assignment had not been made:" *Held:* That, as there was an interest left in the patentee's hands upon which the second assignment could fairly be said to operate independently of that embraced in the first deed, this last assignment was valid. *Held:* also, that the first assignment was operative, and that a plea to the bill, setting up the second assignment in bar of complainant's right of action, they claiming by virtue of the earlier assignment, must be overruled.

The provisions of the 36th section of the Patent Act of 1870, with regard to the recording of assignments of patents, are substantially the same as those of the 11th section of the act of 1836, as construed by the courts.

[*William Marshall*, *James L. High*, and *R. Mason* for complainants.
West and Bond, for defendant.]

Recent American and Foreign Patents.

Improved Extension Table Slide.

Abraham S. Bowen, Rushville, Ind.—The invention consists in a novel mode of improving the adjustable slides of extension tables, by combining a recessed and apertured slide with a casting having a tit that fits in the aperture, so as to avoid the use of screws and enable an ignorant workman to properly adjust the casting in the slide; also in providing the tenoned slides with straps and the castings with grooves, cavity and shoulder, so that the slides will freely move upon each other, but without the possibility of separation.

Improved Combined Hitching Strap and Nail.

Ernst Ohm, Terre Haute, Ind.—The invention relates to devices by which horses may be conveniently, quickly, and securely hitched in close proximity to a residence, and consists in a hitching nail consisting of a body and detachable cap having a notched flange.

Improved Hand Potato Planter.

Josiah Sawyer, Tremont, Ill.—A tube is made in sections sliding into each other, so that its length may be readily adjusted according to the hight of the person carrying the dropper. To the lower end is attached a flexible tube of rubber, and of such a length as to touch the ground when the box is carried in position for use, so that the potatoes will not roll when they reach the ground, but will lie exactly where dropped. In using the dropper, the potatoes are cut into pieces of the desired size and placed in the box. The person using it measures off the ground by his steps, and at the proper time he raises enough seed for a hill from the box, and drops it into the tube. When the dropper is set down, the tube rises through the hole in the box, and again slips down into place when the box is raised from the ground.

Improved Saw Gummer.

S. Lee Tibbals, Osakis, Minn.—The presser bar is made with a spring at the attached end, so that it will raise itself from the die, and is perforated to receive the punch. It also carries a perforated guide. The saw is placed on the face of the die, and the bar is brought down on it and held in position by a cam lever. This cam lever is provided with journals, and engages with a slotted hook, within which the end of the bar works.

Improved Car Seat.

Edwin G. Wellman, Canandaigua, N. Y.—This car back is detached from the seat, and is secured by staples to horizontal bars which extend across the ends of the seat. It may thus be readily slid from one edge of the latter to the other, when it is desired to reverse the same. This invention was described and illustrated on page 118 of our current volume.

Improved Coffin Clamp.

William H. Houck and John B. Fox, Quincy, Ill.—This invention relates to an improved coffin clamp for hearses, by which any size or shape of coffin may be firmly secured in the hearse in a quick and convenient manner. Upright standards slide in guide slots of the body of the hearse, and retain the coffin by oscillating clamping pads. The standards are moved in connection with nuts traveling on a right and left hand screw bolt, which is so constructed that the front and rear clamps may be moved together, or one pair separately, for being thereby adjusted to any coffin. The clamps are previously set to the shape of the coffin, which facilitates the clamping, and allows the almost instant locking of the same when the coffin is placed on the hearse by the pall bearers, so as to avoid thereby the annoying delay occasioned by the present modes of clamping the coffins to the hearse. For further particulars address the inventors, P. O. box 2,225, Quincy, Ill.

Improved Horse Hay Rake.

Peter Mast, Waterville, Ohio.—This is an independent shifting lever, interposed between the regular teeth-setting lever mechanism and the pivoted tooth bar, for the purpose of controlling and governing the rake teeth instantly during the progress of raking without changing the position of the adjusting lever, so as to adapt the rake thereby to unevenness of the ground, and increase the facility and efficacy of working the same.

Improved Gas Retort.

Samuel P. Parham, New York city.—This retort has a clay shell and a wrought metal lining, the two being provided with an air space that will admit of expansion. Both ends are open, and the terminals of the lining extend beyond the shell, and on these extensions support end tubes. The latter have outwardly projecting flanges, against which abut the ends of the clay shell, and keep it firmly in place, the shell, lining, and tubes being all simply cemented together. Naphtha liquid is forced or caused to flow through an aperture into the initial tube, and thence drawn through the lining, wherein it loses its liquid form, assumes that of a gas, and is drawn through the outlet by an exhauster. This has been found in practice to produce a very rich gas, sufficiently pure for mixing with the purified coal gas.

Improved Hog Trap.

Peter Lane, Elwood, Ind.—This invention is an improvement upon the hog trap for which letters patent were granted to Overshiner. May 19, 1874. It seizes the animal, throws it on its side, and holds it in convenient position during the operation of spaying.

Improved Mosquito Bar Frame.

William F. Howe, Galveston, Tex.—This is an arrangement of posts and cords, so combined that by withdrawing the pins from the posts, and slipping the cord from the ends of the bars, and detaching the posts from the bedsteads, the bars may be folded together, and they and the post tied into a small and compact roll.

Improved Map Exhibitor.

Sebastian C. Adams, Cincinnati, O.—The chart to be exhibited is attached to two rollers, so that it can be wound from one to the other of the rollers by turning them by means of cranks. The journals of the rollers revolve in spring clips, which press against the ends of the rollers, and thus hold said rollers in any position into which they may be turned, and also keep the chart taut while being wound. The bars to which the clips are attached are halved to the two cross bars, and are secured detachably to said bars by screws, so that they can readily be detached and packed into a compact bundle for storage or transportation.

Improved Ventilating and Warming Drum.

Peter H. Carman, Brooklyn, N. Y.—This ventilator is placed in any position where it can be connected with a flue or chimney of a furnace or fire. It forms a box in which are horizontal and vertical partitions. Tubes, of greater diameter at the bottom than at the top, extend from the lower partition to the upper partition, all passing through the central partition, with the exception of the outside tier. This central partition is cut short to allow the heat to pass from the lower compartment to the upper compartment by means of flues. Above and below the horizontal partitions are two compartments. There are six tiers of tubes, half of which connect one set of compartments, and half connect the other set. The fresh air is admitted into a compartment, and passes up through the left hand tiers of tubes, by means of which the air is heated and discharged into the chamber, whence it is conveyed to the apartment. At the same time, the foul air at the bottom of the apartment is drawn into another chamber, an upward draft being induced by the heat with which the tubes are surrounded, and is discharged into a chimney or flue, and conducted from the building.

Improved Tanning Apparatus.

Harvey Reed, Atlanta, Ga.—This invention consists of tan vats contrived with removable partitions and sliding and removable racks for supporting the skins; also with an arrangement for circulating the liquor through the leaches and vats in an endless course, so that the skins may be put in at the end of a series of vats, out of which the liquor is forced into the leaches again and shifted along, from time to time, to the other end. Into the latter the liquor flows again after being renewed in the leaches, and thence the tanned batches are lifted into the drying house. The leaches are arranged in a series and introduced into the endless channel for the liquor at one end with new material, and shifted along to and removed with the spent material at the other end. The exhausted liquor thus enters the oldest leach as it comes from the vats, and passes to the newest in going back to the vats, and thus extract the tannin and applies it to the skins most effectually. The invention also consists of a softening and scouring wheel contrived to produce the current of liquor, and having outwardly projecting floats to act on the water, and inwardly projecting floats to scour and rub the hides placed in it, while the liquor is pumped up into it as it revolves.

Improved Middlings Purifier.

Edwin W. Johnson, Foreston, Ill., assignor to himself and Joseph U. Knodle, of same place.—The meal is acted upon by a continual spreading out, as produced in a series of vertically disposed saucers with great facility, by a strong upward current of air, caused by the suction fan through side apertures, near the bottom of the separating chamber, so that thereby the bran and other impurities are separated from the flour and carried partly around the saucers, by the central apertures of the valve chamber and fan casing, to the discharge conductor, and partly through a suitable number of side channels at the inner circumference of the separating chamber, to the valve chamber and the exit conductor.

