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IMPROVED FLOODWAY FOR WAREHOUSES.

It is frequently the case, when small conflagrations break out in buildings, that the water thrown in to extinguish the fire does more damage than the flames themselves. Percolating through flooring, it deluges the apartments and their contents below, ruining plastering and soaking goods and furniture, often despite the efforts of the insurance patrol to save the latter from injury. The same takes place when, through freezing or other causes, the water pipes burst, in case of an overflow of tanks, basins, etc., or when bad leaks occur in the roof, necessitating considerable outlays for repairs or to cover the losses.

The invention illustrated in the annexed engraving has for its object the prevention of this flooding. It consists of a metallic pipe, A, leading continuously from the top floor of the building to the street sewer or drain. Metallic water ways or collecting basins are sunk in each floor at the point where the pipe passes through, and these communicate with the pipe by a suitable opening in the latter, which is covered with wire gauze in order to prevent the entrance of obstacles. Each basin is provided with a grated cover, as shown in Fig. 2, which, being flush with the floor, will enable the whole floor space to be occupied. If desired, the leader from the roof may be turned inward and also connected with the pipe (avoiding the use of an outside leader), extending the full height of the building, and allowing the same to be built in the walls or otherwise, so as to be out of sight.

The use of the invention is graphically told by our large engraving. The water, instead of accumulating on the floor and finally making its way through, as is shown to be the case in the building on the right, runs into the basins and thence down the pipe. As many pipes as may be desired can be employed, suitable diagonal connections led across the cellar serving to attach their lower ends to the sewer conduit.

Fig. 3 illustrates a form of water way or basin which is provided with a swinging valve, A, to prevent back flow of air or water. The valve is rubber-lined at the edges.

The patentee, in his circular, gives the following information:

1. The object of this invention is to provide a means of preventing warehouses and other buildings from being flooded in case of fire, as is now commonly the case when a fire breaks out in any of the upper stories of a building and thereby to save a large amount of goods, which might otherwise be destroyed by water soaking through the floors to the rooms below, often, despite the efforts of the insurance patrol, exceeding the damage done by the fire itself, thereby reducing the risk to a considerable extent.

2. It is an auxiliary to the fire department, as firemen can more readily get at, handle, and safely dispose of goods and valuables, on the floor where the fire exists (without scuttling), at the same time rendering the covering of the goods, or the removal of the same from the floors below, in most cases entirely unnecessary, facilitating generally the saving of goods and valuables, as well as time and labor.

3. The invention also provides a means of escape for water

in case of pipes bursting from frost or otherwise, which, if not checked immediately, would cause great damage both to building and property contained therein. And furthermore, the leader from the eaves may be turned inward, so as to conduct the water from the roof into the pipe or pipes, and thereby utilize them and save the additional cost of a full length leader, as ordinarily applied to the outside of buildings.

4. It is always ready for use without any personal aid, and requires but little or no attention in any building, whether occupied or not. The arrangement is such that no impure air can enter the building from the main pipe.

5. It also affords protection to expensive ceilings, valuable furniture, and other property, in case of an overflow of basins, tanks, etc. It is also a protection in case of bad leaks occurring in roofs.

6. The apparatus is simple, complete, and effective, and can be applied to buildings of any description, old or new, in any part of the floors or walls, without the slightest injury, so that the whole can be occupied as though it did not exist. It simply has the appearance of a register, which can be made as ornamental as desired, at so small an expense, and with so little trouble, that property owners generally (both real and personal) should not fail to give it their immediate attention.

In short, it is the one thing substantially needed for the purposes herein set forth and described, principally in cases of fire. Architects, builders, insurance companies, and the public generally are respectfully invited to examine the same.

Patented through the Scientific American Patent Agency, July 6, 1875, by Mr. John H. Morrell. Patents have also been secured in Europe and Canada. For further particulars address or apply at The Morrell Storage and Safe Deposit Buildings, corner Fourth avenue and 33d street, New York city, where it can be seen in use.

Safety Valve Tests.

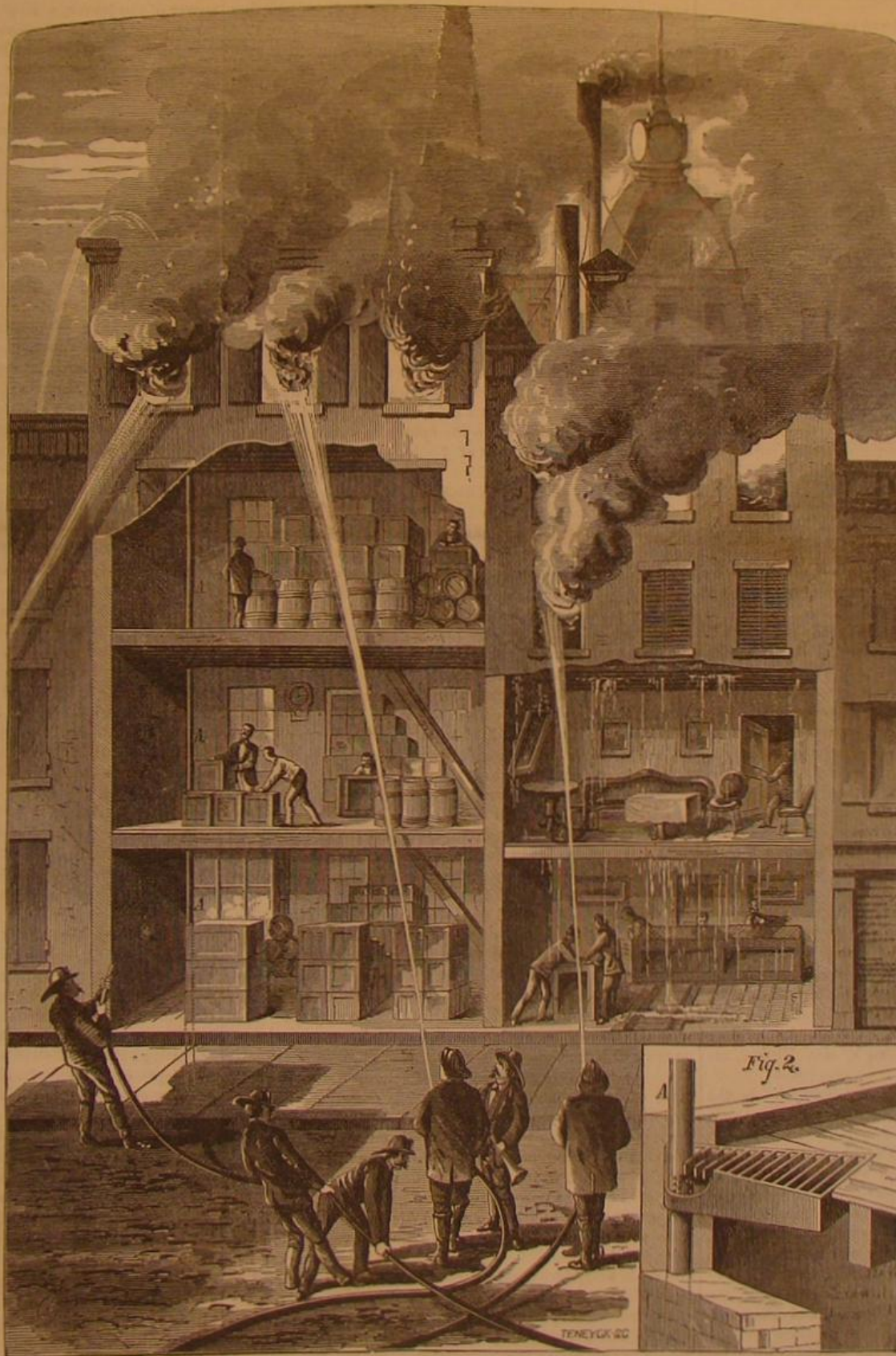
A committee appointed by the Board of Supervising Inspectors of Steam Vessels begin a test of steam boiler safety valves, at the Washington Navy Yard, on the 13th inst. All valves presented must have a uniform area of opening of five square inches, and will be submitted to the following trials (in competition):

1. Capability of discharging any excess of steam above a fixed working pressure.
2. The limits of pressure within which the valve will open and close.
3. Uniformity of action at different pressures.
4. Reliability of action under continued use.
5. Simplicity of arrangement and facility of management.

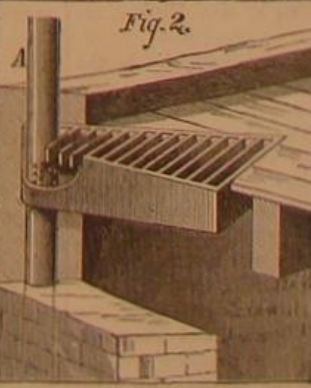
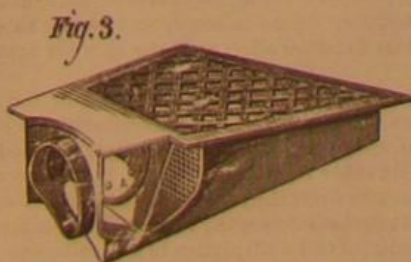
The valves will be tested at a pressure of not less than twenty nor more than eighty lbs. to the square inch, and are not required to be provided with an inclosing case. All

valves must be operated by the pressure of the steam, and the greatest diameter of opening for double seated valves will be the same as for single seated valves. The flange for attaching to boiler must be eight inches diameter—flat face, without bolt holes.

THE French government is considering a project for constructing a canal, by which the vineyards of the Rhone may be flooded as a remedy for the phylloxera. The canal will cost twenty million dollars, but it will bring into fruitfulness 60,000 acres of vine lands, which will yield forty million dollars annually.



MORRELL'S FLOODWAY FOR WAREHOUSES



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INSECT-EATING PLANTS.

The SCIENTIFIC AMERICAN for July 3, 1875, contained a page of engravings representing the principal plants which capture insects, with a summary of what had been published in regard to their strange habits. An immense addition to this new and marvelous department of knowledge has just been made in Mr. Darwin's "Insectivorous Plants," in which he sums up the results of some fifteen years of observation and experiment: a contribution to Science as noteworthy as his work on "The Fertilization of the Orchids," or that on "The Structure and Distribution of Coral Reefs," works which the most determined adversaries of Darwinism have not presumed to denounce as unscientific. More than half the volume, which comprises nearly five hundred closely printed pages, is devoted to the study of the common sundew of England, *Drosera rotundifolia*. Six other species of *Drosera* from various parts of the world were also brought under observation; also the Venus fly trap (*Dionaea muscipula*) of North Carolina; the aquatic *aldrovanda vesiculosa*; the fly catcher of the Portuguese, *Drosophyllum lusitanicum*; *roridula dentata*, from Cape of Good Hope; *byblis gigantea*, from Western Australia; several species of *pinguicula*, and a number of *utricularia*. The *nepenthes*, studied by Dr. Hooker, are merely noticed incidentally.

The characteristic feature of *Drosera rotundifolia* is the abundance of gland-bearing filaments—tentacles, Mr. Darwin calls them, from their manner of acting—which cover the upper surface of its round leaves. There are on the average about two hundred of these tentacles to each leaf; and as their terminal glands are always surrounded by drops of extremely viscid secretion, which glitter in the sun like dew drops, the plant gets from them its poetical common name. It gets more—and that is its living; for its short and simple roots are capable only of absorbing water. It is by means of the secretion of the glands and the inward bending of the tentacles that its prey are caught, digested, and absorbed. The glands are wonderfully sensitive to pressure and repeated touching; and when excited, the tentacles bend inward to the center of the leaf and remain inflected over the captured object according to the amount of nutrition it affords. Extremely minute particles of glass, cinders, hair, thread, etc., when placed on the glands, cause the tentacles to bend; but the inflection is not so energetic nor so persistent as when the exciting substance is organic and soluble. So sensitive are the glands that a bit of human hair, exerting a pressure of not more than a millionth of a grain, suffices to induce a movement of the tentacles. The pressure of the delicate feet of gnats causes them to be quickly and securely embraced. The tentacles are indifferent, however, to single touches and even hard blows; also to the repeated blows of drops of rain; greatly to the plant's advantage, Mr. Darwin

remarks, for it is thus saved from much useless movement. The absorption of animal matter and various fluids, heat, and galvanic action, also cause the tentacles to become inflated, the movement beginning in about ten seconds when a bit of raw meat is applied to a gland.

The bending of the tentacles is effected by a process of aggregation of the protoplasmic contents of the glands and tentacles. This aggregation is excited by all the stimulants which produce movement: the quickest and most energetic of the many stimulants tried being carbonate of ammonia, a dose of $\frac{1}{134400}$ of a grain sufficing. The process of aggregation goes on only as long as the protoplasm is in a living, vigorous, and oxygenated condition. Immersion in warm water causes the leaves to be inflected and increases their sensitiveness to the action of meat. Inflection is rapid at temperature between 115° and 125° Fah. Temporary paralysis ensues on exposure to 130°, but the leaves recover on being left for a time in cold water. Exposure to 150° causes death: so does prolonged exposure to 145°. Different leaves, however, and even separate cells in the same tentacle, differ considerably in their power of resisting heat.

By testing the leaves with various nitrogenous and non-nitrogenous fluids, Mr. Darwin found them able to detect with almost unerring certainty the presence of nitrogen. Results so obtained led to the enquiry whether the plant possessed the power of dissolving solid animal matter, that is, whether it really had the power of digestion like that that possessed by animals. Numerous experiments proved conclusively that the leaves of *Drosera* are capable of true digestion, and that the glands absorb the digested matter: the most interesting, Mr. Darwin thinks, of all his observations on this remarkable plant, as no such power had previously been known to exist in the vegetable kingdom. The resemblance of *Drosera* digestion to that of animals is singularly close. The digestive secretion is more copious in the presence of nutritive material, and is distinctly acid, like that of the animal stomach. It also contains a ferment closely analogous to or identical with the pepsin of animals, which is secreted only when the glands are excited by the absorption of already soluble animal matter. Albumen (hard-boiled egg), roast meat, fibrin, areolar tissue, cartilage, fibro-cartilage bone, milk, casein, legumin, and other substances were found to be acted on by the plant secretion precisely as by the gastric juice of animals. Fresh gluten was too strong for the plants; but after the starch was removed by treatment with weak hydrochloric acid, it was digested rapidly. Starch is indigestible, and so are epidermic substances, such as human nails, hair, quills of feathers, fibro-elastic tissue, mucine, pepsin, urea, chitine, chlorophyll, cellulose, gun cotton, fat, and oil: all of which are similarly unaffected by gastric juice, though some of them are acted on by other secretions of the animal alimentary canal. The plants are also, to a limited extent, vegetable feeders, having power to digest some parts of leaves, and to partially dissolve pollen and living seed. Like animals, too, these plants suffer grievously from dyspepsia, in case of surfeit, even of the most digestible substances.

The sensitiveness of the leaves to carbonate of ammonia has already been mentioned. Like effect, in varying degree, is produced by all the other salts of ammonia. The citrate is least, and the phosphate most, powerful. Of the latter, less than one twenty-millionth of a grain in solution, applied to a gland, is sufficient to cause the tentacles bearing the gland to bend to the center of the leaf. Many other salts were experimented with, the nature of the base proving, as in the case of animals, far more influential than that of the acid. Nine salts of sodium all caused well marked inflection, and none were poisonous in small doses; whereas seven of the nine corresponding salts of potassium produced no effect, two causing slight inflection. Some of the potassium salts were poisonous. The so-called earthy salts produced little effect; on the other hand, most of the metallic salts caused rapid and strong inflections, and were highly poisonous. To this rule there were some odd exceptions; for example, the chlorides of lead and zinc and two salts of barium did not cause inflection, and were not poisonous. Twenty-four acids were tried, much diluted: nineteen caused the tentacles to be more or less affected. Most of the acids were poisonous. Benzoic acid is very poisonous, though innocuous to animals. Many of the poisonous acids caused the secretion of an extraordinary amount of mucus, long ropes of it hanging from the leaves when they were lifted out of the solutions. Allied acids act very differently, formic acid, for instance, producing but slight effect, while acetic acid of the same strength is poisonous and acts powerfully.

A large number of vegetable alkaloids and other substances were experimented with, developing some very curious results. Substances like strychnin, nicotin, digitalin, and hydrocyanic acid, which act poisonously on the nervous system of animals, are also poisonously to *Drosera*, but probably excite inflection by acting on elements in no way analogous to the nerve cells of animals. The poison of the cobra, so deadly to animals by paralyzing their nerve centers, is harmless to these plants, though causing quick and strong inflection. The absence of nerve elements is made still more probable by the indifference of the plant to morphia, hyoscyamus, atropin, veratrin, dilute alcohol, and other substances which produce a marked effect upon the nervous systems of animals.

To summarise the physiology, so to speak, of the plant's sensitiveness, and the manner of its manifestation, would expand this article beyond limits. The structure and movements of six other species of *Drosera* have been studied though less extensively than those of the common sundew. They are all insect-catchers, using very nearly the same means. More wonderful in its adaptation to a carnivorous life is

the Venus flytrap, found only in the eastern part of North Carolina. Its poorly developed roots, like those of *Drosera*, are capable only of absorbing water, so that, lacking its prodigious habit, it would soon cease to exist. Its manner of catching insects and general behavior have already been described in this paper in the observations of Mrs. Treat. Like the sundew, it is extremely sensitive to the touch of edible matter, yet indifferent to rain drops and gusts of wind. This is the more remarkable in the case of the Venus flytrap, since it captures its prey, not by means of a viscid secretion, but by a sudden shutting of its leaves, trap-fashion. The digestive power of this plant varies somewhat from that of *Drosera*. The secretion from its glands dissolves albumen, gelatin, and meat, if too large pieces are not given. Fat and fibro-elastic tissue are not digested: nor is chemically prepared casein or ordinary cheese. The mechanism of the *Dionaea* trap is such that minute insects escape, while the relatively large ones are retained: an arrangement which Mr. Darwin regards as very beneficial to the plant, inasmuch as it would manifestly be a great disadvantage to the plant to waste many days in remaining clasped over a minute insect, and several additional days or weeks in afterwards recovering its sensibility. The amount of nutriment would not compensate for the effort. There is evidently room, however, for further investigation in this direction, since, owing to the limited digestive power of the leaves, a single large insect is often too much for them. As in the *Drosera*, the impulse which causes motion in the leaf travels in all directions through the cellular tissue, independently of the course of the vessels of the leaf. It was in this connection that Dr. Burden-Sanderson made his wonderful discovery that there exists a normal electric current in the blade and foot stalk of these leaves, and that, when the leaves are irritated, the current is disturbed in the same manner as during the contraction of the muscle of an animal.

The characteristics of the less known insectivorous plants will be summarized in another article.

COMPLETION OF THE HELL GATE EXCAVATIONS.

On July 4, 1876, the great explosion which is to shatter the submarine rocks at Hallett's Point and open a navigable channel for vessels of large draft, coming and going through Long Island Sound, to and from New York city will take place; such, at least, we understand to be the present intention of those in charge of the work. The excavations were completed about two months ago, and the operation now in progress consists in the boring of the holes in which the heavy charges of nitro-glycerin are to be placed. These borings are about half finished, and will require the labor of two or three months longer, after which two months more will be occupied in inserting the charges.

The entire surface undermined measures 2½ acres, and the cuttings aggregate 7,542 feet in length, varying in height from 8 to 22 feet, and in width from 12 to 13 feet. There is a roof ten feet thick between the mine and the water, and the latter, at the outer edge of the excavation, is 26 feet deep at low tide. Between the headings and galleries heavy piers are left, which now sustain the immense weight of rock and water above. In each pier from ten to fifteen 2 and 3 inch holes are being drilled, and in the roof similar apertures are being made at intervals of 5 feet apart. All of these openings will be filled with nitro-glycerin, in charges of 8 and 10 pounds, and all will be connected together by gas pipe filled with the same explosive. This will be done during the cold weather, when the danger of hauling the nitro-glycerin is greatly diminished.

Previous to the explosion, the coffer dam will be broken away and the water allowed to fill the entire excavation, so that it will serve as a tamping. Then, by means of an electric fuse, the nitro-glycerin in the gas pipe will be fired, which will determine the blowing up of the whole affair. No fear is apprehended as to the result, since it has been determined that the explosion of half the charges will be sufficient to cave in the roof, and cause it to fall to the sunken floor, deepening the water at once to a proper depth, or necessitating but little dredging to complete the work.

The new operations at Flood Rock will involve still greater cuttings than at Hallett's Point. The shaft is now down to a depth of 50 feet. The Hallett's Point work has been under way since 1869, but has been greatly delayed by the failure of Congress to provide sufficient appropriations; if the same course is to be followed with reference to the Flood Rock excavations, it will be manifestly impossible to form any estimate of their time of completion.

DRUGGING HORSES.

There is a subject in connection with our four-footed servants, which is worth more attention than ordinarily is accorded it; and since it is an abuse, a remedy or means of prevention is needed. We allude to the drugging of horses, either to give them temporarily the appearance of being in fine condition, or to have the opposite effect, by making them ill to defeat their chances of success in a race. Both of these practices are cruel and inhuman, as well as criminally fraudulent, and hence commend themselves to the notice of societies for the prevention of cruelty to animals, while at the same time indicating a possible necessity for severe penalties.

An act of Parliament has recently been passed in England, the object of which is summarily to put a stop to these nefarious practices. It provides that if any one, other than a member of the Royal College of Veterinary Surgeons, shall give any animal any of the drugs contained in a given schedule without the consent of the owner, he shall be liable to fine or imprisonment. The drugs and preparations enumerated are as follows: Arsenic and its preparations, prussic acid

cyanides of potassium and all metallic cyanides, strychnin and all poisonous vegetable alkaloids and their salts, aconite and its preparations, tartar emetic, corrosive sublimate, cantharides, safin and its oil, ergot of rye and its preparations, oxalic acid, chloroform, belladonna and its preparations, almond oil, opium with its preparations, sulphuric acid, nitric acid, hydrochloric acid, butter of antimony, sulphates of iron, of copper, and of zinc. Of these perhaps arsenic is the most commonly administered, since its effect upon the horse, in point of appearance, is to give an artificial plumpness and sleekness which might easily pass for fine condition. This all disappears, however, in a few days, leaving the animal wretched.

While some such law as the above might tend to mitigate present evils here, we doubt if such would be the case other than in very small proportions. Veterinary surgery in this country has not arisen to the height of a special profession generally recognized, although there are plenty who are adepts in the art. It requires no license to practise; and until the same restrictions are thrown about its practitioners as are now about regular physicians, it would be difficult to designate who may and who may not administer medicines in the absence of the owner, with anything like the certainty expressed in the term "members of the Royal College," etc.

The matter lies exclusively in the hands of the societies above named and in those of horse owners. The former are already empowered to prevent cruelty, and drugging comes under that head. The latter, if their horses are in the charge of servants, can prevent the injury only by careful guardianship. A horse owner disposed to defraud cannot be prevented from doing so by any legislation; but if he tortures his animal, he comes under laws; and if he sells him under false representations, he becomes doubly liable. About the only enactment available in addition would be one imposing heavy penalties for selling doctored horses, in addition to those already mentioned in the statute books for the peculiar degree of fraud, and empowering local societies for the prevention of cruelty to sue for and collect the same, devoting the money to the furtherance of the objects of the said societies.

CELLULOID.

A destructive fire, attended by an explosion, recently occurred at the celluloid works, Newark, N. J. One life was lost, several persons injured, and property to the extent of \$150,000 destroyed. It is alleged that, when the fire was discovered, the engineer immediately turned on steam into the apartment, when an explosion instantly ensued, the inference being that the steam assisted the explosion. But this we think, is a mistaken inference.

Celluloid is a manufacturer's name given to a species of collodion, or dissolved and dried gun cotton. Common cotton, the refuse of cotton mills, and other vegetable fiber is dipped in a liquid composed of nitric acid and sulphuric acid; then drained, washed in water, and dried, when it is found to possess highly inflammable and explosive qualities, and is termed gun cotton, as it may be used as substitute for gunpowder; it has twice the power of the latter. This prepared cotton may be dissolved in ether and alcohol, when it forms a thick transparent liquid, known as collodion. This is the material used by photographers, who, in taking a portrait, spread a thin film of collodion liquid on a glass plate. The ether and alcohol soon evaporate, leaving the dissolved cotton to dry upon the glass in the form of a thin membrane or skin, which receives the silver compounds used in taking photo pictures. Collodion, when dried in any considerable mass, forms a tenacious, transparent substance, somewhat resembling horn. If whiting, zinc oxide, and other coloring substances are added to it while in the liquid state, and then dried, substances resembling ivory, hard rubber, bone, etc., result. All such forms are, however, very inflammable.

The use of alcohol and ether is expensive as a solvent, and the celluloid makers substitute camphor, the use of which forms the basis of their patent. By peculiar manipulation, involving the combined employment of heat and pressure, they are enabled to produce plates and blocks of dried collodion, of beautiful texture and color, possessing a certain degree of elasticity, with great strength and toughness, and little weight. From these plates and blocks, a great variety of merchantable articles are made, such as harness trimmings, jewelry, dental plates for artificial teeth, billiard balls, knife handles, etc. They are a complete substitute for hard rubber and ivory for many purposes, and considerably cheaper.

But not only is the manufacture of the crude celluloid dangerous, but even the most finished articles made from it will readily inflame. As a practical experiment, any one may take a strong and highly polished martingale ring of celluloid, which the strength of a horse could hardly break; apply to its surface a lighted match, and it will quickly ignite like a torch.

Celluloid factories must be classed among the extra hazardous risks, so far as fire insurance is concerned, and their presence in large cities is not desirable. The manufactories should be isolated; the finished goods should only be stored or exposed in small quantities in the shops.

STEAM BOILER PHENOMENA.

We recently took occasion, while giving an account of the work of the United States Commission on Steam Boiler Explosions, to explain the principles involved in such phenomena, and to indicate when danger might arise, and when explosion might not follow the introduction of the feed water. We have just received accounts of two cases of low water, neither of which resulted in explosion, and one of

which gave such a striking example of a rare phenomenon (apparently contradicting our previously expressed views) that we place the case before our readers as we receive it, and trust that we shall learn the particulars of similar occurrences, should any have become known to them. We presume that the explanation is a perfectly simple one, but prefer to leave the point open to discussion by the correspondents of the SCIENTIFIC AMERICAN for the present.

In the first case, a plain cylinder boiler, nearly new, had been left, with the furnace door standing wide open, and with a very low fire on the grate. The boiler became absolutely dry, and heated up to a temperature which is estimated at somewhere between 600° and 1,000° Fahrenheit. When it became known that there was no water in the boiler, it was also found that steam pressure had fallen nearly or quite to zero by the gage. An independent feed pump, taking steam from a neighboring small boiler, was started and the boiler filled up without producing any apparent injury. Immediately after starting the pump, however, steam jumped to 190 lbs. pressure per square inch. The safety valve was found to be loaded to nearly 200 lbs. The shell of the boiler was subsequently carefully examined and appeared to be entirely uninjured; no worse symptom was discovered than the scorching of the paint on top of the shell. Even the valves remained tight; but an india rubber joint under the safety valve was melted, and a leak was produced there.

In the other case, the boiler was also of the plain cylindrical type, and the circumstances of the case were very similar. The fire was dull; the furnace door was open; the steam pressure had fallen very low, and the water seems to have entirely left the boiler. The temperature could apparently not have been far different in the two cases. In each, the boiler had been standing, as we are told, a half or three quarters of an hour with little or no water. In the second case, also, an independent pump was at hand and was put on with a full supply of feed. Here, however, to the astonishment of the attendants, steam rose to about 20 lbs. by the gage, and then as suddenly fell, the steam gage immediately indicating a complete or partial vacuum, the hand swinging quite past the zero mark, at which point there was no stop pin. So far as we have been able to judge, the general arrangement and conditions of these two cases were similar, as we have described them; the accounts are, we believe, accurate.

We shall hope to obtain particulars of other cases which may aid in explaining the facts. Meantime, we shall be glad to obtain light from our readers or from our friends of the steam boiler insurance companies, or from the United States Commission.

"STRAY IDEES."

"I got five hundred dollars for it, by Jove!"

We stopped writing, and, relinquishing our pen and with it an obscure argument the thread of which, doubly tangled by the lazy hot weather, we were laboriously endeavoring to follow, gazed resignedly at the speaker of the foregoing ejaculatory remark, as he threw himself into our solitary spare chair. He removed his hat, mopped his steaming brow with a capacious bandanna, dived into the pocket of the dustiest of dusters, and extracted a dirty bundle of papers. Then he beamed on us benignantly over his spectacles, and banging his fist on our desk, emphatically observed: "Them's the documents. Want you to tell about it in the paper."

"Tell about what?"

"About the five hundred dollars. Why, man, I got it for just nothin', nothin'. There never was no such luck. Look here: you remember that ere patent you SCIENTIFIC AMERICAN people got out for me, nine year ago—one of a lot—'bout an ice masheen?"

As this agency had been instrumental in the obtaining of several thousand patents in the period mentioned, we naturally were unable to recall the special one alluded to by our visitor, and in reply hinted as much.

"Forgit it, hey? Wa'l, no matter, here it is," he said, hitching his chair close beside ours, and pointing with the stub of an amputated forefinger at a time-worn drawing.

"You see, I was tinkerin' at ice masheens about that time, and patented a lot of them. One day, while I was fussin' at a model which wouldn't go, it kinder struck me that if I turned that ere pump over and changed round the valve, it would make a better pump out of it. I didn't know whether the thing would be worth anything or not. Any how I was busy at somethin' else then, and couldn't tend to it; but I thought to myself: Here I'm takin' out patents lively now; I might as well have one for this too. So I came to your people, and they got the papers for me, for the masheen as it then was, and a claim mixed in for the pump. Wa'l, after a time, I forgit all about it, didn't think it of no account. In fact, as I soon had a dozen bigger patents a goin'. I worked away, tryin' to get the masheens in the market, and was doin' pretty fair until the panic and the strikes came along, and them busted our company and left me poorer than Job's cat ever since.

"I went back to the iron works as foreman, and got along good enough to keep the pot a bilin' home; but—you see, I've got a boy. As lively and smart a young feller as ever handled a tool. Just oughter see him jump a lathe; yer oughter see him run—oh, wa'l, I'm his father; and fact is, now he's served his time, I made up my mind to send him to that 'ere Stevens Institoot, and have him learned to be a engineer. It was all well enough to decide he was to go; but the next question was stamps. I didn't have none laid by; and couldn't sell anythin' to raise enough money. I was thinkin' it over last night, blue enough I tell yer, when wife said a man at the door wanted to see me. I went down and after passin' the time of day, and all that, the feller

asked if I ever patented a pump, which he kinder explained. First, I said no; but then I thought of the ice masheens, so I got the drawings, and told him to look and see if it was there. He went over them all, till he struck the one I've been tellin' yer about. 'That's it,' he says, quick, like; 'what'll yer take for it?' 'Why?' says I. 'Cause my boss wants it,' says he; 'he's got a big pumpin' masheen for mines and sitch to be patented, and some of it has got to be like yours, and he wants ter buy yer out. What'll yer take? I'll give yer five hundred dollars cash.'

"It took about two seconds for me to settle that bargain. I came right down to York in the early train, had the papers all fixed in the office here, got my five hundred, which is thar" (slapping a plethoric wallet), "and now that boy makes a bee line for that Institoot this very day. Shake hands on it! Come and take somethin'? No? Wa'al; mebbe you'll write us a word to Professor What's-his-name at the Institoot, 'cause we're a goin' now."

We penned the desired note of introduction, accompanied our radiant visitor to the door; and as we watched him and his stalwart "boy" start blithely off toward Hoboken, we thought to ourselves that there was one man at least who had found out the value of "idees." He had caged a passing thought, deemed of no material importance, by the timely safeguard of a patent; and stored it away until its worthlessness had changed to worth. He had invested the evanescent product of his brain, just as he had invested the substantial products of his industry; but, the last, misfortune swept away from him, the first lay dormant for years, in the end to revive and aid him in his hour of necessity.

Certainly "idees" are worth keeping, and if so are worth guarding safely. Sickness may drive them from the brain, fraud may wrest them from carefully hidden memoranda, or ingenuity may fathom the secret even when concealed in cabalistic cypher; but to patent them is to lock them for years under the protection, not of oneself, nor of one's servants, who may betray their trust, but under the ward of a great government. Certainly it is best to cherish our ideas; but all are not equally valuable, and those that are so are often intermingled with many worthless and chimerical. Time and experience, however, will sift them away and reject them; but their worthlessness for the moment, so long as not based on opposition to the laws of Nature, should not determine us to throw them carelessly aside. It is better to remember that such stray ideas may some time, if inherently good, doubtless will prove valuable; it is well to remember also that, in order to originate, a man need not necessarily be a mechanic or practical worker in any branch of industry. The merest tyro in a casual stroll through a shop, or in his daily domestic experience, may light upon a "stray idee" which to men of almost unlimited skill has never occurred—a thought in which, in the future, if not now, he may find both fame and fortune.

THE NEW COMMISSIONER OF PATENTS.

The President has appointed to be Commissioner of Patents, vice Thacher, resigned, the Hon. R. Holland Duell, of Cortland Village, New York. Inventors will of course desire to know something of his history. He was born at Warren, 1824; received a common school and academic education; studied and practises law; was District Attorney of Cortland county from 1850 to 1855; was County Judge of the same county from 1855 to 1859; was Assessor of Internal Revenue for the twenty-third district of New York from 1869 to 1871; was elected to the Thirty-sixth, Thirty-seventh, and Forty-second Congresses, and was re-elected to the Forty-third Congress as a Republican. With all these important and extensive experiences he ought to make a good Commissioner, and under his administration we shall look for many improvements in the affairs of the Patent Office.

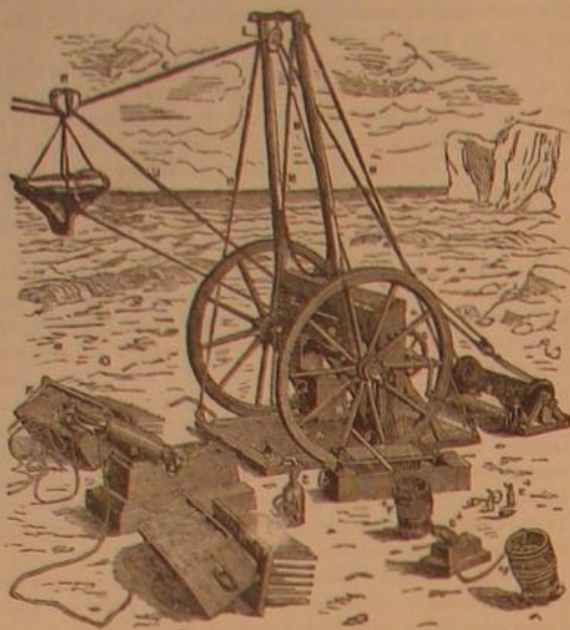
The Washington Republican says: "The appointment of the Hon. R. Holland Duell, of New York State, to the position of Commissioner of Patents gives, we are pleased to learn, universal satisfaction to all acquainted with his ability as a lawyer, whose large experience and valued practice in patent law so eminently fit him to fill the place so acceptably to all having business before that office. Judge Duell is one of those rare men whom position seeks, not they position—and probably no member of Congress ever gave more general satisfaction to his constituents than did Judge Duell during the four terms he served as such from his native State. Indeed, as some of our highest officials have justly remarked, there is no position under the government that Judge Duell is not qualified to fill; and when we consider that, to fine ability and large experience as a patent lawyer, Judge Duell brings the rare quality of an urbane sternness, so to speak, which enables a man to do stern, just things in a gentle manner, we can but congratulate the patent fraternity upon the prospects before them—the learned and experienced in that they will meet an equal, competent to grasp and dispose of their most intricate points, and the less educated and experienced in that in him they will find one who, whilst perhaps dispelling many a chimerical dream, will lift their minds encouragingly up to higher and grander accomplishments."

Disinfectants.

After an exhaustive series of practical tests of the various disinfectants sold in this city, embracing over fifty kinds, Professor Elwin Waller, of Columbia College, concludes that the best disinfectant is carbolic acid. About one per cent of the mixture should consist of carbolic acid. For prompt disinfection which is only temporary, strong oxidizing agents, as chlorine, potash permanganate, nitric acid, etc., should be used. Of these, the cheapest and most available is chloride of lime.

LIFE-SAVING APPARATUS.

The life-saving apparatus and exhibits of the *Société de Sauvetage des Naufragés*, and of the British Board of Trade, at the International Maritime Exhibition at Paris—representing the official appliances for saving life from wrecks—may be regarded conjointly, and also in comparison with other means directed to the same good end.



ROGERS' LIFE-SAVING APPARATUS.—Fig. 1.

In relation to the lifeboat service, the French system is virtually identical with the English; and the same remark may be held to apply to the apparatus for effecting rope communication, which practically differ from each other only in the means employed to launch the projectile on its way. On this point the reasons assigned by the French Society for setting aside the Manby mortar and Boxer rocket are, namely, the former on account of the heavy powder charge, causing frequent rupture of the line, the latter for the uncertainty of its flight.

There appears to be a radical objection, common to both systems, namely, that, however successful they may be in casting a light line on the wreck, in mere contact, their success may perhaps be entirely neutralized by the fact that the persons endangered may be unable—from lack of knowledge, presence of mind, energy, or actual power, and from mere exhaustion—to render that essential aid without which all that has preceded must be so much waste labor and frustrated hope.

The subjoined statement appears in the catalogue of the British section, in the description given by the Board of Trade of their collective exhibits:

"III. LIFE-SAVING APPARATUS.—7. *Enamelled Plates*.—In one; see five men tied themselves on to the rocket line, and all were drowned except one." And it is exactly because this class of appliance is dependent, for its utility and success, so much on the mere chance that reliance can be placed on the possession by the shipwrecked mariners of the ability to avail themselves properly of the means placed within their reach—it is for this reason that system is to be regarded as far from being perfect or unsurpassed.

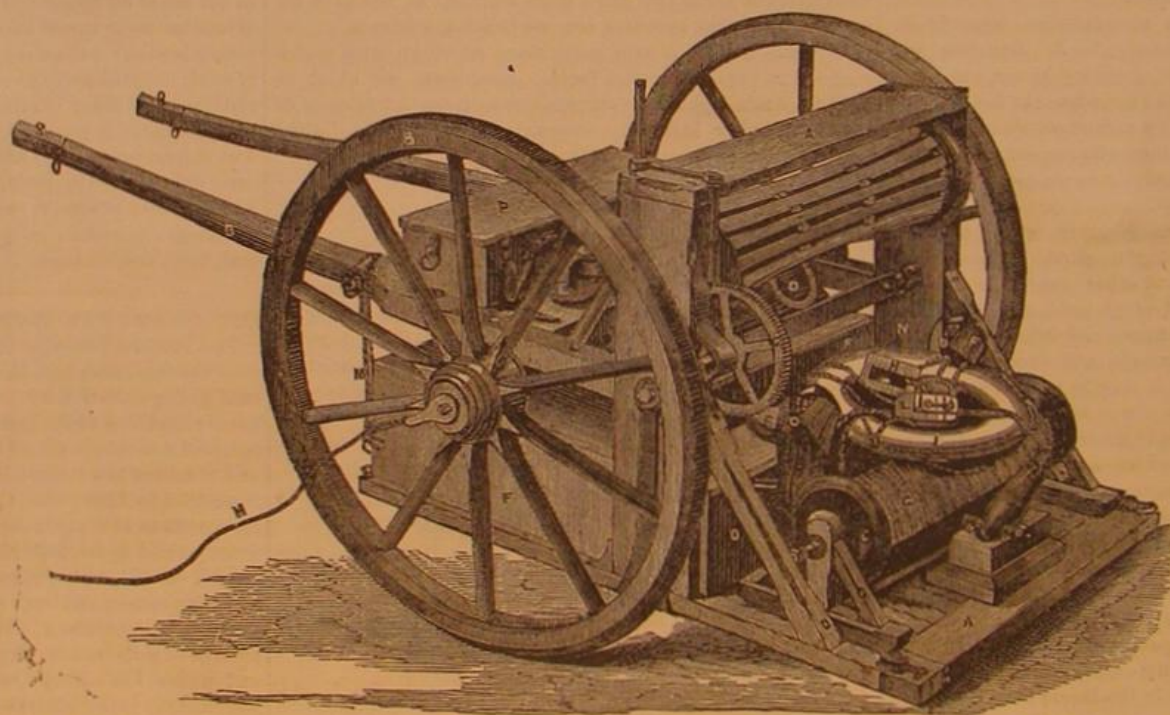
Of course, the actual circumstances render it impossible to reduce to a certainty the saving of all lives endangered by wreck; but in the only complete apparatus of the kind which can be put in comparison with the two foregoing, namely, Rogers' system of rove-rope communication with wrecks, the right principle has been adopted primarily, by throwing a block and double line which can be worked from the shore, so as to effect as much as possible by the life-saving party on land, and make as little demand as possible on the aid and efforts of the poor sinking wretches struggling for bare life amid the horrors of shipwreck. Practically, this renders it possible to save life with the minimum of assistance from the mariners on board, limited to making fast the cone block. Conversely, when employed from on board ship, it is the most reliable method of getting a rove rope thrown at once on shore for direct communication. And finally, it may be remarked that it constitutes a valuable adjunct to a lifeboat, to facilitate the launching, and getting an offing, against storm and surf, without incurring the risks ordinarily attendant on that service, or wasting the strength of the lifeboat men, as frequently occurs.

Mr. Rogers' apparatus has undergone little modification and improvement in detail, since its introduction in 1868.

The whole, as here exhibited, is exceedingly well devised, compact, and easy to transport, set up, and operate.

The annexed engravings, Figs. 1 and 2, show the general appearance and arrangement of the same as now submitted for the first time to the consideration of the seafaring interests: first, as packed at the station, ready for transport; and, secondly, as disposed for actual use *in situ*. A is the platform on which all gear is stowed, and which can be weighted, when in use, to gain stability; B, wheels and shafts, acting, when erected, as a derrick, thus giving elevation to keep the line, etc., as much as possible clear of rocks and surf; C, winch or windlass, for hauling in and out the rove rope, etc. D D are the large and small mortars, which can be used with or without the bed or carriage, as position will allow, for their respective services; E E*, the large and small cone block shot, for service with corresponding gun; E E, large anchor for launching service and use on board ship; F F*, pin boxes and tubs for coiled lines; J; G, the hawser, as used for setting up to run breeches block and buoy to and fro; G*, the reel and stand for carrying hawser on, which can be detached from the cart when in use, the bottom being formed sledge-shaped; H, the breeches block, used to suspend the buoy, I, from the hawser; K, the block and tackle for veering and hauling on, to take up slack and meet the motion of the line, so avoiding rupture of line by excessive strain; L, the snatch block, suspended to the shaft end to carry the hawser free and above obstacles; M, the guys to the derrick, serving also as drag ropes and suspending ropes in store or transit. N is the powder magazine; O, the medicine chest and means for resuscitation; P, the box of tools.