Improved Chain Gripe and Tightener.

John N. Ackerman and George J. Ackerman, Hackensack, N. J. —A cast iron frame has a pivoted sheave. A lever has an end yoked so as to receive the aforesaid frame, and is pivoted thereto by the same bolt. A pawl is pivoted on the yoke of the lever, and a spring keeps it in position. To operate this device, the flat side of the frame is placed against the load, and the chain is thrown over. The chain is next passed up over the sheave, and then down through the yoke of the lever; then, by pulling the said lever downward, it will cause the pawl to gripe the chain and draw it through, and another pawl, resting on the sheave above the chain, will gripe and hold it while the lever is being raised in position for a fresh gripe.

Improved Bee Hive.

Monroe Davis, Arcola, Mo.—The essential feature of this invention is a moth trap, composed of a nest of curved plates, which prevent the insects from entering the hive, or from returning thereto after having once emerged.

Improved Screw Propeller.

Elbert B. Porter, Havana, Cuba.—The invention consists of a screw propeller with semi-elliptic or otherwise bent and twisted blades attached at one or both ends of shaft, and provided with interior and exterior auxiliary wings of sufficient size and twist. The propeller is made of rolled metal plates, each auxiliary and main blade being separately attached, so that any part may be repaired without interfering with the other parts.

Improved Potato Digger and Cultivator.

Alden Crosby, Gray, N. Y.—The forward ends of three beams are spread apart, and are connected by a curved bar. The forward ends of the said beams may be adjusted closer together or farther apart, as may be desired. To the beams are attached the plow standards, which carry the plow plates. The forward plow plates are made with teeth upon the outer part of their lower edges, and their inner parts or wings are so formed as to throw the soil toward and around the plants, and round it up into a ridge. The rear plow plates are so formed as to move the soil farther inward, and complete the formation of a ridge around the plants. When the machine is to be used as a potato digger, the plow plates are so adjusted as to remove the soil from the sides of the ridge; and to the center beam is attached a standard, to which is attached a sharp-pointed plow, which opens up the hills and throws out the potatoes. Another device rakes over the soil thrown up by the plow, and thus separate the potatoes from it, leaving the said potatoes lying upon the top of the soil.

Improved Electric Fuse.

Charles A. Browne and Isaac S. Browne, North Adams, Mass.—The invention relates to electric fuses, consisting of a shell having wires in packing, and attached to a second shell or cup containing the explosive compound. It consists in preparing these for transportation and subsequent consumption, so that the outer or second cap containing the fulminate charge can be shipped in a wet state, and then dried and attached by the consumer to the independent fuse.

Improved Arm Fracture Apparatus.

David Bissell, Detroit, Mich.—The arm splint comprises two pairs of clamping plates, one for the arm and the other for the fore arm, the plates being of concavo-convex form, whereby they are adapted to envelop the arm, or nearly so. They are also made double, and contrived to lengthen and shorten, and may be adjusted toward and from each other, to shift along the arm, as may be required. The upper plates of each pair are detachably connected to the others, so as to be taken off and put on readily, in applying the splint to and removing it from the arm; and the part to be applied to the fore arm is provided with flexible springs, with adjusting screws for applying the pressure to the arm. The object is to conform the pressing device to the shape of the arm for regulating the pressure on the different parts, and to hold the arm in the requisite shape. The clamping plates are made of zinc, and a zinc plate is used in front of the pressure springs for the benefit of its cooling nature, and to facilitate the application of electricity.

Improved Street Railway Car Truck.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This consists in connecting the sections of the tubular truck frame of a street railway car by tubular joints, thus forming a continuous passage therein. Thus constructed, the entire frame is adapted for use as a water tank for supplying the boiler, and may be of any size found necessary or practicable.

Improved Wheel for Vehicles.

Abraham B. King, Camden, O., assignor to Catherine King, Rome, Ga.—The interior of the hub is in three divisions or chambers, for containing the nut and washer on the arm of the axle, the rubber or metallic springs around the pipe box, and the extension for the spoke tenons. Stops which enter grooves in the springs hold the latter stationary. Confined as these springs are around the pipe box or axle, a degree of elasticity is imparted to the axle and wheel which counteracts the usual jarring and concussion, and renders the motion of the vehicle soft and easy.

Improved Spring Bed Bottom.

George W. Hatch, Fond du Lac, Wis.—In this bed bottom the wire springs are each formed of a series of bends, having an upward inclination, straight connecting portions, and eyes, said springs being arranged lengthwise of the slats.

Improved Safety Valve.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—The first invention consists of a piston of large area, subject to the pressure of the steam, which pressure holds the valve closed through the medium of a spring until the set point for blowing-off is reached. The pressure is then caused, by means of a rod and lever, to react on the spring, and to open the valve and allow the steam to escape. The invention also consists in the arrangement of an adjustable collar for varying the set point at which the valve shall open and allow escape of steam.

Improved Washing Machine.

Horace G. Williams, Hamilton, Iowa.—This consists in the peculiar construction and arrangement of the devices for operating a vertically moving and horizontally oscillating plunger. In using the machine the clothes are placed upon the bottom of the tub, a sufficient quantity of soap and water is put in, and the free end of a lever is worked up and down, which alternately presses the water out of the clothes, and allows them to again become saturated. As the lever is being worked up and down, it is, at the same time, moved to one or the other side, so that the presser may strike the clothes each time in a new place.

Improved Spring Seat Support.

Frank A. Hawley and Amos Pearsall, McGregor, Iowa.—The seat is supported, by means of brackets, on a compound spring frame, which is constructed partly of wood and partly of steel springs. The wooden spring part is of slightly curved shape, and applied under suitable upward inclination to the front part of the perch. The brackets are attached to the wooden spring part of the frame, which is laterally braced by a stiffening piece. The steel springs are of inverted C shape, and applied with or without straps to the upper ends of wood spring pieces.

Improved Grain Cradle.

John W. Settle, Glasgow, Ky.—Upon each finger, at the point where the rod usually passes through, is placed a socket, which is secured detachably to the fingers by a small screw passing through said socket and into or through the fingers. By this construction, the fingers are not weakened by having holes formed through them for the passage of the cross rod, and are thus less liable to break at that point, while the sockets allow any finger to be conveniently removed and replaced with a new one.

Improved Leg Fracture Apparatus.

David Bissell, Detroit, Mich.—This is composed essentially of two fracture boxes for the leg and thigh, respectively, with an adjustable and extensible bed in the leg box for the leg to rest on; also adjustable, extensible, and removable pressure pads for the sides and top of the leg and thigh; also means for extending the limb; also means for adjusting them to crook the leg at the knee; also means for effecting extension from the shoulder, and certain other contrivances.

Improved Steam Generator.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This is a new steam generator composed of three distinct shells or walls, separated so as to leave spaces. A fan assists the chimney in drawing the exterior air through openings into the open space, and causing it to ascend to the top of the furnace, where it passes through openings in the middle shell and into another space in which it descends to the openings beneath the grate. In passing down through the spaces, the air becomes heated and is delivered to the fuel in the condition of a hot blast. Devices are included in the boiler whereby a constant separation of sedimentary and foreign matters contained in the water is made to take place, resulting in great advantages in preserving the interior surfaces of the water-heating tubes in a clean and efficient condition.

Improved Iron Bridge.

Edwin I. Farnsworth, Leavenworth, Kan.—This invention consists of an improved construction of girder or arch for bridges, of two vertical (edgewise) channel or ⊐ beams, with a flat plate riveted on top, transverse plates under side at the posts and feet of the arch, and diagonal or lattice bracing intermediate to the transverse plates. This affords greater strength for resisting the crushing effect on the feet of the arch where the greatest strain exists, and also greater lateral strength along the arch. It also enables the inside of the arch to be painted.

Improved Middlings Purifier.