Briefly described, a small mortar, with a light powder charge, sends a cone block shot, carrying a sheave in its base through which a rope is rove, of which the two ends are coiled in pin boxes or tubs, so as to be carried out free from turns and ready for use, as we have actually seen and recorded; the projectile being also fitted with a tail, whereby it can be readily attached and made fast; which, being effected, the men on shore can, by means of the rove rope, haul out a hawser, and subsequently even a man or boat, if other means fail of getting the necessary attachments completed on board; the object being to establish the *ea et-vient*, or to and-fro travel or safety buoy along the hawser, by means of the



ROGERS' LIFE-SAVING APPARATUS.—Fig. 2.

breeches block and whip line. The wheels and shafts are set up in lieu of the unstable triangle, and stayed to the platform by the guys, forming a derrick. In the inverse case of

Fig. 3.



effecting communication to the shore from the ship (as also for getting the lifeboat off shore) a heavier trifluted anchor shot or grapnel is employed. The entire apparatus is for use

Fig. 4.



when the wreck is lying within about a furlong of the shore. A greater distance, of 400 or 500 yards, a quarter of a mile

or more, the inventor justly thinks the service is rather on for the lifeboat, than suitable for this particular class or appliance. The hawser and whip used by the *Société de Sauvetage des Naufragés*, and by the English Board of Trade, do not exceed a working length of 240 yards; and as regards ex-

Fig. 5.



perience, we learn that, during nine years' use on the French coast, the maximum distance at which their apparatus has been employed is 165 yards.

To throw the line, have the whip and hawser hauled out, send the traveling buoy on board, and bring a man ashore

Fig. 6.



from a supposititious wreck in four minutes, at a distance of 600 yards, necessarily implies the work of rope-hauling (four journeys) at the rate of 20½ miles per hour; and at 300 yards in one minute, the velocity requisite would be fifty-two miles per hour. Whereas it is clear that in the one case two, and in the other three, sets of whiplines and hawsers would have to be joined up and used; and moreover, to set up a taut hawser 600 yards in length is obviously preposterous, under such circumstances and for such a purpose.

As exhibited in Paris by Messrs. Rogers and Anderson, the apparatus contains two separate services, namely, for launching lifeboats, and for saving life from wreck by rope communication; either of which separately would be lighter than the conjoint system.

The two pairs of views, Figs. 3, 4, 5, 6, show the *modus operandi* of the systems which we have described; the first two of what may be called the contact system, and the last two of the rove rope system. Under the former the whip line has to be hauled out by those on board the wreck; but not so under the latter.

It will be seen, therefore, that, both with regard to what it does for the shipwrecked mariners, and what it relieves them from the necessity of doing, Messrs. Rogers and Anderson's apparatus is calculated to be more effective than the French or English systems previously used.

Machine Builders at the Centennial.

According to the latest reports, applications for space in the machinery department of the Centennial are coming in fairly from all branches of mechanical industries, except from the mining tool, chemical apparatus, leather-dressing, embroidery, and jewelry-making machine manufacturers, and, strange to add, the boiler men. More boilers are wanted to supply the 500 horse power. The fact is remarkable, as there is no lack of excellent though different forms of boilers, and certainly no lack of competition between their makers. The iron and wood working people are sending in twice as many applications as any other class. Pumps and printing presses are likewise at the front. The locomotive interests are well looked after, but still are behind expectation. The latter is the case with the silk, cotton, woolen, rubber, and paper machines, only forty applications in these great classes of mechanism having been received. The shipbuilders are tardy; but there are indications of a good show of pleasure boats. Clock manufacturers are plentifully heard from. A Connecticut company is to supply a big electric clock with twenty-five dials. The Western Union Company, and President Orton especially, are taking great interest in the telegraphic display, so that in that department a fine exhibit may be looked for. From 20 to 25 per cent of the total space, it is estimated, will be occupied by foreign machinery.

TO PRESERVE ice water, make a hat-shaped cover of two thicknesses of paper, with cotton batting, half an inch thick, between. Place over the entire pitcher.

WATER PRESSURE ENGINE.

The engine herewith illustrated is designed chiefly as a substitute for manual labor, especially in localities where the use of steam power is either inadvisable or impracticable. The cylinder is oscillating and supported on its trunnions by fixed bearings cast in one solid piece with the respective crank shaft bearings. The two double bearings are bolted upon a foundation plate, supporting also an air vessel on its after part. The bearings are further connected by stays, as shown. The cylinder is made, on both right and left sides, with flat faces, turned and adjusted truly rectangular to the axis of its trunnions. Into these faces open the ports of the two water passages contained in the lower part of the cylinder body, communicating at their other ends with the bore of the cylinder. Adjusted truly to them, and so held up as to be easy but tight against the cylinder faces, are two boxes, one at each side, which receive the water from the conduits and distribute it by an admission port alternately to the two cylinder ports, and consequently fore and aft the piston. A fly wheel is provided to overcome the dead points which occur at each end of the stroke. The water which has performed its work is expelled by the returning piston back through its passage and enters the above named boxes through two separate ports to the right and left hand of the admission port, whence it flows through suitable conduits to the drain pipe into a cistern or other receptacle, whence it may be used again for other purposes. Screws are used for the purpose of setting and fixing the valve boxes in their proper positions in reference to the cylinder ports. By means of set screws, they are screwed slightly up to the cylinder to make a tight joint between their faces and still allow of free motion of the cylinder between the boxes. This adjustment can be done, on account of the tendency of the water pressure inside to separate the boxes from the cylinder, to such a nicety that the friction between the said faces is practically nothing.

In Zürich, Switzerland, the water supply is elevated from the lake into reservoirs, partly by means of a water wheel placed within the principal pumping engine house, which is built upon piles in the middle of the river Limmat (the outlet of the lake of Zürich) but principally by means of large steam machinery in the same and other edifices.

At the present time 200 indicated horse power is employed, which raises 444,000 cubic feet of water per day, 55,000

cubic feet of which are consumed by water power engines. We are informed that, to such an extent have the advantages derived from the use of this water supply as a motive power been recognized, at the present time no fewer than 75 water power engines, of from $\frac{1}{2}$ to 2 horse power, are in daily operation, besides a great number of very small motors, used for driving sewing machines and similar light work.

Lithographers, printers, joiners, turners, piano manufacturers, machine makers, locksmiths, and kindred trades drive their lathes, saws, planing, drilling, boring, and molding machines, etc., with water engines. Butchers move their meat-cutting or pulping machines; weavers and lace makers operate their looms and winding machines, distillers their pumps, cutlers their grindstones and emery wheels, with them. These engines are also employed with hoists for stores, and for raising building material to buildings in construction. The inventors point out that their application, however, is not limited to town industries, but that it may be used advantageously in larger proportions for natural falls of water from 64 feet upwards, there being some engines at work with pressures up to 10 and 12 atmospheres. The only care required in using the machines is that the water should not carry pebbles or sand, which in most cases can be prevented by allowing such substances to collect in a reservoir at the head of the fall.

These engines may also be used for raising and forcing liquids, sewage, etc., for cleaning pits, as fire pumps, or for contractors' purposes, by simply applying motive power to the crank shaft and converting the in and out let pipes into suction and delivery hoses respectively.

The city engineer of Zürich, Mr. Bürkle, we learn, has subjected one of these engines to a trial under the brake, with water pressures varying between 35.2 and 140.8 feet head, and under speeds from 0.6 to 2.4 revolutions per second. The average result obtained was 90.2 per cent. The highest duty was given out at speeds of from 1 to 2 revolutions per second. The particular engine in question was of the following principal dimensions: Diameter of cylinder, 3.5 inches; stroke of piston, 6.8 inches; diameter of water inlet pipe, 2 inches; and area of base plate, 32 inches long by 14 inches wide.

The power given off by 120 revolutions per minute, and 140.8 feet head, was 2.133 horse power. From these data it is plainly seen that the space required for the engine is

very small in proportion to the power developed. Patented in the United States to the inventors, Messrs. Wyss and Studer, Technisches Bureau, Zeughausstrasse No. 9, Zürich, Switzerland, who may be addressed for further information relative to sale of patent, etc.

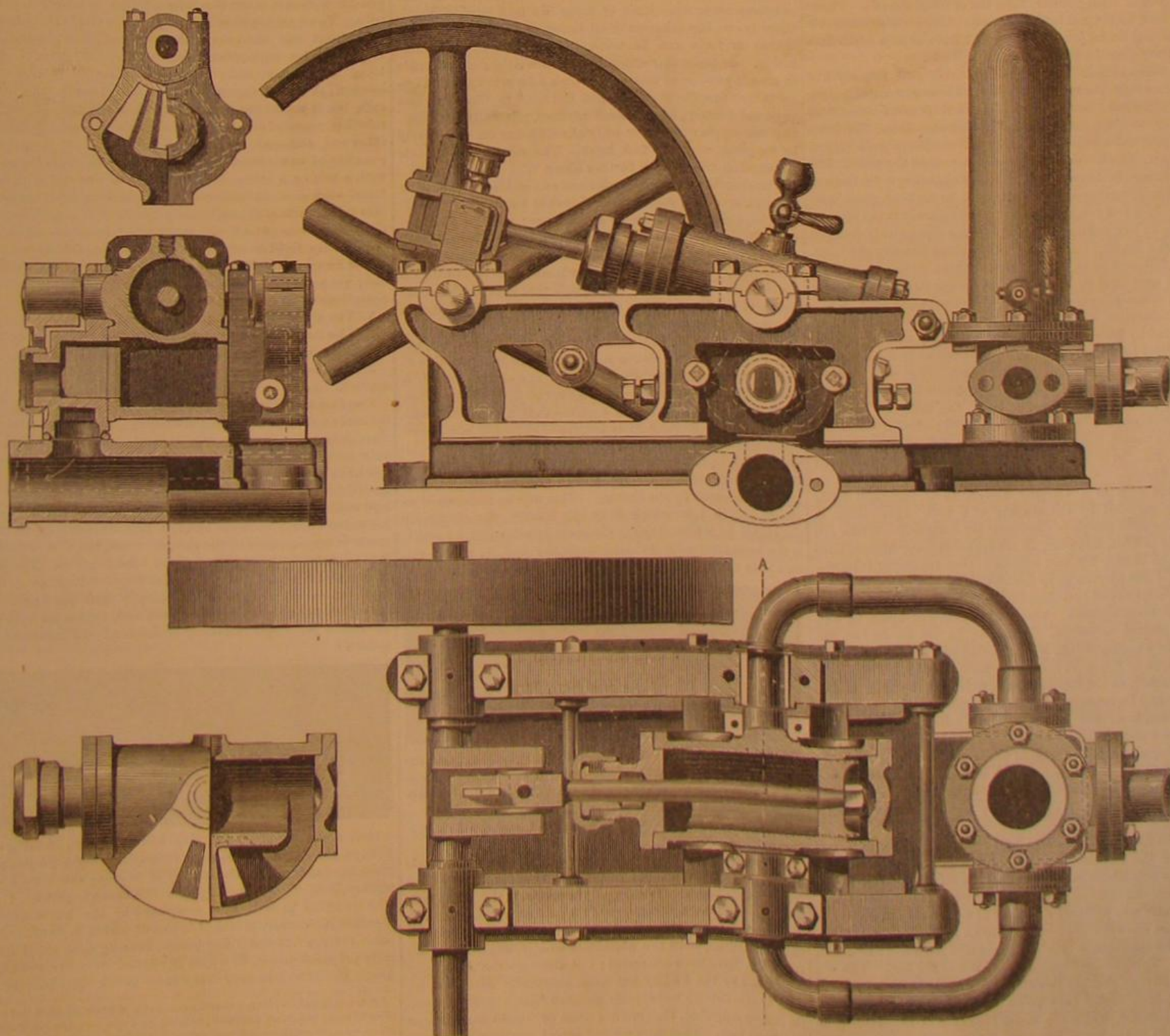
Interesting Torpedo Trials at Newport, R. I.

An extended series of torpedo experiments was recently made by the officers of the U. S. Naval Torpedo station at Newport, R. I., in the presence of the Secretary of the Navy and a large number of officials. The electrical instruments by which the torpedoes were fired were disposed on a lawn, or an elevated plateau, and were connected with batteries in the building. Among those instruments was an electric chronograph, invented and perfected by Farmer, worked by a pendulum driven by electricity, and designed so that it will fire from 1 to 120 torpedoes in as few seconds. By the side of this was an electric engine invented by Lieutenant Moore, which equals at best about two horse power. The first item on the programme was a subaqueous salute to Secretary Robeson, of nineteen torpedoes, each charged with 10 lbs. of powder, arranged in line, south of the ferry landing. These were fired in the presence of the whole company by Lieutenant Manley, by the action of the pendulum of the chronograph above named, at intervals of six seconds, commencing southward. No better description can be given than by imagining a row of nineteen giant fountains, whose streams of water rise up in massive column to the average height of 180 feet, each opening with a loud report and concussion.

The experiments were chiefly intended to show the utility of applying electricity under various conditions to the torpedo service, and thus, as a further illustration, Mr. Merrill next exploded a twenty-five pounder north of the ferry in deep water, to show the usefulness of Farmer's machine for boats.

Torpedo No. 3 consisted of 100 pounds of powder, placed east of the landing, and was fired by Farmer's machine for ships. This was in deep water. At the instant of the discharge it seemed as though 1,000 cannon had been fired under water. The spray flew up nearly 300 feet, deluging the persons in the nearest craft, and causing the water to seeth like a vast whirlpool.

Torpedo No. 4 was fired by the Lay torpedo boat against a



WYSS AND STUDER'S WATER PRESSURE ENGINE

raft at about 1,000 feet distance. The boat, having a five-pound torpedo fastened on the stern, was handled from the croquet lawn by Lieutenant Bradford. The boat is made almost in the shape of a cigar, with two pointed ends, and is almost totally submerged, the green outline appearing above the water being almost like a huge green fish. The boat is fitted inside with a small oscillating engine, driven and steered by carbonic acid gas, the steering being regulated through the electric machine, and by means of which it can be made to perform the most difficult evolutions so long as there is any gas left in the receiver. The object of this invention is to attack an enemy's vessel at a distance of two or two and a half miles, and, by means of immense torpedoes or charges of gunpowder or nitro-glycerin, destroy the enemy and the boat also. After a few fancy manœuvres, the deadly looking craft made right for the target, and in a few seconds the edge posts were shivered into atoms and thrown into the air a distance of twenty feet. Then the boat was sent on a cruise among the sailing boats and turned round and round with a rapidity that was astonishing, considering the distance.

Experiments were next made with the Ericsson torpedo boat. The engine was worked by compressed air, which was forced through an inch india rubber tube from the air box of a twenty-five horse power engine. The hose supplying the air is 800 feet long. The length used is also used to draw back the boat. The engine was started and the two propellers, which work in opposite directions, were set in motion. The air pressure was from seventy-five to a hundred pounds, and soon the tube, like an immense tail, began to run out after the boat.

In a few seconds the boat began to sink; and as the speed of the stationary engine, on the Nina, was increased, she sunk deeper and deeper, until the white disk on the ten-foot iron shaft on the upper portion of the boat was only three feet above the surface. Unlike the Lay boat, she made no ripple, and all that could be seen above water at 600 feet distance was the disk. The air is made to steer her through the tube that supplies her cylinder as effectually as the carbonic acid gas is made to govern the movements of the other boat. Great interest was manifested in this invention. As soon as the pressure is taken off, the boat rises to the surface; when speed is gained she sinks completely.

Next a group of torpedoes, six in number, were exploded north of the landing. They were in about six feet of water and charged with powder, from ten to forty pounds. These were fired by several ladies present. There was another row of startling water jets, which would have sent a small fleet to "Davy Jones' locker" in a few seconds.

A steam launch next appeared, with two seventy-five pounders rigged on spars at the bow. These were rapidly fired by Lieutenant Commander Wildes and several assistants. When the splash and splinters had cleared away, the Nina came past the stand with a 100-pound service torpedo rigged to a spar, which was exploded as she passed the stand. The torpedo used in this way is intended as a substitute for the ram which is attracting so much attention in modern naval warfare. In a few seconds, however, she returned to the charge, towing in her wake a "Harvey," which she quickly dragged against a floating raft and sent everything literally sky high. Now followed in rapid succession three fifteen pounders, which were fired by the contact of a small steam launch with buoys containing circuit losers of a peculiar construction.

In connection with these experiments the circuit indicator designed by Lieutenant Converse was used, which gives to the officer in charge absolute information as to the condition of his cables and torpedoes at all times. If a wire becomes defective or broken, it is signaled instantly by the ringing of a bell, which sound is kept up until the defect is repaired. It also enables him to fire the torpedo at will when the enemy's vessel does not come in contact with the circuit closer, and yet is near enough, in his judgment, to send her to the bottom. At the same time all the torpedoes can be rendered safe to a friendly vessel, their approach being merely signaled by the ringing of a bell, this being, in fact, the most complete apparatus yet designed. When one torpedo is fired, however, all others are thereby disconnected from the battery for half a minute, thus rendering it impossible for one torpedo to be fired by the action of another.

The next experiment was the simultaneous firing of seventy-nine dozen igniters. These were followed again by two extemporized torpedoes, the one in an old tin oil can, the other in a molasses jug, which rattled and thundered so that the whole of Newport must have been affected. These were constructed, at the request of the Secretary, by Messrs. Higginson and Davenport from the materials at hand. After the experiments on the east side of the island, Professor Hill created a commotion by exploding a hundred pounds of nitro-glycerin, placed to the west of the island, five feet from the surface of the water. The shock was quick and severe, and thousands of fish came instantly to the surface, apparently stunned, while many others were treated to a brief aerial voyage.

At the spot called Junction No. 12 by the experimenters, was effected the explosion of twenty-five pounds of dynamite under a raft which was floating on the surface of the water. This was the most splendid piece of work yet accomplished. The water was agitated a quarter of a mile distant from the raft, and the volume of water thrown in the air was laden with the splinters, which fell again into the water like match wood. The grandest spectacle of all was the last. The old coast survey schooner Bowditch lay quietly at anchor, 1,300 feet distant, under bare poles. Near her were a hundred little sailboats, while the steam launch was endeavoring to drive off; beneath her, however, was a terrific mine, consist-

ing of three 100-pound gunpowder torpedoes and 250 pounds of dynamite in two others.

Mrs. Field, wife of Judge Field, of the Supreme Court, closed the circuit, and in an instant a vast column of water ascended about 300 hundred feet, followed by a roar and a concussion, and the timbers of the stately looking old craft were flying through the air. In the place where she had rested so placidly but a few seconds before a whirlpool was now seen spreading out its waves and receiving the falling debris as it descended, splash, splash, into the harbor; it was a complete annihilation. Not enough to make a doorpost, scarcely, was left whole. The hulk disappeared like a dream, for the instant the explosion took place she was crushed and carried up in the form of chips in the vast volume of water thrown by the force of the mine beneath.

Ballooning at Night.

M. Wilfrid de Fonvielle made a successful night ascent on August 1, for the purpose of observing meteorites. From 10 P. M. to 4 A. M., forty-two meteorites were observed between Rheims and Fontainebleau. Some of these emanated from *Cassiopeia*, others from *Perseus*, and as many as nine took a vertical direction, descending from the part of the heavens which was concealed by the balloon. None of these were very noteworthy, and it is probable that none would have been observed at the surface of the earth. Eight persons were in the car.

Correspondence.

What is the Electric Force?

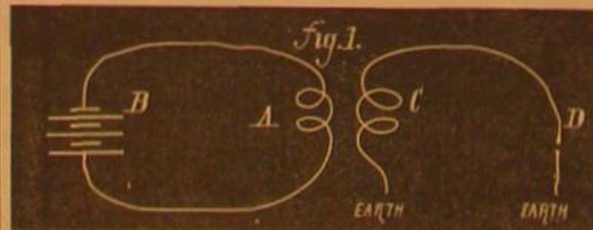
To the Editor of the Scientific American:

At the close of a life of patent research and experiment, it was the conclusion of Faraday that the electric force could not be defined; and it is almost universally conceded today that the nature and functional character of electricity must for ever remain one of the things unknowable. It is the purpose of the present article, in simple terms, to point out the partial fallacies of this proposition; and in order to arrive at a correct understanding of the subject, it is necessary that we frequently step aside from our subject to consider the bearings of other forces in respect of the electric force.

We may or may not accept at the outset a fact, susceptible of easy demonstration, that there is but one law regulating the transmission or continuation of force. It is of no sort of consequence what kind of force we may have in hand; there is one law inherent in all forces, and that law, in brief, is that no force can be transmitted except by molecular action. By molecular action I mean this: the first molecule or atomic particle of matter to which a force is imparted imparts that force to the next, and the next to the next, and so on indefinitely, in the same manner, generally speaking, that we topple over a row of bricks standing on end merely by toppling over the first brick. The correctness of this assumption will be seen further along.

The electric force is characterized as a subtle fluid flowing through or over a conductor. However subtle this "fluid" may be, it must therefore be a substance; and the fluid hypothesis assumes that it is a substance. The electric fluid is, therefore, something which, placed upon the terminal of a telegraph wire in New York, for instance, travels with inconceivable rapidity over or through that wire to the other terminal in Chicago. Let us note the facts which absolutely disprove this assumption.

We must first take into consideration the battery, or generator of electricity; and in so doing we are brought face to face with the question whether, when the electric circuit is established, any substance passes over or through the wire. In order that it may not be asserted that the fluid which leaves one pole of the battery returns to the other pole, thereby maintaining the equilibrium, we apply the battery to an induction coil, and for hours we discharge into the earth, from the secondary wire, a stream of brilliant sparks, the electricity generated by the battery. This will be understood as shown in Fig. 1, in which B is the battery, the electricity generated by which flows in the local primary coil, A; and C is the secondary coil, insulated from the coil, A, whose circuit is to the earth by way of the separated points, D.



We find an immense volume of electricity collecting at the points, D, and we know that the discharges cannot return to the battery. Therefore, if the electric force be a fluid or substance proceeding from the battery, the battery will in a certain period of time, have lost a certain quantity of its substance.

The battery is composed of certain metals, and chemicals in solution. By the action of the battery the nature of the metals and chemicals is changed, in precisely the same general manner that fire converts fuel into dust and gases, or water into steam. Now we have used our battery, we will say, for weeks, until the chemicals wholly, and the metals partially, have been converted; but although the electricity generated by the battery has been constantly given off, we find, if the battery be properly guarded from evaporation and its fumes collected, that not one atom of weight or substance has been lost. Therefore we can assert positively that the

electricity generated by our battery, which has been constantly discharging in vivid sparks, not into the local circuit of the battery, but into the secondary earth circuit, is not a fluid or substance; that nothing leaves the battery and passes through the wire; that nothing passes through the wire, in the sense of substance; for this we do know, that, however subtle a "fluid" electricity may be argued to be, if it really be a fluid or substance flowing from the battery, there must inevitably be a loss in the weight of the substances comprising the battery, which we know there is not. There can be nothing more positive than these facts; and in view of them it cannot be argued that electricity is a substance, or a fluid, or a subtle fluid.*

Having gained this much, it will presently be seen that we have gained a great deal. What, then, is electricity?

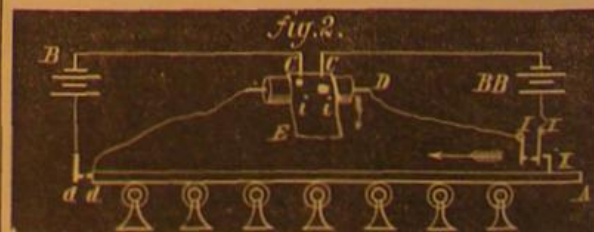
First, it is clearly a force. Secondly, it is transmissible.

Being a force and being transmissible, it is like all other forces (all of which are transmissible) in its transmissibility. Like all other forces, electricity exists in a certain condition of the molecular or atomic structure of substances. It is no more a subtle fluid, nor is its transmission any more singular, than the force of traction is a subtle fluid or its transmission singular. And it is proposed to adduce the most striking facts to prove that the electric force differs from other forces only in the character of the molecular action in which the forces exist, without entering into a discussion of the ultimates of matter and force, for we can never have knowledge of these ultimates. We know there are matter and force; but when we arrive at a studious questioning, we find it impossible to distinguish between matter and force, to decide whether matter is an attribute of force, or force an attribute of matter; and finally we might carry the thing so far as to wonder whether force is not everything and everything is nothing.

It may be confidently asserted that in the transmission of any force whatever, from the transmission of force through a simple lever to the transmission of electricity and light there is but one law, which is perhaps best exemplified in the toppling over of a row of bricks, as herein before mentioned. In this example, each brick crudely stands in the position of a molecule of matter, and acts upon the next brick in precisely the same manner (that is, as to imparting of force) that one molecule of matter acts upon another. If you blow a quantity of air into one end of a long tube, the same quantity of air will emerge from the other end; but you know that it is not the same air that is blown into the tube. The first impelled quantity of air yields its impulse to the next, and the next to the next, and so on indefinitely. So if you take, with proper shape, a tube of water a mile long, for instance, and pour a certain quantity of water into one end, the same quantity will be displaced at the other end; but it would not be said that the water poured into the tube had traveled the length of the tube and emerged at the other end, although the effect is the same as though the quantity of water poured in had so traveled. It is the same with a belt or a lever; if you impart to one end a certain force, each atom or molecule of the belt or lever imparts that force to the next until finally the force is manifested at the distant end. And if the medium of transmission could be perfectly rigid or unyielding, the force applied at one end would be manifested almost instantaneously at the distant end; yet no one is astonished in witnessing the three general operations of an ordinary lever, namely:

1. The application of force at one end.
2. The transmission of that force to the other end by the molecular action of the matter composing the lever.
3. The manifestation, at the distant end, of the force applied.

The first and third operations, are visible; the second is invisible, but apparently instantaneous. I say apparently instantaneous, for I have made several experiments with a view to determining the speed of transmission of this force, and have ascertained that a reasonable period of time is required for the transmission of force through a rigid bar of iron as short as fifty feet in length. My first experiments led me to approximate the speed of this transmission to the speed of transmission of the electric force, but I have found that it varies with temperature and kind of metal. The bar of iron which I used, and which was fifty feet long, gave the best results. It was placed horizontally upon eight pulleys, with platinum contact points at each end, connected with an automatic telegraph recording instrument and batteries as follows:



Here are shown the bar A, fifty feet in length, running on pulleys, and the electrical connections, X being a projecting piece fixed to the bar, whose duty is to close the circuit of battery, B B, by forcing together the contact points, I I. The circuit of battery, B, is completed by the bar bringing together the contact points, d d, one of which is fixed to the bar. C are the recording points, bearing upon the chemically prepared paper, E, which is carried over the metallic drum, D. It will be seen that a blow struck upon the end of

* It is a singular fact that, whenever something appears which is not capable of ready definition, instead of seeking for a solution, and suspending judgment until a solution is found, refuge is taken in hypothetical subtle fluids, or synonymous somethings.

the bar at A, to move it in the direction of the arrow, will close both circuits by bringing together the contact points, *dd* and *II*, and that a discoloration of the chemical paper under the recording points, *CC*, will take place at the instant of such contact. Therefore, if the force applied at A be instantaneously transmitted through the bar, the points of chemical discoloration will be side by side on the paper E, moving in the direction of the arrow; whereas they really stand with relation to each other as shown at *ii*, the first mark made being that caused by the closing of the circuit at *I*, where the blow is struck, and the second being that caused by the closing of the circuit at *dd*, which closing of circuit will not take place until the force applied at A shall have been transmitted to the other end of the bar by the action of the atomic particles of the bar.

In my experiment, the length of chemical paper carried beneath the recording points was 90 inches per second, any greater speed occasioning a break, and the dots caused by the contacts were $\frac{1}{10}$ of an inch apart; that is $\frac{1}{10}$ of an inch from the line they would have observed had the contacts been simultaneous. Therefore the time required for the transmission of the force applied from one end of the bar to the other was the $\frac{1}{3000}$ part of a second, or at the rate of 2,045 miles per minute. These results, however, were probably far from accurate. The speed of transmission may not only be much greater than attained in my experiments, but the process of determining it by chemical decomposition is faulty in many particulars. I do not claim that it does more than show a remarkable speed of transmission of ordinary force, and that not only this transmission could not have taken place without the molecular action of the metal, but that the molecular action of the metal alone accounts for the difference in time between the imparting of the force at one end of the bar and its manifestation at the other end. And I doubt whether any one, witnessing this phenomenon, would attempt to account for this transmission of force by urging the passing through the bar of a subtle fluid, generated by the bone, flesh, and blood of the person applying the force; yet we have in electricity the selfsame principle in the molecular action in which the electric force exists and by which it is transmitted.

The sun emits light. Now we know that this light has sufficient force, falling upon a surface properly placed, to impart motion to that surface. Therefore a ray of light must either consist of a solid projected from the sun, traveling through space and falling upon that surface, or it must be a certain condition of the molecular or atomic structure pervading everything, which condition is propagated, with inconceivable rapidity, from one atom to another, until, finally, the atomic light condition of the sun, though in less intensity, is reproduced at the earth. Now it is not only beyond all reason and hopelessly absurd to suppose that an atom of matter is projected from a burning body through a resisting medium at the rate of 192,000 miles a second, as, for instance, a ray from a feeble candle flame traveling through atmosphere and glass; but such a supposition is controverted by all the phenomena of forces. All forces—light, heat, sound, expansion, gravity, electricity—are transmitted in a similar manner to the transmission of force through a tube of water or air, as related; and as this is the fact, so all forces must reside in a certain condition of the atomic or molecular structure of matter. Primarily, there must be a normal condition of the molecules of matter as to shape and state of motion or quiescence. What that normal condition is, whether in shape the atomic particles are round, square, or otherwise, whether their motion is vibratory or circular, whether a certain motion attracts and another repels, we can of course never accurately determine, although we may theoretically approximate some of the conditions, as, for instance, the conditions necessary to the expansion of a metal by heat.

Washington, D. C.

W. E. SAWYER.

Salicylic Acid for the Preservation of Infusions, etc.

"The wonderful reports of the conservative properties of salicylic acid led me some time ago to commence a series of experiments to determine the proportions of acid necessary to add to infusions, etc., in order to keep them a reasonable length of time without change. The results I have obtained are not quite as satisfactory as I had anticipated, but probably they will not on that account be less interesting to pharmacists in general.

Before experimenting with the infusions, I sought a suitable solvent for the acid, and several weeks ago found that solution of borax was its best solvent; but this does not take up a sufficient quantity to allow of its being added to medicinal preparations for the purpose of preservation. Boiling water dissolves the acid in proportions sufficiently large for the purpose, and does not deposit it again on cooling; therefore I made the infusions, etc., upon which I experimented, with water in which I had previously dissolved the requisite proportion of the salicylic acid. The following are the results of the investigation:

Infusion of cascarrilla, without acid, kept two days; with acid (five grains to pint), kept five days. Another infusion made of double strength, with water containing ten grains of acid to the pint, has now kept over a fortnight and is perfectly fresh.

Infusion of quassia.—A quart of concentrated infusion (one to seven) was prepared, having forty grains of the acid dissolved in it: this has kept now over a month, and is as nice as when first made. One part of it was diluted with seven of water and kept for comparison with a simple infusion; the latter was unfit for use on the fourth day, whereas the former kept for six days.

Infusion of orange, made with water containing five grains of the acid to the pint, kept perfectly bright and fresh for eleven days, but then gradually became turbid.

Infusion of calumba went bad in three days, and a sample with three grains of acid to the pint only kept four days. A stronger infusion, with ten grains to the pint, was put into an uncovered beaker, and was clear and good at the end of the week; but spots of mold then began to form upon its surface though it still remained bright.

Infusion of senna with eight grains of acid to the pint kept seven days, being four days longer than one without acid.

Infusion of malt (two ounces to pint).—A simple infusion was quite sour in three days; but with eight grains of the acid to the pint, a portion of the same infusion retained its odor upwards of fourteen days, and even now, at the expiration of twenty-one days, the odor might be distinguished.

Tragacanth mucilage.—The addition of acid, in the proportion of eight grains to the twenty ounces, causes this to keep for a length of time, a sample prepared nearly a month ago being quite fresh, while a mucilage without this addition had acquired a repulsive odor in about eleven days.

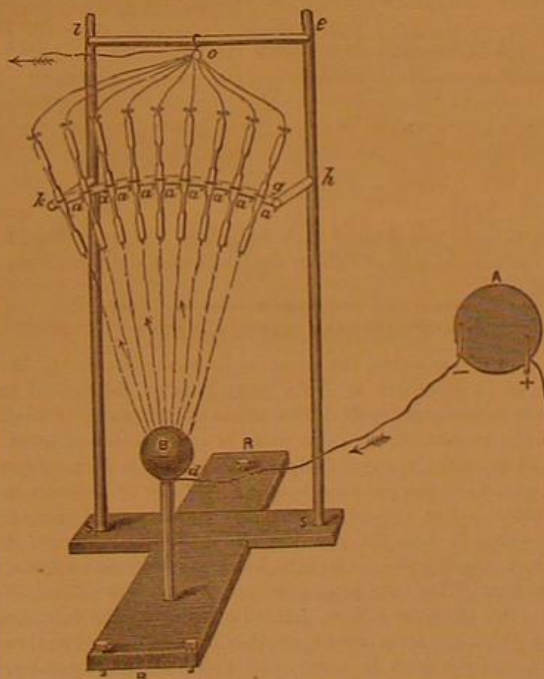
Mucilage of acacia also appears to keep well with this addition.

Lemon juice will retain its odor for weeks, and will not turn moldy, even if kept in an uncovered vessel, if five grains of salicylic acid are added to each pint.

Having read that this acid would keep leeches healthy and prevent the water in which they were kept becoming foul, I added ten ounces of acid solution (eight grains to pint) to half a gallon of water into which fifty leeches were put. Previous to this addition, we had found two or three dead leeches every week when the water was changed; but since, we have not lost a single leech, and the water keeps fresh for weeks. I forgot to note that, by adding ten grains of acid to each pint of sirups of red and white poppies, violets, etc., fermentation is effectually prevented. The addition of a little yeast to several of the samples produced no effect."—*J. C. Thresh, in Pharmaceutical Journal.*

AN EXPERIMENTAL AURORA.

M. Lynström, of the University of Helsingfors, has sent to the Geographical Exhibition, Paris, an interesting instrument invented by him to demonstrate that auroræ are produced by electrical currents passing through the atmosphere in the polar regions. Our illustration will give an idea of the apparatus.



A is an electrical machine, the negative pole being connected with a copper sphere and the positive with the earth. *SS'* are of ebonite, as well as *RR dd*, so that B is quite isolated as the earth in the space. B is surrounded by the atmosphere. *a' a' a' a' a'* are a series of Geissler tubes with copper ends above and below. All the upper ends are connected with a wire which goes to the earth, consequently a current runs in the direction of the arrows through the air, and the Geissler tubes become luminous when the electrical machine is set in operation. These Geissler tubes represent the upper part of the atmosphere, which becomes luminous when the aurora borealis is observed in the northern hemisphere. The phenomena produced by the Lynström apparatus are quite consistent with the theory, advocated by Swedish observers, that electrical currents emanating from the earth and penetrating into the upper regions produce auroræ in both hemispheres. The experiment, says *Nature*, differs from the apparatus of M. De la Rive, who placed his current *in vacuo*, and did not show the property of ordinary atmospheric air of allowing to pass unobserved, at the pressure of 2 feet 6 inches, a stream of electricity which illuminates a rarified atmosphere. The experiment was most attractive, and hundreds of persons witnessed it every day.

A board of engineers is now in session in this city, examining Captain Eads' plan for the improvement of the mouth of the Mississippi river. The recommendations thus far carry the total length of the east jetty to 12,700 feet, or 300 feet beyond the west jetty, and fix upon 1,000 feet as the space to be left for the current between the two artificial walls.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE BARNACLES ON THE GREAT EASTERN.

Mr. Henry Lee describes in *Land and Water* a recent examination of the bottom of the Great Eastern, made by him in search of new barnacles and other marine animals. His labors were unrewarded with much of novelty; but among other interesting facts remarked, he notes that the portion of the hull usually submerged was clad with an enormous multitude of mussels, extending over a surface of 52,000 square feet of iron plates, and in some parts six inches thick. The average weight of the mussels was from 12 to 13 pounds per square foot, so that the vessel was cumbered with fully 300 tons of living marine animals, enough to load, with full cargoes, two ordinary collier brigs.

ANOTHER NEW ANTISEPTIC.

Among the benzol group, all of which are derived from coal tar, are (besides the phenol or carbolic acid (C_6H_5O) and its many compounds) the cresol (C_6H_4O), the phlorol ($C_6H_3O_2$), and the phynol. The latter, of which the composition is $C_{10}H_{14}O$, is also found in the volatile oil of thyme, together with thymene, $C_{10}H_{16}$, and cymene, $C_{10}H_{14}$; but the cheapest source of its production is coal tar. Several compounds of the phynol were studied by chemists long ago; but it was reserved for Lewin, of Berlin, to discover that it is a powerful antiseptic. When pure, it consists of transparent crystals of a very agreeable and strongly aromatic odor: while it is so powerful that a single grain in thirteen ounces of hot water is a sufficiently strong mixture for all purposes. Comparative experiments have shown that it possesses a much greater power to arrest fermentation and putrefaction than either carbolic or salicylic acid. Added to a solution of sugar, with yeast, it arrested fermentation; added to milk, it arrested coagulation till 20 days later than is usual, and after 40 days there was no vegetation visible. Albumen of eggs did not show putrefaction at the end of 11 weeks, and the peculiar aromatic smell was still prevalent at that time. Even in bony substances, otherwise so ready to start decomposition and putrefaction, it was able to arrest all putrefactive change for not less than 35 days.

It appears thus that the benzol series contains the best disinfectants, and that carbolic acid, which has hitherto enjoyed the highest reputation, is by no means the best in the series; and that it will be superseded by the fragrant thymol, until perhaps some better antiseptic is discovered.

A NEW OLEAGINOUS SEED.

The commission of the permanent Exposition of the French Colonies has lately called the attention of Marseilles soap makers to a new source of oil, found in the seed of the carapa, which is a tree abounding in immense forests in French Guiana. Twice a year the tree produces an abundant harvest of seeds, which at certain times cover the earth to a depth of four or five inches. These, immediately subjected to pressure, give 35 per cent of their weight in an excellent soap-making or illuminating oil.

NATIONAL TREE PROTECTION.

By a United States statute of March 3, 1875, a penalty of \$200 or six months' imprisonment is attached to permitting cattle to run on national lands, and to break down trees and hedges. The unlawful cutting or wanton destruction or injury of "any timber tree or any shade or ornamental tree, or any other kind of tree" on the lands of the United States is punishable by \$500 fine or a year's imprisonment.

A Shower of Hay.

Dr. Hawtrey Benson, of Dublin, writing in the *Dublin Daily Express* under date July 27, describes a remarkable shower of small pieces of hay which he witnessed at Monkstown that morning. It appeared in the form of "a number of dark flocculent bodies floating slowly down through the air from a great height, appearing as if falling from a very heavy dark cloud, which hung over the house." The pieces of hay picked up were wet, "as if a very heavy dew had been deposited on it. The average weight of the larger flocks was probably not more than one or two ounces, and, from that, all sizes were perceptible down to a simple blade. The air was very calm, with a gentle under current from S.E.; the clouds were moving in an upper current from S.S.W." The air was tolerably warm and dry, and the phenomenon is thus accounted for by Dr. J. W. Moore: "The coincidence of a hot sun and two air currents probably caused the development of a whirlwind some distance to the south of Monkstown. By it the hay was raised into the air, to fall, as already described, over Monkstown and the adjoining districts."

A similar shower of hay fell near Wrexham, England, July 25.

Collodion.

Few bodies are more easily electrified than collodion. With the least friction by the hand, the membrane adheres to the fingers. If a collodion sheet be fixed, like a flag, to a glass tube, and waved in dry and hot air, it is electrified. Other uses of collodion sheets, here mentioned, are in experiments on polarization of light, on colors of thin films, on diathermancy, on vibrations in acoustics. M. Gripon prepares these sheets by dissolving 15 to 17 grains gun cotton in a mixture of 50 grains alcohol and 50 grains ether. The collodion is poured on a glass plate after the latter has been breathed upon so as to receive a coating of moisture. When—after some hours—the collodion is dry, the plate is put in water; and a sheet of paper having been applied and attached to the collodion by the edges, the film is drawn off with the paper.

IMPROVED VISE.

We illustrate herewith a novel form of vise, of simple and strong construction, and possessing double jaws, which may be adjusted so as to hold an object at any desired angle with great firmness. This arrangement offers considerable advantages to the operator, since he can thus place his work in whatever position is best suited to his convenience. A perspective view of the invention is given in Fig. 1, and sectional views in Figs. 2 and 3.

The fixed jaw, A, is grooved at B, Fig. 3, to receive an annular projecting portion of the standard, C, and also has a shank which enters into a socket in said standard. To hold the jaw in its place, a score is cut around the shank, and a similar score is made above in the socket. Into the aperture thus formed a hardened steel pin, D, is placed. This pin prevents the jaw, A, from being drawn out, while it does not interfere with the rotating of said jaw in the direction of the arrow, and as indicated by the dotted lines in Fig. 1. Fig. 3 shows the rear face of the jaw, A, and exhibits in the groove, B, a number of holes. On the standard is a spring bolt, shown at E, Fig. 1, which, when it is desired to adjust the jaws at an angle, is drawn back, and, when the jaw is set, is slipped into one of the apertures, holding it firmly. The movable jaw, F, has a hollow shank which enters the jaw, A, and the standard. Into the end of said shank is placed the flanged nut, G, into which passes the vise screw. The latter is held in place in the movable jaw by a pin, H, arranged in similar manner, to the pin, D, already described. It will be seen, from the shape of the shank of the movable jaw, that that jaw turns with jaw, A, and is held with the latter. The gripping of the jaws is effected by turning the handle in the usual manner, the screw acting in the nut and drawing the parts together very tightly. All parts of the vise are made to gage, so that, when any portion becomes broken, it can be replaced by sending number and size of jaw to the manufacturer.

The faces of one pair of jaws are roughened, and those of the other pair left smooth, to suit different kinds of work. The general construction is such as to prevent any dirt entering the working parts. The pins, H and D, present a novel and ingenious mode of securing the jaws; and although of hardened steel, they sustain but very little of the thrust, and hence are not likely to wear out. They are easily removed, admitting of the implement being taken apart for oiling, etc. A screw thread cut on one end, engaging in a similar thread made in the jaw for pin, H, and in the standard for pin, D, holds each pin firmly in place.

Patented January 26, 1875. For further information address the manufacturer, Elmore Penfield, Middletown, Conn.

FOX'S REVERSIBLE CAP.

Mr. Morris Fox, of New York city, has recently invented

Fig. 1.

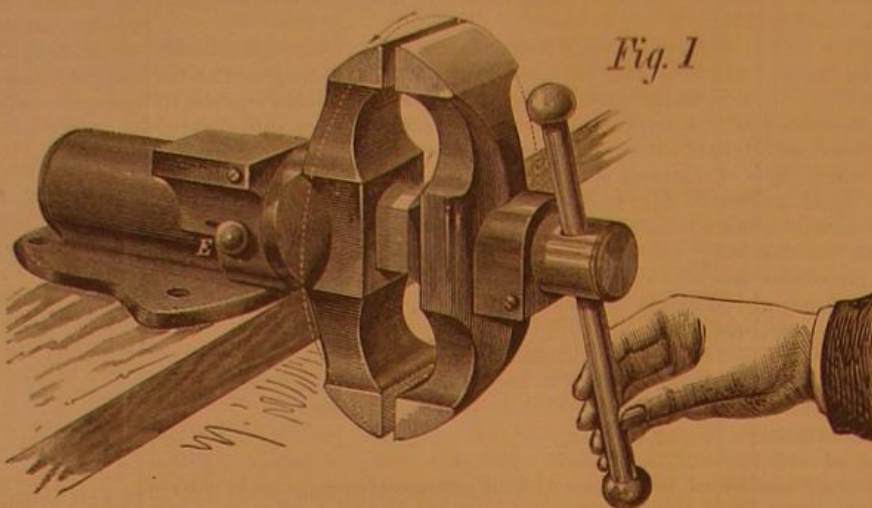


a new form of cap for the use of car drivers and others exposed in winter, by their occupations, to the inclemency of

Fig. 2.

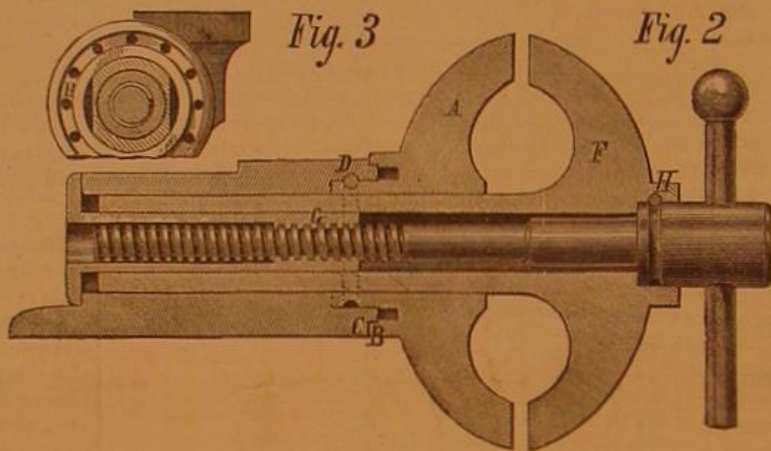


the weather. It has a double back section, marked B, in Fig. 1, over the crown of the head, and a double front section, E, Fig. 1, over the front of the head. The front piece, D, is also made double. By detaching loops by which the sections are fastened when the cap is worn as shown in Fig. 1, the folded rear part, B, may be reversed and extended down to the neck, as shown in Fig. 2; the supplementary crown section, E, is then swung over the front, below the chin, to cover the ears and front part of the neck, and the



PENFIELD'S IMPROVED VISE.

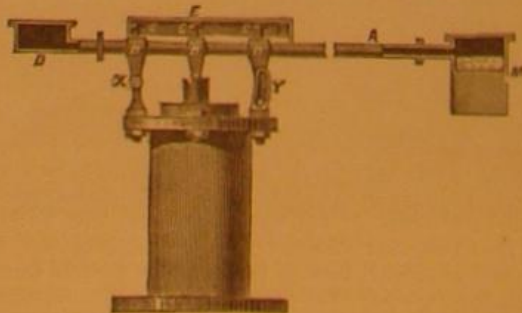
upper front is thrown over the lower part of the front piece, D, forming a head covering which is claimed to be perfectly waterproof in the roughest weather. The inventor pro-



poses to make one side of each section of fur, as in Fig. 1, and the reverse side of rubber cloth or other waterproof material.

A) MERCURIAL SAFETY VALVE.

A new safety valve, the patented invention of Mr. E. W. Colls, is in operation at Erith, near London, and is said to answer exceedingly well. The action of the valve is such that, the moment it begins to move in consequence of an excess of pressure, it opens fully, so as to allow a free escape of steam until the pressure becomes sufficiently reduced in the boiler, when the valve closes as quickly as it opened. This action is brought about in the following manner: A lever, A, consists of a metal tube, having at each end a closed metal box. This tube passes through eyes in the pillars, B B B. One of these pillars, jointed at X, forms the fulcrum upon which the lever works; another presses upon the valve itself, and the third is unattached at its lower extremity, where it has a stud which works up and down in the curved slot, Y. This slot acts as a guide preventing the valve from being forced out of its seat. The screws, C C C, passing through the pillars at the top, press upon and hold the lever, A. To the end of the lever, A, behind the fulcrum, is se-



cured a cast iron box, D, the inside of the bottom of which is a prolongation of the lower level of the tube. At the opposite end of the lever is another box of cast iron, much deeper, the bottom being of thick cast iron to give weight. The space intervening between the floor of this box and the lower level of the tube is filled with mercury, M. The pressure upon the valve is regulated by setting this weighted end of the lever at a proportionate distance from the fulcrum. For this purpose, the lever is duly adjusted, and then secured in its place by the screws, C. When once the lever is adjusted by the engineer or other responsible person, it may be secured from being altered by the man in charge of the boiler by sliding over

the head of the screws, C, a tubular cap, E, having a slot formed along it at the bottom for the stems of the screws to pass through. The cap is closed at one end, and at the other is provided with a cover which is applied to it when the cap has been slipped over the heads of the screws. The cap is then secured by a padlock, and all access to the screws is thus prevented.

When the maximum pressure of steam at which the valve is set is attained, the valve proceeds to lift slightly, as if constructed in the ordinary way; but the moment this takes place the lever is thrown out of its horizontal position, and the mercury from the weight box begins to flow through the tube into the box behind the fulcrum. The weight of the mercury is thereby displaced from the end of the lever and acts as a lifting force by being transferred to the rear of the fulcrum. Thus the valve is no longer loaded to the same extent as before, and opens freely for the escape of steam. When the boiler has been relieved of pressure to the extent of two or three pounds, the lever weight is sufficiently heavy to close the valve, and the mercury returns to its original position, thereby preventing the valve from opening again until the maximum pressure is once more attained. As used at the Erith oil works, the steam blows off at a pressure of 35 lbs., and closes when it falls to 32½ lbs. The valve is easily set to a pressure ranging from 10 lbs. to 100 lbs., on the square inch.

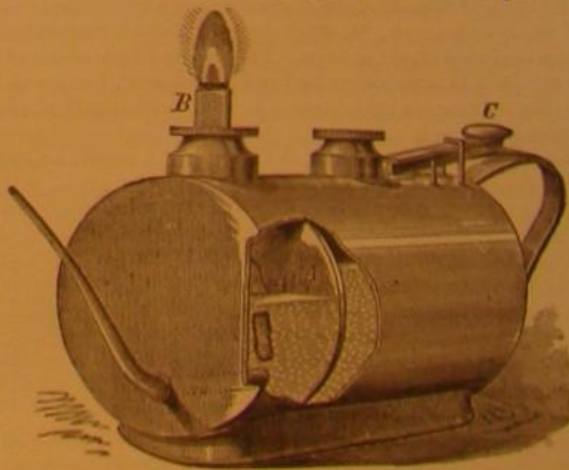
Japanese Variegated Foli.

Professor Lielegg, of Japan, writes to Europe to describe a process used by the Japanese in the production of a metal leaf used for decorative purposes. Thirty or forty thin plates, of gold, silver, copper, and various alloys, are laid one over the other in a given order, and soldered together at the edges, so that the whole forms a stout plate of metal. Punches of various shapes, conical, pyramidal, with triangular, square, or pentagonal sides, are now used to make a pattern of perforated figures, which exhibit on their inner sides concentric circles, triangles, and other forms corresponding to the punches used. The plate so prepared is hammered and rolled until it has become quite thin, the holes disappear, and the figures have spread out, preserving, however, their parallelism. A number of broken, straight, and curved lines are thus produced, their effect being further enriched by the use of acids to modify the colors. Thin plates prepared in this way have an extremely flexible nature admitting relief, with stamped or engraved designs; and, capable of receiving the most varied colors and forms, will have many uses in decorative art.

ROBERTS' COMBINED LAMP AND OIL CAN.

A simple little invention is illustrated in the annexed engraving, which, we think, will prove of considerable convenience to engineers. Any one who has ever attempted to oil out-of-the-way machinery in the dark, and especially in the confined limits of a steamboat's hold, will understand that keeping one's self clear of the moving parts, while both hands are occupied, the one with a lamp, the other with an oil can, is certainly not an easy, and is in some respects a perilous, operation. The present device, which combines lamp and oil can in one, allows one hand to be free, so that the user can steady and support himself, and in addition a further advantage is offered in having a light so placed as to illuminate the darkest recesses of the machine, which it otherwise might be difficult to light up sufficiently to enable oil cups to be readily found.

As shown in the engraving, a cylindrical vessel is provided



with a flanged stand, and is divided within by a partition, A. The large space nearest the handle serves to hold lubricating oil, and the spout therefor passes through the partition and the small space, which contains lamp oil, and extends in a nozzle outside the can in the usual manner. The lamp oil space is filled through the aperture, at B, in the cover of which a lamp burner is arranged carrying the usual wick. The flow of lubricating oil is regulated by a spring lever, C, by which a small air hole is closed or opened at will.

Patented through the Scientific American Patent Agency

June 23, 1875. For further particulars regarding sale of rights, etc., address the inventor, Mr. William Roberts, Quincy, Adams county, Ill.

THE CENTENNIAL BUILDINGS.

We have already published complete views of three of the buildings now being erected for the purposes of the Centennial Exposition to be held in Philadelphia next year; and we now add a representation of the large structure to be devoted to the agricultural show. It will stand north of the Horticultural Building, and on the eastern side of Belmont avenue, Fairmount Park. It will illustrate a novel combination of materials, and is capable of erection in a few months. Its materials are wood and glass. It consists of a long nave crossed by three transepts, both nave and transept being composed of Howe truss arches of a gothic form. The nave is 820 feet in length by 135 feet in width, with a height of 75 feet from the floor to the point of the arch. The central transept is of the same height, and has a breadth of 100 feet, the two end transepts being 70 feet high and 80 feet wide.

The four courts inclosed between the nave and transepts, and also the four spaces at the corners of the building, having the nave and end transepts for two of their sides, will be roofed to form valuable spaces for exhibits. Thus the ground plan of the building will be a parallelogram of 540

traffic on the ocean, traffic which a distinguished member of the association had said, at one of its meetings, forty years ago, was impossible. Similar advancement has been recorded in the department of telegraphy; and what a splendid success had not the railroads proved! The railways in the British Islands now produce, or rather save to the nation, a much larger sum annually than the gross amount of all the dividends payable to the proprietors, without at all taking into account the benefit arising from the saving in time. The benefits under that head defy calculation, and cannot with any accuracy be put into money; but it would not be at all overestimating this question to say that in time and money the nation gains at least what is equivalent to 10 per cent on all the capital expended on railways. It follows that, whenever a railway can be made at a cost to yield the ordinary interest of money, it is in the national interest that it should be made.

COMPARATIVE SAFETY OF RAILWAYS.

Speaking of accidents on railways, Sir John said that they were fewer now than they had been; indeed, that there is only one passenger injured in every 4,000,000 miles traveled, or that, on an average, a person may travel 100,000 miles each year for forty years, and the chances be slightly in his favor of his not receiving the slightest injury.

TEXTILE INDUSTRIES.

More ingenuity and creative mechanical genius is perhaps

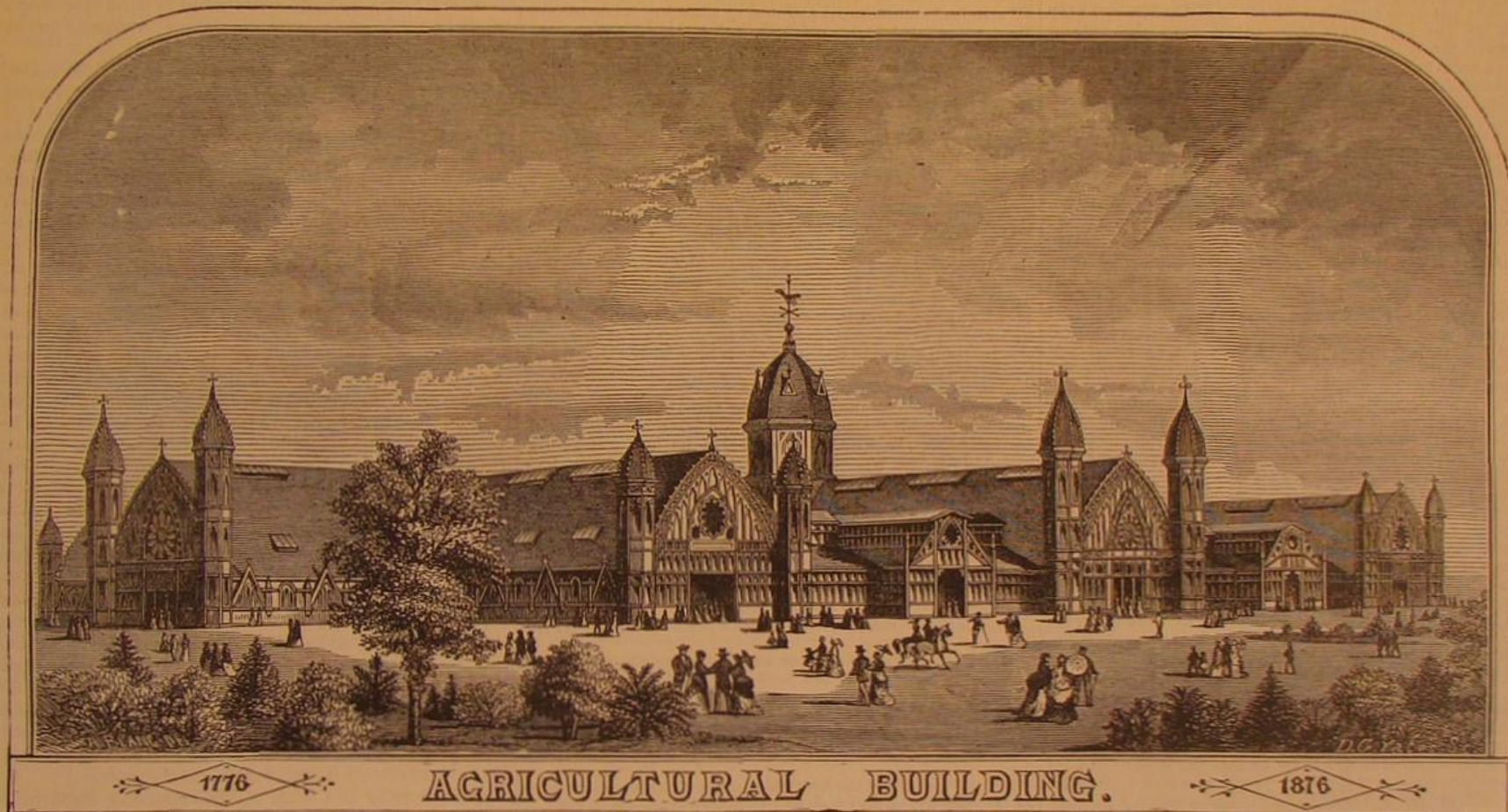
cost had been before Heathcoat's improvements were effected.

TELEGRAPHY.

There is no more remarkable instance, of the rapid utilization of what was in the first instance regarded by most men as a mere scientific idea, than the adoption and extension of the electric telegraph.

The first useful telegraph was constructed upon the Black-wall Railway in 1838, Messrs. Wheatstone's and Cooke's instruments being employed. From that time to this the progress of the electric telegraph has been so rapid that, at the present time, including land lines and submarine cables, there are in use in different parts of the world not less than 400,000 miles of telegraph.

Among the numerous inventions of late years, the automatic telegraph of Mr. Alexander Bain, of Dr. Werner Siemens, and of Sir Charles Wheatstone are especially worthy of notice. Mr. Bain's machine is chiefly used in the United States, that of Dr. Werner Siemens in Germany. In Great Britain the machine invented by Sir Charles Wheatstone, to whom telegraphy owes so much, is chiefly employed. By his machine, after the message has been punched out in a paper ribbon by one machine, on a system analogous to the dot and dash of Morse, the sequence of the currents requisite to transmit the message along the wire is automatically



by 820 feet, covering a space of above ten acres. In its immediate vicinity will be the stock yards for the exhibition of horses, cattle, sheep, swine, poultry, etc.

Several foreign countries will erect buildings, more or less important in size and appearance, in the park. These will add importantly to the appearance of the whole, and many of them will be attractive specimens of modern architecture. Altogether, the Commission must be congratulated on their success in obtaining the necessary buildings for the Exposition.

Progress of Engineering.

At the meeting of the British Association for the Advancement of Science, which took place at Bristol on the 25th ult. Sir John Hawkshaw delivered the address, devoting himself especially to the history and progress of engineering. "Inventions," he said, "were lost and found again. The art of casting bronze over iron was known to the Assyrians, though it has only lately been introduced into modern metallurgy; and patents were granted in 1609 for processes connected with the manufacture of glass which had been practised centuries before. An inventor in the reign of Tiberius devised a method of producing flexible glass, but the manufactory of the artist was totally destroyed in order to prevent the manufacture of copper, silver and gold from becoming depreciated.

ANCIENT ENGINEERING.

A high tribute to the wonderful engineering capacities of the Romans was paid by Sir John. Wars, with all their attendant evils, often indirectly benefited mankind, as when, under the Romans or Napoleon, great systems of roads and bridges were instituted for military purposes. Roads followed the tracks of Rome's legions into the most distant provinces of the empire. Three hundred and seventy-two great roads are enumerated, together more than 48,000 miles in length, according to the Itinerary of Antoninus. The water supply of Rome during the first century of our own era would suffice for a population of 7,000,000, supplied at the rate at which the present population of London is supplied. A rapid glance was taken at the progress of mechanical skill in the manufacture of textile fabrics and the immense growth of steam

displayed in machines used for the manufacture of textile fabrics than by those used in any other industry. It was not until late in historical times that the manufacture of such fabrics became established on a large scale in Europe. Although in China man was clothed in silk long ago, and although Confucius, in a work written 2,300 years ago, orders with the greatest minuteness the rules to be observed in the production and manufacture of silk, yet it was worth nearly its weight in gold in Europe in the time of Aurelian, whose empress had to forego the luxury of a silk gown on account of its cost.

Until 1738, in which year the improvements in spinning machinery were begun, each thread of worsted or cotton wool had been spun between the fingers in this and all other countries. Wyatt, in 1738, invented spinning by rollers instead of fingers, and his invention was further improved by Arkwright. In 1770 Hargreaves patented the spinning jenny, and Crompton the mule in 1775, a machine which combined the advantages of the frames of both Hargreaves and Arkwright. In less than a century after the first invention by Wyatt, double mules were working in Manchester, with over 2,000 spindles. Improvements in machines for weaving were begun at an earlier date. In 1579 a ribbon loom is said to have been invented at Dantzic, by which from four to six pieces could be woven at one time, but the machine was destroyed and the inventor lost his life. In 1800 Jacquard's most ingenious invention was brought into use, which, by a simple mechanical operation, determines the movements of the threads which form the pattern in weaving. But the greatest discovery in the art of weaving was wrought by Cartwright's discovery (in 1784) of the power loom, which led eventually to the substitution of steam for manual labor, and enabled a boy with a steam loom to do fifteen times the work of a man with a hand loom.

For complex ingenuity few machines will compare with those used in the manufacture of lace and hobbins net. Hammond, in 1768, attempted to adapt the stocking frame to this manufacture, which had hitherto been conducted by hand. It remained for John Heathcoat to complete the adaptation in 1809, and to revolutionize this branch of industry, reducing the cost of its produce to one fortieth of what the

determined in a second machine by the perforated ribbon. The second operation is analogous to that by which, in Jacquard's loom, the motions of the threads requisite to produce the pattern are determined by perforated cards. By Wheatstone's machine, errors inseparable from manual labor are avoided; and what is of even more importance in a commercial point of view, the time during which the wire is occupied in the transmission of a message is considerably diminished.

By the application of these automatic systems to telegraphy, the speed of transmission has been wonderfully accelerated, being equal to 200 words a minute, that is, faster than a shorthand writer can transcribe; and, in fact, words can now be passed along the wires of land lines with a velocity greater than can be dealt with by the human agency at either end.

Owing partly to the retarded effects of induction and other causes, the speed of transmission by long submarine cables is much smaller. With the cable of 1858 only 2½ words per minute were got through. The average with the Atlantic cable, Dr. C. W. Siemens informs me, is now 17 words, but 24 words per minute can be read."

Steam at 500 lbs. Pressure.

For several years the successful experiments of Mr. Loftus Perkins, in England, in the use of steam at enormous pressures, rising as high as 500 lbs. per square inch, have been known, but the explanations for the delay in the manufacture have not until now been made public. It appears, from the law proceedings in a suit lately brought by Mr. Perkins against the Yorkshire Engine Company, that Mr. Perkins assigned the exclusive license under his patents to the Company, they in turn agreeing to proceed with the building of the new engines and boilers forthwith. But this the Company failed to do, and so the invention became as it were locked up, and Mr. Perkins was compelled to appeal to the courts for relief. The case recently came on before Justice Fields, Nisi Prius Court, Leeds, when the following interesting explanation was elicited:

In opening the case, Mr. Wills said that his client, Mr. Loftus Perkins, was a civil engineer, who resided in London. He was the inventor and constructor of various devices for

the improvement of boilers and engines, which were the subject of several patents; and the defendants were the Yorkshire Engine Company, Limited, which company traded principally in the manufacture of locomotive engines, and carried on their business in the neighborhood of Sheffield. The action was brought upon an agreement entered into between the plaintiff and the defendants on the 31st of March, 1872. The great object, or rather the principle, which lay at the root of the various improvements invented by Mr. Perkins were, in the first place, the use of extremely high pressure steam; and in the second place, the use of fresh soft water distilled over and over again with the minimum of loss, so that, practically, there was but little replenishing of the original supply necessary. The investigation of the profitable application to mechanical purposes of extremely high pressure steam was a matter which had been hereditary in the family of Mr. Perkins, for his grandfather was the inventor of what was scarcely more than a toy—an extremely ingenious toy, which was well known thirty or forty years ago, and which he (Mr. Wills) recollected seeing in his boyhood, and which some of the jury might have seen, exhibited in the Polytechnic, in London—Perkins' steam gun—in which by high pressure of steam, the result which was ordinarily got from the explosion of compounds was secured. Mr. Perkins had followed in the footsteps of his grandfather and father, and he became convinced many years ago that great economy would result both in wear and tear, and that there would be great economy of fuel, by the use of high pressure steam—steam with many times the amount of pressure that was ordinarily used in high pressure engines. The first thing which became necessary was to construct a totally new kind of boiler, because it was obvious that boilers of the ordinary construction never could stand such pressure as Mr. Perkins wished to put upon them, namely, from 200 to 300, and even up to 500 lbs. per square inch. Accordingly, Mr. Perkins conceived the notion of making these boilers tubular, and making them tubular in exactly the inverse sense in which we generally understand a tubular boiler. In an ordinary tubular boiler the tubes which carried the heated air passed through the boiler and were surrounded by the water which was to be turned into steam. By Mr. Perkins' process this was reversed. The heated air was carried outside the tubes, and the water to be turned into steam was placed within the tubes. Mr. Perkins constructed tubes with a diameter of three inches, and with tubes of that diameter the necessary strength was practically attainable. The tubes were tested by hydraulic power up to 3,000 lbs. per square inch, and no tube was used which did not undergo that pressure. Mr. Perkins thus overcame one difficulty, and he was thus able to get the means of obtaining safely, within the walls of iron, the water which was necessary to produce this very high pressure. That idea once grasped, a great practical difficulty occurred, namely, that of fastening tubes of this sort into plates which must hold them, and maintain the necessary connection between these tubes in such a manner as to be as strong as the tubes themselves. The first patent which formed the subject of agreement in this case was taken out on the 27th of April, 1868, and was for improved means of fastening these tubes—connecting them together and fastening them in the plates, which would also hold them. Mr. Wills went on to explain the method by which the tubes were fixed to the plates, and then said the next difficulty was a very formidable one. Steam at that pressure had a temperature of something like 450 or 500 degrees Fah., within a few degrees of the temperature at which metal became red hot, and a cylinder into which the steam was to be introduced must be worked without any vegetable matter about it, or it would have been impossible to work it. This difficulty was overcome by the construction of a double cylinder, of the form of which the jury could have an idea if they thought of a fig drum with a large marmalade pot on the top of it. The upper cylinder, represented by the marmalade pot, had no communication with the external air. The upper cylinder needed no stuffing box. The bottom of it was always filled up by the piston. The steam at 500 lbs. pressure, or the water that was to be let into the upper cylinder there, did its duty at that high pressure, never finding its way at all into the lower cylinder. As soon as it did its work the steam was let out by a system of mechanical valves into a larger cylinder, and arrived there at greatly diminished pressure, which it was safe to use with the ordinary mechanical appliances for stuffing boxes. The upper cylinder was the only part in which the high pressure steam was introduced.

His Lordship—What did it do, there?

Mr. Wills—It pushed the piston down, but never did the up stroke. After the steam had done its work at a pressure of, say, from 50 lbs. to 70 lbs. per square inch in the larger cylinder, it went by virtue of an arrangement which was not new, which Mr. Perkins laid no claim to, but which was called the compound engine system, to another cylinder larger still, where the pressure was from 20 lbs. to 25 lbs. per square inch. After doing the work there, the steam was taken away in the ordinary course of things into the condenser. The condenser, again, was a peculiarity of Mr. Perkins' invention. By this system the condensing of the steam was effected in tubes just as in the boiler, the result being that it absolutely prevented all chance of the admixture of water, and also prevented the escape of steam, so that it could be used over and over again with an amount of waste which was incredibly small. By means of this system marine engines which had to use salt water could be supplied with fresh water, a few tubs being amply sufficient to supply the waste in long voyages. There was also an enormous economy in the consumption of fuel, Mr. Perkins being able to construct the largest engines so as to consume only about 1½ lbs. of fuel per horse power per hour. That was one source of economy. The consequence of using the same water over and over again in this way was that they could start with distilled water—the purest water that could be got—and grit or impurities, which became elements of danger in boilers, were prevented from getting in. In the case of marine boilers and engines this was a very important result. It rendered it absolutely unnecessary to depend upon salt water for the supply of the boiler, salt water being a source of enormous loss, because, from the moment it got into the circulating system to the moment it left it, it was a source of attack upon the integrity of the metal. Wherever it got, it corroded and ate away the boiler. It also worked in another way, because it gave a great deposit of saline matter, which became incrustated at the bottom of the boiler, and did great mischief by forming an impervious non-conducting coating inside the boiler. The incrustation became as thick as the boiler plate itself, and made the application of the fire heat to be effected under circumstances of enormous disadvantage. The practical result of that was that the life of an ordinary seagoing steam boiler, in large steamers, was from five to seven years, but there might be exceptional cases in which it lasted ten years. Boilers made by Mr. Perkins had been submitted to the most

rigid test by officers of the Admiralty, and it was satisfactorily proved that they had been thirteen years in use without repair or alteration of any kind. Mr. Perkins having invented and perfected this arrangement, and having had it satisfactorily used in 1868, he took out the first patent. Mr. Perkins was not a man of boundless means. He was a gentleman who, in company with his father, was carrying on a profitable business in supplying apparatus for heating private houses and churches, in which this new tubular principle had been brought to bear. He had constructed five or six of these engines for himself, one of which was placed in a steam tug, and had been working ever since. But it was impossible for him to construct these engines at a price which would make them a commercial success, and he looked about him for a person who was possessed of the necessary capital. He was introduced to persons connected with the Yorkshire Engine Company, Limited—a company well adapted for his purposes if they had faithfully carried out their promise. They had large premises, and turned out a locomotive a week, which meant a turnover of \$750,000 a year at least. They had a capital of \$1,000,000, and had power to increase that capital to \$2,500,000, therefore it was no imprudent step if he was deluded into the belief that the company would make the invention a success. Accordingly, on the 31st of March, 1872, after six months' preliminary investigation, during which these gentlemen had full opportunity of satisfying themselves of everything connected with the practical character of the invention, a deed was entered into, and it was upon that that Mr. Perkins' complaints were founded. Under that deed Mr. Perkins agreed to give these gentlemen an exclusive license to work his patent, and shut himself out from the possibility of working with other people. They covenanted that he should have 10 per cent royalty upon all articles manufactured and sold by them under the patent. They covenanted to proceed with the manufacture of engines and to set up such extra machinery as might be necessary for the purpose of executing orders. The very first thing that was necessary was to construct sample engines. They agreed that before September, 1872, they would construct two traction engines—one single and the other double. They also agreed, before the 1st January, 1873, to construct a marine engine, of 250 horse power nominal, suitable for a steamer. The first of these engines, a single traction engine, was constructed many months after the reasonable period allowed for its construction, being finished in December, 1873. But it would not work. It never has been worked, and it was broken up, and sold for old iron. The company proposed that, instead of constructing a double traction engine, they should construct instead a locomotive with tram-car attached, suitable for trams in England or abroad. Mr. Perkins assented, but with a strong remonstrance. The engine had never been completed. It had never been put upon the stocks, not a sixpence had been spent upon it, and no attempt had been made to carry it out. With regard to the construction of the marine engine, Mr. Sacre, the manager of the company, wrote to Mr. Perkins on the 10th of July, 1872, three months after the contract should have been begun to be carried out, in which he stated that he had endeavored in every possible way to arrange for a ship to fit the engines to, but without success. The engines would require a steamer of 2,000 tons burden, and as steamers of that burden carried a large number of passengers, an objection was raised as to trying engines of such an experimental character. They proposed to construct an engine of 120 horse power, and they undertook to supply a steamer as well as the engine. Mr. Perkins accepted the modification, but complained of the loss of time in carrying out the agreement.

His Lordship (interrupting) asked what was the case for the defence.

Mr. Seymour said their case was that everything that could reasonably be expected had been done, and that difficulties arose.

His Lordship said there was a clear breach in point of time. It was a very valuable invention, and this agreement was made in 1872; we were now in 1875, and nothing had been done.

Mr. Seymour said his Lordship had not heard the history of the difficulties they had had to meet; at one time difficulties with regard to Board of Trade certificates for ships; at another time difficulties with regard to packing, in which Mr. Perkins had himself shared. The packing under this high pressure was exposed to a great strain, and some new invention must be perfected, and it was not till January, 1875, that that difficulty was finally overcome, by a simple but grand discovery on the part of Mr. Perkins and Mr. Sacre. They had now an order from the Admiralty for marine engines, which were being made, and Mr. Perkins wrote a letter speaking of the Admiralty order as putting this machinery on its trial, and the result would be to satisfy the Government as well as the public of the great value of the invention.

His Lordship asked if they could not meet together and arrange the matter amicably?

Mr. Wills said that if the defendants would relieve the plaintiff of the exclusive license they would have a license on most favorable terms. But the plaintiff would do nothing unless he got rid of that exclusive license. He was still in the hands of the Yorkshire Engine Company.

After some further conversation,

His Lordship suggested that counsel should speak to him privately, saying 14 years was the life of an inventor, and three and a half had gone already.

Some further conversation took place, and afterwards his Lordship and the counsel retired. Subsequently it appeared that the Company agreed to a new arrangement, satisfactory to the court and the plaintiff.

The New Jetties at the Mouth of the Mississippi River.

The Board of Engineers, appointed under the act of Congress to promote the improvement of the mouth of the Mississippi river, recently held several important sessions in this city, during which the plans of Captain Eads, of St. Louis, were carefully discussed and in the main adopted. The plan involves the construction of extensive lines of jetties along the courses of the moving water, the jetties being simply dykes or levees under water, which are intended to act as banks to the river, to prevent its expanding and diffusing itself as it enters the sea. It is a notable fact, he says, that where the banks of a river extend boldly out into the sea, no bar is formed at the entrance. It is where the banks are absent, as is the case in delta-forming rivers, that the bar is an invariable feature. The bar results from the diffusion of the stream, as it spreads out, fan-like, in entering the sea. The diffusion of the river being the cause, the remedy

lies in contracting the stream or in preventing the diffusion. A glance at the map of the Southwest Pass reveals the narrow and uniform width of the pass until it is within about 7½ miles of the bar, which is three miles beyond the Land's End. In this 7½ miles, the river is building up and extending its own banks into the sea at the rate of eight inches per day. Its jetties are completed by its own forces, and Captain Eads thinks they will probably never change their location, although every time the stream overflows there fresh deposits will raise them still higher. He points, therefore, to the fact that the river itself is continually employing the jetty system, and that Nature makes parallel not converging, jetties. At 7½ miles above the bar of the Southwest Pass, the natural jetties are finished, and narrowed to their normal width of 1,250 feet, and there the Pass is 60 feet deep in consequence. Captain Eads thinks that the bar was once unquestionably where this depth of 60 feet now exists. From this point the river gradually widens out to the sea, and the current gradually diminishes from 4½ feet to about 3 feet per second at the bar, and to zero some twenty miles beyond in the Gulf. Since man has known the Mississippi, this distance between the bar and the narrow banks of the Pass above has been the same, 7½ miles. For 11 miles above, the Pass presents the same narrowness and depth. The bar, says Captain Eads, has marshalled the way through ages past to the Gulf, and the natural jetties have been built up at exactly the same rate of speed, and have constantly kept the bar 7½ miles in advance. As the natural jetties advance, the bar is slowly eroded away.

Now, says Captain Eads, suppose that, by artificial means, these natural jetties could be suddenly extended 7½ miles out to the bar. The volume of water would be almost if not exactly the same, and so would be the current. Instead of passing over the bar as it now does at three feet per second, it would pass out between these artificial jetties at the rate of over four feet per second. The question is, could the bar re-form again afterward, nearer than 7½ miles from the end of these artificial jetties? Suppose there were no littoral current or Gulf Stream to carry away the sediment, the bar would certainly form again, but at the rate it has been going for the last 40 years it would take the river 65,000 days or 178 years to extend its jetties from the place where they are finished out to the present crest of the bar. If man, therefore, should do in three or four years what will require the river 178 years to do, it will be after the lapse of centuries when the bar can reappear, because it must be located at least seven miles beyond the artificial jetties. This argument was made as to the Southwest Pass, but applies with equal force to the South Pass, where he is building the jetties.

Captain Eads further stated that the permanence of these jetties will depend mainly on the skill and experience of the engineers. The river itself is daily showing that it is able to construct jetties of sedimentary matters which it transports, which are imperishable and constantly increasing in strength. On its banks are found millions of young willows and poplars, which, properly formed into fascines and securely interwoven in large masses, and sunk with stone in the line of the proposed jetties, and securely held in position by huge blocks of concrete, will soon become filled with sedimentary deposit, and form artificial banks, indestructible as those Nature is daily building at the passes.

The following is a table of the increase of depth in 18 rivers in Europe where jetties have been effective:

Names of rivers.	Country.	Original depth, feet.	Present depth, feet.
Danube.....	Roumania (Turkey)	7 to 11	20½ to 21½
Maas.....	Holland.....		17 to 18
Trave.....	Prussia.....	7	18
Oder.....	Prussia.....	7	23 to 24
Warne.....	Prussia.....	6	13
Wipper.....	Prussia.....	4	13
Persante.....	Prussia.....	4	15
Pregel.....	Prussia.....	12	20
Stolpe.....	Prussia.....	4	14
Niemen.....	Prussia.....	10	23 to 24
Loban.....	Russia.....	6	16
Dvina.....	Russia.....	6	18
Wendora.....	Russia.....	4	9
Pernan.....	Russia.....	3	12
Nissa.....	Sweden.....	5	12
Konno.....	Sweden.....	6	9
Altra.....	Sweden.....	6	9
Grenaa.....	Denmark.....	5	13

A Model Scientist.

The late W. F. Henwood, F.R.S., the distinguished mining geologist, who died at Penzance recently in his seventy-first year, was originally a clerk in the employment of Messrs. Fox, of Falmouth, to whose counsel he was considerably indebted in his early scientific work. By very great industry and careful observation he acquired an unsurpassed knowledge of the mineral deposits of Cornwall and Devon; and after fulfilling a succession of important mining appointments, he became assay master of tin to the Duchy of Cornwall. This post being abolished, Mr. Henwood's great experience was utilized in reporting upon and developing a number of mining districts in South America, Canada, etc.; and after the cessation of his travels, he lived at Penzance in comparative retirement. His great works are the fifth and eighth volumes of the "Transactions of the Royal Geological Society of Cornwall," devoted respectively to the metaliferous deposits of Cornwall and Devon, and to those of the foreign countries he had visited. But his scientific writings besides these were very numerous; a list of them occupies seven columns in the *Bibliotheca Cornubiensis*.

As a scientific man Mr. Henwood was characterized by indefatigable labor, great caution, love of accuracy, and moderation of expression. In his publications he scarcely ever

mentions a fact of any kind which had not come under his own experience, without giving the authority for it. Thus many of his writings are marvels of copious reference. He persisted in doing everything with this extraordinary amount of labor and care up to the last, notwithstanding that he suffered for many years from a very painful heart disease. His scientific work ceased only with his death. So long as he could sustain even an hour's intellectual effort during the day, that was devoted to the arrangement of his stores of facts and observations. Scarcely one of his cherished objects in this respect remains unfulfilled.

In personal character Mr. Henwood won the high regard of all who knew him intimately. His acquaintance with men and manners was so great and varied, his memory so retentive, and his conversational style so simple and lucid, that to talk with him was one of the most delightful and instructive of intellectual recreations. His estimate of his own labors and merits was unaffectedly modest, although he would resist, if possible, any unfair representation of his work.

In the spring of the present year the Marchison Medal of the Geological Society was awarded to Mr. Henwood.—*Nature*.

Edible Birds' Nests.

Edible birds' nests are found for the most part in the Southern Archipelago. The chief region of supply is that comprising Java, Borneo, Celebes, and the Sulu Islands. The bird which produces the nests is a little swallow, *hirundo esculenta*. This salangan swallow, as it is called, is slightly bigger than a blue tit; it has a brown back; but the under surface of its body, as also the extremities of the feathers in its forked tail, are white. It flies with wonderful speed and precision; and on the Java coast, where the surge breaks wildly against the precipitous and caverned walls of rock, the little birds may be seen in swarms darting hither and thither through the spray. They probably feed on fragments of molluscs and other small animals which abound on those coasts. As you watch the surface of the water rising and falling, you notice how the holes in the rock are now concealed, now open again; and the little creatures, watching their opportunity, dart in and out with lightning speed. Their nests are fixed to the arched roof of these caverns.

What sort of a thing, then, is the edible bird's nest that ministers to the taste of the luxurious Chinese? It is that portion of the fabric which serves as a sort of bracket on which the nest itself (made of grass, seaweed, fibers, small leaves, etc.) is built. There are two forms of this support, one flat like an oyster shell, the other deep and spoon-shaped. It is a transparent mass, somewhat like isinglass, mother-of-pearl, or white horn, and is of animal origin. It was formerly supposed that this gelatin-like mass might be prepared in the bird's crop, from seaweed and other marine plants. This, however, is a mistake. If one opens the animal's stomach about the time of building, it is found to contain insects, but no vegetable matter; moreover, in all species of the family of swifts, the crop is wanting. Dr. Bernstein has found that at that season the salivary glands under the tongue are enormously developed. On opening the bill, they are seen as two large swellings, one on either side, and these chiefly supply the material in question. They secrete a viscid mucous substance, like a concentrated solution of gum arabic, which can be drawn out of the mouth in long threads; and in the air, it soon dries, and is found to be the same (even microscopically) as the bracket material.

When one of the little birds wishes to begin building, it flies repeatedly against the selected spot, pressing each time a little saliva against the rock with the tip of its tongue. This it will do from ten to twenty times, moving away not more than a few yards in the intervals. It then alights, and arranges the material in semicircular or horseshoe form on the rock, continuing to add saliva; and by the motions of its body from side to side, the yet soft saliva is forced out over the harder parts, producing those peculiar undulatory bands which give the nest a stratified appearance. It is thought not unlikely that part of the secretion used by the bird comes from the largely developed glands in its stomach; also, that gelatinous matters picked up in the surge are employed in the construction of its nest. The salangan never uses the same nest more than once, and that for only a month; and after the young brood is flown, the nest soon decays and falls to pieces.

We have now to consider the adventurous work of gathering the nests. The plucker, with nothing on but a cloth round his loins, and with a knife and a netted bag at his side, takes his place on a stage (of two crossbars) fastened to the end of a rope, and is let down against the face of the precipitous rock. With the left hand he grasps the rope; in the right, he has a rod, with which he holds himself as far as possible from the rock. Thus he descends, often several hundred feet, amid the roar of the breakers and the swarming of innumerable birds. When he has come opposite a salangan hole, he makes a signal, and the lowering is stopped. He now sets himself swinging—and here follows the most dangerous part of the operation—gradually increasing his width of swing, till he thinks he will be able to leap off into the hole, and find foothold on a part of the rock which he has previously noted. Should the venture fail, death is certain. The man has generally a thin cord fastened round his body, and connected with the rope, so as to enable him to pull the stage to himself again. Sometimes, though rarely, this breaks, and then there is nothing for it but to make a bold spring out towards the dangling stage. But so fearless and practised are the men that they generally accomplish this fearful leap successfully, even when laden with their booty. When the plucker has got safely into the

hole, he cuts off the nests with his knife, and puts them in his bag; for those high up, he uses the rod with the knife fixed to the end of it. The operation demands great address; the slippery rock, perhaps, hardly affords standing ground, and the man will cling with hand and feet to the little cracks or projections; while the alarmed birds flit to and fro in the gloom, and the tumultuous water beneath flashes with phosphorescence. The plucker, however, knows his work; and when he is sufficiently laden, he draws the stage towards himself, mounts it, and is pulled up by his companions. Thereupon, another repeats the operation.

As the method just described is both a dangerous and a slow one, the natives adopt, when possible, another, which consists in fixing a rope ladder from the top of the rock down to the cavern, and also a sort of hanging bridge of rope within the cavern, either running round the wall or passing across. The internal surface of the cavern is often greatly pitted by the action of the weather, presenting a spongy appearance, so that it is not difficult to find points for attachment of the ropes. All the young birds and eggs found are cruelly thrown into the sea. The best harvest is in the months of July and August; the next best, in November and December; the worst, in April and May. The collected nests are cleaned and assorted; they are first packed in bags of bamboo fiber or palm bast, and the merchants again pack them for the market (after a second assortment) in cases containing a half picul, or seventy pounds.