Joseph W. Wilson, Warsaw, Ill.—The spout, through which the middlings are passed into a stationary bolt, incloses a fan, to the outer edges of which are attached brushes, for the purpose of agitating the middlings. The fan takes the air around the shaft at the bottom, and forces it, together with middlings and impurities, out into a chamber, where there is a current of air passing upward to another fan which carries the impurities up and out into a dust room. The middlings are allowed to fall to a sweep which discharges them on a horizontal bolt. The latter has a jarring longitudinal motion, together with a quivering motion, which keeps the middlings constantly agitated over the cloth, and also keeps the cloth clean without the aid of knockers or brushes.

Improved Corpse-Preserving Casket.

Bartholomew Hartwell, Baltimore, Md.—The invention relates to burial caskets, in which the body of a deceased person is placed after death, and preserved by ice from decomposition. The invention consists in preventing any liquid from coming in contact with the body and in making the cooler in sections that may be easily filled and carried into the house by a single man. A lining is used to go around the inside to hide the joints where the ice cans come together.

Improved Cotton Seed Planter.

B. F. Cadenhead, Bolingbroke, Ga.—The invention relates to the construction of cotton planters so that they may be simple, efficient, and at the same time obtainable at a small cost. It consists in a seed wheel having feed recesses at regular intervals between the periphery and hub, and in a box slotted in front, rear, and bottom, and provided with stirrers turned by friction.

Improved Cut-Off Adjusting Device.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This consists of two cut-off valves, one for each port of the slide valve, having independent rods extending out through the steam chest, one within another, and connected with an adjusting nut, one by a right hand and the other by a left hand screw, so that the sleeve, which is swiveled to the eccentric rod, being turned right or left, will shift the valves toward or from each other simultaneously and alike.

Improved Bag Fastener.

James Macphail, Laporte City, Iowa.—This is a fastening string attached to the sack, passed in a loop through holes of an elastic disk and metal button, and secured by a knot to retain the disk and button in position. The string is then wound around the bag end, and securely fastened thereon by being wedged intermediately between disk and button.

Improved Car Coupling.

B. F. Cadenhead, Bolingbroke, Ga.—The invention consists in an automatic car coupling, consisting of a link slotted at each end and pivoted drop-catches combined with a laterally perforated drawhead and removable crossbar, also in combining cross pieces and a draw pin with the cross bar, and in using a presser pin with a drawhead having rear perforations.

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Prize Essay on the Balance Spring and its Isochronal Adjustments. By Moritz Immisch. $2.00, mail free. E. & F. N. Spon, 446 Broome Street, New York.

Advertiser, having the best Patent Wrench in the United States and Canada, desires some party with Capital to join him in Manufacturing the same for Market. Address, stating amount to invest, to Charles Steel, 642 Lorimer Street, Greenpoint, L. I., Brooklyn, N. Y.

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2nd Hand Engines and Boilers for Sale at Low prices. Address Junius Harris, Titusville, Pa.

Engines, 2d H'd, for Sale—Perfect and complete with all fittings: 25 h. p. Hoadley Portable, $1,475; 8 h.p. Hoadley Portable, $600; 5 h. p. Upright, with 6 h. p. Boiler, $420; 50 h. p. Upright "Chubbuck," $1,200; 18 h. p. Upright Boiler, $225; 50 h. p. Horizontal Boiler, $700. Also, new Stationary and Portable Engines, from 1 to 100 h. p., a specialty. Address Forsaith & Co., Manchester, N.H.

An old established responsible House wishes, in connection with their different European Offices, to take the exclusive European Agency for first class special Machinery. Only established firms, who can guarantee their ware, need address D. & W., Box 2620, New York.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

W. Campbell's Self-Acting Shade Rollers. The Trade supplied, 87 Center Street, New York.

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Wanted—Responsible parties to make and sell Clarke's Safety Pocket Book" on a royalty. One year in use. Address Geo. B. Clarke, Patentee, Leonardsville, N. Y.

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Advertising.—Geo. P. Rowell & Co., New York. This is, perhaps, the most enterprising and reliable, as it is the largest Advertising Agency in the United States. Their offices in the Times building contain files of papers published in all parts of the Union, and they have a system of classifying newspapers for advertisers that is as unique as it is useful.—[N. Y. Daily Star, Dec. 15, 1870.]

Wood-working Machinery, 2d H'd, for Sale—All in good working order: 24 ft. Circular Saw-mill, Set Works, 48 in. Saw, all the Belting, with drawing-in Rope, $380; 23 ft. Daniel's Planer, wide bed, $175; Side Jointer, planes 16 ft. long by 16 in. sqr., $130; 300 ft. ⅝ in. wire iron chain, 4c. per lb.; 1 Iron Felloe Machine, $50; No. 1 H. P. Smith 4-sided Moulder, $310. New Wood-working Machinery, all kinds, a specialty. Address Forsaith & Co., Manchester, N. H.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau st., N. Y.

Engines, 2 to 8 H.P. N. Twiss, New Haven, Ct.

Miller's Brick Presses for fire and red brick. Factory, 309 South Fifth Street, Philadelphia, Pa.

To Machinists.—For Sale, Cheap—A partially finished Engine Lathe, 11 feet bed, 28 inch swing. For further particulars, call on or address Clark, Smith & Co., Fort Plain, N. Y.

Send stamp for specimen copy of the Sheet-Metal Builder; all about Galvanized Iron Cornices. Published monthly. Address Sheet-Metal Builder, Salem, Ohio.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Lathes, 2d H'd, for Sale, perfect order—Two 8 ft. Screw-Cutting Engine Lathes, 15 in. swing, complete, $249 each; one 22 ft. Engine Lathe, 28 in. swing, $575; 4 Spindle Upright "Assonet" Driller, $60; 8 ft. Iron Speed Lathe, 18 in. swing, $70; 6 ft. Engine Lathe, 17 in. swing, $135. Address Forsaith & Co., Manchester, N.H.

Piano and Organ Wire Work of all kinds, Valve and Key Pins, Iron and Brass Finishing Nails, &c. &c. The Hendey Machine Co., Wolcottville, Conn.

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Send to Atlas Works, Indianapolis, Ind., for a Photograph of their 20 inch Engine Lathe.

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Grindstones—4,000 tuns. Berea Stone Co., Berea, O.

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Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

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Wood-working Machinery, new, for Sale—Iron Frame Band Saws, $150; Excelsior Machines, $325; Eureka Gang Lath Sawing Machine, 6 saws, $180; Iron Frame Power Matcher and Jointer, $250; Hand or Box Board Matchers, $65; 24 in. Rotary Bed Planers, $200; 26 in. Double-belted Rotary Bed Planer, weight 2,400 lbs., $350. Circular Saw Mill, Shingle, Clapboard, and Stave Machinery a specialty. Address Forsaith & Co., Manchester, N. H.

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Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Notes & Queries

A. B. L. can cement emery to wood by using the best glue.—R. B. K. is informed that French polish is generally used on pianofortes. See p. 11, vol. 32.—W. D. will find a recipe for a gold lacquer on p. 362, vol. 30.—H. C. Y. can purify his garments by burying them for a while in the ground.—H. T. D. and many others are informed that Mr. Seth Green's address is Rochester, N. Y.—A. D. should keep his preparation for preserving hides, etc., covered with a thin layer of glycerin in a well corked bottle.—L. V. R. ought to know better than to try to construct a perpetual motion.—J. C. should consult a physician.—Mrs. S. C. Jr. and J. M. S. will find a description of a fountain on p. 406, vol. 29.—E. C. C. will find an exposure of the motor in question on p. 273, vol. 30.—E. R. T. will find a recipe for treating moles on p. 331, vol. 32.—F. T. W. can blue steel by the process described on p. 123, vol. 32.—J. H. P. will find a good recipe for baking powder on p. 123, vol. 32.—P. D. and others who inquire about the cultivation of sumac should address the Commissioner of Agriculture, Washington, D. C.—S. B. can dress buffalo skins by the method described on p. 266, vol. 26.—C. B. F. will find a recipe for indelible ink on p. 112, vol. 27. Solder for silver is described on p. 251, vol. 28.—C. L. V. can make a rubber varnish by the process given on p. 11, vol. 32.—F. P. will find directions on p. 388, vol. 29, for keeping moths out of clothes.—W. R. M. can cement leather to rubber by using the preparation given on p. 119, vol. 28.—J. W. will find directions for browning gun barrels on p. 11, vol. 32.—G. F. will find instructions for vulcanizing rubber on p. 378, vol. 28.—G. R. D. can etch steel saw blades by the process described on p. 250, vol. 27.—J. M. McC. will find a recipe for diamond cement (cementing whalebone, etc.) on p. 90, vol. 30.—D. F. (diameter of pipes), H. W. G. (dividing a board), J. E. S. (steam pipes), and H. L. L. (boilers and engines), do not send sufficient data.

(1) B. P. D. asks: 1. Would a common cast iron, such as is used for making plows, answer for an engine cylinder 2 x 4 inches? A. It will be better to make the cylinder of brass. 2. What size of boiler would be necessary to run the engine for one or two hours daily, or would a horizontal or upright be best? A. A boiler such as is used in connection with a water back will answer very well, and you can get all necessary information from a plumber. 3. How much pressure would be best? A. Carry a pressure of 15 or 20 lbs.

(2) J. G. asks: What proportion of heat will a pound of iron, completely burnt, yield compared with a pound of anthracite coal? A. About one fifth as much.

(3) J. W. F. says: P. M. B. says that a boat screw, 4 feet in diameter and of 6 feet pitch, run at 120 revolutions, makes 9 knots, thus showing a negative slip of 9·1 per cent. What kind of a screw does he use to give this result? A. Probably he is in error, either as to speed of boat or pitch of screw. What is called 9 miles an hour is sometimes only a guess.

(4) F.C. says: I am working a vacuum engine close to a boiler, with ⅝ inch pipe, giving ample steam. I wish to remove the engine to a distance of about 600 feet. The pipe will have to be run partly in the open air, partly through a long shed, and partly under a street, and I would like to know the best description of covering, size of pipe, etc., and if it will be necessary to put a steam trap near the engine. A. Use a pipe about 1 inch in diameter, well felted, and attach a trap near the engine. Avoid as much as possible abrupt changes in the direction of the pipe.

(5) B. C. & Co. ask: How can we separate silver from tin and lead? A. Cupel the alloy.

(6) I. H. F., of Flekkefjord, Norway, asks: Are oak bark ashes (from under the boiler in a tannery) considered as good as wood ashes for fertilizing purposes? A. Yes.

(7) E. H. asks: What is the cause of what is called the sun's "drawing water?" It is an appearance of lines running from the sun to the horizon. A. The sun's rays passing through the interspaces of clouds. When reflected, the rays sometimes converge.

(8) G. F. P. S. asks: 1. Is the plane of the moon's orbit always parallel to itself? A. No. 2. When does the line formed by the intersection of the moon's and earth's orbits point to the sun? A. When the new or full moon is at one of its nodes. 3. Does not the moon have the greatest altitude at night in winter when passing the meridian? A. No. Greatest meridian altitude of the moon is 77° 18′, at summer solstice. Least, 20° 6′, occurs at winter solstice.

(9) N. P. asks: Will the lenses of a magic lantern answer for a small telescope for night use? A. Not well. To try any two lenses as a spyglass, the one of longest focus is to be placed in one end of a paper tube as objective, the other is placed in a paper tube which slides within the first. Separate the two lenses the sum of their focal lengths, then contract the aperture by cardboard stops until you get some kind of definition.

(10) J. P. asks: Has the earth two or three motions? A. An infinite number of perturbing forces vary the earth's motion. Each periodic movement in the solar system communicates its rhythmic oscillation to all its members, whether sun, planet, or meteorite.

(11) R. R. D. says: I wish to make a translucent covering for hotbeds, of cloth instead of glass. One man recommends covering with 2 ozs. lime water, 4 ozs. linseed oil, 3 ozs. fresh eggs. Another recommends 1 quart linseed oil, 1 oz. pulverized sugar of lead, 4 ozs. pulverized rosin. These are to make the cloth waterproof and airtight. Which is the best of the two? A. The latter.

(12) K. asks: How many books did Euclid write? A. There were 13 of the original books written or arranged by Euclid. Most modern works on geometry contain the substance of the original work.

How arose the inequality in the number of days in the different months? A. It has been taken from the reckoning of the Romans, by whom it was fixed in the time of Julius Cæsar.

Would it be necessary to steam the planks for building a boat 17 feet long by 4 feet wide, of cypress, ½ inch thick? A. No.

(13) C. B. H. says: 1. The journals of the rollers in rolling mills are usually kept wet by a constant stream of water running upon them. A kind of oil or roll grease is used on such journals, and it is capable of withstanding the action of the water. What is its composition? A. It must be some kind of grease, such as tallow, that is solid at ordinary temperatures. 2. I have a well which produces the best quality of lubricating oil; can I use this oil to produce the above roll grease for wet journals? A. It is doubtful if you can.

My well produces an abundance of gas, which, when confined, gives 30 or 40 lbs. pressure; can I utilize this gas in running an engine, using the gas instead of steam? A. An ordinary steam engine will answer if it is well made. If, however, the gas when mixed with air forms an explosive compound, we advise you not to try the experiment.

(14) C. H. S. asks: How fast can cut cog gearing be run? A. The sudden acceleration and retardation of the wheel make trouble with these gears. It is not possible to definitely answer your question.

(15) C. B. W. says: 1. We have a 1 inch pipe, 1,800 feet long, through which we get water. We have about 80 feet head, and lift the water 15 feet with a siphon, 400 feet of the pipe forming the siphon. If the 400 feet of the pipe forming the siphon were larger, would we get any more water delivered through the 1 inch pipe in the same time? A. There is not likely to be any advantage in changing the pipe. 2. How much pressure would this head of water give? A. A head of 80 feet corresponds to a pressure of nearly 35 lbs. per square inch.

(16) J. O'C. asks: What is the use in making the face of a pulley crowned? Are not pulleys frequently made flat? When two shafts with their pulleys are properly ranged with each other, the faces of the pulleys being flat, will not the belt run evenly on them, and no more to one side than the other? If the faces are crowned, and the shafts not parallel, the crowning will not keep the belt even on the pulleys. A. The object of crowning pulleys is to correct slight inaccuracies in lining the shafting, and those arising from the belt being crooked. It is true, however, that there are very many places in which flat pulleys are used with good satisfaction.

(17) K. asks: 1. What size, pattern, and pitch should a propeller be for a 6x6 engine in a boat 30 feet long x 8 feet beam of good model, drawing 2½ feet astern? A. Three bladed, 30 to 32 inches diameter, 40 to 42 inches pitch. 2. What number of revolutions of such an engine, well constructed, would give the best result? A. About 300. 3. What speed ought I to get in smooth water? A. From 8 to 9 miles an hour.

(18) G. F. asks: What is the amount of moisture contained in a cubic foot of air on a warm damp day? A. About 0·0599 of 1 lb.

(19) B. E. E. asks: 1. Can the solution described on p. 55 of vol. 32 be used to preserve the hull of a yacht? A. Yes. 2. Can it be put on after the yacht is built? A. No, as the wood requires to be steeped for some time in the solution in order that it may become thoroughly impregnated by absorption of the liquid. 3. Can I paint over it? A. Yes.

(20) M. B. L. asks: 1. I have a 12 inch 4 ply belt, driving a shaft 35 feet distant. I have occasion frequently to reverse, and I find that often, when it is working true, the belt has a strong tendency to run off on reversing. How can I correct this? A. It is probable that the belt is crooked, or the shafts are not in line. 2. What is the best plan of putting a large belt together where it has to be uncoupled frequently, saving of time and an effectual joint being the objects? A. We do not know of any fastening that will answer all of these questions. 3. What would you suggest as the best means of conveying power from a saw mandrel, 30 to 35 feet, to drive a propelling wheel of a boat, speed of mandrel being 300 or 400 and of wheel 30 or 40? A. A chain running over suitable pulleys would be the best.