China is the only considerable recipient of these cases; the few cases which are brought as a curiosity to Europe and America are hardly worth mention. The greatest trade in birds' nests is done with Canton, the entire import there being reckoned at 168,000 lbs. We may reckon on fifty nests to the pound, so that altogether 8,400,000 nests, or, from three pluckings, the products of 2,800,000 pair of birds, are annually introduced into China. There are, principally, two kinds of nests distinguished in Canton—the mandarin nests, and the ordinary; of the former or perfectly white kind, each pound costs in China twenty to thirty dollars, a quite exorbitant price, compared with that which the salangan pluckers themselves receive for the dangerous work, and which is, at the most, only ten to twelve per cent of the market value. The second quality of nests are sold at half that price. The nests are dissolved in water or broth, and so taken as soup. It is highly spiced with minor substances. This forms an *entrée* which is rarely wanting on the tables of the wealthy Chinese, and never from that of the imperial court of Peking. The Chinese set a high value upon it, considering it one of the best stimulants; but for this opinion there seems to be little or no ground. The most recent analysis of the nests we owe to Professor Troschel of Bonn. He finds that the material does not consist of specially nourishing or stimulating substances, but is quite similar in constitution to any animal saliva. Thus the Chinese pay dearly for what has really no intrinsic value.—*Chambers' Journal*.

The Water Shell.

A correspondent writing from Okehampton, England, where some artillery experiments have recently been made, states that the trials have been successful in proving the great value of the new water shell, which will at once be adopted as a service weapon. The effects of this novel instrument of warfare surpass in destructive power the renowned Shrapnel shell; and in one experiment when a battery of the Royal Horse Artillery was in action, as many as fifty-one hits were recorded with the new shell, against twenty-eight made by the Shrapnel, fitted with time fuses. The wooden dummies, which represented the enemy drawn up in loose order, one pace apart, in the manner of an advancing army, were struck again and again by the minute fragments of the water shells, which, according to our correspondent, inflicted wounds of a far more dangerous nature than those made by the Shrapnel or common shell.

The nature of the water shell may be explained in a few words. It is not a projectile of special construction, but simply a common shell or cast iron cylinder filled with water, into which is fitted a small cylinder containing a quarter or, at the most, half an ounce of gun cotton; it is then hermetically sealed; a few grains of fulminate of mercury is placed between the gun cotton and the fuse, and, as soon as the latter is fitted, the shell is ready firing.

The charge of gunpowder used in the same sized shell is sixteen ounces, the explosion of which breaks the shell up into 3 or 4 pieces, whereas the one charged with half an ounce of gun cotton flies into a hundred or more fragments. The reason is this: The gunpowder explodes comparatively slowly, and breaks up the shell at its weak points, while the gun cotton detonates with a sudden and terrible force, which, being communicated to a non-compressible body (water), bursts the shell instantly into minute fragments, the energy being exerted equally on all sides. So rapid and terrible is the force generated by the gun cotton that the iron shell is sometimes pulverized, the fragments of metal being so minute as scarcely to be visible.

The idea of this terrible shell is due to Professor Abel, the scientific referee of the English war department, who is also the patentee of a process to manufacture gun cotton, by which process, it appears from our correspondent's letter, the gun cotton is rendered the safest as well as one of the most powerful of all known explosives; being kept always in a wet state, preventing accident without diminishing its efficiency. The English, German, and French governments have adopted this new form of gun cotton for torpedoes and shells, as well as for military engineering and submarine mining.

Appreciation.

The following are samples of letters frequently received at this office. It would occupy too much space to publish a small fraction of them, but we occasionally, as an acknowledgment to the writers of all such letters that we are not unmindful of their good words, make public one or two of these unsolicited expressions of appreciation. They are mementoes treasured by the recipients, and act as a lubricant to machinery, smoothing the way, and making light the work incident to active professional pursuits:

MESSRS. MUNN & Co.—

GENTLEMEN: Letters patent have been received for our tyre tightener. Allow us to return our thanks for the able manner in which you have conducted our business, in securing our letters patent. And in the future we will remember you to others who may need assistance in securing patents. Very truly yours, HORTON & HAYES.

McKinney, Texas, August 27, 1875.

RESULT OF AN ADVERTISEMENT.

On the day that the above was received at this office, the following letter, from Senator Randolph, of New Jersey, came to hand:

O. D. MUNN, Esq.:

It is due to you to say that, of over 300 enquiries about the Ditcher since June, 75 per cent refer to the advertisement of it in the SCIENTIFIC AMERICAN. We have advertised largely in other directions with little success. The single advertisement in the SCIENTIFIC has brought us applications from every State and Territory of the United States, and from Canada, England, France, Belgium, Australia, Brazil, and Buenos Ayres. These are hard, dull times; and I cannot present you with a Ditcher, but can make you feel that, despite the times, people read and heed your good paper.

Yours truly, THEO. F. RANDOLPH.

New York, September 3, 1875.

Opening of the American Institute Fair.

The annual exhibition of the American Institute of this city is now open, and presents a most interesting and attractive display of industrial productions. We shall take occasion to report whatever is new and of interest in the exhibition when order reigns within the building.

THE Chinese alloy called *pakfong* is made by fusing together 10 parts copper shavings and 4 parts arsenic, arranged in alternate layers in a covered crucible, with a layer of common salt on the mixture.

DECISIONS OF THE COURTS.

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

THE GOULDS MANUFACTURING COMPANY vs. JOHN P. COWING et al.—PATENT PUMP.

[In equity.—Before Mr. Justice HUNT.—July, 1874.]

This was a suit in equity, brought upon letters patent for an "improvement in gas pumps," granted to the complainants on the 8th day of August, 1871, as the assignees of William H. Pollard, the inventor. The case came up on exceptions to the master's report, to whom under a previous decree had been sent for an accounting.

The rule is settled that, when the patent is for an improvement upon a machine, the damages for the infringement of such patent are confined to the profits made by the use of the improvement only, and not by the manufacture of the whole instrument.

The complainants, at the accounting, proved the expenses of making and selling the infringing pumps; that they were prepared and ready to fill the orders taken by the defendants, and the prices at which the pumps were sold by the defendants; and the master took the difference between such expenses and such prices (being \$47.71 on each pump) as the measure of damages. Held, that as the patent invention was merely an improvement in pumps, being only a special construction of the side chamber, whereby the same is adapted to use with the valve casings bolted on the outside, and constituting but a small part of the aggregate mechanism, this rule was erroneous; and that the damages could not exceed the profits upon such improvement.

The burden of proof, to show the amount of damages or profits, is upon the plaintiff. Where he fails to show the profits or damages arising from the use of the patented improvement, as distinguished from the profits on the entire machine, nominal damages only can be recovered.

[J. B. Perkins, for complainants.

Eliza Foote, for defendants.]

Supreme Court of the District of Columbia.

[In General Term.]

FREDERICK G. AND WILLIAM F. NIEDRINGHAUS.—APPEAL.—WHAT CONSTITUTES A DESIGN PATENT.

In the matter of the application of Frederick G. and William F. Niedringhaus for a patent for a "Design for Ornament for Enamelled Iron Ware," filed June 3, 1874.—Appeal from the Decision of the Commissioner of Patents.]

A beautiful appearance is not of itself entitled to a design patent. The design must also be new and original, and the result of invention and genius.

Mere exhibition of skill on the part of workers in enamel, in giving beautiful forms and colors to their productions, when they are the common efforts of persons ordinarily skilled in the art, is not the invention which is protected by the law.

The use of an old design is clearly excluded from patent by the statute, and mere change or "double use" cannot receive its protection. The same degree of originality is required in both design and functional patents—that is, the claim must not comprehend what is already in existence.

A design consisting in a mere mottled appearance to be given to enamelled iron ware is not patentable.

Mr. Justice McARTHUR delivered the opinion of the court: This is an appeal from the decision of the Commissioner of Patents refusing a design patent in enamelled iron ware to Frederick G. Niedringhaus and William F. Niedringhaus. The statute in regard to design patents reads as follows:

"Any person who, by his own industry, genius, efforts, and expense, has invented and produced any new and original design for a manufacture, such as, statue, alto-relievo, or bas-relief; any new and original design for the printing of woollen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture; or any new, useful, and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, or patented or described in any printed publication, may, upon payment of the fee prescribed, and other due proceedings had the same as in cases of inventions and discoveries, obtain a patent therefor." (Sec. 4929 United States Revised Statutes.)

In their specification, the applicants claim to have invented and produced a new and original design of ornament or pattern, to be printed, painted, or otherwise placed on, or marked into, the various articles of enamelled iron ware which they make and sell. A photograph is annexed to illustrate the outline. They also say that "the article itself, however, when completed, presents to the eye a beautifully mottled appearance, resembling granite in color, which the illustration fails to exhibit. It is this peculiar mottled appearance which constitutes the chief merit of our design, and it is on this we place most importance."

The Primary Examiner, the Examiners-in-Chief, and the Commissioner have all concurred in refusing the application for the patent. The Commissioner, in his decision, says:

"I concur in the opinion of the Examiners-in-Chief, so far as want of patentability in the general subject matter embraced by the application is concerned. The so-called design is effected by printing, painting, or in any other way placing upon iron ware a peculiarly mixed color. The enamelling of iron ware in various colors is an art well known. If applicant has achieved anything new, it is to be found in the mixing of colors, by which he produces a mottled appearance having the effect of granite coloring. If he has in this way obtained a new paint, it may or may not be patentable; but the application of such a paint in an ordinary way does not constitute the subject matter of a design patent, even under the most liberal construction of the statute."

The court are unanimously of the opinion that the decision of the Commissioner ought to be affirmed. The art of enamelling has been practised for many centuries, and the different kinds of enamel have been produced in every variety of shade and color. The materials used for the purpose of

coloring, and the process by which they are fused, have been known so long that, to change them, requires only the taste and skill of one engaged in the business. The applicants, of course, do not mean to claim any exclusive right to what is so well known. But their specification certainly seems to suggest that the change of color "resembling granite" imparts great value to their invention. They say "the mottled appearance which constitutes the chief merit of our design, and it is on this we place the most important part of the argument, and it is on this we place the most important part of the argument." The specimens of enameled iron ware exhibited by counsel on the argument was of a color resembling granite, and was marked by spots of different shades darker than granite. The enamel and coloring substances are manifestly liquidized by intense heat, such as enamels use, until they are completely fused, and they are laid upon the iron ware while in this condition. The spots are then formed at random, in larger and smaller patches, without regard to regularity or design of any kind. It is undoubtedly a very ornamental to the article, and has a pleasing effect on the eye. This is equally true of the hundreds of objects upon which this art is employed. Ornamental work is great variety, and paintings that never lose their freshness, are executed in enamel. Indeed, the primary object of this art is to impart greater luster and beauty to every article of luxury or utility to which it is applied. A beautiful appearance is not in itself patentable. The design must be new and original, and the work of invention and genius. The ingenuity and taste of workers in enamel are quite wonderful to all but those employed in it; but no one would imagine that these exhibitions of skill, in giving beautiful forms or colors to their productions, was the kind of invention to be protected by the law. They are the common efforts of persons ordinarily skilled in the art. The applicants contend in their brief that "it matters not if the design has been previously used, if now combined with an 'object' with which it has not been hitherto combined; and if, as a result of such association, a new and distinctive aspect is given to such object, the law is complied with," and refers to former decisions in this the Commissioner of Patents as cases in point. We cannot concur in this view. The thing provided for in the law is, "any new and original design for printing," "the same not having been known or used by others before his invention or production thereof." The use of an old design upon an old object is clearly excluded by the statute, and mere changes or "double use" cannot receive its protection.

Besides, it is now well understood that the same degree of originality is required in both design and functional patents. That is, the claim must not be for a copy or imitation of what is already in existence. If, for instance, the applicants should manufacture their iron ware with a figure of the statue of the Three Graces, it might improve the appearance of the article, but would scarcely entitle them to the benefits of a patent. To manufacture it with enamel is a change of the same kind, for the same thing has been before formed on metals from time immemorial. To give the enamel any particular color is a matter of ordinary skill and taste. The coloring substances have always been fused with the enamel in the heat of the furnace. We can, therefore, observe nothing in the present specification to which the term invention can be applied.

I am aware that the Supreme Court of the United States, in *Gorham Company v. White*, 11 Wall., 321, have said, in regard to design patents, that "they contemplate not so much utility as appearance, and that not an abstract impression, but an aspect given to those objects mentioned in the arts."

That was an action brought for the infringement of a design patent for the handles of tablespoons and forks. The design consisted in the configuration of the spoon and the ornamentation of the handle. The outline and all the details of the design were new, and valuable in each spoon alike. No question was discussed as to the originality of the patent, for it had never been known before, and the court decided that the article manufactured and sold by the defendant did not differ substantially from plaintiff's, and that it was therefore an infringement. But the whole tenor of the decision is to the effect that the appearance or aspect of the object must be of a design that is new and original. Indeed, no other view is admissible, for such is the express requirement of the law.

The decision of the Commissioner is affirmed.

[Charles M. Moody, for appellant.
Wm. H. Doolittle, for the Commissioner.]

United States Circuit Court—District of Massachusetts.

PATENT BOTTLE FASTENER.—HENRY W. PUTNAM vs. E. D. WEATHERS and others.

[In equity.—Before Shepley, J.—May, 1875.]

Where a patent has been a long time in existence, has been renewed by the Patent Office after the expiration of the original term and in the face of opposition, and has been sustained by the adjudications of several of the federal courts, the patentee is entitled to protection by a preliminary injunction, at least until the adjudication of some tribunal shall decide the patent invalid.

Where a motion for an injunction was heard outside the district where the suit was pending, the order withheld until the court should be sitting within the district.

The bottle stopper fastener covered by the Putnam release of January 19, 1864, which consists of a piece of wire of U-form with the ends returned and connected to the bottle (in order that the pressure on the cork or stopper may cause the fastener to hold more securely), is not anticipated by the sheet metal U-shaped yoke of the Allender fastener of 1855.

The wire embraces the cork, under pressure from within, and thus prevents the fastener from tripping. It also presents a change of form which permits the fastener to be pressed off without injury to the thumb of the operator or to the cork.

Consideration given to the fact that the Commissioner of Patents, in both granting and extending the patent, was aware of the nature of the Allender device, but held that the Putnam fastener contained something more than the mere substitution of a wire U-shaped yoke for a sheet metal U-shaped yoke.

[This was a suit in equity brought for an alleged infringement of released patent granted to Henry W. Putnam, January 19, 1864, for an "Improvement in Bottle Stopper Fastenings." The invention will be found illustrated in the reported case of Putnam vs. Hickey (5 Fisher, 324).
[W. H. Clifford and Thomas H. Dodge, for complainants.
Ben. J. Thurston, for defendants.]

NEW BOOKS AND PUBLICATIONS.

THE SHOE AND LEATHER REPORTER, devoted to the Trade in Leather, Boots and Shoes, Findings, Hides, Skins, Wool, Furs, Tanning Materials, etc. Edited and Published by Isaac H. Bailey. New York city: 17 Spruce street.

This paper, which is devoted to the shoe and leather interests of not only this city but of the whole country, has changed proprietorship. Isaac H. Bailey, Esq., a gentleman well known to the leather trade in this city, has become its owner. Mr. Bailey was for many years a merchant, and has an extensive acquaintance among our business men, both in the "Swamp" and out of it; and it there is any writer that can make the subjects of leather and boots and shoes interesting to the public, that man is the present editor and proprietor of the *Shoe and Leather Reporter*. Published weekly. Price, including postage, \$3.50 a year.

THE MECHANIC'S FRIEND, a Collection of Receipts and Practical Suggestions. By William E. A. Axon, M. R. S. L. With 300 Illustrations. 12mo, cloth. Price \$1.50. Copies sent free by mail on receipt of price. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This work consists of extracts from the pages of *The English Mechanic*, the nature and scope of which periodical are well known to our readers. The ideas and suggestions are practical and, in many cases, original; and artisans of every class will find much that is useful in its pages.

NATIONAL HYMN AND TUNE BOOK, FOR CONGREGATIONS, SCHOOLS, AND THE HOME. Price 40 cents. Boston, Mass.: Ditson & Co.

The music in this work is that with which every young person should become familiar, since it includes the tunes, old and new, that will be used during the next life-time in public assemblies. The arrangement into four simple parts has an educational value, and either one, two, three, or four parts may be practised and sung. There are more than 200 tunes, with 340 accompanying hymns.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From July 7 to August 25, 1875, inclusive.

BRECH-LOADING FIRE ARM.—N. King, Hartford, Conn.
CASTING METALS.—C. Grasser, Somerville, Mass.
CHAIN CABLE.—C. A. Chamberlin, Camden, N. J.
COMPRESSING FLUIDS.—T. S. Danton, Philadelphia, Pa.
DENTAL PLATES.—V. Smith, Schenectady, N. Y.
DISCHARGING GRAIN, ETC.—C. W. Mills, Montclair, N. J.
ELECTRO-MAGNET.—W. L. Powelson, San Francisco, Cal.
FILLING MILL.—W. B. Lodge, Danbury, Conn.
LIQUID METERS.—E. Marsland, Ringling, N. Y.
LOCOM.—J. Fish, New York city.
MAKING BUTTON HOLES.—A. H. Cramp (of New York city), London, Eng.
MOTOR.—J. G. Lane, Millbrook, N. Y.
OVER-SKIVING MACHINE.—J. L. Boone et al., San Francisco, Cal.
PLAYING CARDS.—I. Levy (of New York city), London, England.
PRINTING PRESS FEED.—F. Deming, Waterbury, Conn.
REVOLVING PISTOL.—E. Remington & Sons, Ilion, N. Y.
SPINNING RING, ETC.—H. A. Chapin, Springfield, Mass.
STEAM ENGINE.—G. B. Dixwell, Mass.
UMBRELLA FRAME.—J. Horton et al., New York city.
WINDING UP LIFTS, ETC.—V. W. Mason, Providence, R. I.

Recent American and Foreign Patents.

Improved Dust Brush.

Henry R. Conant, Geneva Lake, Wis.—The brush portion of the duster, which may be made of feathers, hair, silk, or any suitable material, is attached to springs in bunches, and the springs are connected together so as to form a mutual support for each other, and keep the brush in place.

Improved Claw Bar.

Andrew Shaw, Petroleum, W. Va.—This is a bar for drawing spikes from railroad ties, and for drawing spikes or nails in other places, so made as to allow the clutch jaw to be raised and the leverage obtained, diminished after the spike has been partly extracted, so as to draw the spike clear out.

Improved Car Brake.

Alfred T. Riley, Halleck, Mo.—A lateral band spring of suitable power is seated in side supports near the central bottom part of the car frame, and connected by a rod to the brake-operating lever that is connected to the front drawhead, and to the brake wheel on the tender or locomotive. The drawhead or spring controls jointly the operations of the brakes of all the wheels. When the car is in a state of rest, so that no strain is exerted on the spring and front drawhead, the brakes are all, by the action of the spring on the lever and brake rods, tightly applied to the wheels; but when the cars are coupled and drawn forward, the front drawhead slides forward and releases the brakes by the strain on the spring.

Improved Ironing Board.

Orlando S. Pride, Yonkers, N. Y., assignor to himself and John E. Woodruff, same place.—In using the device, the board is passed into the shirt, and the neck band is turned down into a notch. Portion of a frame is then placed in the said notch to confine the said neck band, and the rear part of the board is raised, and its rear edge is placed against the inner edge of a rear cross bar. The shirt bosom is then drawn straight and smooth, and the frame and the rear part of the board are pressed down. In this way the shirt bosom will be held straight, smooth, and firmly, so that it can be quickly ironed.

Improved Grain Separator.

William E. Torley, Milwaukee, Wis.—The cockle and small wheat pass off from a fine screen to the indented concave sides of a drum for the cockle to fall into the indentations, which will not hold the wheat, because of the elongated form of the grains, so that the wheat will pass off first when the sides turn down with the drum. At the point where the wheat will naturally slide off the plates is a chute, to receive and conduct it into the hopper. A brush in front of the drum brushes back any of the cockle on the front edge of the indented sides liable to slide off with the wheat and throw it back into the pockets.

Improved Corn Sheller.

Solomon Williams, Tehuacana, Tex.—This is an attachment for corn shellers, consisting of a block having a conical cavity with ribs or teeth on the inside, and arranged upon the extended end of a cylinder journal. Its object is to remove the small kernels from the end of the ear, or nub it, before it is put into the sheller.

Improved Horseshoe.

Arthur C. Snowden, South Norwalk, Conn.—This horse overshoe consists of two plates of metal, which are hinged together near the toe, so that the shoe will open and close. The interior plates cover the under part of the foot, but not the frog, for which they are shaped to leave space, and are lapped or shut past each other. Hook flanges on each plate fasten the overshoe to the shoe on the horse. The hinged parts are spread by means of a screw, so that the hooks on the plates will tightly embrace and hold the overshoe to the shoe on the horse.

Improved Welding Compound.

John Scott, Jr., and Amos S. Scott, Coatesville, Pa.—This is an improved welding compound, to be used in the manufacture of iron and steel, and it consists of a mixture of kaolin and sand.

Improved Hat and Coat Hook.

Charles Schoenlein, Brooklyn, N. Y.—This invention consists of a horizontal supporting arm with forked levers pivoted thereto, of which the upper one is weighted at the rear end to bear on the lower lever and open the front ends, which close like jaws on the coat or other article suspended from the lower lever. When the coat is removed, the jaws open instantly by the action of the weighted lever, and are ready for repeated use.

Improved Sharpening Machine.

Andrus S. Weaver, Joy, N. Y.—A reaper knife is fastened to the adjustable table by a cam lever. The table is adjusted by the two eccentric levers and by a spring. The grinding stone is moved back and forth on the knife by a bar and rack and pinion to grind the teeth to the proper level after the knife table has been properly adjusted. A crane is hinged to the plate on which the bar rests, so as to readily move forward and back. The forearm is hinged to the top of the crane. The grinding stone, as well as the reaper knife, may be adjusted to almost any position.

Improved Wind Wheel.

Horace J. Brimball, Jr., of Millington, Ill., assignor to himself and Samuel E. Foster, same place.—This invention consists of fans shaped like the are of a circle, and pivoted at the middle of the top and bottom to horizontal arms projecting from the shaft, so that they may swing into radial, or nearly radial, positions to take the wind, and into a circle to close, so that the wheel will not be turned by the wind. The buckets are connected to a slider on the shaft, which is moved by a lever to open and close them for starting and stopping the machine.

Improved Safety Center Pinion for Watches.

Charles R. Bacon and Leuthold C. Brown, San Francisco, Cal., assignors to Cornell Watch Company, same place.—This consists of a center wheel with detachable pinion, having projecting teeth that inclose a spring secured by a spring at one end to a perforation of the center wheel, while the opposite free end of the spring binds pinion and center wheel to revolve in the usual manner, while it turns freely without the center wheel in opposite direction.

Improved Ice Breaker.

Joseph T. Martin, Newark, N. J.—This ice breaker consists of a shaft carrying radial arms. Said arms are rigidly secured to said shaft, and are provided at their outer ends with ax or wedge shaped heads. The whole is mounted in a suitable frame, adapted to be secured to a vessel, and operated so as to cut a passage before the vessel through ice.

Improved Hose Nozzle.

Charles Oyston, Little Falls, N. Y.—This is a hose nozzle for extinguishing fires, so constructed as to divide up the stream of water into a fine spray. A plate, in which are formed a number of annular openings, is connected with three arms, the outer ends of which are connected with the flaring middle part of the shell of the nozzle. A series of concentric ring wedges also are connected together by three arms, and in the outer surface of the outer ring is cut a screw thread to screw into the shell. The ring wedges and arms are cast in one piece, and the said ring wedges are so arranged that their edges may be directly opposite the annular openings in the plate, so as to divide up the ring sheets of water.

Improved Glazier's Diamond.

Philip Stutz, Baltimore, Md.—The object of this invention is to obviate the difficulty experienced by unskilled persons in securing the right inclination of a glazier's diamond to produce the best cutting effect. It consists in a broad-faced instrument, having at one end a diamond and at the other a guide roller, which latter forms with the diamond the supports of the instrument upon the glass, and keeps the sharp angle of the diamond in proper position for cutting. In between the guide roller and the diamond are different sized notches, which are cut into the face of the metal for the purpose of breaking off the cut portion of the glass.

Improved Steam Boiler.

John E. Jerrold, Meadville, Pa.—The ends of the boiler tubes are flared or spread outward into grooves, and the inwardly projecting edge of the metal around the opening (in the tube sheet) is bent or turned down over the end of said tube, thereby clamping or confining it in place and forming a tight joint, and preventing rapid injury from heat.

Improved Boot and Shoe Calk.

Rufus D. Guilford, St. Charles, Mich.—This calk is formed from a rectangular piece of sheet steel, struck up in suitable dies, whereby its corners are bent or turned down to form spurs.

Improved Indicator for Steam Engines.

Joseph W. Thompson, Salem, Ohio.—The indicator is designed to register the relative amounts of steam pressure exerted on the piston at each portion of its stroke. It is in part an improvement upon the automatic recording indicator for which letters patent of the United States were granted to C. B. Richards, March 24, 1863. The object of the invention is chiefly to reduce the number and weight of the parts composing the recording mechanism proper, and thus correspondingly reduce their momentum when in action, to the end of securing a more perfect record of the several steam pressures existing in the engine cylinder during a given stroke or strokes of the piston.

Improved Injector.

Samuel Fowden, Philadelphia, Pa.—The steam is admitted through an annular opening formed by a water tube and a mixing tube, while the water is admitted through a central tube, the opening through which is regulated by an adjustable spindle. The apparatus for lifting the water consists of valves with hollow stem, steam pipe, and jet.

Improved Middlings Purifier.

Richard W. Gunter, Carrollton, Mo.—The invention comprises a series of flat inclined laterally and longitudinally shaking sieves, placed one above another, with a fan blowing into and through the space under each, to carry off the light matters. Valves are provided to regulate the blasts, and a conveyor is placed under the bottom sieve. There are inclined close bottoms to the sieves, descending toward the fans to carry the middlings back. These have openings at certain intervals for discharging to the fans below. In front are wind breakers to prevent the wind from blowing the middlings back up the bottoms.

Improved Sugar Cooling and Draining Apparatus.

Joseph H. Hynson, Alexandria, La.—This consists of an oblong cooling vessel, with bottom inclined from both sides toward the center, where a longitudinal slot connects with a slotted revolving draining tube, fitting tightly to the under side of the central bottom part of the vessel. When, after the striking is finished, the sugar in the cooler has sufficiently granulated, the process of drainage is commenced by turning the crank until the slotted part of the tube opens gradually toward the bottom slot of the cooler. If the sugar is still warm, the molasses drains rapidly through the narrow crevice without allowing any of the grains of sugar to pass; but if the sugar has cooled and become firmer, the opening between tube and bottom slot may be opened wider for the readier draining of the molasses which has collected by granulation at the central bottom part of the cooler. The molasses may in this manner be drained off more or less rapidly, according to the degree of heat in the sugar.

Improved Car Starter.

Anthony A. Jones, Utica, N. Y.—A ratchet wheel is fixed on the front axle of the car, and a long pawl lever is arranged to operate it. When it is desired to start the car, the front (free) end of the lever is depressed by the driver applying his weight thereto (through the medium of a rod projecting up through the platform) which causes the ratchet wheel to revolve the front axle and thereby the car wheels.

Improved Cotton Sweep.

Manfred Call, Richmond, Va.—The invention consists in a cotton sweep with sharp cutting wings on both sides of a nose or point, inclined with their lower edges in advance, and attached by bolts to the standard as well as the nose flange.

Improved Vehicle Spring.

Henry Jeffrey, Seymour, Ind.—V-shaped bearing springs are interposed between the ends of the flat top and bottom tension springs. Both the flat tension and V-shaped bearing springs are made of semi-elliptic shape, and joined at the outer ends by being bent around the bolts of the clips, to which they are connected. The clips are set into casings of the carriage body and frame. The bearing springs are seated against a solid central shoe part, and retained by crosspins connected by outer links passing sideways.

Improved Shingle Machine.

John J. Kendall, Greensborough, N. C.—The reciprocating driving heads carry two knives and work alongside of stationary heads, against each side of which a bolt is to be held on the table by an attendant. Spring clamps behind the cutters receive the blanks cut off from the bolts between them and the side of the head, to hold them ready for the feeders, which consist of the swinging dogs placed on vertical oscillating shafts. The feeders catch in the sides of the blanks by thin notched and pointed ends, and push them along stationary guides, between shaving cutters, so that when they pass off from the riving heads they drop in front of their ends, to be pushed by them through the shaving cutters. These cutters are open when the blanks are pushed in by the feeders; one closes on the blank just before it begins to be pushed along, and continues to move it toward the other cutter. An eccentric opens the cutters again just before the feeder works, ready for receiving another blank; and immediately after the feeder works, the riving head comes against the blank fed into the cutters, and pushes it forward. The throw of the eccentric may be changed to open and close the shaving cutters more or less, according to the required thickness of the shingles.

Improved Shot Charger for Shot Pouches.

John S. Long, Elkville, Ill.—This is a steel cutting valve with a cleaning ring at the lower end, working through a chamber, which is enlarged on one side of the valve, so as to give clearance to the shot as they are divided without pinching on the blade. Also a series of slots in the upper portion of the barrel, for gauging different charges, are arranged radially to the pivot hole of the lever, to which the valve is connected.

Improved Butt Hinge.

A. H. Isham, Avon, N. Y.—This invention consists in providing each wing with an inclined notch near the upper end and the rising spindle with a doubly inclined lug, so that the spindle will always be drawn down by the action of the wing.

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A. K. will find directions for polishing meerschaum on p. 155, vol. 31. A. J. B. will find directions for cleansing greasy waste on p. 202, vol. 31. R. J. will find directions for gliding picture frames on p. 90, vol. 30. F. J. will find directions for adjusting a level on p. 218, vol. 31. J. N. will find a recipe for sulpho-cyanide of potassium on p. 219, vol. 31.

(1) G. F. asks: How is telegraph wire galvanized? A. Galvanized wire is simply a wire covered with a coating of zinc. The wire is first immersed in acid, and then run through a vat of melted zinc.

(2) W. H. G. asks: How many cells of the Callaud battery will it take to run a small foot lathe on light work, with an engine to match? A. It depends upon how much power you require. You can get ½ of a horse power by using 100 cells of very large size.

(3) A. J. asks: Can I get porous cups made at a pottery? A. Yes. 2. Would a gallon battery, consisting of a jar with copper cylinder, inside of which is a porous cup with zinc, the inside jar being filled with sulphuric acid and water, and the porous cup being filled with salt water, do for plating watches? A. It would not be a very good battery.

(4) H. P. R. asks: Does the conductivity of a lightning rod depend upon the surface of the rod or the cross section, that is, will a rod ¾ inch in diameter, round, be as good a conductor as the same amount of metal, flat and with a large surface? A. It depends upon the quantity of metal, irrespective of the shape.

(5) M. L. B. says: I propose to construct a burglar alarm (to be attached to doors and windows of my house) as follows: I use line wire No. 20, of copper, put up on brick work with shingle nails, the wires being 4 inches apart; longest circuit is 120 feet; bell magnet has No. 23 wire, to be operated by one cell of Leclanché battery. The wire is to be put up before the plastering, and is, of course, covered by the plaster. The wire is common copper wire not insulated, but all joints are to be soldered. Will it work? A. Use copper wire insulated with gutta percha or kerite.

(6) E. E. R. asks: Has any person discovered the properties of lightning? A. Franklin discovered the identity of lightning and electricity. Its properties are the production of heat, magnetism, chemical decomposition, shocks, light, and polarization.

(7) D. B. B. asks: 1. Where can I get a hard rubber plate for a Holtz electrical machine? A. At the rubber factories. 2. Would the ordinary hard rubber in sheets answer the purpose? A. Yes. 3. Is the effectiveness of a machine increased by a higher polish of the rubber? Yes.

(8) V. F. P. M. C. asks: How large a flue ought we to have in a stack 75 feet high, other things being in proportion and the surroundings favorable, for a boiler 5 feet x 13 feet, with seventy-one ¾ inch flues, in order to get the greatest benefit of fuel used? A. Make the area of the flue about the same as the collective cross area of the tubes.

(9) L. H. M. asks: What fluid would be the best to use for changing the weight from one end of a tube to the other at will, in a certain stated time, by letting it pass slowly through a small opening, the same as in an hour glass? A. Dry sand, such as is sold by stationers, will answer. Perhaps mercury would be better. We could not tell without knowing more particulars.

(10) J. C. says: My steam gage points to 5 lbs. when everything is cold. Is it reliable? A. Possibly it has water pressure on it. You should have it tested, however, as soon as possible.

(11) J. R. N. asks: If there is an iron vessel of sufficient strength to stand a pressure of 250 lbs. to the square inch, and of sufficient capacity to hold 1 gallon of cold water, can there be any more water forced into the vessel? A. Yes, since water is slightly compressible.

(12) J. T. R. asks: 1. How can I inflate a cotton balloon with hot air? A. Soak a sponge in alcohol, set fire to it, and hold it under the balloon. It is well to put the sponge in a barrel or deep vessel. 2. Please give a recipe for varnishing cotton balloons. A. See p. 135, vol. 28.

(13) W. B. asks: Has the screw ever been applied to car brakes instead of the chain, as a means whereby to work them? A. Yes. Does any substance projected into space return with the same velocity as that with which it ascended? A. No, if your question refers to initial and final velocities.

(14) M. M. says: 1. Some of our engineers use old india rubber hose to make joints on the hand hole plates of their boilers; they claim that

it makes a tighter joint than hemp and white lead, but I think the gum corrodes the iron around the joint. Am I correct? A. No. The practice is very common, and generally approved. 2. Please give a rule for putting gage cocks in locomotive boilers. A. Place one 3 or 4 inches above crown sheet, and the others the same distance apart over it.

(15) C. T. O. says: I have been making some tests of a plain slide valve engine. I have taken the following data every half hour: Revolutions, indicator card, pressure of steam and atmosphere, and the temperature of outside of engine and in boiler room, injected water, and steam. I put a plug in the steam dome and in the water pipe, and filled it with mercury; but I do not get within 3° of the temperature due to that pressure. Could you tell me the reason? A. It would seem that either your pressure gage or thermometer is incorrect; but you do not send enough data to enable us to form a very definite opinion. We would be glad to receive from you an account of the trial, giving data and results, with description of manner of conducting the experiment. You need not be afraid of making it too full.

(16) N. C. F. Sr. says: I wish to build a small steamship about 3 feet long after the model of the Cunarders, to be driven by a screw. How large an engine would be required to move it rapidly? A. Make everything about on the scale of the original. We imagine that in Boston you can pick up more in a ship yard, in a short time, than you can learn from the most elaborate treatises.

(17) A. M. Z. asks: Will a flat bottomed boat, 15 feet long, 28 inches wide, and 12 inches deep, sail as fast and stand as much as a round bottomed boat of the same dimensions? A. With a center board, it will do very well.

(18) A. D. H. says: 1. I am building a boat 25 feet long by 6 feet beam, drawing 2 feet of water. I wish to put in an engine 4x4 inches, and a boiler 2 feet in diameter by 4 feet high, having 28 two inch tubes. Will boiler and cylinder be in proportion, and will they be large enough for the boat? A. The machinery will answer very well. 2. What size of screw should I use, and what pitch? A. Use a propeller 2 feet in diameter, and of 3 feet pitch.

(19) C. R. says: Suppose we are standing on the upper side of the globe; when it has made a half revolution, and we are then standing with our heads downward, why are we not conscious of it? A. We are, to a considerable extent, if we take account of such incidents as sunrise and sunset.

(20) J. M. L. asks: 1. Is any advantage likely to be derived from attempting to bleach or clarify crude mineral oils, by bringing them in contact with bleaching gases, such as sulphurous acid or chlorine, or even only by hot air or steam, by some process similar to that used in Louisiana for bleaching sugar cane juice? A. No. Agitate the oil with one sixth of its bulk of oil of vitriol for some time; wash with water, and repeat the acid treatment a second time if necessary. 2. Could not chlorine be made at such a low price as to allow of using it instead of sulphurous acid in bleaching sugars? A. Chlorine gas may be obtained cheaply and in large quantities from chloride of lime (bleaching powder) by treating it with a little oil of vitriol.

(21) H. asks: What kind of acid is used to frost glass? A. Hydrofluoric acid is used for this purpose, and is obtained in the gaseous form by subjecting powdered fluor spar to the action of strong oil of vitriol in a leaden tray. This should be placed in a warm place, and the glass to be frosted placed over it as a cover. The sand blast has lately been substituted for this tedious and expensive process, with very satisfactory results.

(22) J. F. G. asks: 1. What material is best to coat paper with to render it waterproof? A. Dissolve 8 ozs. of alum and ¾ ozs. of white soap in 4 pints of water; in another vessel dissolve 2 ozs. of gum arabic and 4 ozs. of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture, and hang it up to dry, or pass it between steam-heated cylinders. 2. Is it practicable to coat paper with porcelain enamel, such as pots and kettles are lined with? A. It is not possible to enamel paper with a silicate.

(23) R. L. asks: Can you explain the fact that flies, resting on the wall, or any perpendicular fixture or furniture, if alive will rest with their heads downwards? If dead, they will be found with the heads upwards. A. Our observations do not sustain yours. We find that, of flies resting upon the wall, etc., some have their heads pointing upwards and some downwards.

(24) C. M. says: 1. I am told by good authority that muriate of soda will prevent coal oil from exploding. Will it do it? A. No, if we understand your question. 2. What is the reason that, the moment you place a chimney over a smoking lamp it ceases to smoke, the lamp wick being at same height in both cases? A. The shape of the chimney causes a greater supply of air to the flame, and consequently of oxygen; and the result is a more perfect combustion.

(25) C. B. H. asks: 1. How can I get rid of the peach borer in peach trees? A. The following plan, proposed by Harris, has been found very successful: Remove the earth around the base of the tree, crush and destroy the cocoons and borers which may be found in it and under the bark, cover the wounded parts with common clay composition, and surround the trunk with a strip of sheathing paper eight or nine inches wide, which should extend two inches below the level of the soil and be secured with strings of matting above. Fresh mortar should then be placed around the root, so as to confine the paper and prevent access beneath it, and the remaining cavity may be filled with new or unexhausted loam. This operation should be performed in the spring, or during the month of

June. In the winter the strings may be removed, and in the following spring the trees should again be examined for any borers that may have escaped search before, and the protecting applications should be renewed. 2. Will boiling water around the roots kill the trees? A. Yes.

(26) H. R. asks: 1. Is an engine 2x4 inches large enough to run a boat 30 feet long? A. The engine is too small to give much speed. 2. Please give me the proportions of a boiler suitable for this engine to work at 300 lbs. pressure. A. Make an upright boiler with about 50 square feet of heating surface. 3. Please tell me the proper diameter and pitch of screw. A. Use a propeller 30 inches in diameter, and of 25 or 30 inches pitch. 4. How fast will she run? A. Ascertain this by experiment.

(27) R. L. S. asks: Will cold-blooded animals, such as fish, alligators, and snakes, live for years, grow, and fatten, without food? A. No. 1. Are any of those stones known as Indian arrow points found in Europe, or anywhere else than America? A. In Europe. Consult Harper's Magazine of June and July, 1875, on an article entitled "The Stone Age in Europe." 2. Were they in use by the Indians in America when it was discovered, or since? A. Before.

(28) C. J. G. asks: 1. Will phosphorus shine in the dark when put into a hermetically closed bottle? A. Yes, if the bottle contain air. 2. Will it consume itself therein? A. If not ignited by friction or otherwise, it will not. 3. Must it be put in water, even when hermetically closed? A. Yes.

(29) E. F. asks: 1. How would you advise me to use cotton seed as a food for cattle? A. You should remove as much of the oil as possible first. 2. In what condition should it be given, raw or cooked? A. Either way will answer; but with regard to the latter method, we find no account of it having been prepared. 3. Should it be given alone, or mixed with other food? A. The latter is perhaps the better method. 4. Will it give an oily taste to the meat? A. No. 5. Will cotton seed answer the purpose as well as corn, etc.? A. No.

(30) J. T. asks: 1. What is the exact quantity of the ordinary commercial sulphuric acid required to decompose a given amount of protosulphide of iron? A. Ten pounds of FeS will require 11.24 lbs. of H₂SO₄. 2. What is the amount of sulphuretted hydrogen and sulphate of iron thereby formed? A. This reaction will give you 3.8 lbs. of H₂S and 17.4 lbs. of FeSO₄.

(31) P. and B. say: We occupy a business room which is roofed with tin from each end to center, with gutter in the middle, through which the water from five other rooms passes. This gutter occasions us a great deal of trouble by leakage. The contraction opens the seams in the tin, especially during cold weather. If we put in a gutter of one continuous sheet of tin the whole length, will the contraction be sufficient to break it? A. You do not say how long the gutter is; but in any case you will not be able to find a sheet of tin long enough to make the whole gutter in one piece. If you take galvanized sheet iron, and make in it some slight corrugations crossing it at right angles to its length, there would be no danger of its breaking from contraction; and the corrugations would make no material impediment to the flow of the water.

(32) C. T. H. asks: Will worn-out printer's type make good Rabbitt metal? A. No.

(33) R. G. says: 1. We have a stream of water here (the Wabash river) which is estimated to furnish 10,500 cubic feet of water per minute, having 10 feet fall. I estimate the power at 160 horse power; other parties who ought to know put it at less than 100. Will you give me your estimate? A. About 300 horse power could be obtained from the water if all the power were utilized. 2. What percentage of the water could be raised 80 feet by using the remainder as power? A. With good apparatus, you might expect to obtain an efficiency of from 60 to 70 per cent of the power of the water, from which it will be easy to determine the proportion of water raised to any height.

(34) H. A. asks: At how many revolutions per minute must I run an engine, cylinder 4x4 inches, to obtain 4 or 5 horse power, with boiler pressure at 80 lbs., and a boiler large enough to generate all the steam required? A. From 400 to 450.

(35) P. H. W. says: A steamer is 42½ feet long by 7 feet 5 inches beam, and 2 feet 10 inches deep below guard. The engine is 5½ inches in diameter by 7 inches stroke. The screw is of 38 inches diameter, 12 inches width of blade at point, and 5 feet pitch. The engine makes 250 revolutions per minute, with 80 lbs. pressure. We make about 10 miles per hour. We have run 22 miles (conveying 18 passengers) in 2½ hours, steam pressure averaging 87 lbs. With a view of increasing speed, I put on a steel plated screw of similar dimensions to the old one, except that the blades are 18 inches wide at point, tapering back to center. Each screw had two blades. With this screw the engine made 255 revolutions per minute; but it required 45 minutes to make 7 miles, which with the old screw would take 40 minutes. How much more power will I require? A. More than double the power used at present.

(36) F. L. B. asks: Can you make clear the workings of what is known as planchette? A. It never works, if no one touches it, as far as we have heard. "A word to the wise is sufficient."

(37) J. McC. says: Let a body of air be compressed in a cylinder, and let it remain so until it cools. Then, if allowed to expand, it will be minus a force equal to the heat it has lost. If, now, the same air be immediately recompressed into the same space, it will not, according to my idea, lose any more heat, and therefore give back as much power as it receives, except what is lost in friction. Am I right? A. This is what will take place

If the air, on being compressed, is allowed to cool, its pressure will be decreased. Then, if it expands, and does work, its temperature will fall; and if it is recompressed, without loss from radiation, its temperature and pressure will again be increased. All this is expressed in the simple statement that, if there is no loss of heat by conduction or radiation, the air that is compressed is capable of exerting as much power, in expanding, as was employed to compress it.

(38) A. A. P. says: Suppose I take a cylinder of iron that will hold a gallon of water, more or less: Can I increase the power of a press in using all the water at once, without introducing the water gradually into the cylinder? A. Yes.

(39) S. B. asks: How long can a man live in a submerged boat, the air capacity of which is 200 gallons? A. With proper arrangements, the vessel would contain a supply of air sufficient for between 1 and 2 hours.

(40) G. W. S. says: I tried to extract potash from corn cobs by burning the cobs to ashes, and leaching them with water. I then boiled the leachings to dryness, and the potash which was the result would attract moisture from the atmosphere and turn to a strong lye. How can I prevent this? A. The product you obtained was, undoubtedly, pearlash, an impure carbonate of potash. This should be calcined in a suitable furnace and packed in airtight casks, as it is very hygroscopic.

(41) C. M. R. asks: How can I coat some small castings, made of Babbitt metal or pewter, with tin or some white metal to keep them white? A. Make your castings of Babbitt metal; and they will wear well and keep as clean and bright as tin would.

(42) G. A. M. L. asks: What is the composition and process of manufacture of common white shirt buttons? A. Some varieties of these buttons are made as follows: Finely powdered steatite is saturated with soluble glass, dried, and repulverized, and the powder thus obtained is pressed into molds by suitable machinery. They are then baked or fired in ovens, again dipped in solution of soluble glass, and subjected a second time to the firing process. When cool, they are polished by being placed in a rotating cask with water, dried, and again polished by rotation in a similar cask with soapstone powder.

(43) J. A. H. asks: Where is the Pennsylvania soapstone dug or quarried? A. At Texas, Nottingham, Unionville; in South Mountain, ten miles from Carlisle; and at Chestnut Hill, on the Schuylkill.

(44) A. L. S. asks: How can I perfume soft wood in pieces three inches long? A. The wood might doubtless be impregnated, by means of hydraulic pressure, with any of the essential oils, etc., but we know of no substance the perfume of which might be considered as permanent or inexhaustible.

(45) A. C. W. asks: What preparation will make gutta percha stick to wood? A. Melt together equal parts of pitch and gutta percha. Apply hot.

(46) E. H. asks: 1. What influence has vegetable charcoal on the system? The dose is a teaspoonful in water. A. Its antiseptic properties render it a valuable medicine in some affections. Is there any cure for catarrh of the throat and nose? A. The following has been highly recommended: Carbolic acid 10 drops, tincture of iodine and chloroform, each 7-5 drops. A few drops of the mixture should be heated over a spirit lamp in a small test tube, the mouth of which should be applied to the nostrils as volatilization is effected. The operation should be repeated in about two minutes, when, after the patient sneezes a number of times, the troublesome symptoms rapidly disappear.

How can I make paraffin varnish? A. Paraffin is soluble in benzene, benzole, bisulphide of carbon, etc., and may be recovered from such solutions on evaporation of the solvent.

(47) W. H. W. asks: How is compressed yeast made? A. It consists usually of beer lees, flour moistened with beer, and other fermented matter, the superfluous moisture having been removed by pressure. As a general rule, however, the recipes for the so-called yeast cakes, etc., are not made public.

(48) E. D. R. says: J. D. can clarify his cider by adding to each barrel of it 1 pint boiling milk; if the cider contains enough free acid to coagulate the milk, the coagulum, in precipitating, carries down with it all impurities held in suspension in the cider; this process has the effect of decolorizing the cider in some degree.

(49) S. S. S. says: I have been experimenting for 10 years on gums, trying to bleach them. I have succeeded with shellac, sandarac, copal, etc., but have not yet been able to bleach a solution of dark gum arabic. Do you know of any process by which gum arabic in solution may be bleached, without injuring the adhesiveness of the mucilage? A. Try filtering the dilute solution through a stratum of animal charcoal; and then concentrate by evaporation over a water bath. This, we think, will render your mucilage perfectly clear.

(50) H. C. asks: How long does it take the moon to make a revolution around the earth? A. The moon makes the tour of the heavens in a mean or average period of 29.5, 5h., 43m., 11.5s., returning, in that time, to a position among the stars nearly coincident with that it had before.

COMMUNICATIONS RECEIVED.

The Editor of the *Scientific American* acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On the Qualities of Sounds. By W. J. S.
- On Industrial Expedients. By —.
- On Fog Signals. By W. B. T.

On Aerial Navigation. By E. M. B.
On Northern Lights. By L. B.
On a Solar Chronometer. By H. C. P.
On Advice to Engineers. By C. C. J.
On Repairing Bells. By J. E. E., and by J. H. B.
Also inquiries and answers from the following:
J. G.—B. A. P.—J. M. P.—J. J. M.—H. J. F.—H. B.
J. J.—N. R.—W. B. W.—E. T. H.—T. E. C.—J. T. N.—E. G. F.

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.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best photographic chemicals? Who makes the best brick-pressing machine? Who sells piano wire, in lengths of a mile and upwards? Whose is the best printing press for illustrated book work?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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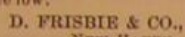
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5,120.—E. G. Scovill, Simonds, N. B., et al. Piling iron. August 30, 1875.	
5,121, 5,122.—G. N. Sanders, Jr., New York city. Spike. August 30, 1875.	

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IMPROVED LIQUID MIXER.

Molasses is usually supplied to the markets in four grades—common, fair, prime, and choice—and to obtain these different qualities, it is necessary to mix together large amounts of the liquid at a time. The apparatus represented in the engraving is designed to facilitate this operation. It may also be employed in any other cases where the mingling or equalizing of fluids in bulk, as in refineries, distilleries, etc., is required.

The mixing vessel or vat is conveniently located in the ground, or beneath the floor level. At both sides are arranged boxes provided with strainers, A, through which the liquid escaping from the barrels, which are rolled, bungs downward, upon the tops of the boxes, is filtered. The bottoms of the boxes are inclined so that the fluid runs to an opening at the inside, and thence in to the vat. Within the latter, and placed longitudinally, is a stirrer wheel, B, which is revolved by suitable power transmitted from the engine, and by means of which the liquid collected is thoroughly mingled. When the operation is finished, the wheel is stopped, and the contents of the vat are drawn off by the pump, C, operated from the driving shaft, as shown, and through a suction strainer set in a draining box at the bottom of the receptacle.

Large quantities of liquids may thus be handled easily and mixed in a short space of time, while being also strained from any coarse impurities, in the passage to the mixing vat.

Patented through the Scientific American Patent Agency, July 20, 1875. For further information address the inventor, Mr. John B. Meyers, 475 Josephine street New Orleans, La.



MEYERS' LIQUID MIXER.

stones. (11) \$1,200 (in 1878) for a theory of steel based upon experiment, and having for its object to better regulate the manufacture of steel. (12) \$200 (in 1876) for the establishment in France of a workshop for the complete treatment of the ores of nickel, and the preparation of the pure metal, the nickel ores from the Alps, the Pyrenees, and Algeria being at present only treated for smalt, and then sent away, to Germany more especially, for the extraction of the nickel. (13) \$200 (in 1880) for means for the economical production

feet; France and colonies, 43,314; England, 51,776; Germany, 27,705; Austria, 24,070; Canada, 24,070; Australasia, 24,070; Sweden, 15,358; Belgium, 15,358; Japan, 16,566; Netherlands, 8,167; Norway, 6,897; Switzerland, 6,646; and Denmark, 5,647.

The Treatment of Hydrophobia.

The French *Journal des Connaissances Médicales* relates that a man, 43 years of age, having been bitten by a mad dog, was cauterized with a red hot iron four hours later. A month passed without any distressing symptoms, but at the end of that time he began to complain of epigastric and pharyngeal constriction, and was very much cast down. Recourse was had to chloral at doses of about sixty grains, which succeeded twice in affording a good night's rest; but the third time it remained without effect. The patient experienced great anguish; his voice was hoarse; he had tetanic contractions in the arms, neck, and breast, and expressed great fear, accompanied with hallucinations. In the morning he was utterly discouraged.

They then administered sixty grains of bromide of potassium, which gave a quiet night, with a great improvement on the following day. Another dose of about seventy-five grains was given with equal success; all convulsive motions had disappeared.

The medicine being suppressed, the convulsions began again a week later, when bromide was again administered to the amount of about ninety grains, which completed the cure. This remedy is readily tried, and we shall

be glad to hear of any results that our readers can communicate.

Southern Pacific Railway.

Any one, says the *Los Angeles Herald*, desiring to obtain any idea of the stupendous accomplishments of railroad engineering should spend a few days at Tehachape Pass, investigating the operations of the Southern Pacific Railroad Company. About twenty miles of that road is a succession of cuts, fills, and tunnels. Within this distance there are thirteen tunnels, ranging from 1,100 feet to a few yards in length. For the greater portion of the way the road bed is cut through solid granite. The elevation is so great from the present terminus of the road, at Caliente, to Tehachape Valley, that the first mile and a half out of Caliente is attained by laying down eight miles of track. Higher up in the pass the road runs through a tunnel, encircles the hill, and passes a few feet above the tunnel. After completely encircling the hill, and going half round again, the track doubles on itself like a closely pursued hare, and, after running several miles in the opposite direction, strikes up the cañon. This circling and doubling is for grade. Once the track crosses the pass, and this involves the building of a long and very high bridge. We doubt if a more difficult and expensive piece of engineering was encountered in the building of the Central Pacific over the Sierras than that with which the Southern Pacific is now struggling in Tehachape Pass. Another tremendous piece of work is the San Fernando tunnel, which

Prizes for Metallurgical Improvements.

The *Société d'Encouragement pour l'Industrie Nationale* (offices at Paris, rue de Rennes, 44) offers a prize of \$600, to be competed for in 1876, for a process of manufacture of cast steel rails from common ores, containing from 0.50 to 1.50 per cent of phosphoric acid. In 1876 will likewise be accorded the D'Argenteuil prize of \$2,400 for the discovery or improvement of the greatest consequence to French industry; and in 1879 the society's own prize, of the same amount for the same object. Other prizes are: (1) \$600 (in 1876) for a steam engine of from 25 to 100 horse power, burning 1.54 lbs. of coal per horse power per hour, the engine weighing less than 720 lbs., and costing under \$80 per horse power. (2) \$200 (in 1878) for a small motor for domestic purposes. (3) \$400 (in 1878) for specified improvements in flax and hemp spinning. (4) \$400 (in 1879) for cotton carding. (5) \$400 (in 1880) for a file cutting machine. (6) \$400 (in 1877) for a method of obviating the shock and vibration of heavy machinery, such as steam hammers. (7) \$200 (in 1876) for any useful application of the recently discovered metals—calcium, magnesium, strontium, thallium, etc. (8) \$200 (in 1876) for a new alloy useful in arts. (9) \$400 (in 1877) for artificial graphite for drawing pencils. (10) \$600 (in 1877) for the artificial preparation of compact black diamond, for obtaining a powerful means of action in working iron, steel, and precious

New Allotment of Space at the Centennial.

The Centennial Directors have abandoned their original idea as to allotting space, which by the way was never formally adopted, and, for the very convenient arrangement of placing nations across the building and groups of similar objects longitudinally, have substituted the far less sensible plan of putting each nation's exhibit promiscuously within a certain area. The beauty of the first scheme was that, to inspect the display of any one country, the visitor had only to enter the proper side door and walk across the hall, the whole exhibit being in the zone traversed; or, if he desired to examine, say all the cotton machinery of the world, he would simply begin at that class of mechanism at the end of the building and walk its entire length, in so doing crossing the space of each nation where cotton machinery had been placed. There were plenty of objections to the plan, good as it was, which need not be detailed, since the new one has been definitely adopted. The United States now occupy about one fourth of the floor space, and the areas next in point of size are allotted to England, Germany, and France, the four great nations being grouped together. The other countries are scattered apparently without regard to their geographical position. The areas allotted thus far, according to the new plan, are as follows: United States, 166,351.7 square

when completed, will be over a mile and a half in length, and in places over 1,000 feet beneath the surface. Yet the company will accomplish this great work, and run cars through from San Francisco to Los Angeles, by the 1st of next July. All the force that can be used is kept at work on the San Fernando tunnel. In the Tehachape Pass 5,000 men are employed, and the force is being increased at the rate of 1,000 Chinamen per week.

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A NEW USE FOR CRIMINALS.

Even vermin have their uses, say the pessimists. It is a cheering theory, and one which we should rejoice to see demonstrated, especially with reference to those vermin of society, the criminal classes.

Thus far they certainly have been the reverse of useful. Not only have they been a serious detriment always, to national prosperity through their depredations upon life and property and public peace, but also by their vicious example, and, more effectually still, by the transmission of their vicious traits to after generations.

Our present mode of dealing with them labors under the double disadvantage of being very inefficient and very costly. Every year sees the machinery of justice become more magnificent and burdensome, yet it none the less fails either to cure or to materially lessen the evil. Indeed the law has often more terrors for the good citizen than for the bad: he has a large bill of costs to pay at any rate; whereas the rascal who plunders him has everything to win and very little to lose. If he escapes, which is most likely, he gets the booty; if caught, he simply loses for the moment what is no use to any one—his liberty.

Is it not time for the well disposed, the innocent, and the law-abiding to turn the tables and recoup themselves, if possible, for their numerous losses? The ways in which this can be done are as numerous and varied as the varieties of criminal constitution and character.

Just now the authorities of Massachusetts are puzzled to decide what to do with the murderous Pomeroy boy. Hang him! said the court; and the multitude re-echoes the cry. That is an easy way to get rid of him; but will it pay? What good will it do to kill him? His death will not atone for the damage he has done, nor will it deter another of like mental and moral perversity from the commission of similar crimes. Then why throw away all the possibilities of use and instruction which his peculiar character affords?

In a case of this sort, vindictiveness is folly. The boy is what he is through conditions of heredity and culture which ought to be investigated. He represents a stage of human development or atavism which ought to be understood. What was the antecedent stage, and what will the next one be? His character is likely to change with increasing years; what is the direction of that change? Education and moral training are supposed to have a determining influence upon character; what can they do for him? The boy is a very bundle of scientific problems; why not keep him for investigation? For the solution of many of the problems of culture and civilization, he is worth a dozen ordinary children. He ought not to be thrown away. Make it impossible for him ever to transmit his vicious nature to a future generation, then investigate him, and all others like him, for the good of the race.

Apply the same principle in a different way to a very different character, say the once famous, now infamous, Colonel Valentine Baker, late of the British Army: a man of years and high standing, whose irrepressible impulses led him to make criminal assault upon an unprotected fellow traveler. He has lost his place in the army and in society; he has been fined and nominally imprisoned; but his impulses remain unaltered, and his example—punishment and all—seems to provoke others to similar deeds rather than to deter them; for his unusual offense has been since repeated by several. And when he returns to the world, his term of idle imprisonment ended, he will be simply what he was at first, lacking the restraining influence of his rank and possibilities of usefulness.

This may be justice, but it is not good policy. What was needed in his case was chiefly the extirpation of the cause of his uncontrollable passion—which any surgeon could have done in a few minutes—to destroy the only element of danger in his character.

In a rude state of society, the usefulness of a public offender is necessarily measured by his power to do rude work, in the quarry, the mine, or the like. We have arrived at a stage when a portion of our superabundance of such characters can easily be put to more profitable uses; though we should by no means personally object to the employment of the more able-bodied criminals in that way, especially in the coal mines. Instead of manufacturing for such needful service a degraded and largely criminal class—a process which any one can see in operation by visiting a coal-cracker among the Pennsylvanian mountains, where swarms of ill bred children spend their days at hard labor under the most debasing influences—it would be infinitely better to have the work done by ready made criminals, drafted from the country at large. It would be a saving of virtue, and possibly in the cost of coals. But there are still better uses to which the majority of criminals can be put.

Among the most important problems of civilization are those relating to health and disease. Of very few human maladies can it be said that we know their causes, their natural history, their effects upon the physical and mental organism, or a satisfactory mode of treating them. As little do we know how to prevent or avoid them. Yet of what vital importance is such knowledge to the well being of society!

The limited positive knowledge which Science has acquired of the ills which flesh is heir to has been gained through observation complicated by a thousand unknown conditions, through experiments upon unoffending animals, and by dissection of dead. During the middle ages, the last mentioned source of knowledge was barred. Every scholar knows what sudden and immense advances men made in anatomy and physiology, and in the healing arts which rest on them, when students began to draw their knowledge of man's physical frame directly from human subjects, and not indirectly and incorrectly from the study of animals. A similar advance might be expected in preventive and curative medicine could the action of disease be directly studied in human subjects over which the observer should have absolute control.

Our suggestion would therefore be that such a portion of the criminals convicted from day to day, as might be found available, should be turned over to boards of surgeons and physicians, duly appointed, under whom they might be used for the investigation of sanitary problems, for the good of humanity.

For example, men convicted of capital crimes, instead of being uselessly hanged, might be employed in the study of diseases usually fatal, or of other diseases whose effects in their various stages would need to be studied anatomically. Especially atrocious murderers might be reserved for cases involving vivisection. Criminals of lower grades could be utilized in the study of diseases of minor severity, according to their physical adaptation and the nature of their crime. Having their subjects under absolute control from the inception of a disease to its termination, the investigator could not fail in time to arrive at certain knowledge both as to its prevention and mitigation, if not its cure. Medicine is full of problems whose solution might be greatly hastened by such means.

The same may be said of other departments of social science. How far, for example, is the criminal diathesis curable, and under what conditions? What is the comparative influence of the different sorts of mental and moral training? How can the taint of hereditary crime be averted? How are the various grades of criminality affected by surgical operations, especially those calculated to make the perpetuation of hereditary crime impossible? And how far may the subjects of such treatment be safely allowed at large?

But the field of investigation is limitless. The possible advantages of its systematic prosecution are correspondingly great. The right of society to defend itself against its inter-

nal enemies, even to the taking of life, is unquestioned. To attempt it by means of punishment has proved unavailing and costly. It is time that a different plan be tried. Suppose we sink the idea of retribution—if need be, of reformative also—and seek to make all human vermin first harmless, then useful, either by their productive labor or by their subjective contributions to human knowledge for the protection of health and the saving of life.

As for its deterrent effect, such a passionless, unvindictive, business-like treatment of all violators of the common weal certainly could not be less efficient than the jumble of uncertainty, vengeance, softness, retribution, sentimentality, and uselessness, which constitutes our present judicial and correctional systems. We are disposed to think that the possibility of being made a subject for the study of small pox, cholera, typhoid fever, or even a bout at measles or the mumps, would restrain a pickpocket or a burglar quite as efficiently as the chance of a few weeks on the Island, or a few months at Sing Sing. At least the knowledge gained by means of him and others like him would go far to recompense society for all it might suffer from his depredations.

HOW FAR WILL BODIES SINK IN THE OCEAN?

The often repeated inquiries which we receive, as to the depth in the ocean at which heavy bodies will float, prove the great prevalence of the error that water is so compressible as to become at certain great depths considerably heavier, by its own superincumbent weight. The fact is that, on the contrary, water is one of the least compressible bodies, so that, under a pressure of 7,200 lbs. per square inch, corresponding to a depth of 16,800 feet, or 3 miles, its bulk is only diminished from 1,000 to 978 parts, and its weight or specific gravity increased from 1.000 to 1.022. At double this pressure, or 33,600 lbs. per square inch, at 6 miles in depth, the compression is double that amount.

Oerstedt of Copenhagen, who in 1819 discovered the relation between electricity and magnetism, a discovery which was the first step in the invention of the modern telegraph, was the first who practically demonstrated and measured the amount of compressibility of water and other liquids, by means of an apparatus still named after him. It consists of a small hydraulic press, of which the piston is pressed powerfully down by means of a screw, so as readily to produce pressures of 500, 1,000, and even 5,000 and more pounds per square inch. The walls, being of extremely strong glass, give opportunity to observe the instruments of measurement enclosed. Experiments with this apparatus show data which may be tabulated thus:

TABLE OF THE DEPTH AND CORRESPONDING PRESSURE AND DENSITY UNDER THE OCEAN'S SURFACE.

Depth below surface.	Pressure of water column in lbs.	Pressure of water column in atmospheres.	Density of water.	Bulk of equal weight of water.
0	0	0	0.0000	1.000000
32 feet	15	1	0.0090	1.000048
160 "	75	5	0.0097	1.000023
1,000 "	750	50	0.0097	1.00023
1 mile	1200	80	0.0096	1.00037
1 1/2 miles	2400	160	0.0096	1.00074
2 miles	3600	240	0.0096	1.00111
3 "	4800	320	0.0095	1.00148
4 "	7200	480	0.0095	1.00222
5 "	9600	640	0.0095	1.00296
6 "	12000	800	0.0095	1.0036
6 "	144000	960	0.0095	1.0044

It will be seen from this table, of which the data are perfectly reliable, having been verified over and over again by various experimenters, that when water is submitted to a pressure of 144,000 lbs. to the square inch, corresponding to a depth of 6 miles, a bulk of 1,000 cubic inches will only be compressed to a space of 957 cubic inches, and the specific gravity increased to 1.044, water being 1.000.

Therefore, if a body be capable of floating at such a depth, it must satisfy two conditions: 1. Its specific gravity must be between 1.000 and 1.044. If the specific gravity is not more than 1.000, it will not sink at all; and if it be 1.044 or above, it will sink to any bottom less than 6 miles deep. 2. The sinking body must be less compressible than water; if it is more compressible, it will grow comparatively heavier all the time it is descending, and can never find a stratum of the same weight, in which it might float in equilibrium. Now all the bodies known to be less compressible than water are much heavier than the limit given; such are stones, metals, etc.; and the amount of their compressibility, as compared with that of water, is still problematic. But they will certainly all sink to the very bottom of an ocean, be it ever so deep. In regard to the bodies of which the specific gravity surpasses that of water slightly, so as to come within the range under discussion, they are all very compressible. All kinds of wood, when submitted to great pressure, so that all pores are filled, attain the specific gravity of the primitive wood fiber, the lignin, of which the specific gravity is 1.400; and they will thus sink to the very bottom, like water-logged wood. So it is with all similar substances; and the theory that there is a certain depth in which all or many bodies may float in the ocean must be modified to a statement that there are various depths at which certain various bodies may be kept floating; but that the cases are extremely rare, exceptional, and perhaps only temporary, so that all bodies will finally either sink or float. In the latter case, the destructive power of the elements will soon dispose of them; in the former they are usually preserved, as is seen in observing the structure of the diatoms, those delicate beings the details of which serve now to test our best microscopes, and which the depth of the ocean has preserved, in the mud deposited there, for thousands of years.

THE PROPOSED RAILWAY TUNNEL UNDER THE ENGLISH CHANNEL.

The preliminary arrangements for the commencement of this great work are progressing favorably, and there appear to be good prospects for its execution under the combined auspices of the English and French governments. Preliminary surveys of the best routes have been made by eminent engineers, who have become satisfied thereupon that no especial difficulties are likely to be encountered. The length of the tunnel will be about twenty-two miles.

The subject came up for discussion recently before the British Association, when Sir John Hawkshaw, who is one of the engineers of the work proposed, gave a variety of interesting particulars:

The channel waters, he said, were a mere fish pond. They were only 180 feet deep. Borings have been made to a depth of 600 feet on each side of the Channel, and also in the Channel bottom at many points on the line, and it has been experimentally ascertained that the tunnel would pass through a chalk formation for nearly the whole distance. The tunnel would be 230 feet below the bottom of the Channel; and with this large amount of material existing between the bed of the tunnel and the ocean above, there was little danger of any trouble from the ingress of water.

Some people seemed to assume that the tunnel would be so badly ventilated that nobody would dare to go into it. When the tunnel came to be constructed the great difficulty would be to get in and out of it. There would be a vast number of workmen and an enormous amount of building material to be carried in and out. There would be a drift way tunnel; and in order to facilitate the men and the material going in and out, it would be desirable to put on each side of the tunnel a pneumatic tube—in fact, they would be almost essential for the mere construction of the tunnel. When the tunnel was finished, he would suggest that these tubes remain. All that was necessary would be to make apertures on one side of the tunnel, and by pumping the air which flowed in at each end of the tubes into the tunnel the ventilation would be practically easy and not very expensive. He had been silent as to this point because engineers were generally silent about works until they were executed. When the work was accomplished, the way in which it was executed would be patent to everybody.

SCIENCE PUGNACIOUS.

"The battle ground of Science" has hitherto been but a metaphor. Not that Science has not waged conflicts, and won victories: that, indeed, is her constant course against error and superstition; but such warfare has been of mind to mind, not hand to hand, and Science, exemplifying truth, prevails, as truth against falsehood always will. For once in history, however, Science has had a genuine battle ground, and a genuine combat. Not the antagonism of two learned pundits, who wax wrathful, and resort to personalities, and hurl jaw-pulverizing epithets across a debating room at each other; but a "square" fight, between Science, as exemplified by the Hayden surveying party, and Error, or stupidity, or dirt, or any other antithesis, in the form of a band of thieving redskins. And Science prevailed as usual, and got herself out of a bad scrape.

The army of Science consisted of seven men, commanded by Geographer Gardner. The army of Error, etc., numbered several times as many souls. Science was peaceably cracking stones, and chasing butterflies, and pulling up plants and measuring lines. She had some of her latest devised firearms along, firearms which could shoot several times to Error's once, but they had nothing to do with the stone-cracking, etc.; they were auxiliary to the theodolites and the hammers. Error met Science smilingly, and requested fire water and plug tobacco. Science had a large store of valuable information to impart about these delusive materials, but no fire water, save such as was improved by the presence of pickled toads, and not even a chew of the nicotian weed. Error departed disgusted and opened fire as soon as Science's back was turned. Then came hot work; if Science stood still, starvation and thirst would result; to proceed was to face the enemy in rocky and precipitous cañons. It was voted to press on. Science exhibited splendid marksmanship at 1,000 yards, with redskins for bull-eyes. Twenty-four hours' continuous running fire followed, Error being dislodged from every stronghold as fast as gained, until, finally, open country was reached; and Error, having no more rocks to hide among, ran away, minus several of her numbers.

It was a good fight, bravely fought, and as bravely won, against heavy odds. The world will benefit by the contemplation of the valor of the scientist, in defense of his country, his flag, and his—specimens.

GAS FROM NIGHT SOIL AND DEAD ANIMALS.

Some time ago an improved method of making illuminating gas from night soil and dead animals was invented by A. Sinderman, of Breslau, Germany, and was very favorably reported upon by a committee selected by the authorities of that city. Subsequently the system has been put into practice under the supervision of the Director of Gas Works, Professor Troschel, who submitted it to a scrupulous examination in regard to quality of the gas produced and the cost of production. Recently the results have been published, and they are mainly as follows:

1. The quantity of gas obtained from a certain mass of material is considerably less than that obtained from an equal quantity of coal; so much so that, to obtain the same quantity of gas, the works required would have to be of double the dimensions sufficient for the coal.

2. The expense of production is, contrary to the expecta-

tion of the inventor and the report of the committee, double that of making gas from coal.

3. The method is objectionable. Ten per cent of the material used for gas-making must be heated in ninety per cent of water; and the aqueous vapors of this ninety per cent of water must be condensed in an enormous cooling apparatus.

4. When making gas from such material, the fuel must be bought; while when making gas from coal, forty-five per cent of the coke obtained is abundantly sufficient for fuel.

5. The enormous amount of various impurities, such as nitrogen, sulphur, and phosphorus, and their compounds, such as ammonia, sulphuretted hydrogen, and phosphoretted hydrogen, are present in this gas in much larger quantity than in coal gas; and the purification of the same requires, by reason of this abundance, arrangements of so complex a nature as to become utterly impracticable in working on a large scale.

It is proved thus that the utilization of these materials for the purpose of illumination is not as profitable as transforming them into fertilizers of the soil.

LIGHTNING RODS.

To the Editor of the Scientific American:

In the issue of the SCIENTIFIC AMERICAN dated September 18, in an article on lightning rods, you say, in speaking of the terminal: "This terminal may consist of an iron water pipe, * * * or a very considerable extension of the rod into wet or damp earth; or a trench filled with iron ore or charcoal may be made available."

Now, I have a lightning rod on my house, the end of which was inserted to the depth of six feet in the earth upon the southerly side of it, at the time the rod was put up. Would the earth be sufficiently damp (the house is on a hill) at that depth? In the country, but few dwellings would be likely to have iron water pipes with which to connect lightning rods; there are none in this vicinity.

In the sentence quoted, you say: "Or a trench, filled with iron ore or charcoal, may be made available;" and, in the concluding sentence of the article: "We repeat, the golden rule for safety is to have the bottom of the rod placed in connection with a large mass of conducting material in the ground."

Now, the query is: How large should the trench be that is filled with iron ore, to afford protection to the building? Scrap cast or wrought iron, I suppose, will do as well (as ore is not found on Long Island), or charcoal, which is easily obtained. Definite information is wanted as to quantity.

Glen Cove, L. I.

ISAAC COLES.

REPLY.—A test with the galvanometer would doubtless show that our correspondent's lightning rod is unsafe—that its bottom is sealed up or insulated so that the bulk of an ordinary discharge of lightning would be more likely to go through the dwelling than through the rod. Situated as his house is, the earth would ordinarily be dry, and a length of six feet of rod, say $\frac{1}{2}$ inch square, in the ground, furnishes less than one square foot of conducting surface, which is insufficient as a terminal.

This correspondent, and also several others, request definite information as to the quantity of conducting material that the rod terminal should have in order to ensure safety. This can only be measurably determined by a test in each case, with the galvanometer, because the requirements vary with almost every building and with the hygroscopic condition of the ground. But an approximately safe rule has been suggested by Mr. David Brooks, the electrician, of Philadelphia, which is to the effect that, in dry soils, the terminal of the lightning rod (which may be composed of any of the conducting materials mentioned by our correspondent) should have a conducting surface, in contact with the ground, equal in area to that of the roof surface of the building. For example: If the roof surface is 30x40 feet, or 1,200 square feet, then the rod terminal should have 1,200 square feet of conducting surface in contact with the earth. Now this is only a suggestion of Mr. Brooks, intended for extreme cases of dryness in the soil; and if it errs, it is probably on the side of safety.

In our paper of September 11, we gave an account of a lightning rod test, made at the instance of Mr. George B. Prescott, Chief Electrician of the Western Union Telegraph Company. In that case the rod was arranged substantially like that of our present correspondent, had less than one square foot of conducting surface in the ground, and the galvanometer test showed it to be very unsafe; but the instrument also showed that the rod would be rendered a safe conductor, if put into connection with the house water pipe as a terminal, and this was accordingly recommended. This pipe, of iron, was half a mile long; and allowing it to be one inch in diameter, it presented a conducting surface, in contact partly with the earth and partly with water, of not far from 1,200 square feet.

THE FAIR OF THE AMERICAN INSTITUTE.

Owing to the fact that manufacturers throughout the country are now busily completing their preparations for the coming Centennial, we have been inclined to the belief that the local fairs held this fall would not receive their usual amount of attention, and hence, in point of novelty and variety of exhibits, would fall somewhat below the standard hitherto maintained. We have, however, been agreeably disappointed; for, judging from the reports which reach us from Cincinnati, from Newark, and other localities where industrial exhibitions are now in progress, the displays have never been better, and perhaps never so good. It is certain that, in the case of the Fair of the American Institute, the present show is far superior to any that has been held dur-

ing the last five years. It is larger, and the exhibits, as a rule, are more elaborately prepared, while there is a goodly variety of new inventions, well calculated to interest as well as instruct the public.

So far as the interior aspect of the building is concerned, there are not many changes from last year, to note. The general arrangement is about the same, and a better and more refined taste has evidently been exercised on the decoration. We note with pleasure the abolition of the Fourth-of-July festoons which were a standing menace of conflagration to the dry wooden arches from which they hung. In place of this, a neatly painted strip of canvas has been carried around the building, so as to resemble a gallery, with very good effect. A number of large paintings, representing scenes in different sections of the country, very fairly executed, are suspended in frames in front of the imitation gallery rail, and agreeably break its monotony. The old pictures on the main arches remain as hitherto; and as there have been no further attempts made toward ornamentation, it will be seen that the same, as it should be, is very simple, and in no wise detracts from the display of articles on the floor.

It is difficult, at the time we write, to form any fair idea of the future contents of the machinery department, owing to many of the exhibits not yet having arrived. The most remarkable features are the

FOUR DRIVING ENGINES.

These consist of an 80 horse power Wheelock, 14 x 42; a 60 horse power Wright, 16 x 36; a 60 horse power Hampson & Whitehill, same dimensions, and a 60 horse power Harris-Corliss, 14 x 36. In the Wheelock machine we note several improvements, tending to simplify the working parts. The dash pots have been raised above the floor, and there is a new and ingenious form of cylinder oil cup, into one portion of which the steam condenses, and then, flowing in the shape of water into a larger portion, lifts the oil to proper height for entering the cylinder. The Wright engine has a new way of attaching the governor to the cut off valve. Instead of the governor acting directly on the valve, it merely determines the fall or closing of the same by controlling a lug, which throws a spring catch off a cam. The cam is actuated by the engine itself, and the catch connects with the valve. It is of course impossible to convey a very clear idea of this or other devices in the brief terms here necessary, but, the attention of the reader being directed to the novel features, he may perhaps find it interesting and profitable to examine for himself. In

MACHINE TOOLS.

the machinery department will have an unusually fine display—to which, in our future reports, we shall take occasion to allude in detail. Woodworking machinery is also well represented. We notice several portable engines for farm use, and one especially, of English make (Ransome, Sims, & Head, Ipswich), which has a furnace fitted to burn straw and similar fuel. Two heavy drop hammers are in position, and there is a prospect of a good show of pumps. Any further comment on the contents of this department must, for the reason already given, be reserved for the future.

THE MAIN BUILDING.

About the most prominent object on the main floor is a Jardine organ, a fine instrument of very powerful tone. Advantage is taken of that well known experiment in physics, the hydrostatic paradox, to drive the bellows. Water is pumped up into a barrel on the roof, and thence it descends, through a two inch pipe, a distance of 50 feet, moving a piston 4 inches in diameter over an 8 inch stroke. Near the organ, the visitor will find a handsomely built cottage or summer house, covered entirely inside and out with wood papering. This last is merely thin sheets or veneers of wood attached to paper and applied to the wall in the same manner as paper hangings. The effect is that of solid planks, or of fine inlaid work. Almost every kind of wood is employed, and the results, when several varieties are contrasted, are very striking and elegant.

There is another house in the fair, made entirely of packages of Hecker's flour. It encloses an area large enough for the exhibitor to manipulate his cooking utensils over gas stoves, and use up his building material in the manufacture of excellent griddle cakes and waffles, which are freely distributed to visitors. This is a practical way of showing up articles of food, which, to our minds, is far better than loading people down with circulars setting forth long schedules of "advantages." Why do not the other "cereal" exhibitors follow the same plan?

The fair is especially rich this year in

HOUSEKEEPING ARTICLES.

a fact which will ensure its popularity. There is an ingenious gridstone which may be adapted to hold a polishing wheel for plate, for knives, or for stair rods, and will save a world of hard rubbing. The stone is horizontal and has beveled edges (adapting it excellently for sharpening mowing machine knives), and its spindle is surrounded by a spiral into which a pawl, on a traveling slide actuated by a spring treadle, engages. The pawl on its downward motion only acts upon the thread, and thus rotates the stone very swiftly. The silver plate manufacturers as usual show several cases of fine ware; and the china dealers have a remarkably large exhibit, including some specimens, from celebrated European factories, which will greatly interest lovers of rare porcelain. The visitor will find a table covered with pails, dishes, bowls, in fact every kind of vessel, made from paper. These are very light and strong, and for many uses will be preferred to tin or wood.

CARILLON MACHINES.

Most of our readers have heard church bells play tunes. At one period such an arrangement was very common, and on the Continent of Europe the system is brought to considerable perfection; but in England it is only within a recent period that the employment of machinery for the production of airs from church bells has become popular.

As the method of producing tunes from church bells is but little understood, it will be well to preface our description of the machine we illustrate by a few words of explanation.

Church bells are caused to sound in two ways—either, that is to say, by swinging them, and so causing the clappers to strike them; or by the aid of hammers of various weights, according to the size of the bell, caused to rise and suffered to fall on the bell. Peals are rung by hand, the bells being swung; clocks always strike the bell with a hammer, the bell being at rest. The hammer is raised by a wire, which pulls down the hammer tail, the wire being worked by a lever, the end of which is caught by a cam on a revolving barrel in the clock below. It is obvious that if a number of bells are all fitted with hammers, and the number of cams is sufficiently great, and the cams are properly arranged, that a tune can be played by a mere multiplication of the device by which a clock is made to strike the hours on a single bell.

The carillon machine embodies this arrangement, only, instead of cams, a number of short pins are set in a revolving barrel, and these pins catch the toes of levers connected by wires with the hammer tails in the bell chamber above. The pins are set or pricked in precisely in the same way as the little points in the barrel of a musical box. If our readers will bear the musical box in mind, and fancy that the whole is enormously enlarged, and that the toes of the levers take the place of the springs, the arrangement will be quite clear. Such is the old fashioned, or, as we may term it, positive carillon machine: and its defects are very serious.

The hammer, after it has fallen, can only be lifted by the rotation of the barrel; and as the time of dropping the hammer depends entirely on the rotation of the barrel, it is obvious that the barrel can only revolve at a slow speed, and much time is lost in lifting the hammer. The result is that a rapid musical passage cannot possibly be performed. Another result is that, when the small bells, the high notes, come to be played, the barrel meets with less resistance, and revolves faster than when it has to deal with the deep notes and large bells. It follows that the air is played out of time.

These difficulties are overcome by the invention of Messrs. Gillett and Bland illustrated in the engraving—which explains a principle, and not details. This principle we may call negative. The hammers are always kept raised, and are only allowed to drop by the agency of the musical barrel. The instant they fall they are lifted again; and so long as the lifting is accomplished quickly enough, the time of lifting has nothing to do with the production of the air. That is determined solely by the musical barrel, which, being relieved of the work of lifting, has little or no strain on it, can be made small and light, and will always revolve at the same rate, and so insure that the tune shall be played in perfect time. It also follows that the most rapid passages can be played with the greatest ease and precision.

The second engraving is intended to show the gear for working one hammer. It must be multiplied in proportion to the number of hammers, but the parts are all repetitions of each other. It will be understood that this engraving does not show details, but simply illustrates a principle.

The musical barrel, B, is set with pins in the usual way. A is a cam wheel of very peculiar construction, operating a lever, C, by what is, to all intents and purposes, a new mechanical motion, the peculiarity of which is that, however fast the cam wheel revolves, the tripping of the lever is avoided. In all cases the outer end must be lifted to its full height before the swinging piece, D, quits the cam. The little spring roller, E, directs the tail, D, of the lever into the cam space, and when there it is prevented from coming out again by a very simple and elegant little device, by which certainty of action is secured. At the other end of the lever, C, is a trip lever, F. This lever is pulled toward C by a spring, and whenever C is thrown up by the cam wheel, F seizes it and holds it up; but the wire to the bell hammer in the tower above it is secured to the eye, G, so that, when D

is lifted, the eye, G, being pulled down, the hammer is lifted. The pins in the musical barrel, B, come against a step in F; and as they pass by, they push F outwards and release C, which immediately drops, and with it the hammer, so that the instant a pin passes the step, F, a note is sounded. But the moment D drops, it engages with A, which last revolves at a very high speed, and D is incontinently flung up again, and the hammer raised, and raised it remains until the next pin, B, passes the step on F, and again a note is struck. It will be seen, therefore, that, if we may use the phrase, B has nothing to do but let off traps set continually by A; and so long as A sets the traps fast enough, B will let them off

chine is to play thirty-one tunes—a fresh tune for every day in the month—on seventeen bells weighing altogether about thirty tons, and will also have barrels for changes similar to ringing a peal, and an ivory key board, the same as a pianoforte, attached to the machine, so that any musician can play tunes upon the bells with the fingers as easily as playing a pianoforte or organ. Taken altogether, this will be the largest work of the kind in the United Kingdom, and will cost over \$35,000.

Mound Explorations.

Dr. W. W. Ranney, of Lansing, Iowa, communicates to the *Journal*, of that place, an interesting account of an examination, recently made by himself and other parties, of an ancient mound in Union City township, Iowa.

The mound is not in the form of the burial mounds or *tumuli*, but forms a circle, the circumference of which is 700 feet. The ridge or elevation averages about 25 feet in width, leaving a circular inclosure 210 feet in diameter. The height of the ridge or mound is about three or four feet from the surface of the ground. On opening it, pieces of broken pottery, made of a bluish clay and partially pulverized mussel shells, were discovered; stones, showing evidence of having been used for hearths or supports for the earthen vessels while being used for cooking food; collections of fish scales, bones of buffalo, deer, badger, bear, fish, and birds; but no evidence of human bones. The long or marrow bones of all animals were found broken or split, supposed to have been done for the purpose of extracting the marrow for food, which circumstance is also noted in the *Kfokenmøddings*, or kitchen middens, of Denmark. One peculiarity noticed was that in different localities the ornamentation of the pottery was dissimilar. For instance, all found on one spot was ornamented with horizontal circular rings; all found in another place was ornamented with zigzag lines, and at another, near by, they had the same zigzag lines with dots in the angles. This was accounted

for by the supposition that each family had its own particular method of ornamentation, by which they recognized their property. These vessels were quite capacious, the diameter of one having been fourteen inches at the mouth. About one and three quarter inches below the mouth they abruptly widened out six inches all around, making the largest diameter twenty-six inches. The bottoms had been rounded in such a manner that they never tipped over; but let them be set down as they might, they oscillated till they finally, when still, sat in an upright position. For the purpose of handling, the vessels were provided with handles on two opposite sides.

Besides the beforementioned articles, copper ornaments, one inch wide at the base and one and a half inches from base to apex, were found, the form being the same as a perforated flat iron, as if to attach some additional ornament or a string to fasten in the ear.

The conclusion was that the mound was once the habitation of a community of families; that huts or wigwags were built in a circle, and the piles of burnt stone unearthed represented a hearth in a hut, on which the pottery sat while cooking, and around each of which a separate family warmed and fed themselves, and that each family had a separate distinct mark on their vessels by which they were known from their neighbors in the next hut or wigwag.