(21) A. B. says: 1. We have a new boiler and cistern beneath the door of our engine house, built of brick and coated with water lime. Beside furnishing steam for heating our factory, the boiler supplies steam for running the engine, and the exhaust steam from the cylinder passes up through the factory (by a system of pipes separate from that used for heating direct from the boiler) and thence into the cistern beneath the level of the water. By this arrangement little of the heat is lost except what passes out of the smoke stack. As no water is wasted, it is used over and over, and will become practically as pure as distilled water, and so leave no sediment or incrustation on the boiler. The water in the cistern is now quite hard by reason of the fresh lime, and this will for a time cause a deposit of lime in the boiler. What will soften the water or cause the precipitation of the lime before the water is pumped into the boiler? A. Mechanical means, such as a heater with sediment collector, would probably be the best. If, however, your cistern is arranged to be supplied by drainage from the roof when it rains, introduce a little soda with the feed into the boiler, and blow off frequently, until the cistern becomes filled with soft water. 2. What gases are produced by an explosion of gun cotton, and are they of a nature to injure a metallic surface? A. The products of the explosion vary greatly according to circumstances, but they are not ordinarily injurious to a metallic surface.

(22) C. W. N. says: Please explain your reply to Z. as to the expansion of gases by heat. If the gas increases its volume $\frac{1}{273}$ part for each degree C. of the rise in the temperature, it would double the volume existing at zero at a less temperature than 273°, on the principle of compound interest. If at 273° below zero, the gas is all gone, what will be the result when you heat up again? Supposing you reduce the temperature to −136½°, in accordance to your answer to Z. you will have half the volume that you commence with. Now you must (according to Z.) increase the temperature 273° to recover the half you lost by reducing 136½°, that is, to double the volume attained by reducing the temperature. A. It is true that some contradiction is involved in the statement generally given in text books on physics. It is only within finite limits that it is correct to say that the volume is increased or diminished $\frac{1}{273}$ for such change of temperature of 1° C. A more correct method of stating the law is as follows: If the product of the pressure and volume of a gas at 0° C. is given, the product of these two elements will be increased by $\frac{1}{273}$ of the amount at zero, for each increase of temperature of 1° C., and will be diminished in like proportion for each diminution in temperature of 1°. It will be observed that the increase or decrease is referred to the pressure and volume of the gas at a temperature of 0° C. Below is given the analytical statement of the law: p=pressure of the gas in pounds per square inch, at a temperature of 0° C. P=pressure at temperature T° C. v=volume of a given weight of the gas in cubic feet, at a temperature of 0° C. V =volume of same weight, at temperature of T° C.

$$P\times V=p\times v+\frac{T^\circ}{273}\times p\times v.$$ Now if T°= 273°, P×V=0, a condition that does not involve the annihilation of matter, and merely expresses that the gas no longer exists as gas. (This also answers J. J. T.)

(23) C. W. N. says: 1. You advise H. M. to use a 2 feet diameter wheel with a 3 feet lead for 300 revolutions per minute. We are using a 28 inch wheel with 55 inches lead (4 buckets) on a boat 36 feet long and of 6 feet 6 inches beam. Our cylinder is 6x5, and with 90 lbs. of steam we have run our wheel at over 310 revolutions per minute. We find, however, that this is a great waste of power, as the wheel appears to lose most of its propelling force and does nothing but churn the water into a foam, and the speed is not so good as when we turn 200 to 230 revolutions. Next spring it is our intention to put on a three bucket wheel, same diameter, with 6 foot lead, which we think we can turn up faster (as it will take all the water that comes to it, through larger openings between the buckets) and will drive the boat faster. Let us have your opinion on the subject. A. This will be an improvement. 2. Where should we cut off steam on this engine, and how much should it be open after the center is past? A. At from ⅝ to ¾ of the stroke, with a lead about $\frac{1}{16}$ inch on each end.

Is the pressure on a steam boiler alike all over? A. It is greatest at the lowest point.

Is an injector practicable on a marine boiler? A. Yes.

(24) F. C. G. asks: Is taking the tin off tin scraps a successful business? A. During the past ten years; we have had the history of more than a dozen attempts, aided by ample money capital, to make a business out of tin scrap, which resulted disastrously. Last summer there were in this neighborhood five independent tin scrap establishments; now there is but one, and its proprietors are reticent.

(25) J. W. H. says: Fire balloons made of tissue paper occasionally take fire from the blaze of the alcohol. How can the lower part of the balloon be made fireproof? A. Try steeping the paper in a solution of tungstate of soda. See article on p. 55, vol. 32.

(26) E. B. McC. asks: 1. How can I bring tin to a liquid condition? A. We do not know of any method better than melting it. 2. How can I powder tin? A. Tin may be very finely granulated by first heating to bright redness and immediately pouring from some hight into a vessel of cold water through a wet broom or sieve.

(27) M. V. O. says: In your reply to C. W., you say that the water in the drive well rises by the pressure due to a higher source of supply. If this is true, what need is there of any pump at all, and why does not the water flow over the top of the pipe? A. Your view is correct; but our correspondent's question referred to the cause of the water rising up to the level from which it was taken by the pump.

(28) O. C. asks: 1. What is the difference between the composition of gunpowder and blasting powder? A. There is no essential difference. 2. Which wood makes the best charcoal for powder, balm of Gilead, cedar, soft maple, or willow? A. Willow.

Is ivory black anything but burnt bones? A. No.

(29) W. M. G. asks: Will water or any other liquid boil away faster in the night than in the daytime? A. Not if the other conditions are the same.

What is meant by the multiplication of the cube? A. Give an example to illustrate your meaning.

1. I saw it stated that the cylinders of the Great Eastern were 14 feet in length; should it not be 4 feet? A. No. Fourteen feet is correct. 2. Was there ever an engine with 14 feet stroke? A. There have been quite a number.

Will a water wheel run with more force in the night than in the daytime? A. No.

(30) A. B. D. asks: If a tank has a pipe, $\frac{1}{2}$ inch, running in, and a siphon, $\frac{3}{8}$ inch, running out, the tank being empty, when the pipe running in was opened, when would the water begin to run out? A. As soon as the water level was up to the highest point in the siphon.

I am making a small steam engine, 3 inches stroke by $1\frac{1}{2}$ inches bore. Would a boiler 28 inches high and 12 inches in diameter do, and of what thickness and metal should it be? A. Make it about twice as large, of $\frac{3}{16}$ copper.

How can I remove Indian ink marks from my arm? A. We are not sure that there is any safe method. See p. 331, vol. 30.

How can I bronze a gun barrel? A. Rust the surface with chloride of antimony, or dilute muriatic acid. Then clean it, polish with wax, and apply shellac varnish.

(31) L. B. C. asks: 1. Would a 10 horse power engine raise enough water to run an overshot wheel that would give 30 horse power? A. No. 2. Would a 3 inch stream on a 10 foot overshot wheel force an inch stream up a hill 100 feet? A. No.

(32) H. S. asks: What is the shortest correct rule for getting the amount of 1 inch lumber in a log, given the diameter and the length? A. We doubt whether any general rule can be given. Of course it is easy to find how much can be cut from the log after it is squared, but frequently there are several slab boards taken off in squaring. Lumbermen, however, by a little observation, can readily construct tables, by which to estimate the contents of any log.

(33) J. C. B. asks: In driving a pipe for a well, how do you determine when you have arrived at water? A. By applying a pump, or sounding.

Will sulphur answer as well as lead to secure iron to rock? A. Yes.

(34) D. H. W. asks: 1. To what class of mechanical powers does the wagon wheel belong? A. It is a lever, as in the case of a locomotive. 2. Which runs the lightest, an iron axled or a thimble-skeined wagon? The iron axle is $1\frac{1}{2}$ inches in diameter, and the thimble-skeined axle 3 inches. A. Probably the question cannot be answered in a general manner, as it depends upon the friction between the wheel and the axle, and consequently upon the fit. 3. Which is the fulcrum, the axle or the ground? A. In the case of a wagon propelled from within, as a locomotive, the axle is the fulcrum. If it is moved by the application of a force from without, and the wheels revolve, the ground may be regarded as the fulcrum. It is evident, in this case, that the wagon could be moved without revolving the wheels.