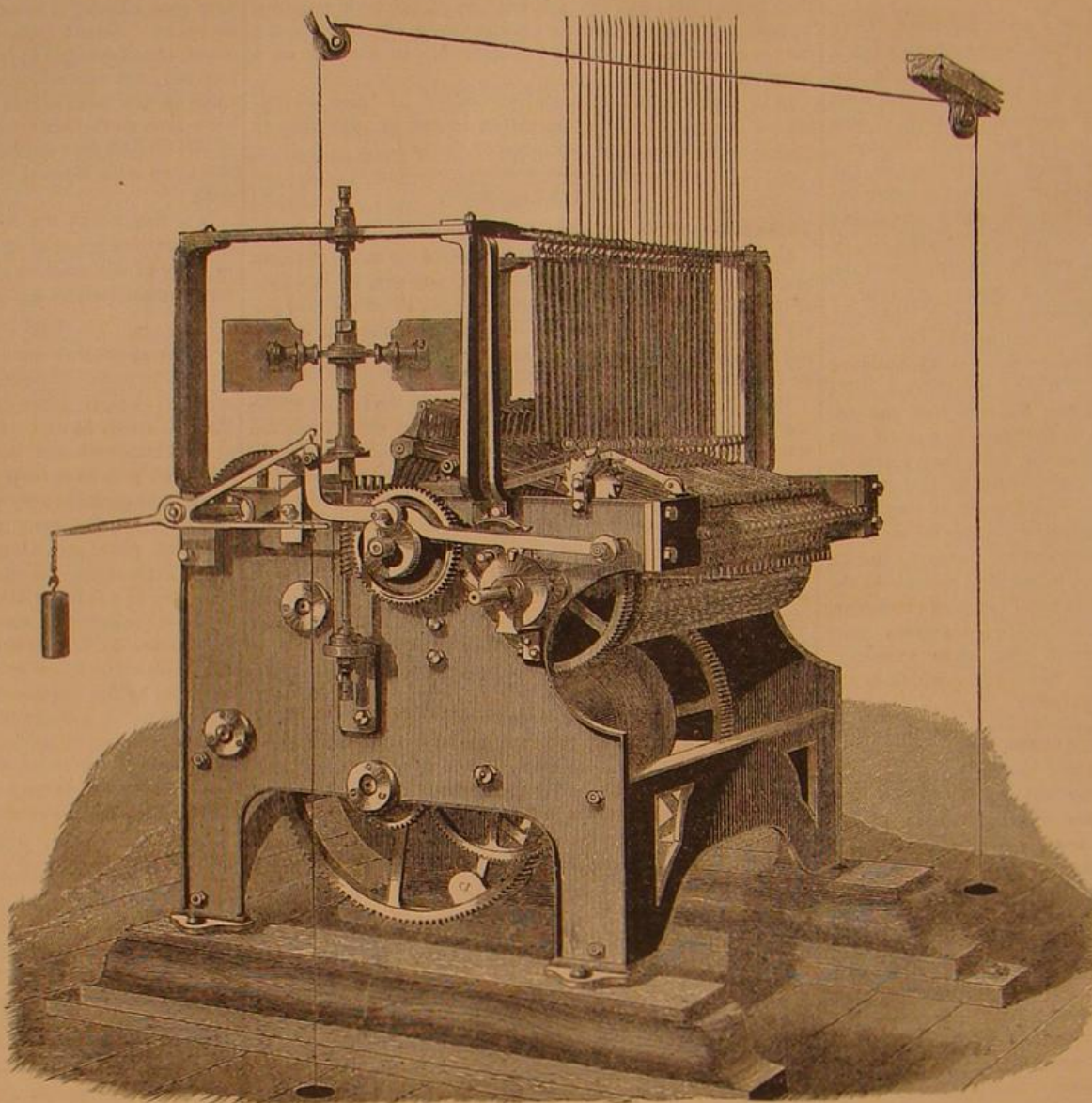
The central inclosure was used for their games, dancing, and pleasure, and perhaps, in case of attack from wild beasts or their fellow men, as a place for the aged, the young, and the women to flee to while the warriors met their encroachments outside the circle of dwellings. Forty rods south were found some 83 burial mounds or *tumuli*, out of which were procured parts of human skeletons.

Preserving Photo Sensitive Paper.

Prepare a number of sheets of cheap blotting paper by immersing them in a solution of bicarbonate of soda and letting them dry. These may be used over and over again. Then sensitise as much paper as is likely to be wanted during the next three or four weeks, interleave it with the blotting paper, and place the whole under a weight.

Sensitive paper thus treated may be preserved ready for use for a long time.

RATS detest chloride of lime and coal tar

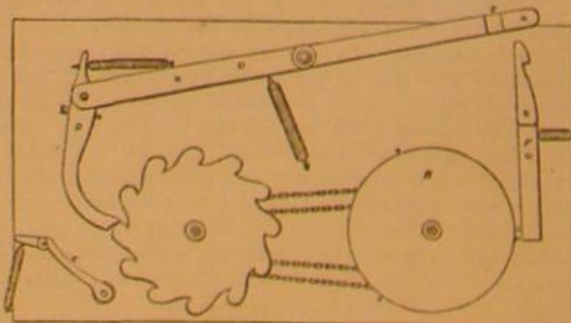


GILLETT AND BLAND'S CARILLON MACHINE.

in correct time. But A revolves so fast and acts so powerfully that it makes nothing of even a 3 cwt. hammer, much less the little ones; and thus is obtained a facility of execution heretofore unknown in carillon machinery. We venture to think that our readers will agree with us that such a carillon machine as we illustrate is about as ingenious a combination of mechanism as is to be met with in the range of the arts.

Our large engraving shows a machine on this principle recently put up in the parish church at Shoreditch, London, by Messrs. Gillett and Bland. This plays fourteen tunes on twelve bells—one of the finest peals in London, the tenor weighing no less than 34 cwt. Two barrels are used, which can be changed by hand. The peal ranges from CC to G.

Fig. 2.



There are twenty-four levers, two to each bell, to insure facility in playing rapid passages without driving the cam barrel too fast. The motive power is supplied by a weight of 9 cwt., allowed to fall 72 feet, and wound up every twenty-four hours. The performance of the machine leaves nothing to be desired.

The corporation of Manchester have decided upon having a great clock and carillon for their magnificent new town hall. The clock is to strike the hours upon a bell of seven tons, and to chime the four quarters on eight bells, the time to be shown upon four 16 feet illuminated dials. An automatic gas apparatus will be fitted to the clock for turning the gas up and down, and so constructed as to suit all seasons of the year. The clock will also have an electric connection with the Royal Observatory at Greenwich. The carillon ma-

DEEP SEA SOUNDING BY PIANOFORTE WIRE.

The use of piano wire for deep sea sounding was first successfully carried out by the celebrated physicist and electrician, Sir William Thomson, to whom belongs the merit of its introduction.

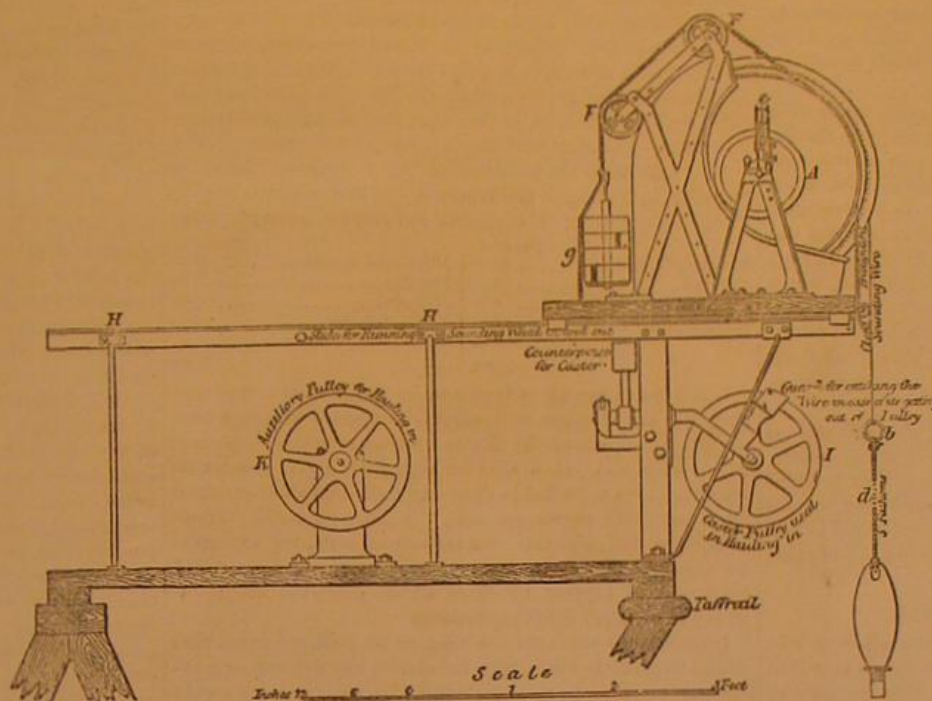
Since that first attempt, the pianoforte wire has done excellent service on submarine cable expeditions in various parts of the world; among other places, across the Atlantic, across the Pacific—where Captain Belknap, U.S.N., found depths exceeding 500 fathoms—and in South American waters, from Cuba to the River Plate.

The sounding apparatus, as it is now finished and sent out by Mr. White, of Glasgow, Scotland, and as it is has been used by the steamer *Faraday* on the Direct United States (Messrs. Siemens') Cable expedition, is represented in the accompanying engraving, which we extract from *Engineering*. It consists of a large light drum, A, of galvanized sheet iron, on which the wire is carefully coiled. The free end of this wire terminates in a stout galvanized iron ring, B, and to this ring the sinker, C, is attached by a hemp line, D, several fathoms long. The interposition of the line between the wire and sinker prevents the wire from reaching the bottom, and the ring is heavy enough to keep the wire tight—thus kinking of the wire is avoided. The circumference of the drum is one fathom, and an indicator, E, is fixed to the axle to indicate the number of revolutions of the drum. A slight correction, due to the thickness of wire on the drum, has therefore only to be applied to the indicated number of turns in order to give the amount of wire paid out, or depth of the sounding in fathoms.

In order to stop the drum immediately on the sinker reaching the bottom, the brake, F F, is employed. It consists of a friction cord attached at one end to the framework of the apparatus, and passing over a secondary groove on the circumference of the drum, A, the other end being weighted at G. By means of this brake the increased pull on the wire, due to the amount of it paid out, is to be more than counteracted, so that the drum will revolve by a pull on the wire due to something less than the weight of the sinker. For, in this case, when the sinker is supported by the bottom, there will be a friction on the drum, bringing it to rest. The weights, G, have, therefore, to be applied gradually, as the wire runs out. The rule adopted in practice is to apply resistance, always exceeding by 10 lbs. the weight of the wire out. Then, the sinker being 34 lbs., we have 24 lbs. weight left for the moving force. This is amply sufficient to give a very rapid descent, so that in the course of half an hour the bottom will be reached at a depth of 2,000 or 3,000 fathoms. The person in charge watches a counter (the indicator, E), and for every 250 fathoms (that is, every 250 turns of the wheel) he adds such weight to the brake cord as shall add 3 lbs. to the force with which the sounding wheel resists the egress of the wire. That makes 12 lbs. added to the brake resistance for every 1,000 fathoms of wire run out. The weight of every 1,000 fathoms of wire in air is 14½ lbs.

In water, therefore, the weight is about 12 lbs.; so that if the weight is added at the rate indicated, the rule will be fulfilled. So it is arranged that, when the 34 lbs. weight reaches the bottom, instead of there being a pull, or a moving force of 24 lbs. on the wire, tending to draw it through the water, there will suddenly come to be a resistance of 10 lbs. against the motion. A turn or two and the drum comes

to rest. The instantaneous perception of the bottom, even at so great a depth as 4,000 fathoms, when this rule is followed, is very remarkable. The sounding apparatus is best fixed so as to project beyond the bow or stern taffrail. In order to take a sounding, the drum, A, is run out to the end of the rails, H H, where it admits of the sinker dropping sheer into the sea. The sinker is then gently lowered by turning the handle of the drum until it touches the water, when the indicator is set at zero. Everything being ready and the ship at rest, the handles of the drum are then unshipped, the check pawl of the drum is unlocked, and the wire runs rapidly out. When bottom is reached, the indicator is read off, and the hauling up is set about at once. The wire is first supported from the framework by a yarn stop-



WHITE'S DEEP SEA SOUNDING APPARATUS.

per, or is held by a couple of men with canvas or leather protection for their hands. The drum is then run inboard again, and the wire is led over ½ circumference of the castor pulley, I, then passed over the auxiliary hauling-in pulley, K, so as to make ½ or 1½ turns before it is coiled on the drum.

The tube in the end of the sinker, if fitted with a valve door, brings up a specimen of the bottom. As the wire comes in, it may be partially dried by rubbing it with a piece of canvas; and as it is being coiled on the drum, to preserve it from rusting it is drenched occasionally with oil. When not in use the drum is kept in a bath of oil. It was formerly the custom to apply a solution of caustic soda in the same way, but the oil has superseded it.

This is the complete apparatus for deep sea sounding, but a simpler affair will suffice for soundings of even 1,000 fathoms, and especially for flying soundings from telegraph or mail steamers approaching land. With the wire three men can do the work in a small fraction of the time; the sounding is surer, for the wire goes down very sheer; and difficult maneuvering of the ship in rough tides, to keep her over the line, is avoided during hauling in, because the lateral friction of the wire to its passage through the water is so small compared to that of the hempen line. A sounding in 2,500 fathoms, which would engage several men and a donkey engine, require very alert handling of the ship, and occupy from four to five hours, can now be done by three men in the space of about forty minutes.

Breaking of a Fire Ladder.

By the breaking of a patent fireman's ladder machine in this city, during a recent drill of the fire department, three men lost their lives. The machine consists of a combination of ladders, which, by the turning of winches, are quickly elevated to an angular or perpendicular position, the ladders sliding out one beyond the other. The unfortunate men were on the upper ladder, ninety feet from the ground, when one of the lower ladders gave way, and they were precipitated to the pavement. Cause—bad material and bad workmanship.

Dietetic Effects of Water.

Certain experiments made by a French assan, with the view of ascertaining how far the phosphate of lime in bone may be replaced by other phosphates, have been used by Mr. W. J. Cooper to illustrate how profoundly the bodies of animals are influenced by the waters they drink. This is an aspect of the water question which will be new to most people; but there is no doubt that the composition of the body is materially influenced by the mineral constituents of the fluids we habitually drink. The active effects of several mineral waters upon the functions are well known; it is not so generally known that water from artesian wells, so pure from organic pollution, sometimes contains sulphate of magnesia and other salts to such a degree as to be positively injurious. On the other hand, in some districts in Holland where there is only rain water to be obtained for drinking purposes, softening and distortion of the bones are frequent. That, as shown by the experiments referred to by Mr. Cooper, the use of natural waters may tend to alter the structure of our bodies, introduces another element into the much vexed question as to the proper source whence to draw the supplies of potable water for towns, by showing that the inorganic impuri-

ties of water are of more importance to health than they have been usually considered; while it lends support to the opinion that the same conditions have something to do with the goitre and other glandular affections endemic over certain regions.

ENGINEERING IN NEW ZEALAND.

We publish herewith a view of a bridge, designed by Mr. J. Millar, of Dunedin, New Zealand, to carry the Otago Great Northern Trunk Railway over the Waitaki, a river of great width, and liable to considerable variation in depth of water. The bridge consists of 28 bays, each of 133 feet from center to center of piers. On one side an extra span of 45 feet leads the general road traffic upon the bridge, as shown, the rail level being on the top, and the road level at the bottom, of the Warren girders, which compose the long structure. The river, which is, in times of low water, reduced so much in volume that the bed is exposed in banks of shingle, as shown in the engraving, is greatly flooded at the season when the snow melts from the mountains, and passes down in torrents. At such times the width of the river is increased to a mile, and the water rises to a level within 5 feet of the level of the bridge.

HAIR should never be put in mortar until a few days before the material is used, as the lime will soon destroy it.



BRIDGE OVER THE WAITAKI NEW ZEALAND.

Nitro-Glycerin Explosives.

Nitro-glycerin is the most powerful explosive in use. In difficult blasting, where very violent effects are required, it surpasses all others. In spite of the many accidents that have occurred with it, it has been found to be so valuable that its use has steadily and largely increased.

Its liquid form is a disadvantage, except under favorable circumstances, as when made at the place where it is to be employed. It, however, forms the essential ingredient in a number of solid mixtures, which will be taken up farther on. When used in blasting or similar work, it is usually put in tin cans or cartridge cases.

Since nitro-glycerin is so readily detonated, it has the advantage of not requiring strong confinement. Even when freely exposed, it will exert violent effects, such as breaking masses of rock or blocks of iron. So, in blasting, it requires but little tamping. Loose sand or water is entirely sufficient.

The relative force of nitro-glycerin is not easily estimated, since the effect produced depends greatly on the circumstances. Thus, a charge of nitro-glycerin in wet sand or any soft material will exercise but a slight effect, while the same charge will shatter many tons of the hardest rock. In the former case much more sand would be thrown out by a slower explosion, which would gradually move it, than by the sudden violent shock of the nitro-glycerin, which would only compress the material immediately about it. But in the hard rock, the sudden explosion is much more effective than the same amount of force more slowly applied. Roughly, it may be said that nitro-glycerin is eight times as powerful as gunpowder, weight for weight.

Products of decomposition: On explosion, nitro-glycerin is resolved entirely into the gases carbonic anhydride, water, nitrogen, and oxygen, the last named appearing only in small quantity. If explosion is imperfectly accomplished, oxides of nitrogen are formed, and the total quantity of gas is lessened. If fully exploded, no disagreeable or poisonous gases are given off.

NITRO-GLYCERIN PREPARATIONS.

The explosive preparations containing nitro-glycerin will be taken up in this place, since they are but forms in which nitro-glycerin itself is presented for use. Their explosive power is derived from the nitro-glycerin in them; so that they are not explosive mixtures in the sense in which that term has been employed in these pages.

In all of them nitro-glycerin is present as nitro-glycerin, but it is mixed with some absorbent substance or vehicle. In this way a solid or semi-solid substance is obtained, which is much more convenient and safer to use than the liquid itself.

DYNAMITE.

In dynamite, the absorbent is usually a natural silicious earth. Deposits of this silicious earth are found in many places, notably in Hanover. From the Hanover earth, the original dynamite was made. This silicious earth, or *Kieselguhr*, is a fine white powder, composed of the skeletons of microscopic animals (infusoria). It has a high absorptive power, being capable of taking up from two to three times its weight of nitro-glycerin without becoming pasty.

Artificially prepared silica has been proposed by the writer as a substitute for the natural earth, and has been used at Newport with good results. This silica is prepared by precipitating it from a solution of sodium silicate (water-glass) by sulphuric acid, washing, and drying. Its absorptive power is a little less than that of the natural earth, but it retains the nitro-glycerin very well.

The process of making dynamite is very simple. The nitro-glycerin is mixed with the dry, fine powder in a leaden vessel with wooden spatulas.

Dynamite has a brown color, and resembles in appearance moist brown sugar. It usually contains from sixty to seventy-five per cent of nitro-glycerin. In this country, dynamite is made and sold under the name of giant powder.

The explosive properties of dynamite are those of the nitro-glycerin contained in it, as the absorbent is an inert body. It freezes at the same temperature as its nitro-glycerin, to a white mass. If solidly frozen, it cannot be fired; but if loose and pulverulent, it can be exploded, although with diminished violence. It can be thawed by placing the vessel containing it in hot water.

The keeping qualities of dynamite are those of the nitro-glycerin it is made from. It is safer because it avoids the liquid condition, and from its softness it will bear blows much better. Exudation must be guarded against. Therefore, it must not contain too much nitro-glycerin, especially if it is liable to be exposed to comparatively high temperatures, which tend to make the nitro-glycerin more fluid, and consequently less easily retained.

The firing point of dynamite is the same as of its nitro-glycerin. If flame is applied to it, it takes fire and burns with a strong flame, leaving a residue of silica. It is not sensitive to friction or moderate percussion.

Mode of firing: Dynamite is fired by a fulminate fuse. Gunpowder will fire it, but not with certainty, and the effect obtained is much less than when the stronger agent is employed.

Use and relative force: Dynamite is the best of the nitro-glycerin preparations, and is indeed the best form in which nitro-glycerin can be used. It has earned a good reputation for safety, in spite of the horror usually excited by nitro-glycerin, or anything connected with it. It contains more of the explosive agent than the other nitro-glycerin preparations, and is therefore stronger. Safer than the liquid nitro-glycerin, from its mechanical condition, it is not complicated by the admixture of substances which may exercise injurious effects.

It is used for blasting and other purposes instead of nitro-glycerin. It is now extensively employed in mining and quarrying with excellent results, and its use is constantly increasing. Much more effective than powder, it is practically safer, since it is not liable to explosion by sparks or flames. Carelessness is therefore less likely to be followed by accident. For military purposes, also, it is largely employed. The explosive force of dynamite is, of course, that of the nitro-glycerin contained in it. If it contains seventy-five per cent, its comparative force may then be approximately stated at six times that of gunpowder, weight for weight.

DYNAMITE NO. 2.

Dynamite proper contains only nitro-glycerin and the silicious absorbent. Mixtures containing other substances are sometimes included under the same name. The true dynamite is often called dynamite No. 1, and the others dynamite No. 2, etc., or receive fanciful names. All these mixtures contain less nitro-glycerin than the No. 1, so that they cost less per pound, but of course they are proportionately less powerful. Possibly they may sometimes be of use.

The following are varieties of No. 2 dynamite made in England, according to the report of the Select Committee of House of Commons on explosive substances, June 26, 1874:

Per cent.	Per cent.
Nitrate of soda..... 69.00	Nitrate of potash..... 71.00
Paraffin..... 7.00	Paraffin..... 1.00
Charcoal or coal dust..... 4.00	Charcoal..... 10.00
Nitro-glycerin..... 20.00	Nitro-glycerin..... 18.00
100.00	100.00

It is hard to see any advantage in these mixtures except that they are cheaper, and might be applied to uses where the great violence of the larger amount of nitro-glycerin is not needed, and yet a sharper explosive than powder is wanted. It is improbable that any useful effect is obtained from any other ingredient than the nitro-glycerin. Those containing deliquescent salts (nitrate of soda, for example) are objectionable from their liability to exudation. All of them will be injured by water, which dissolves the salts, which are the principal ingredients.

It is easy to see that the number of such mixtures that might be made is very great, for almost any dry salt or powder may be taken as an absorbent.* No special value would attach to any of them. The only requisites would be that the absorbents should not exert any injurious action, and that no more nitro-glycerin should be present than could be perfectly retained at the highest temperature that would probably be experienced.

Many of these mixtures have been proposed and made, but it is undesirable at the present time to touch upon more than a few of the most prominent, which will serve as examples.

LITHOFRACTEUR.

Lithofracteur is a mixture which, according to Trauzl, has the composition:

	Per cent.
Nitro-glycerin.....	52.00
Infusorial earth.....	30.00
Coal.....	12.00
Soda saltpeter.....	4.00
Sulphur.....	2.00-100

Sometimes, instead of the sodium nitrate, the potassium or barium salt is used, and variations made in the quantity of nitro-glycerin present. Like all the nitro-glycerin preparations, lithofracteur has no necessarily definite composition, being merely a mixture made according to the caprice of the manufacturers, as shown by experiments with lithofracteur in England by a special committee. Experiments in 1873 with a lithofracteur containing 66.7 per cent of nitro-glycerin showed great liability to exudation. In 1873 the manufacturers submitted another sample of 47.5 per cent, which, of course, retained the nitro-glycerin much better.

This preparation is made by Krebs Brothers & Co., in Cologne, and has been used to some extent in Europe. It is claimed by the makers that the other substances (coal, saltpeter, and sulphur), mixed with the nitro-glycerin, increase the quantity of gas delivered, and, therefore, the explosive force. This is not, however, correct. Nitro-glycerin is so sudden in its explosion that nothing can be added to it from the slower burning of any of the other combustible ingredients, which are present in comparatively small amount, and in bad proportions. Neither does the presence of these substances add anything to the safety of the mixture. They tend to lower its firing point, and render it more easily exploded.

Lithofracteur must be regarded as inferior to dynamite proper, especially for military purposes. It is much more liable to exudation.

The mixtures known in this country as giant powder No. 2, rend-rock, etc., and those already spoken of under the head of dynamite No. 2, are similar to lithofracteur; but in them the silicious earth is generally omitted.

DUALIN.

Dualin is a mixture made by Carl Dittmar, a Prussian, of nitro-glycerin, sawdust, and saltpeter, in about the proportions:

	Per cent.
Nitro-glycerin.....	50.00
Fine sawdust.....	30.00
Saltpeter.....	20.00
100.00 (Trauzl.)	

* During the siege of Paris, in 1870, nitro-glycerin and dynamite were made in the city in considerable quantity for military purposes. The glycerin was obtained from the candle factories, but of course the silicious earth was unobtainable. Many experiments were made to discover a good absorbent. Pulverized brick, tripoli, charcoal, magnesia, chalk, lampblack, and others were rejected as not possessing sufficient absorptive powers. Finally, the ash of the coal used for gas-making was hit upon. This was a white powder, mainly composed of aluminum silicate, and capable of taking up twice its weight of nitro-glycerin, without becoming plastic. The mixture so made was called dynamite.

This preparation is also inferior to dynamite. The sawdust and saltpeter have much less absorptive power than the silicious earth, and retain the nitro-glycerin comparatively feebly. Its firing point is said to be considerably lower than that of dynamite. Also, its lower specific gravity is a drawback.—*Professor Hill's "Notes."*

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

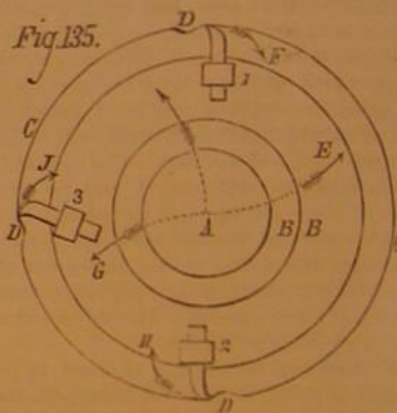
NUMBER XXXII.

BORING BARS AND TOOLS.

A very important consideration with reference to boring bars is the position which the cutters should occupy towards the head or the body of the bar. We have already been over the same ground with reference to parting or grooving tools for lathe work, cutting tools for planing work, and cutters for cutting out holes of a large diameter in boiler plates; but there are so many principles involved in the shape and holding position of cutting tools, so many variations, and so many instances in which the reasons for the adoption or variation of a principle are not obvious, that it is of vital importance to specify, in the case of each tool, its precise shape and position of application, together with the reasons therefor. The field of application being so extensive that the memory can hardly be relied upon.

A careful survey of all the tools thus far treated upon will disclose that, in each case wherein the cutting edge stands in advance (in the direction in which the tool is moving, or, if the work move, in the direction of the metal to be cut) of the fulcrum upon which the tool is held, the springing of the tool causes it to dig into the work, deepening the cut, and in most cases causing the tool point or cutting edge to break; while in every instance this defect has been cured (upon tools liable to spring) by so bending or placing the tool that the fulcrum upon which it was held stood in advance of the cutting edge; and these rules are so universal that it may be said that pushing a tool renders it liable to spring into the work, and pulling it or dragging it enables it to take a greater cut and to spring away from excessive duty; and thus the latter prevents breakage and excessive spring, because, when the spring deepens the cut, it increases proportionally the causes of the spring, and creates a contention between the strength of the tool and the driving power of the machine, resulting in a victory for the one or the other, unless the work itself should give way, either by springing away from the tool and bending, or forcing it from the lathe centers or from the clamps which hold it.

For instance, in Fig. 135, is shown A, a boring bar; B B



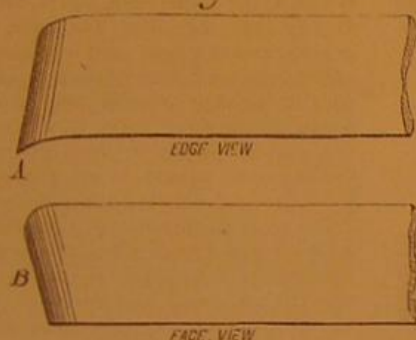
is the sliding head; C C is the bore of the cylinder, and 1, 2, and 3 are tools in the positions shown. D D D are projections in the bore of the cylinder, causing an excessive amount of duty to be placed upon the cutters, as sometimes occurs when a cut of medium depth has been started. Such a cut increases on one side of the bore of the work until, becoming excessive, it causes the bar to tremble and the cutters to chatter. In such a case, tool and position No. 1 would not be relieved of any duty, though it spring to a considerable degree; because the bar would spring in the direction denoted by the dotted line and arrow, E, while the spring of the tool itself would be in the direction of the dotted line, F. The tendency of the spring of the bar is to force the tool deeper into the cut instead of relieving it, while the tendency of the spring of the tool will scarcely affect the depth of the cut. Tool and position No. 2 would cause the bar to spring in the direction of the dotted line and arrow, G, and the tool itself to spring in the direction of H, the spring of the bar being in a direction to increase, and that of the tool to diminish, the cut. Tool and position No. 3 would, however, place the spring of the bar in a direction which would scarcely affect the depth of the cut, while the spring of the tool itself would be in a direction to give decided relief by springing away from its excessive duty. It must be borne in mind that even a stout bar of medium length will spring considerably from an ordinary roughing-out cut, though the latter be of an equal depth all round the bore and from end to end of the work. Position No. 3, in Fig. 135, then, is decidedly preferable for the roughing-out cuts. In the finishing cuts, which should be very light ones, neither the bar nor the tool are so much affected by springing; but even here position No. 3 maintains its superiority, because, the tool being pulled, it operates somewhat as a scraper (though it may be as keen in shape as the other tools), and hence it cuts more smoothly. It possesses, it is true, the defect that the distance from the cutting point stands farther out from the holding clamp, and the tool is hence more apt to spring; and in cases where the diameter of the sliding

head is much less than that of the hole to be bored, this defect may possess importance, and then position No. 2 may be preferable; but it is an error to employ a bar of small diameter compared to that of the work.

To obtain the very best and most rapid result, there should be but little space between the sliding head and the bore of the work; the bar itself should be as stout as is practicable, leaving the sliding head of sufficient strength; and if the bar revolves in journals, these should be of large diameter and with ample facilities for taking up both the diametrical and end play of the boxes, since the one steadies the bar while it is performing boring duty, and the other while it is facing off end faces, as for cylinder cover joints. The feed of a boring bar, which is slight in comparison to its duty, will range at from 30 to 40 revolutions to an inch of travel; while that of a stout bar, held in large and closely fitting journals, may be about 20 revolutions per inch of tool travel for roughing-out cuts, and 4 revolutions per inch of travel for finishing cuts, which may be made to leave the work very smooth indeed.

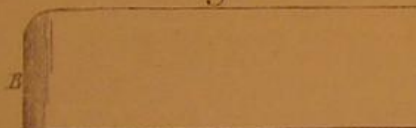
The tools employed for the roughing cuts should not have a broad cutting surface, and should have a little front rake, as shown in Fig. 136, A being the cutting corner. For the

Fig. 136.



finishing cuts, the same tool may be employed, the end being ground to have a broad level cutting surface along the edge, B, as shown in Fig. 137. These tools should be made

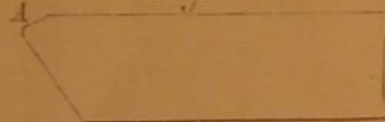
Fig. 137.



of the best quality of steel, and hardened right out, that is to say, not tempered at all.

The lip or top rake must, in case the bar should tremble during the finishing cut, be ground off, leaving the face level; and if, from the bar being too slight for its duty, it should still either chatter or jar, it will pay best to reduce the revolutions per minute of the bar, keeping the feed as coarse as possible, which will give the best results in a given time. In cases where, from the excessive length and smallness of the bar, it is difficult to prevent it from springing, the cutters must be made as in Fig. 138, having no lip, and but a

Fig. 138.



small amount of cutting surface; and the corner, A, should be beveled off as shown. Under these conditions, the tool is the least likely to chatter or to spring into the cut, especially if held in position No. 3, in Fig. 135; for a tool which would jar violently in position No. 1, would cut smoothly and well if held in position No. 3.

The shape of the cutting corner of a cutter depends entirely upon the position of its clearance or rake. If the edge forming the diameter has no clearance upon it, the cutting being performed by the end edges, the cutter may be left with a square, slightly rounded, or beveled corner; but if the cutter have clearance on its outside or diametrical edge, as shown on the cutters in Fig. 135, the cutting corner should be beveled or rounded off, otherwise it will jar in taking a roughing cut, and chatter in taking a moderate cut. The principle is that beveling off the front edge of the cutter, as shown in Fig. 138, tends greatly to counteract a disposition to either jarring or chattering, especially as applied to brass work.

The only other precaution which can be taken to prevent, in exceptional cases, the spring of a boring bar is to provide a bearing at each end of the work, as, for instance, by bolting to the end of the work four iron plates, the ends being hollowed to fit the bar, and being so adjusted as to barely touch it; so that, while the bar will not be sprung by the plates, yet, if it tends to spring out of true, it will be prevented from doing so by contact with the hollow ends of the plates, which latter should have a wide bearing and be kept well lubricated.

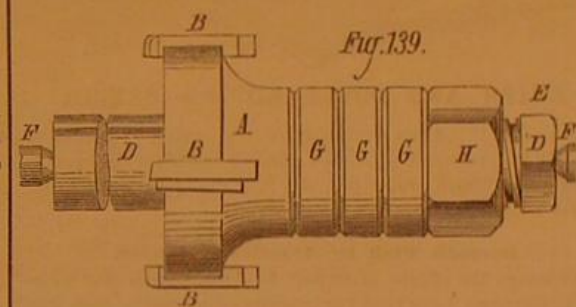
It sometimes happens that, from play in the journals of the machine, or from other causes, a boring bar will jar or chatter at the commencement of a bore, and will gradually cease to do so as the cut proceeds and the cutter gets a broader bearing upon the work. Especially is this liable to occur in using cutters having no clearance on the diametrical edge; because, so soon as such a cutter has entered the bore for a

short distance, the diametrical edge (fitting closely to the bore) acts as a guide to steady the cutter. If, however, the cutter has such clearance, the only perceptible reason is that the chattering ceases as soon as the cutting edge of the tool or cutter has lost its fibrous edges. The natural remedy for this would appear to be to apply the oilstone; this, however, will either have no effect or make matters worse. It is, indeed, a far better plan to take the tool (after grinding) and rub the cutting edge into a piece of soft wood, and to apply oil to the tool during its first two or three cutting revolutions. The application of oil will often remedy a slight existing chattering of a boring bar, but it is an expedient to be avoided, if possible, since the diameter or bore cut with oil will vary from that cut dry, the latter being a trifle the larger.

The considerations, therefore, which determine the shape of a cutter to be employed are as follows: Cutters for use on a certain and unvarying size of bore should have no clearance on the diametrical edges, the cutting being performed by the end edge only. Cutters intended to be adjusted to suit bores of varying diameter should have clearance on the end and on the diametrical edges. For use on brass work, the cutting crown should be rounded off, and there should be no lip given to the cutting edge. For wrought iron, the cutter should be lipped, and oil or soapy water should be supplied to it during the operation. A slight lip should be given to cutters for use on cast iron, unless, from slowness in the bar or other causes, there is a tendency to jarring, in which case no lip or front rake should be given.

SMALL BORING BARS.

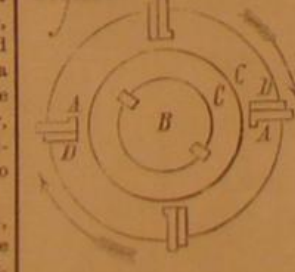
In boring work chucked and revolved in the lathe, such, for instance, as axle boxes for locomotives, the boring shown in Fig. 139 is an excellent tool. A represents a cutter head, which slides along, at a close working fit, upon the bar, D D, and is provided with the cutters, B B B, which are



fastened into slots provided in the head, A, by the keys shown. The bar, D D, has a thread cut upon part of its length, the remainder being plain, to fit the sliding head. One end is squared to receive a wrench, which, resting against the bed of the lathe, prevents the bar from revolving upon the lathe center, F F, by which the bar is held in the lathe. G G G are plain washers, provided to make up the distance between the thread and plain part of the bar, in cases where the sliding head, A, requires considerable lateral movement, there being more or fewer washers employed according to the distance along which the sliding head is required to move. The edges of these washers are chamfered off to prevent them from burring easily. To feed the cutters, the nut, H, is screwed up with a wrench.

The cutter head, A, is provided in its bore with two feathers, which slide in grooves provided in the bar, D D, thus preventing the head from revolving upon the bar. It is obvious that this bar will, in consequence of its rigidity, take out a much heavier cut than would be possible with any boring tool, and furthermore that, there being four cutters, they can be fed up four times as fast as would be possible with a single tool or cutter. Care must, however, be exercised to so set the cutters that they will all project true radially, so that the depth of cut taken by each will be equal, or practically so; otherwise the feeding cannot progress any faster than if one cutter only were employed. For use on bores of a standard size, the cutters may be made with a projecting feather, fitting into a groove provided in the head to receive it, as shown in Fig. 140, which shows the boring bar and head, the nuts and washers being removed. A A A A represent the cutters, B the bar, C C the sliding head, and D D D D the keys which fasten the cutters in the head. The cutters should be fitted to their places, and each marked to its place; so that, if the keyways should vary a little in their radius from the center of the bar, they will nevertheless be true when in use, if always placed

Fig. 140.



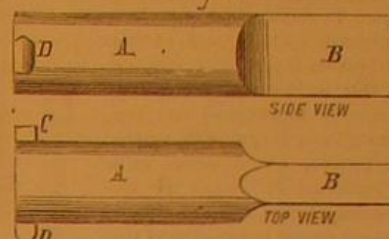
in the slot in which they were turned up when made. By fitting in several sets of cutters and turning them up to standard sizes, correctness in the size of bore may be at all times insured, and the feeding may be performed very fast indeed.

BORING TOOL HOLDERS.

For use on holes too small to admit of a bar having a sliding head, which are usually bored with a slide rest tool, a boring tool holder may be employed to great advantage. Such an appliance is shown in Fig. 141, A representing a round bar shaped at the end, B, to fit into the tool post of the slide rest, and having a groove across the diameter of the end, C D, to receive a short tool. The slot and tool may be

either square or V-shaped, the tool being locked by a wedge. It is obvious that, instead of shaping the end, B, as shown, the bar may be held (if the slide rest head is provided with clamp instead of a tool post) by two diametrically opposite flat faces. For use in holes of from two to eight inches bore, such an appliance is invaluable, especially if the hole to be bored is of unusual depth; because the bar may be made very stout in proportion to the size of the hole, and will, therefore, stand a depth of cut and a rate of feed totally impracticable with an ordinary boring tool, and will not spring away towards the back end of the hole, as boring

Fig. 141.

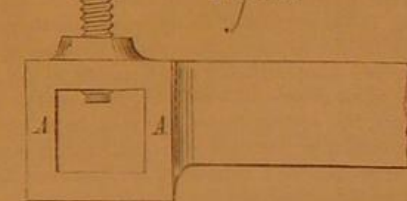


tools are apt to do. Furthermore, the cutting tools, being small, are easily forged, ground up, and renewed when worn out; and the bar maintains its original length, which may be made to suit the depth of hole required to be bored: while a boring tool becomes shorter each time it requires reworking.

The shape of the cutting tool may be as shown at D, Fig. 141, or such other as the nature of the duty may require. For truing out broad recesses in large work, the slot in the end, C D, may be made large enough to receive two tools, one to turn the inside and the other the outside of the recess.

For use upon holes of a large bore, or upon outside work, in which the tool requires to stand out far from the slide rest, the tool holder shown in Fig. 142 should be employed,

Fig. 142.



the tool box, A A, being long enough to receive two of the set screws, B.

The Value of Vivisection.

While the practice of vivisection cannot be defended when the torture is inflicted on lower animals, simply to exhibit truths already fully settled and demonstrated, its utility in original investigation cannot be contradicted. This is amply proved by the results to which it has led. In summing up the benefits to practical medicine accruing from vivisection, in a speech recently delivered before the British Medical Association, the president of that body, Sir Robert Christison, noted among others the following:

By means of the most extended series of vivisection on record, Orfila placed toxicology on a scientific basis, and gave to the world a knowledge of the action of poisons which has been directly instrumental in saving thousands of lives. To experimentation on animals as to the nutritive value of non-nitrogenous substances, the goodly fellowship of anti-vivisectionists who have a tendency to gout or gravel owe the accurate dietetic treatment of their ailments. Sir Robert himself discovered through vivisections the mode in which oxalic acid poisons, and the means of counteracting its effects; determined the rapidity of action of prussic acid; ascertained by experiment, first upon himself and subsequently upon animals, the physiological and toxic effects of Calabar bean, now largely and usefully employed in medicine; in an important medico-legal case he established the guilt of the accused by proving upon animals the fatal action of laburnum bark, the substance administered, the effects of which had not previously been investigated.

To Sportsmen and Hunters.

The editor of the *Forest and Stream* announces the establishment of a most interesting exhibition at the Centennial Exposition, to be held in Philadelphia next year, where he intends to show a genuine camp in the forest, with a running stream—shelter tents, a veritable Indian birch wigwam, canoes, etc., etc. Every department will be complete, and genuine Indians and trappers have already been engaged to superintend each one. Anything that comes within the province of his interesting journal will be welcome to a place, whether old relics or new inventions, things useful or ornamental, boats, guns, rods, dog collars, camp utensils, life preservers, bear traps, snow shoes, lariats, wigwams, buckskin suits, wampum belts, portable stoves, Indian scalp, pelts and horns, jack lamps, moccasins, tents, rubber goods, stable furniture, rare birds and animals, fruits and plants, trolling tackle, bats and balls, billiard tables, aquariums, and cartridge belts.

RECENTLY, off Wicklow, Ireland, the British ironclad *Iron Duke* ran into and sunk the ironclad *Vanguard*. Cause, fog. Both ships were of 6,000 tons burden, plated with 9-inch iron, and carried 14 guns each. No lives were lost.

IMPROVED ADDING PENCIL.

We illustrate herewith an ingenious and quite useful invention, the object of which is to facilitate the labor of accountants in adding up long columns of figures. It is a miniature calculating machine, which performs its work with unerring accuracy and without requiring any thought on the part of the operator, other than that involved in noting that a pointer points to the proper figure to be added. In shape it resembles a pencil, being no larger, and as easily manipulated.

As shown in the hand in the engraving, the device has a metal case which is provided with a longitudinal slot. Within the case, represented in section in Fig. 2, is a cylinder, A, grooved spirally, and having figures marked beside the grooves, ranging from 1 to 700, this last number being considered as probably as large as any one column of figures in a ledger will aggregate. In the groove, which serves as a guide, is an indicator, B. Below the cylinder is a pinion, C, the teeth of which enter similar teeth on the lower edge of the cylinder, so that when the pinion is turned the cylinder rotates within the case. The pointer of the pencil is connected, inside the case, with a rack, D, upon which is an indicator, E, working in a separate slot and ranging along a scale marked with the digits. The teeth of the rack engage with a wheel attached to the pinion when the rack is pushed up, but not when the rack is forced down by the reaction of the spiral spring within the cylinder.