(35) M. G. asks: Which will resist most pressure, a $1\frac{1}{2}$ gas pipe, or a $1\frac{1}{2}$ inch solid rod? A. The solid rod, if the material were of the same quality in each, because the section to resist rupture would be greater.

(36) G. P. asks: What causes a lathe to chatter? A. The springing of the tool or of the bar. It may be that the lathe is too light for the work.

(37) W. H. H. G. asks: Will a four-ply rubber belt be suitable for a fish elevator, the belt coming into contact with salt water and fish slime? A. We think not.

What is the process of deodorizing kerosene with chloride of lime? A. The oil is mixed with lime and heated, then treated with sulphuric acid, and washed with water.

(38) J. N. M. says: Some years ago, experiments were tried in running horse cars by means of compressed air, which was supplied in a strong reservoir at the beginning of the route. Why might not the power of a windmill be applied to condensing air into a large receiver, and the supply of condensed air used as a regular and constant motor for light or heavy machinery? A. The idea seems good. The only way to settle definitely, whether it is so or not, is to try it.

(39) J. H. S. asks: 1. Would a cast iron tank of 1 cubic foot capacity or less, to be heated over a forge, do for melting zinc for galvanizing? A. Yes. 2. What should be used to keep the zinc from oxidizing and vaporizing? A. Use sal ammoniac with the zinc. 3. Would a hemispherical tank answer best? A. Yes.

(40) J. F. G. says: Our water reservoir is 2 miles distant, and 160 feet above our mill. What size of pipe must be laid from the reservoir to the mill, so that the natural pressure of water (at the mill) will throw a stream of water 100 feet high by the use of 50 feet of $2\frac{1}{2}$ inch hose and a $1\frac{1}{4}$ inch nozzle? A. It will depend upon the way the pipe is laid. If it is generally straight and free from abrupt changes of direction, it should be from 5 to 6 inches in diameter.

(41) F. L. K. asks: What wood makes the best patterns for light castings? A. Pine, covered with shellac, answers very well. Mahogany can be used for very nice work.

If small copper tubes be fixed in a mold, and melted brass be poured upon them, will the tubes melt or collapse? A. They would be very apt to melt.

Is there an injector that uses the exhaust steam? A. We do not know of any.

1. What are the holes through the side of the firebox of a locomotive for? A. To admit air into the combustion chamber. 2. How can small leaks at seams and stays be stopped? A. By caulking. It is well to attend to small leaks promptly. 3. Would not the electric light be used as a head light for locomotives? A. It would not be desirable, but it might be done. 4. How much coal will a 40 tun engine burn (on a level) to the mile, pulling a train of 20 cars weighing 10 tuns each, the diameters of the drivers being 4 or 5 feet? A. From 40 to 50 lbs. 5. Why is zero on the Fahrenheit scale 32° below the freezing point of water? A. Because Fahrenheit considered the zero of his scale to be the greatest cold that could be produced.

(42) R. A. I. says: I read that steam at high pressure will not scald. Is this true? A. The statement is to be taken with considerable allowance; but the steam issuing from a tea kettle is far more likely to scald than the same quantity coming from a high pressure boiler.

(43) J. A. V. says: In your answer to W. C. R. (who asks whether, if he should take a cylinder of air with 100 lbs. pressure to the square inch, place it on a small boat, and let the air escape, the air on the outside traveling in the same direction and at the same speed as that coming out of the cylinder, it would move the boat or not) you say that the boat would move. What would make it do so? A. The unbalanced pressure opposite the place of discharge.

(44) W. M. C. asks: 1. The cylinder of my engine is of $2\frac{3}{4}$ inches bore and 4 inches stroke. By carrying 80 lbs. steam, making 150 revolutions per minute, how large a yacht can be propelled? A. Make the boat from 20 to 25 feet long. 2. How large a screw ought to be used? A. From 2 to $2\frac{1}{4}$ feet in diameter. 3. Ought the boiler to be vertical or horizontal? A. Vertical.

(45) H. W. asks: Can I ascertain the power of a locomotive from the diameter of cylinder, length of stroke, diameter of driving wheel, number of wheels connected, and weight of engine? A. No. The weight on the drivers must be given. If you suppose, however, that the adhesion is greater than the tractive force, the solution is very simple. We give the rule by which you can make the necessary calculations. The tractive force in pounds is found by multiplying together the square of the diameter of the piston in inches, the length of stroke in inches, and the pressure of steam in lbs. per square inch, and dividing the product by the diameter of the driving wheel in inches.

(46) H. L. N.—You cannot restore the peculiar finish to a knife unless you employ the original mechanism by which it was produced, namely, an emery grinding wheel and a walrus leather polishing wheel.—W.

(47) J. N. P. says: 1. I am making a small engine, of which the dimensions are as follows: Diameter of cylinder 3 inches, stroke 4 inches, with cut-off at crank angle of 135°, with lead. Exhaust closes at crank angle of 157·5°, and opens at extremity of the stroke. Ratio of crank to connecting rod is 1 to $5\frac{1}{4}$. I propose to use steam at 50 lbs. pressure; what would be the proper dimensions and style of a boiler for the engine, to make steam quick and use the minimum of coal? A. You should have a boiler with from 60 to 70 square feet of efficient heating surface. 2. What do you think of the dimensions of the engine? A. They are well proportioned. 3. I have discarded the slide valve, and am going to have two cylinders side by side, and use two pistons in the smaller to take the place of the slide valve; I thereby will save a greater part of the steam lost in the long ways incident to the slide valve, and avoid the enormous friction of the same. It has probably never occurred to many that, in order to move an ordinary slide valve 8 by 10 inches with steam at 80 lbs. pressure, it would require two draft horses doing their be t, if attached directly to the valve stem, with no lubricant under the valve. A. We think this idea is in general very good. 4. I want to use an injector and indicator; can these instruments be used on so small an engine, and do I need verbal instruction as to their use? A. You can probably learn how to apply and use them by practice, and by studying the theory of their action. 5. How many revolutions will the engine make with 50 lbs. pressure, and no load except the friction of the engine? A. The engine might make 500 or 600 revolutions a minute.

(48) R. T. M. asks: 1. How much per cent of alcohol does lager beer contain? A. The strength of beer varies according to the quality and quantity of the malt and hops used, and the mode of conducting each stage of the process, but especially the fermentation. If the first fermentation be stopped at an early stage, the beer will contain a considerable quantity of sugar and comparatively little alcohol; it will be mild, and if bottled will acquire the property of effervescing strongly when the bottle is opened. If, on the other hand, the fermentation be allowed to go on in the vats or casks till nearly all the sugar is converted into alcohol, and the carbonic acid escapes, the beer becomes more alcoholic. For these reasons, lager beer varies in its amount of alcohol from 2 to 10 per cent. 2. Can a grown person drink a pint of alcohol without being hurt? A. It would probably cause death.

(49) W. M. R. asks: Will strong sulphuric acid injure leather? A. Yes.

(50) H. J. S. says: Wells, in his "Philosophy," defines sound as produced by impressions made on the tympanum or drum of the ear by the vibrations of the air. If a cannon be fired far out of the hearing of any animal with the sense of hearing, would there be any sound therefrom? A. Certainly not, under the above definition of sound.

(51) O. W. B. asks: 1. Does soaking a flute in olive oil benefit it in any respect? A. We think it might possibly prevent the wood from becoming dry and cracking or warping. 2. Why are flutes with ivory heads and blow joints better than those with wood? A. The ivory prevents the instrument from getting out of tune by preserving the blow and key holes at a constant diameter. The common wooden instruments, in many cases, in a short time become utterly useless from the contraction and expansion of the wood.

(52) S. L. M. asks: What is the amount of expansion of an iron rod $1\frac{1}{4}$ inches in diameter and 35 feet long, when the thermometer rises from 10° to 75° Fah.? A. About $\frac{1}{8}$ of an inch.

(53) L. V. R. asks: How can I ascertain the number of degrees of heat required to reduce a certain metal to fusion? A. One method is the use of the pyrometer. As mercury boils at about 660°, we cannot use the mercurial thermometer for higher temperatures. The pyrometer consists of a hollow case of black lead or plumbago, into which is dropped a bar of platinum, secured to its place by a strap of platinum and a wedge of porcelain. The whole is then heated, as, for instance, by placing it in a pot of molten silver, whose temperature we wish to ascertain. The metal bar expands much more than the case of black lead, and, being confined from moving in any but an upward direction, drives forward the arm of a lever over a graduated arc, on which we read the degrees of Fahrenheit's scale. There are several forms of pyrometer, but their use for delicate work is not customary now. The arrangements now used for the determination of high melting points with the greatest accuracy are either based upon the expansion of gases and vapors, or on the electrical properties of bodies. For details, consult Ganot's "Physics."

(54) S. P. asks: Will petroleum gas answer as well as coal gas in forming a lime light? A. Yes.

(55) J. S. asks: 1. What coloring is put into spirits of wine for use in thermometers? A. The coloring made use of generally for this purpose is, we believe, annatto. 2. How can I make an alcohol thermometer? A. Obtain a glass tube having a very small even bore, and having a coil at its lower end. Fill the coil and a portion of the stem of the thermometer with the colored liquid, and boil until the air is completely expelled from the tube, which should then be hermetically sealed with the blowpipe. These thermometers are usually graduated by placing them in baths of different temperatures together with a standard mercurial thermometer, and marking on the alcohol thermometer the temperature indicated by the mercurial thermometer.

How can I mend rubber shoes? A. See p. 203, vol. 30.

(56) C. G. M. asks: 1. To whom should I apply for a license to run a steam engine? A. If it is for a license to manage a steamboat engine, you should apply to the United States Inspector. If it is for a stationary engine, there is probably a State or city inspector in your city. The customs vary in different States. 2. What are the usual questions asked by the examiner? A. The questions ordinarily refer to the applicant's previous experience, and his knowledge of the construction and management of engines and boilers.

(57) J. C. asks: What is the standard of comparison in the determination of the calorific value of fuel, and upon whose investigations is it based? In different books I find it stated that, by the combustion of one pound of carbon, sufficient heat is produced to increase the temperature of from 13,000 lbs. to nearly 20,000 lbs. of water 1° Fah. By some authors it is stated at 8,000°, 8,080°, etc., C. What is the present acknowledged standard? A. The unit usually employed is that first used by Rumford, who estimated the calorific power by the number of parts, by weight, of water which one part, by weight, of the body would, on perfect combustion, raise 1° in temperature. Thus one part, by weight, of charcoal, in combining with $2\frac{2}{3}$ parts of oxygen to form carbonic acid, will evolve heat sufficient to raise the temperature of 8,080 parts, by weight, of water 1° C. Estimates of this character are also made by what is known as Berthier's and Stromeyer's reduction methods. These processes consist in determining the quantity of either cupric or plumbic oxides reduced by a given quantity of the fuel.

(58) J. A. S. J. asks: How can I stain pine coffins black, to dry quickly? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved, then put a handful of logwood, cut small, into a pint of water, and boil down to less than $\frac{1}{2}$ pint. If a little indigo is added, the color will be more beautiful. Spread a layer of this liquid quite hot upon the wood with a soft brush, which will give it a violet color. When it is dry, spread on it another layer; dry it again and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry rub it with a brush and then with oiled chamois skin. This gives a fine black, and imitates perfectly the color of ebony.

(59) J. H. M. says: I have a small boat 48 inches from stern to bow, and 8 inches wide. How large an engine would it take to propel it? A. An engine with cylinder of one inch diameter will answer.

(60) E. M. asks: What will remove grease stains from marble? A. Try chloroform.

What will remove a beard from the face without using soap or razor? A. A depilatory will destroy the beard so that no future growth will take place. See p. 229, vol. 28.

(61) B. F. W. asks: 1. What is the reaction by which hydrogen is evolved when metallic zinc is boiled with K O H, and what chemical compounds are formed? A. By the action of a boiling solution of potash on zinc, hydrogen is liberated, while oxide of zinc is formed and dissolved in the alkaline solution. 2. What effect does the presence of an arsenious compound (As_2O_3) have on the reaction and the resulting compounds? A. The arsenious acid would speedily be absorbed by the potash to form arsenite of potash.

(62) C. M. F. asks: What is a good recipe for boot blacking? A. Ivory black and molasses, each 3 ozs., spermaceti oil 1 oz., white wine vinegar, 1 pint. Mix.

Can I obtain back volumes of the *Science Record*? A. Yes.

(63) S. A. E. asks: How are artesian wells bored? A. For a full description of the method of boring these wells we must refer you to some work on the subject. The instruments used for this purpose principally consist of long augers, chisels, gouges, etc., each one being about 7 feet long. As the hole deepens, fresh lengths are screwed on until the desired stream is reached. The most remarkable example of an artesian well is that recently formed at Grenelle, a suburb at the southwest of Paris, France, which cost eight years of difficult labor to perforate. The depth reached was about 1,800 feet. The water rose to the surface, and discharged itself at the rate of 600,000 gallons per hour. The artesian wells of Elbeuf and Tours, which were formed many years ago, overflow in never-varying streams; and the ancient artesian well at Lillers, in the Pas de Calais, has for seven centuries furnished a constant and equable supply.

How is salt obtained from brine? A. Evaporating pans are constructed of well riveted boiler plate, the shape being rectangular, the length about 30 feet, the width about 20 feet, and the depth 2 feet. These pans are supported by masonry, which also serves to separate the flues by which the pans are heated. Professor Cook's analysis of Onondaga brine gives the following percentage of dry impure salt in the brine: Syracuse 18·54, Salina 14·85, Liverpool 15·86, an average of about 16·41 per cent.

(64) G. W. S. asks: 1. How can I make a cheap paint as nearly like white lead as possible? A. Use white oxide of zinc; this may be readily obtained by burning zinc with a full supply of air. 2. How can I bring it to a flesh color? A. Use carmine or vermilion.

(65) G. E. W. says: I cut to pieces a 2 cent piece and tried to melt it between two pieces of charcoal with a blowpipe and alcohol lamp, and failed. I tried borax with it and failed again. How can I melt it? A. If you use some filings of the coin and mix it with four times its weight of carbonate of soda, you should, if you are a good blowpipist, succeed with an alcohol lamp.

How can I make putty powder? A. It is readily obtained by treating metallic tin with nitric acid; violent action, attended with the extrication of nitrous fumes, occurs, and the tin is converted into a white, crystaline, insoluble mass, which is hydrated metastannic acid; after washing it with cold water, the acid, when dried and ignited, becomes anhydrous, and of a pale buff color; in this form it possesses the properties of the native oxide, and constitutes the putty powder employed for polishing plate, etc. It is also largely used for giving whiteness and opacity to enamels.

(66) G. W. W.—The reward offered by the State of New York for improved means of canal navigation expired and was settled over a year ago. No offer of reward now exists that we know of.

(67) R. D. A. says, in reply to J. G. S. who asked for a cheap paste for putting up paper exposed out of doors: Take 1 lb. white glue, soak in 1 pint water for 12 hours, white chalk 2 ozs., common resin 1 oz., white lead 2 ozs., all thoroughly pulverized and mixed. After the glue has stood the required time, dissolve it by gentle heat, then rub into it, in a mortar, the other ingredients, using only water enough to make a thick paste, in order to facilitate their union. Then add 1 pint more of water and let it boil for 10 minutes; after which add water to bring the paste to the required consistence for use. It will require to be kept warm while using.