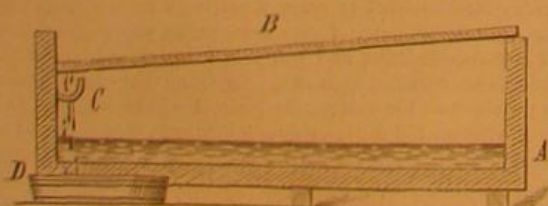
In adding a column of figures, the operator presses the point upon the first number until a corresponding number is noted by the digit indicator, E; thus, in the engraving, the point is pressing on 5, and the indicator shows the same number. This, of course, involves the pushing up of the rack and the turning of the pinion, the revolution of the cylinder, and the consequent guiding of the indicator, B, a short distance up the spiral groove, said distance being in proportion to the total length of the spiral groove, as 5 to 700. The operator then raises his point, the spring forces the rack back, without turning the cylinder, so that the digit indicator returns to 0, while the upper indicator remains at 5. The next figure, 6, in the column is touched, and the digit indicator is carried to 6, the upper indicator is carried forward as before, but starts from its present location, namely, 5, so that at the end of its movement it will have traversed a total distance of 11, denoted by the numbers placed on the cylinder. This operation is repeated for every figure of the column; and when all have been touched, their sum is shown by the position of the indicator, B. By turning the piece, F, and rotating the cylinder in the opposite direction, the indicator, B, is now carried back to zero, ready to begin a new column; or if there be any number to carry from one column to another, instead of being set back to zero, it is adjusted to that number, so that that is added in, as it should be, with the next sum.

It will be seen that there is simply no possibility of error in the operation, unless the user deliberately sets the digit indicator, E, to the wrong number. A little practice will enable him to cause that indicator, however, to stop at the right figure almost instantly, so that the column will be cast up nearly as quickly as he can touch the separate figures, and, as claimed by the inventor, much quicker than the average arithmetician can perform the same mentally. Interruption during the computation is no annoyance, and, indeed, the motion may proceed almost mechanically while engaged in conversation. Or he may stop work in the middle of a column, attend to other matters, and resume it after any period of time. So long as the pencil is not altered in the interval, the results will be absolutely correct.

Patent pending through the Scientific American Patent Agency, to Messrs. Marshall M. Smith and Fletcher W. Potts, of Verdi, Washoe county, Nevada. Patents are also being secured in foreign countries. For exclusive right for United States, State rights, and other particulars, the inventors may be addressed as above stated.

CHANGING SALT WATER TO FRESH.

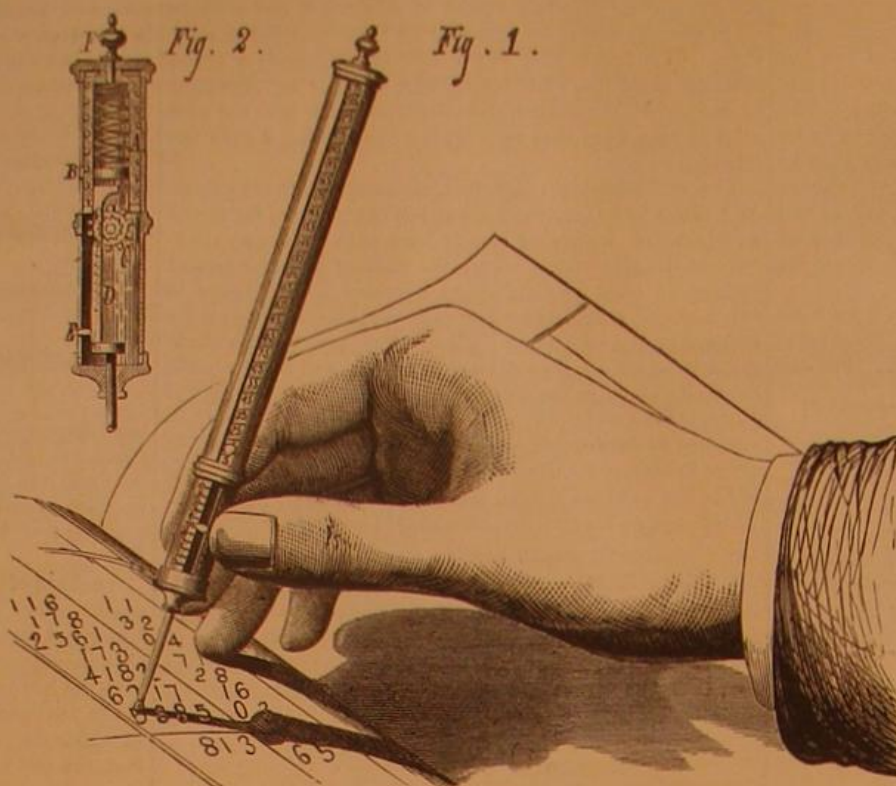
A simple device is described in *Les Mondes* for changing sea water into drinkable water, which deserves to be widely known, and which might be the means of saving an immense



amount of suffering to people wrecked at sea. The necessary portions could easily be got together before abandoning a ship and taking to a raft. The engraving given herewith, prepared from the description, will render the latter more clear. A shallow box, A, is made, 14 feet long, 2 feet broad, and about 6 inches deep. The sides are an inch or more thick and well caulked. Into this, salt water is poured to an inch in depth, and glass, B, is laid over the top at an inclination of an inch and a half. A channel, C, is added below the lower

edge of the glass. Window sashes, such as are used for cabin windows or skylights, will answer the purpose as well as sheets of glass, care being taken to cut away the framing, so as to make wood and glass, on the underside, level.

The device is exposed to the sun, and the effect of the rays is to evaporate the water, which condenses on the under side of the glass, flows down into the channel, and is caught



SMITH AND POTTS' ADDING PENCIL.

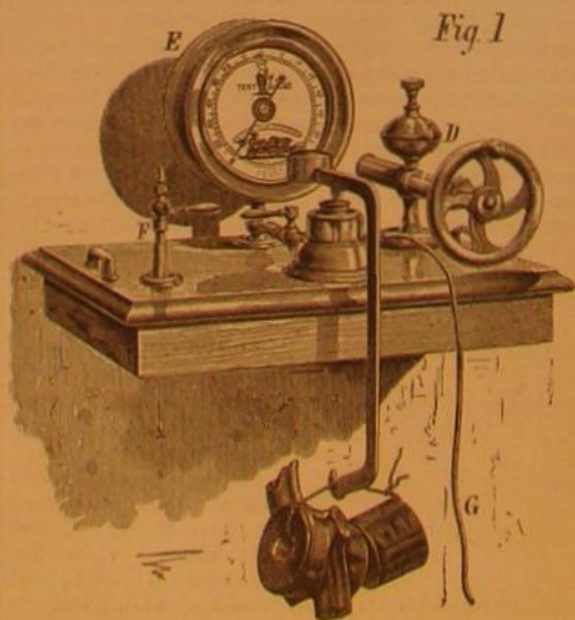
by a vessel, D. After condensation the water of course is fresh. It is stated that, with a glass 3 feet 2 inches square, 2 gallons of fresh water per day may easily be condensed, under a hot sun, from salt water.

German Fish in American Waters.

Although the efforts to import shad eggs from this country to Germany have thus far proved unsuccessful, such has not been the case with the attempts to transport German fish hither. The North German Lloyd's steamer Hermann recently brought to this port sixty carp and forty golden tench, in fine condition, only one fish having died on the voyage. The travelers were met at the wharf by Professor Baird, of the United States Fish Commission, who placed them in tanks of fresh water and sent them to Druid Hill Park, in Baltimore, Md., where they now are. The fish are mostly yearlings, and it is intended to keep them in their present location, using them for breeding and distributing them throughout the warmer waters of the Southern States. The experiment is one which pisciculturists are watching with the liveliest interest, since the carp especially is a very valuable fish for the table. The first distribution will be made, it is expected, in about a year.

WOOD'S PATENT SQUARE-INCH TEST VALVE.

To introduce the below described invention with remarks about the general unreliability of steam gages, and the dis-



astrous consequences attributable to false indications by the same, would only be to rehearse facts with which every engineer and steam user is fully conversant. No man, we believe, has ever had charge of a steam boiler, even for an hour, without thinking that, on the correctness of the needle quivering on the dial before him, the safety of himself, of others, perhaps of millions' worth of property, depended; and if such thoughts should father the desire to know the certainty of the gage, such would be but the result of his natural instinct toward self-preservation. Put into that man's hands, however, a simple device by which, in five minutes, he can assure himself that the instrument is absolute-

ly correct, and one cause, and that perhaps the most prolific of boiler explosions, the false gage, is rendered impossible.

The usual method of testing gages, by means of the test gage and pump, is reliable only so far as the test gage itself is free from error; it is not an absolute trial of the instrument under examination, as is claimed to be the case when the novel device, represented in the annexed engravings, is employed. The principle of the invention is simply that of the safety valve. It is, in fact, a valve which, weighted to a given pressure, lifts when that pressure is applied; being connected with the gage, that latter should indicate the same pressure; if it does not, the amount of error is obvious.

The apparatus, which is shown taken apart in Fig. 2, consists of a brass base, provided with a pipe, A, to be connected to a pump. At B is a hardened steel valve and seat, the latter having knife edges for the valve to rest upon, and being made exactly one square inch in area. There is a guide stem on the seat to enter a hole in the valve and so guide the same; and the water pipe, A, it will be noticed by the direction of the dotted lines, has its aperture directly under the valve. The valve, when in place, makes a tight joint with the knife edges, and the pressure beneath is confined until it exactly balances the combined weight of the valve, yoke, C (which rests by a pointed projection upon the valve), and any extra weight which may be suspended from the lower hook of the yoke.

The mode of operation will be better understood from Fig. 1, which represents the weighted yoke in place, and at the same time the test pump and test gage, which may be purchased from the manufacturers below named, with the test valve. D is the pump, in the reservoir of which water is poured; and by turning the screw, pressure is caused beneath the valve and also in the test gage, E, and in the gage under examination, which is applied at F. The pieces of iron, etc., attached to the lower end of the yoke are previously weighed, so that the valve must lift and the water escape by the overflow pipe, G, the moment such known weight is exceeded by the water pressure. The limit, therefore, cannot be overstepped, and hence the gage under examination and at the same time the test gage should each indicate a pressure equal to the weight attached to the yoke, plus, as before stated, the weights of yoke and valve.



The device is simple, easily operated, and reliable. It is sold for \$18.

Patented to Edwin A. Wood, through the Scientific American Patent Agency, September 22, 1874. For further information, address the manufacturers, the Utica Steam Gage Company, Utica, N. Y.

New Steel Works.

The new Edgar Thomson Steel Works at Pittsburgh, Pa., were duly opened on September 4, in the presence of several hundred invited guests. The latest improvements are introduced throughout the establishment. For example, red hot ingots of steel, weighing a ton, are transferred from the truck to the rolls by one man. The great saving in manual labor and the superior excellence of the metal produced will enable this concern to distance all foreign competition. One of the tests of the steel at these works is to fix one end of a railroad rail, and by means of a wheel at the other end twist the rail twice, which is done without fracture of the rail.

REMARKABLE SWIMMING.—A girl of fourteen, named Beckwith, daughter of the champion swimmer of England, recently swam from London Bridge to Greenwich, a distance of over five miles, in one hour and eight minutes. This is believed to be the fastest swimming on record.

Mortality among Elephants.

We learn from the *Bangkok Herald*, a file of which has just reached this office, of a large mortality among elephants in that district; and a more serious loss of the same kind has been experienced by the Moulema foresters, on the Thongyreen side. The *Mail* states the value of each elephant is from 800 rupees to 1,500 rupees (\$400 to \$750) and that the loss to their people in the aggregate is very considerable, greatly enhancing the price of these useful animals, and increasing the difficulty and cost of bringing timber to market.

KNIGHT'S IMPROVED HEALTH LIFT.

Physical culture, in moderation, is unquestionably bene-

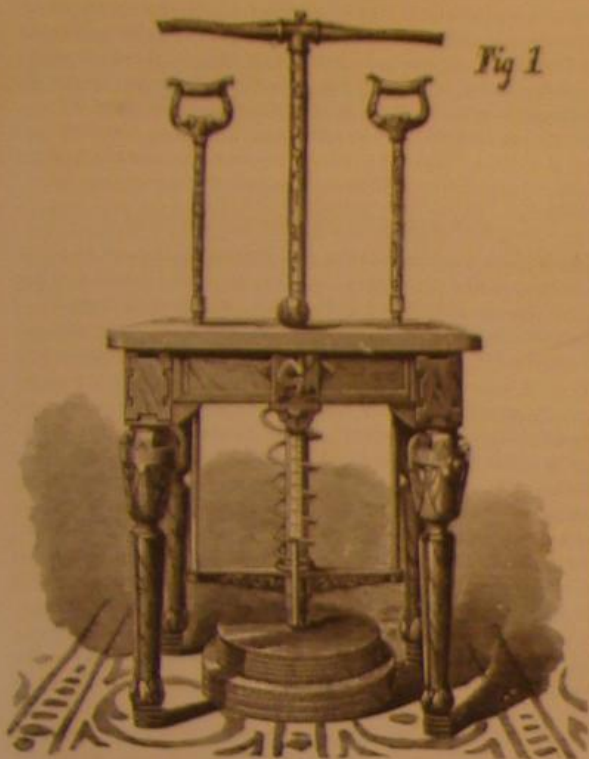


Fig 1

ficial; but physical culture in excess is as certainly baneful and injurious to the system. The present tendency is toward the extreme; and, as exemplified in the repeated failures of overtrained athletes at the moment of trial, the results reached are exactly the reverse of those sought. The reason is undoubtedly to be found in the mistaken theory which impels the development of only those muscles which are to be used in the contest—a theory which neglects the equally important truth that, after all, the human body is but a beautifully organized machine, and, like every other piece of mechanism, its ultimate strength, as a whole, is only equal to the strength in its weakest part. If, therefore, we create an abnormal growth of arm muscles for rowing,

or for leg muscles for walking, we do so at the expense of some other part of the machinery, usually the nerve centers. We accelerate the circulation of the blood in the vessels of the chest until the walls of the veins and arteries become thinned and diseased through distension, and the application of undue strain determines their rupture. It would be exactly the same if we were to seek to strengthen an engine by taking away all the metal about the steam conduits until the walls of the same were as thin as paper, and putting it on the connecting rod and crank. The moment a heavy load was put on the machine, an increased strain would break the pipes, and everything would stop. The kind of exercise needed is that which will strengthen all parts of the body equally, producing a uniformly strong structure. Such exercise would be rational, beneficial, and health-giving, resulting in permanent good effects, and not, as is now too frequently the case, in permanent bad ones.

Whether or not such benefit is to be gained from what is known as the lifting system, we are not, from personal knowledge, prepared to state. That the lift exercise is growing in favor is undeniable, and we may add that we have known a number of persons who have derived much good therefrom. The inventor of the machines illustrated herewith, says, in regard to the value of lifting: "I state what I have proved; for in my practice of Swedish movements (applied exercise), I was compelled to devise some way to cultivate the strength and endurance of certain kinds of patients, without at the same time disproportionately taxing their nervous energies. My machine (in use six years in my office) does it better than anything else known to me; and I feel able to say that if oarsmen—*not* dissent, or professionals—would carefully cultivate the nerve centers by lifting in a prescribed manner everyday, they would accomplish more, and with less waste, than without the machine."

The appearance and construction of the machine referred to will be understood from the engravings. Fig. 1 represents the apparatus arranged for complete spring and dead weight combined, with a maximum resistance of from 600 to 1,200 lbs.; and Fig. 2 is the family machine, constructed with spring alone, having a resistance of from 300 to 600 lbs.

The table legs are supported upon springs, in order to give elasticity to the lift when raising a dead weight from the floor. A slotted tubular socket is attached to the under side of the table, and guides an interior tubular piston that is connected with a yoke sliding on the outside of the socket tube, and resting on a collar at the lower end of the same. A second pin connects the lower part of the sliding piston with a slotted and weighted tube which slides between the socket tube and piston, and which may be adjusted higher or lower on the latter, so that the weighted tube may be raised at any desired moment of lifting the piston. The yoke carries a powerful spiral spring which is compressed by raising the handle, and also side arms, having vertical rods and small side handles. The intermediate tube carries on its base collar a number of detachable weights which allow not only of the adjustment of the apparatus to any degree of spring and dead weight action combined, (but also by the higher or lower setting of the weighted tube) the raising of

the weight at any desired moment after the spring has been partly compressed.

A well graduated strain is thus obtained, which proceeds from a minimum to a maximum, and thence goes back to the minimum, requiring no considerable effort to overcome the constant or fixed resistance, but admitting, by a gradually increasing exercise, a regular training and development of the muscles.

The machine is very handsomely constructed, and forms a neat and ornamental piece of furniture. Its employment is especially recommended to persons of sedentary habits and those suffering from chronic diseases.

Patented through the Scientific American Patent Agency, May 11, 1873.

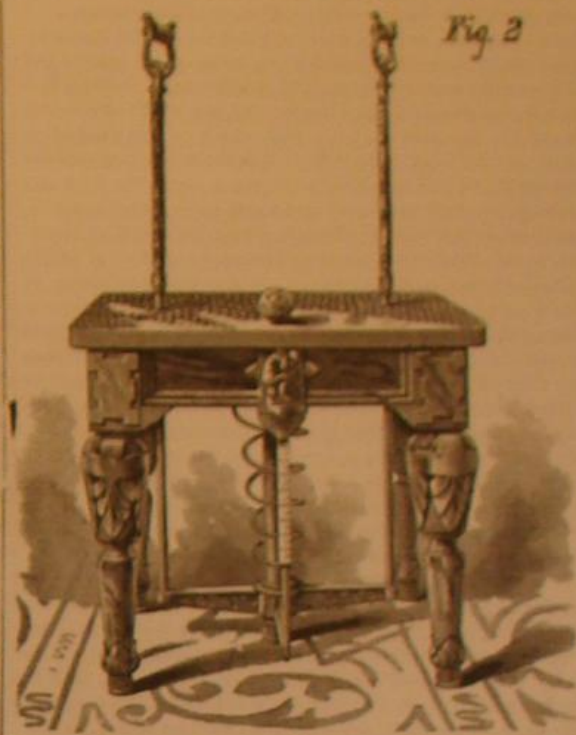


Fig 2

For further particulars address the inventor Dr W. H. Knight, 61 Pleasant street, Worcester, Mass.

A MODEL VILLA.

We have remarked of late a growing tendency on the part of architects and builders to abandon the stiff and ungainly models of rural architecture, and substitute therefor much more tasteful and ornate designs. There are few buildings so severely ugly as those of the conventional types so common in New England towns. We mean, first, the square box, the perfectly cubical shape of which is relieved only by a little cupola perched mathematically in the middle of the roof, looking as useless as it is out of place; second, the innumerable attempts to duplicate the Athenian Parthenon, by

**A MODEL COUNTRY RESIDENCE**

adding a series of ponderous and palpably wooden pillars to the front of the building, and thus darkening, by the overhanging roof, all the front windows of the upper stories; and lastly, the aspiring efforts to rival the modern French construction by imitating the iron and stone mansards and lofty towers, in wood and on a much reduced scale, too frequently in entire incongruity with all the surroundings. In constructing larger country dwellings, the same models, enlarged, have been kept in view, so that it is no uncommon sight to find the villa, standing in the midst of its score of acres, duplicated in the cottage, cramped in a twenty-five foot lot, or the cottage repeated on a magnified scale in the more pretentious residence.

So many excellent plans have been published for country homes that we are led to believe that a genuine taste has been awakened for a really rural style of architecture. A city house, with its lofty staircases and its general construction carried skyward, remains a city house, to all intents and purposes, no matter if planted in a wilderness. It suggests cramped space and narrow limits, and not that carelessness as regards the area covered over, which is the distinctive feature of the country dwelling. Let the reader compare the illustration of the beautiful villa, given herewith, with any of the perky, stiff, tall structures which sprang up like mushrooms when the taste for French design became first prevalent here. The edifice is low and broad, suggestive of ample halls and large, cool, airy rooms. It is irregular in shape, as if it were planned for the convenience of the occupants—adjusting itself to their needs, and not at all suggestive of that hermit crab peculiarity of many people who fix on a residence and then adjust themselves to it. There are broad windows shaded by tasteful porches, the heavy effect of which is relieved by the delicate half-Moorish tracery of their supports, and lastly, there are the piazzas, which fill out the details of the bare walls. Add tasteful painting, in a couple of cool shades of brown, for example, and the embowering westeria or other vines which trail over doors and windows, and a dwelling is made which is in itself a picture of comfort.

It is such architecture as this that we hope to see replace the designs so long prevalent. Taste, or rather the gratification of it, is not necessarily expensive; for it costs no more—perhaps not so much—to erect either a cottage or a villa which shall be graceful and pleasing in appearance, than to construct tall towers, and mansard roofs, and elaborate ornamentation, or even the severely plain edifices which, to our minds, serve only by their contrast to enhance the beauty of Nature's handiwork.

It would be an excellent plan, we think, for persons contemplating building to have models of their houses constructed in paper or thin wood. Few people can obtain a perfect idea of the aspect of any proposed edifice from the architect's drawings. Engineers very frequently adopt this plan in building bridges and similar structures; and in theaters, the scenic artist always submits pasteboard models of elaborate set scenes to the manager and playwright before putting brush to canvas. A good model is always preliminary to the construction of a machine—as indeed it is to almost every structure, except a building—and why architects should not also furnish an embodiment of their designs in the same manner has always seemed to us rather anomalous.

BRITISH ASSOCIATION NOTES.

PROPELLING SHIPS BY WAVE MOTION.

Mr. Beauchamp Tower read a paper on "A Machine for Obtaining Motive Power from the Motion of a Ship among Waves." The machine consists in principle of a weight supported on a spring, so that it can oscillate on the spring through a considerable range in a vertical line. The scale of the spring, and consequently the natural period of oscillation of the weight, can be varied at will. When it is so adjusted that it synchronizes with the waves, the oscillations become very violent, and a large amount of power can be obtained from them. In practice, the springs consist of highly compressed air pressing on the rims of hydro-pneumatic cylinders, and the arrangement is such that the vessel containing the compressed air forms the moving weight. The author exhibited a design of a machine for working an auxiliary propeller of a sailing ship of 1,800 tons displacement. The moving weight in this case is 200 tons, and he showed by calculation that it would give about 30 horse power in the long swell met with in the tropical calms, 200 horse power in average ocean waves, and more than 600 horse power in a heavy head sea. The space occupied by the machine compares favorably with a steam engine of the same power. The author exhibited a model of the machine, which recently, in a moderate sea, had yielded power at the rate of 1½ horse power per ton of moving weight.

WAVE MOTION

Professor Guthrie read a paper on the measurement of wave motion. He said his endeavor in various inquiries was to determine the rate of wave progress. The rate at which the wave moved along depended very little indeed upon the height of the wave, nothing at all upon the breadth of the wave, nothing upon the density of specific gravity of the liquid, but almost entirely upon the wave length—that was, the distance from crest to crest. The learned professor demonstrated by means of experiments that, in circular troughs, the smaller the diameter the more rapid was the pulsation, and that the rate in different sized troughs varied inversely as the square root of the diameter. It was also found that in a circular trough a wave 39.4 inches in length traveled in one minute over 270 feet.

UNDERGROUND TEMPERATURE COMMITTEE.

Professor Everett presented the report of the Underground

Temperature Committee. He said the committee had been in existence for eight years, and during that time had been engaged in trying to determine the rate of increase of temperature of the rock as they went deeper into the ground. The observations had generally been made by means of artesian wells and mines, and he gave interesting particulars of investigations recently made in the St. Gothard tunnels at Chiswick, and at Swinderly, near Lincoln. Mr. Galloway, mining engineer, narrated the result of some observations in mines in regard to the temperature, and Professor Everett said he did not think that in old mines, where good ventilation had been obtained for many years, any reliable data with reference to the temperature of the rock could be obtained without boring to a very great extent.

THE ATMOSPHERE AND SOUND.

Professor Osborne Reynolds read a paper on the refraction of sound by the atmosphere, and related the effect of experiments which he had recently made, with a view of throwing light on the subject. He had confirmed his hypothesis that, when sound proceeded in a direction contrary to that of the wind, it was not destroyed or stopped by the wind, but that it was lifted, and that at sufficiently high elevations it could be heard at as great distances as in other directions, or as when there was no wind. An upward diminution of temperature had been proved by M. Glaisher's balloon ascents, and he showed, by experiments with the sounds of firing of rockets and guns, that the upward variation of temperature had a great effect on the distance at which sounds could be heard. By other observations he found that, when the sky was cloudy and there was no dew, the sound could invariably be heard much farther with than against the wind; but that, when the sky was clear and there was a heavy dew, the sound could be heard as far against a light wind as with it. Professor Everett remarked that Professor Reynolds had given the most important contribution to the subject that had been given for very many years.

SUN SPOTS AND ATMOSPHERIC FORCES.

Professor Barrett read a paper prepared by Mr. T. Moffat, on the apparent connection between sun spots, atmospheric ozone, rain, and force of wind. The author stated that from 1850 to 1869 he discovered that the maximum and minimum of atmospheric ozone occurred in cycles of years. He had compared the number of new groups of sun spots, in each year of these cycles, with the quantity of ozone, and the results showed that in each cycle of maximum of ozone there was an increase in the number of new groups of sun spots. He also showed that there is an increase in the quantity of rain and the force of wind with the maximum quantity of ozone and sun spots, and a decrease in these with the minimum of ozone and sun spots.

CONSTITUTION OF THE SUN.

Professor Balfour Stewart, in an address on this subject, said: Several new metals have been added to the list of those previously detected in the solar atmosphere, and it is now certain that the vapors of hydrogen, potassium, sodium, rubidium, barium, strontium, calcium, magnesium, aluminum, iron, manganese, chromium, cobalt, nickel, titanium, lead, copper, cadmium, zinc, uranium, cerium, vanadium, and palladium occur in our luminary.

If we have learned to be independent of total eclipses as far as the lower portions of the solar atmosphere are concerned, it must be confessed that as yet the upper portions—the outworks of the sun—can only be successfully approached on these rare and precious occasions. Thanks to the various government expeditions despatched by Great Britain, by the United States, and by several Continental nations—thanks, also, to the exertions of Lord Lindsay and other astronomers—we are in the possession of definite information regarding the solar corona.

In the first place, we are now absolutely certain that a large part of this appendage unmistakably belongs to our luminary, and in the next place, we know that it consists, in part at least, of an ignited gas giving a peculiar spectrum, which we have not yet been able to identify with that of any known element. The temptation is great to associate this spectrum with the presence of something lighter than hydrogen, of the nature of which we are yet totally ignorant.

A peculiar physical structure of the corona has likewise been suspected. On the whole, we may say that this is the least known, while it is perhaps the most interesting, region of solar research: most assuredly it is well worthy of further investigation.

THE TRIALS OF SCREW STEAMSHIPS.

Mr. William Denny (Dumbarton) read a paper on "The Trials of Screw Steamships." A considerable part of his paper was taken up in proving the fallacy of the cube of the speed theory, of which "arbitrary and misleading dogma" he hoped there would soon be an end. The system of progressive trials exploded this idea, and if the late Professor Rankine had had the advantage of progressive trials his work would have been more valuable. In making progressive trials, perfect accuracy should be obtained, and they would be worthless if they fell below Admiralty standard, which the majority of private trials, he was sorry to say, did almost invariably. A perfectly calm day was necessary, as the wind told enormously on the slow speed. The great aim was to equalize the development of power on the two runs. They would gain literally nothing from single model trials. Mr. Thornycroft (Chiswick) having observed that, in a ship with a very large surface, the resistance increased in a slower ratio than in a bluff vessel, Professor Kennedy said that shipbuilders had not at present got anything like so far to

adopting progressive trials as Mr. Denny seemed to have gone. But one thing they might at least look for was tolerably complete results. They continually had to work at results which looked very complete, and had a great many figures in them, but frequently happened to leave out one or two matters which were absolutely essential to coming to anything like conclusions from them. It was very easy indeed, on a trial ship, with a moderate amount of care, to get to know a great deal of the commoner particulars, which, if put together and collated, would help them to come to something like a conclusion. They wanted especially particulars of the size of the vessel, her general form, the exact draft, and the exact speed. Mr. W. Smith (London) agreed with Professor Kennedy in his remarks. He said that the very systematic mode of setting about to deceive had been too thoroughly followed, and had been a practice quite recognized in connection with steamship builders, marine engineers, and even the persons associated with them. It was impossible to conceive of anything more fallacious than the records that had been sent to the British Association on this matter. Mr. Denny heartily agreed with what Professor Kennedy and Mr. Smith had said, and added that he had seen glaringly careless trials, which were as bad as dishonest trials.

THE STEERING OF SCREW STEAMERS.

In a paper read before the mechanical section of the British Association, Professor Osborne Reynolds says: 1. That when the screw is going ahead, the steamer will turn as if she were going ahead, although she may have stern way on. 2. That when the screw is going reversed, the rudder will act as if the vessel were going astern, although she may be moving ahead. 3. That the more rapidly the boat is moving in the opposite direction to that in which the screw is acting to drive it, the more nearly will the two effects on the rudder neutralize each other, and the less powerful will be its action. In reference to the effect of the screw to turn the boat independently of the rudder, the author states the following law: 4. That, when not breaking the surface, the screw has no considerable tendency to turn the ship as long as the rudder is straight. On the subject of racing, the author stated that his experiments had enabled him to establish the following laws: 5. That when the screw is frothing the water, or only partially immersed, it will have a tendency to turn the stern in the opposite direction to that in which the tips of the lower blades are moving. 6. That when the boat is going ahead, its effects will be easily counteracted by the rudder; but when starting suddenly either forward or backward, at first the effect of the screw will be greater than that of the rudder, and the ship will go accordingly. 7. That if, when the boat is going fast ahead, the screw is reversed, at first it almost destroys the action of the rudder, what little effect it has being in the reverse direction to that in which it usually acts. If then the screw draws air or breaks the surface, it will exert a powerful influence to turn the ship.

New Photo Dry Process.

M. E. Quinquerez furnishes the details of his rapid dry process, which, he claims, combines the quality of results belonging to the albumen processes with a sensitiveness hitherto unapproached. The plates first receive a preliminary coating of albumen (one in forty) to be filtered immediately before use. M. Quinquerez insists upon the use of ammonia rather than acetic acid for preserving the albumen from decomposition, as the acid causes the growth of a species of fungus which destroys the clearness of the liquid. Any good commercial collodion may be used, but one containing a large proportion of bromide is to be preferred. The silver bath consists of: Nitrate of silver 40 to 50 grains, glacial acetic acid, 2½ to 10 minims, according to temperature, rain water 1 oz., to be saturated with iodide of silver. The plate is allowed to remain in the bath at least four or five minutes, after which it is well washed, first in rain and then in ordinary water, until the whole of the free silver is removed. The preservative, in which the novelty of the process lies, is as follows:

SOLUTION No. 1.—Roasted and finely ground coffee, 3½ ozs.; Caramel, 1½ ozs.; boiling rain water, 40 ozs.

SOLUTION No. 2.—Gum arabic, 1 oz.; albumen (beaten and decanted), 1 oz.; pyrogallol acid, 120 grains; cold rain water, 26 ozs.

When No. 1 has become cold, it is filtered and added to No. 2, the whole being well agitated, when it is ready for use. M. Quinquerez attributes the great sensitiveness of this process to the large quantity of pyrogallol acid employed, the albumen, though present in very small proportion, giving great solidity to the sensitive film. The gum and caramel lessen a slight tendency to harshness noticeable with coffee and albumen alone, and also render the film more permeable during development. The pyrogallol acid facilitates the action of the alkaline developer. The preservative is applied in the usual way by pouring it on and off the plate (previously well drained) three or four times.

The development is performed in a dish, by means of a plain solution of carbonate of ammonia, the plate being plunged direct into the developer without previous washing. If the exposure has been well timed, the details will be brought out without further treatment, when the film is carefully washed and intensified with pyro and silver. If, on the contrary, the exposure has been too short, the development must be continued by means of the ordinary alkaline pyro developer. An eighty-grain solution of sulphocyanide of ammonium is recommended for fixing, as it does not destroy the half tones. The color of the image is a rich red brown; but for those who prefer a black tone, M. Quinquerez recommends the use of chloride of gold.

New Theory of the Resistances of Ships and other Moving Bodies in Water.

The following is an abstract of the address of Mr. W. Froude, C.E., F.R.S., as president of section G (Mechanical Science), British Association:

"I propose," he said, "to treat of certain of the fundamental principles which govern the behavior of fluid, and this with special reference to the resistance of ships. By the term 'resistance' I mean the opposing force which a ship experiences in its progress through the water. Considering the immense aggregate amount of power expended in the propulsion of ships, or, in other words, in overcoming the resistance of ships, I trust you will look favorably on an attempt to elucidate the causes of this resistance. It is true that improved results in shipbuilding have been obtained through accumulated experience; but it unfortunately happens that many of the theories, by which this experience is commonly interpreted, are interwoven with fundamental fallacies, which, passing for principles, lead to mischievous results when again applied beyond the limits of actual experience. The resistance experienced by ships is but a branch of the general question of the forces which act on a body moving through a fluid, and has within a comparatively recent period been placed in an entirely new light by what is commonly called the theory of stream lines. The theory as a whole involves mathematics of the highest order, reaching alike beyond my ken and my purpose; but I believe that, so far it concerns the resistance of ships, it can be sufficiently understood without the help of technical mathematics; and I will endeavor to explain the course which I have myself found most conducive to its easy apprehension. It is convenient to consider first the case of a completely submerged body moving in a straight line with uniform speed through an unlimited ocean of fluid. A fish in deep water, a submarine motive torpedo, a sounding lead while descending through water, if moving at uniform speed, are all examples of the case I am dealing with. It is a common but erroneous belief that a body thus moving experiences resistance to its onward motion by an increase of pressure on its head end, and a diminution of pressure on its tail end. It is thus supposed that the entire head end of the body has to keep exerting pressure to drive the fluid out of the way, to force a passage for the body, and that the entire tail end has to keep on exerting a kind of suction on the fluid to induce it to close in again—that there is, in fact, what is termed *plus* pressure throughout the head end of the body and *minus* pressure or partial vacuum throughout the tail end. This is not so: the resistance to the progress of the body is not due to these causes. The theory of stream lines discloses to us the startling but true proposition that a submerged body, if moving at a uniform speed through a perfect fluid, would encounter no resistance whatever. By a perfect fluid I mean a fluid which is free from viscosity, or quasi-solidity, and in which no friction is caused by the sliding of the particles of the fluid past one another, or past the surface of the body. The property which I describe as 'quasi-solidity' must not be confused with that which persons have in their minds when they use the term 'solid water.' When people in this sense speak of water as being 'solid,' they refer to the sensation of solidity experienced on striking the water surface with the hand, or to the reaction encountered by an oar blade or propeller. What I mean by 'quasi-solidity' is the sort of stiffness which is conspicuous in tar or liquid mud; and this property undoubtedly exists in water, though in a very small degree. But the sensation of solid reaction which is encountered by the hand or the oar blade is not in any way due to this property, but to the inertia of the water. It is in effect this inertia which is erroneously termed solidity; and this inertia is possessed by the perfect fluid, with which we are going to deal, as fully as by water. Nevertheless it is true, as I am presently going to show you, that the perfect fluid would offer no resistance to a submerged body moving through it at a steady speed.

It will be seen that the apparent contradiction in terms which I have just advanced is cleared up by the circumstance that in the one case we are dealing with steady motion, and in the other case with the initiation of motion. In the case of a completely submerged body in the midst of an ocean of perfect fluid, unlimited in every direction, I need hardly argue that it is immaterial whether we consider the body as moving uniformly through the ocean of fluid, or the ocean of fluid as moving uniformly past the body. The proposition that the motion of a body through a perfect fluid is unresisted, or, what is the same thing, that the motion of a perfect fluid past a body has no tendency to push it in the direction in which the fluid is flowing, is a novel one to many persons; and to such it must seem extremely startling. It arises from a general principle of fluid motion, which I shall presently put before you in detail—namely, that to cause a perfect fluid to change its condition of flow in any manner whatever, and ultimately to return to its original condition of flow, does not require, nay does not admit of, the expenditure of any power, whether the fluid be caused to flow in a curved path, as it must do in order to get round a stationary body which stands in its way, or to flow with altered speed as it must do in order to get through the local constriction of a channel which the presence of the stationary body practically creates. Power, it may indeed be said, is first expended, and force exerted to communicate certain motions to the fluid; but that same power will ultimately be given back, and the force counterbalanced, when the fluid yields up the motion which has been communicated to it, and returns to its original condition." He illustrated this portion of his address with several interesting experiments, in one of which he was assisted by Sir William Thomson, showing that, if a chain be set rotating at a very high velocity over a pulley, the

centrifugal forces did not tend to disturb the path of the running chain, and that a stream of fluid in a tortuous flexible pipe would behave in a strictly antagonistic manner. He also introduced an experiment to show that, in a pipe of varying diameter, the pressure of a running stream is greater in the wider part. He then pointed out that the causes of resistance to the motion of a ship through the water are: First, surface friction; secondly, mutual friction of the particles of water (and this is only practically felt when there are features sufficiently abrupt to cause eddies); and thirdly, wave genesis; and that these are the only causes of resistance. He also showed that a ship at the surface experiences no resistance in addition to that due to surface friction and the action of eddies, except that due to the waves she makes.

He then said: "I have done my best to make this clear; but there is an idea that there exists a form of resistance, a something expressed by the term 'direct head resistance,' which is independent of the abovementioned causes. This idea is so largely prevalent, of such long standing, and at first sight so plausible, that I am anxious not to leave any misunderstanding on that point. The notion of head resistance, in the ordinary sense of the word, or the notion of any opposing force due to the inertia of the water on the area of the ship's way, a force acted upon and measured by the area of midship section, is, from beginning to end, an entire delusion. No such force acts at all, or can act. No doubt, if two ships are of precisely similar design, the area of midship section may be used as a measure of the resistance, because it is a measure of the size of the ship; and if the ships were similar in every respect, so also would the length of the bowsprit, or the height of the mast, be a measure of resistance, and for just the same reason. But it is an utter mistake to suppose that any part of a ship's resistance is a direct effect of the inertia of the water which has to be displaced from the area of the ship's way. Indirectly the inertia causes resistance to a ship at the surface, because the pressure due to it makes waves. But to a submerged body, or to the submerged portion of a ship traveling beneath rigid ice, no resistance whatever will be caused by the inertia of the water which is pushed aside. And this means that, if we compare two such submerged bodies, or two such submerged portions of ships traveling beneath the ice, as long as they are both of sufficiently easy shape not to cause eddies, the one which will make the least resistance is the one which has the least skin surface, though it has twice or thrice the area of midship section of the other. The resistance of a ship, then, practically consists of three items—namely, surface friction, eddy resistance, and wave resistance. Of these the first named is, at least in the case of large ships, much the largest item. In the *Grayhound*, a bluff ship of 1,100 tons, only 170 feet long, and having a thick stem and sternposts, thus making considerable eddy resistance, and at 10 knots visibly making large waves, the surface friction was 58 per cent of the whole resistance at the speed; and there can be no doubt that, with the long iron ships now built, it must be a far greater proportion than that. Moreover, the *Grayhound* was a coppered ship; and most of the work of our iron ships has to be done when they are rather foul, which necessarily increases the surface friction item. The second item of resistance—namely, the formation of eddies—is, I believe, imperceptible to ships as finely formed as most modern iron steamships. Thick square shaped stems and sternposts are the most fruitful source of this kind of resistance. The third item is wave resistance. On this point, the stream line theory rather suggests tendencies than supplies quantitative results, because, though it indicates the nature of the forces in which the waves originate, the laws of such wave combinations are so very intricate that they do not enable us to predict what waves will actually be formed under any given condition. In order to reduce wave resistance, we should make the ships very long. On the other hand, to reduce the surface friction we should make her comparatively short, so as to diminish the surface of wetted skin. Thus, as commonly happens in such problems, we are endeavoring to reconcile conflicting methods of improvements; and to work out the problem in any given case, we require to know actual quantities.

We have sufficient general data from which the skin resistance can be determined by simple calculation; but the data for determining wave resistance must be obtained from direct experiments upon different forms to ascertain its value for each form. Such experiments should be directed to determine the wave resistance of all varieties of water line, cross section, and proportion of length, breadth, and depth, so as to give the comparative result for each. An exhaustive series of such experiments could not be tried with full sized ships; but I trust that the experiments I am now carrying out with models for the Admiralty are gradually accumulating the data required on this branch of the subject. I wish, in conclusion, to insist again, with the greatest urgency, on the hopeless futility of any attempt to theorize on goodness of form in ships, except under the strong and entirely new light which the doctrine of stream lines throws on it. It is, I repeat, a simple fact that the whole framework of thought, by which the search for improved forms is commonly directed, consist of ideas which, if the doctrine of stream lines is true, are absolutely delusive and misleading. And real improvements are not seldom attributed to the guidance of those very ideas which I am characterizing as delusive, while in reality they are the fruit of painstaking, but incorrectly rationalized, experience. I am but insisting on views which the highest mathematicians of the day have established irrefutably; and my work has been to appreciate and adopt these views when presented to me. No one is more alive than myself to the plausibility of the unsound views against which I am contending; but it is for the very reason that they are so plausible

that it is necessary to protest against them so earnestly; and I hope that, in protesting thus, I shall not be regarded as dogmatic. In truth, it is a process of scepticism, not of dogmatism; for I do not profess to direct any one how to find his way straight to the form of least resistance. For the present we can but feel our way cautiously towards it by careful trials, using only the improved idea which the stream line theory supplies, as safeguards against attributing this or that result to irrelevant or, rather, non-existing causes."

Remarkable Shower of Ice—Perils of Rocky Mountain Railway Traveling.

At Potter station, on the Union Pacific Railroad, recently, a train was just pulling out from the station when a storm commenced, and in ten seconds there was such a fury of hail and wind that the engineer deemed it best to stop the locomotive. The hailstones were simply great chunks of ice, many of them three and four inches in diameter, and of all shapes—squares, cones, cubes, etc. The first stone that struck the train broke a window, and the flying glass severely injured a lady on the face, making a deep cut. Five minutes afterward there was not a whole light of glass on the south side of the train, the whole length of it. The windows in the Pullman cars were of French plate, three eighths of an inch thick, and double. The hail broke both thicknesses, and tore the curtains into shreds. The wooden shutters, too, were smashed, and many of the mirrors were broken. The decklights on the top of the cars were also demolished. The dome of the engine was dented as if it had been pounded with a heavy weight, and the woodwork on the south side of the cars was plowed as if some one had struck it all over with sliding blows from a hammer. During the continuance of this terrific fusillade, which lasted fully twenty minutes, the excitement and fear among the passengers ran very high. Several ladies fainted, and one lady, Mrs. Earle, wife of the superintendent of the Mountain division of the road, went into spasms, from which she did not recover for over an hour after the cessation of the storm. Several persons sitting on the south side of the cars were more or less injured about the head and face.