C. H. S. asks: At what velocity must a cannon ball leave the earth so as never to return to it?—E. F. W. asks: How can I make carbons for electric lights?—J. H. asks: How can I blue lamp chimneys?—J. R. G. asks: How can I construct a cheap oxyhydrogen blowpipe?—O. F. asks: What formula is used to find the power of a wedge, having the width of the head, length of one side, and the blow in pounds given?—A. C. asks: What is the composition of percan marble?

COMMUNICATIONS RECEIVED.

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

On Spiritualism. By G. W.
On Mathematical Facts. By P. J. D.
On Fast Railway Trains. By E. H. W.
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Also enquiries and answers from the following:

J. F. E.—J. T. C.—W. H. W.—C. E. H.—C. H. H.—R. A. B.—G. T. C.—R. H. L.—R. D.—H. B. H.—J. B. M. B.—D. D. H.—G. McI.—L. K. D.—P. T. P.—H. N. S.—J. H. P.—J. R. G.—C. M.—E. H.—F. J. K.—C. W. W.—W. S. D.—P. M.—H. J. E.—H. B.—E. A. S.

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 enquiries analogous to the following are sent: "Who makes the best leather for hydrostatic press packing? Who makes springs suitable for running a model locomotive weighing 250 lbs.? Who makes a centripedal power? Who makes steam engines of one dog power? Where can the drosera and other carnivorous plants be obtained? Who publishes a good book on steam engines, etc., suitable for beginners? Who makes apparatus for producing illuminating gas from crude petroleum?" All such personal enquiries 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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31,182.—WOOD-BENDING MACHINE.—H. McDonald.
31,211.—SEWING MACHINE.—L. W. Langdon.
31,214.—SEWING MACHINE.—Q. Rice.
34,203.—BOOT SEWING MACHINE.—F. D. Ballou.
39,199.—CURRY COMB.—S. J. Wheeler.

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31,172.—NEEDLE.—G. Cooper.
34,203.—BOOT SEWING MACHINE.—F. D. Ballou.

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8,045, 8,046.—CARPETS.—R. Allan, Yonkers, N. Y.
8,047.—FARM BOILER.—W. C. Davis, Cincinnati, O.
8,048.—CARBURETER.—M. B. Dyott, Philadelphia, Pa.
8,049.—POCKET-BOOK FRAME.—J. C. Hacker, Brooklyn, N. Y.
8,050.—OIL CLOTH.—C. T. Meyer *et al.*, Bergen, N. J.
8,051.—GLOVE BOXES.—M. Murray *et al.*, Johnstown, N. Y.
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8,053.—BRACKET CUP.—J. Kintz, West Meriden, Conn.
8,054, 8,055.—LOUNGES.—J. B. Rother, Philadelphia, Pa.
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2,214.—KID GLOVES.—Harris Bros., New York city.
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2,216.—FABRICS.—E. R. Mudge & Co., Boston, Mass.
2,217.—CIGARS.—G. Wiener, Philadelphia, Pa.
2,218.—RUBBER MOUNTINGS.—A. Albright, Newark, N. J.
2,219.—STOVE POLISH.—Fischer & Co., New York city.
2,220.—REFRIGERATORS.—J. H. Fisher, Chicago, Ill.
2,221, 2,222.—DRY GOODS.—Flaxland & Co., Paris, France.
2,223.—WHISKY.—Jenkins & Co., Richmond, Va.
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2,226.—PERFUMERY, ETC.—S. C. Upham, Philadelphia, Pa.
2,227.—CIGARS.—White & Mecracken, Des Moines, Iowa.

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4,358.—J. Taylor, Toronto city, Ont. Burglar-proof safe Feb. 3, 1875.
4,359.—W. Lamb, Green Bay, Wis., U. S. Wire rope carriage movement. Feb. 3, 1875.
4,360.—A. F. Gue, Eastmanville, Mich., U. S., *et al.* Railway train brake. Feb. 3, 1875.
4,361.—H. Rogers and S. Moore, Sudbury, Mass., U. S. Making boot counters. Feb. 8, 1875.
4,362.—J. I. O'Brien and C. C. Contrell, Brooklyn, N. Y., U. S. Weaving fringe headings. Feb. 8, 1875.
4,363.—J. G. Evenden and F. C. Wilson, Chicago, Ill., U. S. Measuring pump. Feb. 8, 1875.
4,364.—A. Heatherington, Halifax, N. S. Ore amalgamator. Feb. 8, 1875.
4,365.—P. Miles, New York city, U. S. Tub bail fastening. Feb. 8, 1875.
4,366.—C. H. Parker, Robinson, P. Q. Water wheels. Feb. 8, 1875.
4,367.—A. M. Miller and M. M. Miller, Sturgis, Mich., U. S. Bag fastener. Feb. 8 1875.
4,368.—B. F. Barker, Curtisville, Mass., U. S. Grinding wood for paper pulp. Feb. 8, 1875.
4,369.—Wm. E. Lawrence, New York city, U. S. Curry comb. Feb. 8, 1875.
4,370.—J. Lemay (dit Delorme), Montreal, P. Q. Dumb stove. Feb. 8, 1875.
4,371.—G. I. D. Barnjum and Wm. F. Deal, Montreal, P. Q. Speed motion. Feb. 8, 1875.
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4,374.—C. C. Moore, Elizabeth, N. J., U. S. Chewing gum candy. Feb. 9, 1875.
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4,385.—A. Baldwin, Keokuk, Iowa, U. S. Stove radiator and damper. Feb. 11, 1875.
4,386.—E. M. Law, Bell Ewart, Ont. Car coupler. Feb 11, 1875.
4,387.—J. G. Taylor and H. F. Taylor, Brasher Falls, Ont. Horse power. Feb. 12, 1875.
4,388.—W. W. Lewis and J. Mitchell, Cincinnati, Ohio, U. S. Rolling horseshoe blanks. Feb. 12, 1875.

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THE STUDY AND CONSTRUCTION OF TOOTHED GEAR.—Involute, cycloid, and epicycloid. Involute. Cycloid. External epicycloid, described by a circle rolling about a fixed circle inside of it. Internal epicycloid. Delineation of a rack and pinion in gear. Gearing of a worm with a worm wheel. Cylindrical or Spur Gearing. Practical delineation of a couple of Spur wheels. The Delineation and Construction of Wooden Patterns for Toothed Wheels. Rules and Practical Data.

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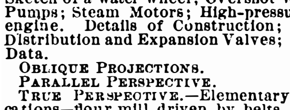

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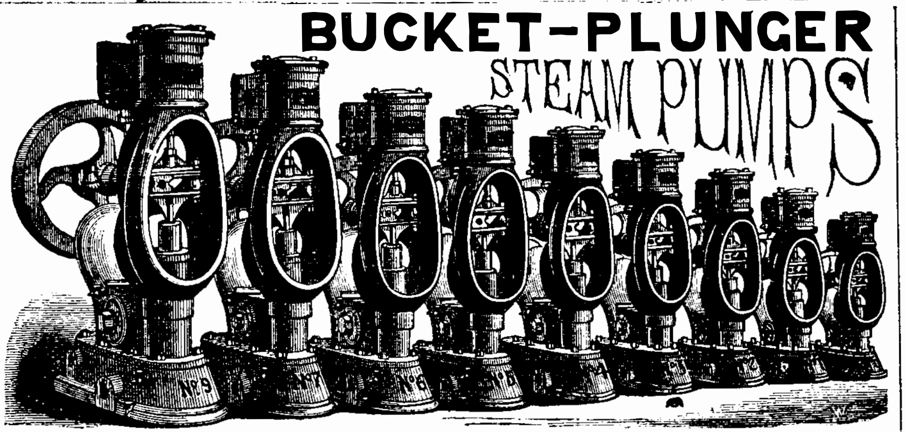

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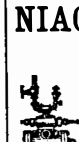

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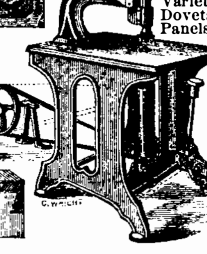

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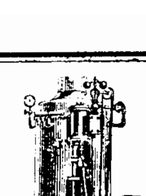

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