As soon as the storm abated a little, the matting in the cars was hung up in front of the windows, and the train moved ahead, the drifted hailstones proving an obstacle for some miles. At the next station, strips of tin were procured and fastened over the windows the entire length of the train. The cars have been run into shop for repairs, and the damage will amount, it is estimated, to several thousand dollars.—*Denver News*.

DECISIONS OF THE COURTS.

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

PATENT PRESS.—GEORGE B. BOOMER AND RUFTUS E. BOSCHERT vs UNITED POWER PRESS COMPANY et al.

Shipman, J. This is a bill in equity filed February 5, 1874, praying for an account and an injunction, for infringement of letters patent for an improvement in cheese presses, granted to the complainants and to Thomas G. Morse, on November 1, 1870. A release was granted to the complainants on January 28, 1873, Morse having previously assigned his interest in the invention to Boomers.

The alleged invention of the patentees consisted in constructing sliding standards, the lower ends of which are attached to the platen, and the upper ends extend through a socket in the head block. When one end of the platen is depressed, these standards tend to incline towards the side of least resistance, and in an opposite direction from that towards which the screw shaft tends to move. In order that these opposing tendencies may be made to counteract each other, a central hub is attached to the screw shaft between the standards; when the standards incline to the side of greatest depression, this central hub or bearing attached to the screw shaft comes in contact with the standard, prevents its further movement, and at the same time, by its pressure upon the standard, prevents the movement of the screw shaft to the side of greatest resistance.

The two styles of machines which the defendants' corporation manufactured and sold, in the city of New York, prior to April 10, 1874, differ only in immaterial details from the press of the complainants.

The defendants contend first that the released patent is void because it is not for the same invention as the one which was claimed in the original patent.

But the court held that the claim of the released patent embraces, in comprehensive terms, the actual invention, and describes what is claimed to be new, and it was not necessary to mention in that part of the specification that toggle levers and a platen were also used in the press. The only ingredients which entered into the invention for which the original patent was granted are those which are specified in the claim of the released patent.

The defendants insist, in the next place, that the complainants' patent is invalid, because the elements which are specified in the claim, as forming in combination the invention, do not of themselves perform or accomplish anything.

But the court held that the claim is properly confined to the invention, and specifies only the improvement which the patentees invented. The elements of the invention are operative in connection with the mechanism of the press, which is accurately described in the specifications.

The defendants contend, thirdly, that the complainants' patent is void, in view of the previous state of the art, as shown in the presses which are described in the patent of Robert Harding, of September 5, 1842, in the patent of P. G. Gardner, of February 28, 1843, in the patent of Nathan Chapman, of January 12, 1858, in the patent of Pickens B. Weaver, of August 21, 1860, and in the French press of P. Samin.

But the court held that no one of these presses contained the combination of sliding standards with the central hub of the complainants' press and no one was constructed upon the principle of keeping the platen level by means of the active resistance which standard and hub make to the tendency of the screw shaft to move towards the side of greater resistance when the platen commences to tilt. The point upon which the defendants most strongly relied in this part of the case was that the sliding standard of the Harding press and the central hub or wheel of the Gardner press could have been combined, and thus the complainants' press could have been constructed without the exercise of invention. This theory is not supported by the facts, and it is manifest that an operative machine could not, prior to the date of the complainants' invention, have been constructed from a combination of the two machines of Gardner and Harding without inventive skill of more than ordinary character.

Let there be a decree for the complainants declaring the infringement, and directing an account of profits and an ascertainment of damages until April 10, 1874, with costs.

[W. B. Smith and A. J. Todd for complainants.

J. Van Suncord for defendants.]

Recent American and Foreign Patents.

Improved Screw-Pegging Machine.

A. C. McKnight, Philadelphia, Pa.—This invention consists of several novel devices in a screw-pegging machine, by which the fastening together of sole and upper of boot or shoe may be greatly facilitated. These new features, both separately and in the aggregate, will materially contribute to the cheaper manufacture of boots and shoes, while the pegging is done thoroughly and in a workmanlike manner.

Improved Machine for Stiffening Hats.

Granville B. Fuller, Middletown, N. Y.—The hats are dipped into stiffening in a tank, and are placed upon blocks, to which a rapid rotary motion is then given to throw off the surplus stiffening. The hats are given a heavy or a light stiffening by varying the gravity of the stiffening solution contained in the tank.

Improved Knock-Down Bedstead.

William S. Moses, Lebanon, N. H.—This consists of a method of detachably locking the end boards and standards of the head and foot portions of a bedstead by hooks on the lower end board and screws at the top, by which the parts may be readily separated for packing and be put together without the aid of skilled labor.

Improved Wrench.

Peter Samuel, New York city.—A movable jaw is first adjusted relatively to the stationary jaw, to embrace the nut between them. The effect of pressure applied to the handle is to cause it to advance the movable jaw and clamp the nut tightly. The increase of pressure increases the closeness of such contact, so that abrasion of the nut is impossible. When the handle is turned, a cam will act on an arm, and thus on the movable jaw; and when turned in the opposite direction, another cam acts similarly, so that the wrench may be operated to screw nuts on or off the bolts. A spring moves the jaw away from the side of the nut; at once the action of the handle ceases, so that the wrench may be readily removed from the nut.

Combined Spark Arrester and Stove Register.

Thomas R. Freeman and Perine Y. Jones, Ripon, Wis.—The body of the stove has a register frame, to which is attached a frame in which is formed a groove to receive a plate of wire gauze, by which the escape of any sparks through the openings of the register is wholly prevented. The plate can be readily removed when worn and replaced with a new one, and does not interfere with the operation of the register.

Improved Beer Refrigerator.

John N. Bohart, Denison, Texas.—This consists of a skid for supporting the barrel, an ice box arranged above the latter, and an outer case or cover. It was illustrated and described on page 150, current volume of the SCIENTIFIC AMERICAN.

Improved Brush.

Moritz Leiner, New York city.—This consists of a brush having the twisted wire which secures the bristles fastened over the block of the brush, the invention applying only to brushes which have blocks of wood or metal or other suitable material, and of sections of twisted or braided wire and bristles.

Improved Toy Store.

Elias Durlach, New York city.—This consists in a toy grocery store, made of sheet metal, and provided with the detachable sign and ornament, shelves, drawers, boxes, or canisters, a movable counter, and pivoted detachable chandeliers.

Improved Grain Drill Tooth.

George L. Ives, Galesburg, Mich., assignor to himself and Henry L. Keith, same place.—This is a tooth for grain drill tubes, consisting of a front wedge-shaped furrow opener and shank, and having a rear cavity running through both, and passing out on a rearward curve near the bottom.

Improved Animal Trap.

Ebenezer Oliver, New York city.—The body of the trap is made with an offset, formed by bending back the upper part of the front wire of the frame. A wire is secured to the frame of the body and carries a spring, one end of which is secured to the body, and its other end is secured to the door. The door is provided with upright wires at a little distance from the side wires of its frame. The door is made a little narrower than the opening, and in the space thus left is placed a wire, secured to the bottom and to the front wire of the body of the trap. Rings pass around the side wires of the door frame and around the wires last mentioned. When the trap is sprung, the rings slide down upon the wires and fasten the door securely, so that no effort of the animal can open it.

Improved Car Coupling.

Peter Harper, Marshall, Texas.—The drawbar has an upwardly extending hook part, and a coupling link, which is passed through a slot of the bar, and raised for coupling with the approaching drawbar by a forked lever, operated by an intermediate lever rod connection from the platform. The link is retained, raised by a hook arm of the buffer rod engaging the connecting lever mechanism, and is released by the concussion of the cars, dropping forward over the drawbar of the adjoining car. A fulcrumed lever with forked lower part engages the hook arm of the buffer rod, and admits the direct lowering of the link independently of the buffer rod.

Improved Windmill.

Chesley Gates, Locust Grove, Mo.—A small wind wheel for regulating the speed of the large one is arranged where it is subject to the varying wind, and has a cord attached to its hub and connected to a brake lever, so as to pull it against the wheel with more or less force, according to the action of the wind on it. Its effect is varied by an adjustable weight.

Improved Grain Drill.

John T. Lynam, Louisville, Ky.—Around the bearings for the wheel shaft are formed circular projections, upon which rest the edges of a curved plate, the outer part of which projects outward, is bent upward, and is attached to a cross bar. To the cross bar are attached arms, which control and regulate the equal movement of the circular plate. A cross bar is moved to adjust the plate to regulate the amount of seed dropped. An arm is provided with an index that points to division marks upon the side of the bar to indicate the amount of seed the machine will drop to an acre when the plate is adjusted in any particular position.

Improved Screw-Cutting Die.

George R. Stetson, New Bedford, Mass.—In this improvement the chasers are fitted in sockets of a solid die, tapered so that they are held by a binding screw at one side of each. Two of the chasers are provided with an adjusting screw to set them up toward the others as they become worn away.

Improved Crown Bar for Steam Boilers.

James McPhail, Ellis, Kan.—This invention is an improvement upon that covered by letters patent No. 129,634, and consists in the employment of a detachable lock bar, having lugs on its ends, in connection with a crown bar composed of two parallel parts. The lock bar aids in preserving the parallelism of the bars, and strengthens and braces the same. It also prevents the bolts being thrown out of vertical parallelism with the bars by reason of the warping of the crown sheet.

Improved Wrench.

John H. Morrissey, Indianapolis, Ind.—The invention consists of a wheel wrench having a central socket part, with diametrically extending arms that are securely locked by fastening springs to the hub band, to be applied to the nut for unscrewing the same, and in reversed position for being stored away without engaging the nut.

Improved Picture Nail.

Owen W. Taft, 221 Pearl Street, New York city.—This consists of an ornamental head made of two cups of sheet metal, one being permanently attached, and the other detachable. The cups are ornamented with spiral ribs, which also form screw threads, by which the detachable part is connected to the permanently attached part. The cup, which is permanently attached to the nail, is fastened by filling it around the shank by solder.

Improved Combined Harrow and Cultivator.

William McCray, Black Oak, Mo.—Wings are used upon each side of the central bar. The forward ends of the wings are connected by bars. The rear ends of the wings are connected by bars secured to their upper sides. To and between the rear ends of the bars and the rear braces are secured the outer ends of the two bars, in which several holes are formed to receive the bolts by which they are secured to the plate, so that the wings may be expanded or contracted to make a wider or narrower cut, as may be desired. The wing teeth, which are curved outward and rearward, are made thin upon their forward edge.

Improved Hose Spanner and Key.

Andrew J. Barnard, Camden, N. J.—By this implement, a hose may be quickly and tightly connected to the water pipe, and the stopcock of the same opened. The handle is made of a double curved or S-shaped form. At one end, and cast in one piece therewith, are arranged recessed prongs, which fit in a semicircle around and, by their recessed parts, on the lug of the hose coupling. The coupling is first screwed on by hand, and then drawn tightly by applying the prongs. A key at the other ends of the handle serves to turn the water on or off by being applied to the stopcock of the water pipe. A tapering lug, forming an extension of the key, serves for lifting the lid of the box, so that the hose may be coupled and the water turned on.

Improved Car Wheel Lubricator.

John Woodville, Washington, Ind.—The car wheel has an oil chamber arranged between its spokes or arms. As the wheel revolves, oil will slide down the back wall and turn into the passage; but if more falls than is required, the superfluous falls back, the collar and washer in the hub preventing its escape.

Improved Rotary Engine.

Jacob W. Vanarder and George F. Savage, Utsaladdy, Wash. Ter.—This invention is an improvement in the class of rotary engines whose pistons are caused to reciprocate as they rotate, by means of a fixed cam; and it relates to cutting out the middle portion of the pistons and fitting them together in such a manner that space is economized within the wheel case.

Improved Device for Hanging Pictures, Mirrors, etc.

Harvey D. Pope, Dayton, Ohio.—The object of this invention is to provide a device for adjustably hanging pictures, mirrors, etc., so as to vary them in their inclination to the wall, according to the lights at which they are hung, and the different quarters whence the light proceeds. It consists of a frame to be attached to the wall, to which the picture or mirror is fastened upon both sides by links which are long enough to give the desired adjustment. The lower part of the picture is hinged to a hollow bar which slides inside a hollow pendant bar or case attached at the top to the frame, and provided upon one of its inner sides with ratchet teeth or notches. Inside the inner bar is a rod or wire attached to a spring pawl at the top, and a thumb latch below, by pressing upon which latter the pawl is disengaged from the ratchet teeth and the picture raised or lowered, the links serving to control the different inclinations to the wall.

Improved Dovetailing Machine.

Charles P. Balle, New Windsor, Md.—This invention relates to certain improvements in that class of dovetailing machines in which a revolving cutter is moved against the boards to be cut so as to produce, by a single movement, the reciprocally fitting tenons and mortises. It consists in a vertical cutter revolving in a sliding carriage moving in horizontal guides, the said carriage being actuated by a treadle, cord, and spring, and the guides in which it is contained being supported upon a vertically adjustable bed.

Improved Insole for Boots and Shoes.

Charles F. Hill, Baltimore, Md.—The object of this invention is to increase the flexibility of the soles of boots and shoes, and it consists in cutting in the insole or lasting sole, or both, slits transversely to the same at the bend of the sole.

Patent Heating and Ventilating Stove.

Marius C. C. Church, Parkersburg, W. Va.—This invention relates to certain improvements in heating stoves, and it consists in a detachable fire pot back, having flanged sides that slide vertically into guide ways in the outer casing. It also consists in the particular construction of the smoke flue ascending vertically from the stove and having partition plates attached thereto, in combination with a detachable cover above the heating chamber, so constructed as to leave an annular outlet for the heated air, which, passing up in columns adjacent to said pipe, heats the room better by affording a more perfect convection. This invention is claimed to be a valuable improvement; but our readers can form their own opinions on obtaining further information from the inventor, as above.

Improved Plow.

J. Freeman, Corpus Christi, Texas.—This invention contemplates an improvement in the present mode of securing the share and moldboard of a plow to a skeleton frame, so as to enable a single bolt both to serve as a fastening of the parts and a brace to the whole structure.

Improved Signal Lantern.

George J. Cave, Elizabeth, N. J.—Two glass tubes, made of different colors and of the same diameter, are placed end to end, and are connected together and kept in place upon each other. The lower tube is secured to a base ring, to which is rigidly attached a handle, so that the glasses can be conveniently raised by grasping and raising the said handle. A spring catch receives the base ring when the glass tubes have been raised sufficiently to display the upper tube above the case. Another spring catch receives the base ring when the glass tubes have been raised sufficiently to display the lower tube. By this construction, by operating a handle, the upper or the lower catch may be drawn out, or both catches may be drawn out at the same time. To the base ring are attached three spring rods, which pass up along the sides of the colored glass tubes, and which, when the said glass tubes are fully raised, rest against the upper part of the globe, and prevent the said glass tubes from shaking about. A shade, made in telescopic parts, is secured to the cap of the lantern, and extends downward so far as to cover the upper glass tube when the tubes are fully raised, so as to prevent any light from shining through said upper tube.

Improved Method of Scouring and Polishing Rice.

Phillip R. Lachicotte, Waccamaw (Georgetown P. O.), S. C., assignor to P. R. Lachicotte and Sons, of same place.—This is a method of scouring and polishing rice by applying friction surfaces to the previously hulled article commixed with the ash of rice chaff.

Improved Railroad Rail Joint.

Joseph C. Wright, Monocacy Station, Pa.—This invention consists of an inside spring plate for the flange, and an outside spring for the tread of the wheel, to take off the weight of the wheel, or a portion of it, from the ends of the rails, and thus prevent the pounding and hammering due to the springing down of the rails when the wheel passes over the ends. It also consists in the form of the plates, and arrangements for fastening them in position, whereby they are secured without bolts or screws.

Improved Oil Can.

John Askwith, Chicago, Ill.—This is an attachment to the bottom of the can, so contrived that the drip escaping from the nozzle or any leak will be caught and retained while pouring from the nozzle. It also consists of a nozzle for pouring out the drip, so contrived with the attachment that it serves for a handle to use in pouring, and of a nozzle so combined with the drip attachment and the nozzle for pouring out of the can that the drip may be poured out together with the contents of the can or through the same nozzle.

Improved Cultivator Teeth.

John Flynn, Monches, Wis.—The invention consists in the combination of the spring and its wheel with the tooth, having a concavity formed in its rear side contiguous to a lug, through which passes a set screw, whereby the wheel can be adjusted in such manner as to cause the tooth to yield more or less readily, as required in different soils.

Machine for Making Crimping Tacks, Awls, Etc.

Henry A. Williams, West Medway, Mass.—This invention relates to roller die machinery for shaping shoemakers' awls, also crimping tacks; and it consists, first, of notches in the surface of the rollers surrounding the dies, and between the dies, and the cavities outside of the dies, for clearance, the object being to utilize the holding-back tendency of the notches on the metal expelled from the sides in the form of fins, to counteract the longitudinal strain which the metal is subject to by the drawing action of the rollers. Second, the invention consists of feed mechanism, in combination with die rollers contrived to automatically feed a long rod forward between the die rollers, hold it until the dies gripe it, and, after the blank is formed, draw the rod back to the cutters, and then leave it and slide back to take hold for feeding again. Third, it consists of grippers contrived to seize the rod as soon as the dies have performed their office, and hold it while the carrier continues to go back for a new hold, and while the cutters detach the rolled piece; and, fourth, it consists of the rollers contrived for shifting laterally along the feed mechanism, and provided with mechanism for so shifting them to utilize one feed for all the different dies of a set of rolls having different sizes or forms for different articles.

Improved Automatic Gate.

William W. McKay, Ossian, Iowa.—This gate is so constructed that it may be readily opened by a person in a vehicle or upon horse-back, and again closed after the said vehicle or horse has passed through. The only operation is slightly pushing upon levers before and after passage, which, through the medium of counterpoises, cause the gate to shut into compact form, or to extend.

Improved Hat.

Charles Sinclair, New York city.—The invention consists of a crown plate, which is adjusted on radial supporting wires into higher or lower position, the wire ends being attached in suitable manner to the sweat band of the hat. The head is thereby kept cool and comfortable, as no pressure of the hat is exerted on the forehead or back of the head.

Improved Stamp-Mill Feeder.

John Walker, Sonora, Cal.—This invention relates to an improved feeder for stamp mills, which is operated in combination with the stamp, and so constructed that a uniform and continuous feed of ore is secured. The invention consists of a feeding disk, with stationary hopper, directing gage piece, and discharge apron, the disk being rotated by pulley, rope, and weight connection of its shaft with a pivoted lever and conical collar of the stamp shaft.

Improved Vehicle Top.

Jerome B. Relyea, Hicksville, assignor to himself and Lewis E. Brewster, Bryan, Ohio.—The case of the device is concaved upon its inner side to fit upon the rear bow of a buggy top. In the middle part of the concaved plate is formed a slot to receive the rubber block, the inner edge of which is designed to rest against the bow to which the device is attached. Upon the outer sides of the concaved plate are formed two caps, the inner ends of which form shoulders for the rubber block to rest against, to prevent the said rubber block from falling out.

Improved Cloth Measure Register.

James Brown, Jr., Matteawan, N. Y.—This is an improved machine for attachment to a store counter, to register the number of yards, of cloth or any other flexible material sold by the yard, measured off, so that the clerk can always know exactly how many yards he has measured, and "will not be under the necessity of re-measuring the goods one or more times, should the purchaser persist in talking to him."

Improved Farm Fence.

Andrew Miller, Guntersville, Ala.—This improvement in fence consists of one of the upper boards of the panel extended a little longer than the others, to drop into a slot in the top of the post, while at the lower part the corners drop alongside of stop cleats nailed on the posts. Cleats are on the middle portion, which, at the same time, drop down on the top of a stake on the opposite side to the stop block, which effectually holds the panel upright, and at the same time allows it to be lifted off the posts readily. The posts are driven into the ground, and are not as high as the panels, being small and light.

Improved Champagne Freezer.

Charles H. Ludwig, New York city.—A frame is applied to the cooler in a fixed or detachable manner, as desired. A central vertical rod is revolved in cross bearings at the top part of a frame by gearing operated by a crank handle, the rod being provided at the lower end with a fixed cross piece, to which jaws, that are fitted to the necks of champagne or other bottles, are hinged. A clamp bolt and screw nut connects the hinged jaws, and admits their rigid attachment to the bottle for being revolved by the rod, and thereby quickly acted upon by the ice in the ice receptacle. Any beverage may thus be cooled in a very short time, and the champagne *frappé* be made in quick and convenient manner. Information regarding territorial or shop rights, purchase of machines, etc., may be had by addressing Ludwig and Battin, No. 50 East 26th street, New York city.

Improved Spring Power.

Valentine Moeslein, Waterloo, Ill.—This invention is a contrivance of double but independent springs in a spring power apparatus, so that both work together to drive one and the same train, and each can be wound up independent of the other, whereby one may be wound up when the other is partly run out, and vice versa, making a regular and uniform continuous power.

Improved Folding School-Desk.

David I. Stagg, New York city.—This folding school-desk is so constructed that when the desk board is folded down, its upper edge will not project above the desk back. Bars are arranged to serve both as handles to the leaf and as a brace to the shelf.

Improved Manufacture of Horseshoes.

Alfred B. Seymour, Jersey City, N. J.—This is a process of making horseshoes by rolling steel bars with a V-shaped flange, then notching said flange transversely, and finally bending the blank into horseshoe shape, whereby the calks are brought closer together at the toe.

Improved Chuck.

Edward S. Perot and Harry C. Beitenman, Philadelphia, Pa.—There is a ring under the wheel, having inclines to ride up and down studs in the bottom of the groove for the wheel, and a shank extending out through the shell of the chuck, for turning it. The slot for the shank is inclined, to correspond with the inclines, so that by shifting the stud to one end of the slot, the ring will push the wheel into gear with the pinions; and shifting it the other way, it will allow the wheel to move back out of gear, thereby causing the jaws to work in the manner of a universal chuck. A stop lug locks the ring when raised up the inclines, to hold the wheel in gear by filling the slot out of which the shank projects.

Improved Center Board.

Joseph L. Dickenson, Hempstead, N. Y.—This is an improved method of hanging center boards, which will enable the center board to be shipped and unshipped while the vessel is floating in the water and loaded, and which will prevent leakage around the center board bolt. The center board trunk has a hole bored into but not through its timbers. There is a bolt, shorter than said hole, and a superimposed plug of wood to be driven into the aperture.

Business and Personal.

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

Handley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct. Amateurs and Artisans, see advertisement, page 221. Fleetwood Scroll Saw, Trump Bros., Manufacturers, Wilmington, Del.

For Sale, cheap—One 60 H.P. Boiler, 40 Engines and Boilers. Address Junius Hart, Titusville, Pa.

Circulars Addressed—Very complete lists of all trades. H. Welsh, 6 Gold St., New York, up stairs.

Wanted—To engage the services of a Practical Man to travel and sell Engines, Boilers, Saw Mills, Machinery, and Machinists' Supplies. Address, with references, Beall Engine and Boiler Works, Cumberland, Md.

Steam Engines—35 per cent. extra power, or an equal saving in fuel guaranteed, by applying the R. S. Condenser. T. Sault, Const'g Eng'r, Gen. Agt., N. Haven, Ct.

We call the attention of those interested to the advertisement of Hyatt & Co.'s Valves, elsewhere in this issue. The goods are standard, and will never disappoint those who use them.

The N.Y. Plow Co., 55 Beekman st.—Works, New-ark, N.J. Agricultural Implements and Iron Castings.

Says the Muscatine (Iowa) Courier: "We have done and are still doing business with quite a number of Advertising Agencies throughout the country, and have no fault to find with them, but Messrs. Geo. P. Rowell & Co. give us more business than any other. Furnishing a large amount of advertising, and paying promptly, has put this house at the very head of Agencies, and has made them a name for honesty, reliability and promptness, which of itself is worth a fortune."

New York Agency wanted for Machinery & Sup-plies. Best of References. J. J. Bockle, Jr., P.O. Box 3007.

The merits of Morton's Brass and Copper Sash Chains with patented attachments are worthy of notice. See advertisement, page 221.

An experienced traveling Salesman, who has few equals, is open for something worth \$2,000 a year. Address Box 14, Clear Lake, Iowa.

Wanted—One 2 spindle Edging Machine. Address, with description and price. P. O. Box 2238, New Haven, Conn.

Bargains in Cotton and Woolen Machinery, New or Second Hand. J. J. Bockle, Jr., 20 Cortland St., N. Y.

Scientific Books—Send stamp for Complete Cata-logue. E. & F. N. Spon, 46 Broome Street, New York.

Enterprise Mfg Co., Philadelphia, Pa., Patented Hardware Manufacturers and Iron Founders. Small gray iron castings, warranted soft and smooth, made to order, and patented articles of merit manufactured on royalty.

A New and Novel Article of Merit—Agents Wanted. Also, Partner to operate Can Adian Patent. I. C. Cowles, opposite Post Office, Syracuse, N. Y.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1875, p. 389. Circulars free. J. W. Sutton, 95 Liberty St., New York.

Something New—Door and Bell Plates—Letters Engraved on Glass. For Beauty and Durability it cannot be excelled. Send for Price List. P. O. Box 443, W. J. Pettis, Providence, R. I.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Double-Entry Book-Keeping Simplified. The most successful Book on the subject ever published. Cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggoner & Co., 424 Walnut St., Philadelphia, Pa.

A Self-Acting Trap, to rid out all Rat and Ani-mal Creation. Agents wanted. No trouble to sell. For Traps, &c., address John Dilline, Limestoneville, Monmouth Co., Pa.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 212 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

Hotchkiss & Ball, West Meriden, Conn., Found-rymen and Workers of Sheet Metal. Will manufacture on royalty Patented articles of merit in their line. Small Gray Iron Castings made to order.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Drop Press, 3,000 to 4,000 lbs. Send description and lowest price to Kittredge Cornice and Ornament Company, Salem, Ohio.

Electric Burglar Alarms and Private House An-nunciators; Call, Servants' & Stable Bells; Cheap Tele-grams; Batteries of all kinds. G. W. Stockly, Cleveland, O.

Steam and Water Gauge and Gauge Cocks Com-bined, requiring only two holes in the Boiler, used by all boiler makers who have seen it. \$15. Hillard & Holland, 62 Gold St., New York.

Scroll Sawyers—If you want the best Jig Saw Blades, get them made by A. Coats, 108 Hester St., N. Y.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

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., 246 Canal St., New York.

For Sale—Large lot second hand Machinists' Tools, cheap. Send for list. I. H. Shearman, 45 Cortland Street, New York.

For Tri-nitroglycerin, Mica Blasting Powder, Frictional Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., result of seven years' experience at Hoosac Tunnel. Address Geo. M. Mowbray, North Adams, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

"Lehigh"—For information about Emery Wheels &c., address L. V. Emery Wheel Co., Westport, Pa.

American Metaline Co., 61 Warren St., N.Y. City.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wiggin, 28 Cornhill, Boston, Mass.

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

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Genuine Concord Axes—Brown, Fisherville, N.H. All Fruit-can Tools, Ferracute W's, Bridgeton, N.J.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Aray, 118 North 3d St., Philadelphia, Pa. Send for Circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon 470 Grand Street New York.

Barry Capping Machine for Canning Establish-ments. T. R. Bailey & Vail, Lockport, N. Y.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$5. with good Battery. F. C. Beach & Co., 246 Canal St., New York. Makers. Send for free illustrated Catalogue.

Temples and Oilcans. Draper, Hopdale, Mass.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Spinning Rings of a Superior Quality—Whitins-ville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see adver-tisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Notes & Queries

G. J. E. will find directions for making rub-ber hand stamps on p. 156, vol. 21.—H. F. G. (size of boiler), H. P. T. (cut-off of engine), and S. M. R. (horse power of a water wheel) do not send sufficient data.—L. H. can cement meerschaum by the process described on p. 22, vol. 47.—W. L. S. will find that his queries as to magnetic variation are answered on p. 164, vol. 33.—T. J. W. will find a description of the polyspherical ship on p. 103, vol. 31.—W. F. R. will find a recipe for paste that will not sour on p. 219, vol. 30.—B. J. B. will find an answer to the cannon and ear question on p. 273, vol. 32.—F. H. will find a recipe for bronzing on iron castings on p. 283, vol. 30.—M. A. will find a recipe for black paint for iron fencing on p. 379, vol. 31.—C. will find a recipe for paste on p. 315, vol. 30, and on p. 11, vol. 31.—B. W. D. will find directions for constructing a windmill on p. 241, vol. 32.—M. H. K. is referred to p. 319, vol. 32, for a means of getting rid of ants. Constructing a sundial is described on p. 409, vol. 29.—W. P. K. will find directions for freeing sulphuric acid from water on p. 111, vol. 29.—E. T. can bleach beeswax by the method described on p. 294, vol. 31.—S. A. R. will find direc-tions for making a filter on p. 251, vol. 31.—G. V. can temper springs by the process described on p. 363, vol. 32.—S. L. will find directions for water-proofing cloth on p. 347, vol. 31. For a book on the lathe, try "The Lathe and its Uses."—A. D. D. McG., A. C. D., and R. F. H. will find a full explanation of the mystery of an ice boat traveling faster than the wind on p. 176, vol. 28.—H. S. S. will find a method of ascertaining the amount of water carried over in steam on p. 257, vol. 31.—A. K. will find a recipe for a cement for filling burr stones on p. 251, vol. 31.—J. A. will find directions for making malleable iron castings on p. 135, vol. 29.—D. L. S. can drive away cockroaches by the method described on p. 315, vol. 32.—W. M. H. will find a recipe for yellow lacquer on tin on p. 139, vol. 32.—T. C. P. will find directions for preserving eggs on p. 219, vol. 31.—H. L. S. will find directions for manufacturing aluminum on pp. 99, 116, vol. 32.—H. G. S. will find an answer to his query as to the growth of the beard on p. 362, vol. 32.—A. K. will find the desired information as to the phylloxera on p. 48, vol. 31.—S. A. T. will find directions for extracting glycerin on p. 292, vol. 31. Consult a physician as to the feet troubles.—T. B. will find directions for making bleaching salts (chloride of lime) on p. 91, vol. 32.—V. L. Jr. and A. J. P. will find directions for silvering without a battery on p. 299, vol. 31.—F. M. E. will find an answer to all his queries as to lightning rods on p. 145, vol. 31.—A. E. G. will find a recipe for paraffin varnish on p. 91, vol. 31. Ants may be destroyed by the method described on p. 319, vol. 32.—J. R. M. can prevent rust on iron by the method given on p. 283, vol. 31.

(1) J. N. Jr. asks: In regard to the fire-proof qualities of a safe, do the walls require to be any thicker for a large sized safe, or does 5 inch filling offer the same protection in a large as well as in a small size? A. The same thickness for both sizes will do.

(2) I. L. asks: What is the name of the fastest steamboat in the world, and what is her best time? A. We think about 25 miles an hour has been made on the North river, and this is the fastest time. Perhaps some of our readers may have notes that will be of interest.

(3) T. H. W. says: Please give me through your valuable paper a rule by which I can exactly calculate the departure of a curve from a tangent, the radius and tangent being given, at right angles to each other. A. You want the equation of the curve, which you can obtain from a treatise on analytical geometry, for any of the common curves. In case you do not know the nature of the curve, it must be determined by experiment. The equation of the circle, referred to its center, R being the radius, and x, y, the co-ordinates, is $x^2 + y^2 = R^2$.

(4) H. L. B. asks: Have I a right to make any patented article for myself? A. No. 1. Does a rifle ball leave the gun before one feels the recoil? A. No. 2. Will the recoil make any difference with the shooting? A. Yes.

(5) D. C. asks: Why does iron not always shrink alike? A. Because it is not homogeneous, being harder and closer in fiber in some places than in others.

(6) C. P. A. says: 1. I have in mind to build a small boat, 40 feet long and 13 feet wide. What size of engine would it take to run it? A. Use an engine of 12 or 15 horse power. 2. Does boiler iron have to be stamped on every plate with the breaking strain and the maker's name? A. The law in regard to stamping boiler plates is as follows: "And be it further enacted: That every such plate of boiler iron or steel, made for use in the construction of steamboat boilers, shall be distinctly and permanently stamped by the manufacturer thereof, and, if practicable, in such places that the marks shall be left visible when such plate shall be worked into boilers, with the name of the manufacturer, the place where manufactured, and the number of pounds tensile strain it will bear to the square inch." This refers to plate subject to a tensile strain.

How are rubber stamps made? A. See p. 156, vol. 31.

(7) R. B. asks: Can water be pumped from an airtight tank, having no vent? A. No.

(8) H. D. M. asks: Can you give us a first class recipe for making Habbitt metal for lining journal boxes? A. It would be better to buy the metal from a reliable manufacturer. We can recommend the use of cast iron boxes, from personal experience and observation.

What is the best style of clutch now known for connecting two lines of shafting, to throw them in and out of gear? A. You will probably find a friction clutch the most satisfactory.

(9) J. O. asks: Can I own and run a steam yacht for my own pleasure upon the Connecticut river and on Long Island Sound, without getting a license? I do not wish to carry passengers for hire. A. You must obtain a license. Apply to the inspector in your district. The fees are: Vessel, \$25; captain, \$10; engineer, \$5.

(10) H. H. says: 1. Following the subjoined directions, I attempted some electro-plating: "Take a \$2.50 piece of gold and put in a mixture of 1 oz. nitric and 4 ozs. muriatic acid (in glass vessel only); when it is all cut, dissolve $\frac{1}{2}$ oz. sulphate of potash in 1 pint pure rain water, and mix with the gold solution, stirring well; then let it stand, and the gold will be thrown down; then pour off the acid fluid, and wash the gold with two or three waters, or until no acid is tasted on touching the tongue to the gold. Now dissolve 1 oz. cyanuret of potassium in 1 pint pure rain water, to which add the gold, and it is ready for use. Clean the article to be plated from all grease and dirt with whiting and a brush; if there are cracks, it may be necessary to put the article in a solution of caustic potash; suspend it in the cyanuret of gold solution with a small strip of zinc about the width of a common knitting needle." With the exception of using some fully 18 carat gold for the \$2.50 gold piece, I followed directions, but the result was not satisfactory. The deposit was about the color of and very similar in appearance and feel to German silver. What was the cause? How can I, in some simple manner, touch up by electro-plating with gold such things as parts of watch movements, etc.? A. A defective colored gilding may be improved by the help of the following mixture: 3 parts nitrate of potash, $\frac{1}{2}$ alum, $\frac{1}{2}$ sulphate of zinc, $\frac{1}{2}$ common salt. These ingredients are put into a small quantity of water, to form a sort of paste, which is put on the articles to be colored; they are then placed upon an iron plate over a clear fire, so that they will attain nearly a black heat, when they are suddenly plunged into cold water; this gives them a beautiful high color.

(11) W. B. H. asks: How can I find the relative conductivity of different substances? A. You can find them tabulated in De la Rive's work on electricity, and in several others. The process of working them out is somewhat complicated, and requires a great deal of experience to do it accurately.

(12) L. J. W. says: I have tried to electroplate with a battery of 2 zincs and a carbon in dilute sulphuric acid, but I cannot get a good deposit either on metal or a wax mold, the wax mold being well rubbed with pure graphite. The zincs are 3 inches x 6 x $\frac{1}{4}$, and the carbon is of the same size. The deposit on the metal is in spots, and brittle, altogether unlike the nature of copper. Please tell me what is the matter. A. Your trouble might arise from several causes. Perhaps your solution is too strong. The best solution of sulphate of copper and 1 part of sulphuric acid with 10 of water. Perhaps your anode is too large. Try a smaller one. Perhaps your cathode and anode are too near together; try them farther apart; that is, separate your metals farther from the copper plate.

(13) L. S. Y. asks: What chemicals and metals are used in the Hill battery? A. Sulphate of copper and sulphate of zinc are the chemicals, and zinc and copper the metals.

(14) A. B. C. asks: 1. How will I proceed to finish up ash doors and frames in oil polish, after filling with two coats of filling? What material is used, and how many coats are necessary to produce a good job? A. The fineness of the polish depends in a great measure upon the care with which the filling may be rubbed down; the rubbing is indispensable, in fact, to a good finish. For the best work, put on three coats of shellac; after the first coat is hard, rub it down with No. 1 sandpaper; after the second coat is hard, rub down with No. $\frac{1}{2}$ sandpaper, and after the third coat, the same. Then put on one or two coats of beeswax dissolved in spirits of turpentine and oil, in some cases three coats. For polished panels, put on three coats of hard flowing varnish, each of the first two coats to stand two or three days until hard, and then be rubbed with rotten stone, the third coat to be rubbed with cotton batting and flour. 2. I have a brick foundation, pencilled, and it is ruined from mold. How can I prevent the mold from affecting the paint? A. The mold is caused

from dampness, and this arises either from a close confined position of the wall, or from water rising in the body of the wall from the ground. The only remedy is to remove the cause of the dampness.

(15) M. H. T. & Co. say: In our business we have orders for hooks, etc., that are to withstand the draft of an ordinary locomotive. Will you please give us your idea of the amount an engine with four drive wheels can lift, dead weight, with single purchase? A. About 8,000 lbs. on an average, taking the adhesion at $\frac{1}{4}$ of the weight on the driving wheels.

(16) C. F. asks: 1. What is the percentage of phosphorus in phosphorus oil? A. Twelve grains phosphorus are put into 1 oz. almond oil. About 4 grains phosphorus are taken up by the oil. 2. What medical action has it? A. Solutions of phosphorus have been used in small quantities to allay excessive oxidation of the animal tissues. Vitreous phosphorus, taken internally, acts as a powerful irritant poison.

Can corrosive sublimate be made by precipitation of mercurial nitrate by muriate of soda? A. No; the precipitate consists of the subchloride of mercury (calomel).

(17) G. says: 1. I have a boiler carrying 70 lbs. to the square inch with a $\frac{3}{4}$ safety valve attached. What would be the pressure on said valve? Will I have any greater pressure on a 3 inch safety valve with the same pressure of steam? A. Pressure on $\frac{3}{4}$ valve = $70 \times (\frac{3}{4})^2 \times 0.7854$; pressure on 3 inch = $70 \times 3^2 \times 0.7854$, hence the pressure in the second valve is 16 times as great as that on the first. 2. Please give me a rule for finding horse powers of boilers. A. We do not know of any standard for the horse power of a boiler.

(18) P. asks: 1. Can gold leaf be applied to glass without the use of oils? A. Gold size is used for this purpose. 2. How can I transfer a wood cut or steel engraving to glass, so that I can apply colors to the back, and let them strike through? A. See p. 123, vol. 30.

(19) G. F. K. asks: 1. I have built an engine $1\frac{1}{4}$ bore x 3 inches stroke, with a fly wheel weighing 12 lbs. Would a copper boiler 20 inches high x 15 inches diameter, with 4 flues two inches in diameter, heated with 4 lamps, making 60 lbs. steam, run said engine at the rate of 600 revolutions per minute? A. If the lamps are very powerful, we think it may answer. It will have to be forced, however. 2. Please state the thickness the boiler shell should be. A. Make it $\frac{1}{4}$ of an inch thick.

(20) C. H. says: I have a 1 inch iron pipe, 480 feet long, to bring water from a spring. The fall is 8 or 10 feet, and the water runs out 3 feet above the ground. I cannot get the pipe to run full of water; it will not run more than half full, though there is water enough to fill it. What is the remedy? A. Probably the pipe has high points, where air collects.

(21) H. N. B. says: I am running a circular saw, with an idle pulley in a horizontal frame, binged, and working a few inches from the saw pulley. The belt is quite slack, increasing the lap six inches. I apply just sufficient weight on the frame to keep the belt from slipping; it works smoothly and well and almost noiselessly. One lacing has lasted three months on heavy work. The proprietor contends that I am wearing the belt on the outer surface and otherwise injuring it by applying the weight. Is he right? A. The plan you have adopted is a very good manner of applying a tightener. It would probably be somewhat more efficient if you stretched the belt a little tighter; but from your account of the manner in which it operates, there seems to be little reason for making any change.

(22) L. M. says: I say that, if a train of cars runs on a circular track or a curve, the road must be inclined outward if the locomotive draws, and inward if it pushes from behind. My friend says in both cases the road must incline inward. Who is right? A. Your friend.

(23) I. D. C. asks: 1. Will a balloon made in the form of a sphere or a spheroid carry as much weight and ascend with as much ease as if made pear-shaped, the gas and all other things being equal? A. Yes. 2. Is gas of a high illuminating power the best for balloons? A. The lightest gas is the best, hence that having the best illuminating qualities is by no means the best for a balloon. 3. How can I determine the weight which a balloon of a given size will ascend with when filled with coal gas? A. See p. 64, vol. 32.

(24) L. B. S. asks: How can I make a small battery for plating and other purposes? A. Put a copper plate in a glass vessel 3 inches deep, and cover it with crystals of sulphate of copper. Suspend a piece of zinc near the top. Connect insulated copper wire to copper plate and another to zinc. Fill the vessel with water.

(25) I. O. T. asks: 1. Please give me a rule for finding how much and what size of wire I must use on relays, in putting up a short or long telegraphic line. A. Use the purest copper obtainable, and make the sum of the resistances of all the relays equal to the resistance of the rest of the circuit, including that of the battery; this gives the best result when the line is well insulated. There is no simple formula for fixing upon the size of wire that would serve for any and every case whatever; but for local and short circuits, Nos. 18 to 23 are convenient sizes, and Nos. 28 to 32 are generally used for main lines. A current of 0.02 of a weber is a very fair working strength for main line circuits. All the necessary data for ascertaining the resistance of the various sizes of copper and iron wire will be found in J. T. Sprague's work on "Electricity, its Theory, Sources, and Applications," under "Conductivity and Resistance." 2. I have been making an induction coil, 7x3 inches, center bundle of wires is 1 inch in diameter; primary coil is of No. 14 wire, about 90 feet long; sec-

ondary coil is of No. 36 silk covered wire, 5,000 feet of it being used. I can detect a very slight residue of magnetism in the iron wires when the current is not passing; should this be? The shock is far from strong. What is wrong? What ought I to expect from such a coil if I add 5,000 feet more to the secondary coil, and a good condenser? A. It would be difficult to tell exactly what is wrong with your coil without inspecting it; properly constructed, however, one of that size should give a very severe shock. From $\frac{3}{4}$ to 1 inch per mile of secondary wire is a fair average for ordinary coils, but this varies with the manner of winding and the degree of insulation. 3. My condenser is made of tissue tinfoil and paper of a thickness of 400 leaves to the inch; it is made like an interleaved book. It contains 45 square feet, and is well connected with the primary coil; but I get no additional effect. What is wrong? A. Your condenser is properly made, and should add materially to the effect if rightly connected to the primary circuit. Sprague's book, above referred to, gives much useful information in regard to the construction of coils.

(26) L. W. asks: Which is the best book on qualitative analysis? A. Fresenius is a standard work on the subject.

(27) F. B. asks: How can I make a silver bath for electroplating? A. Dissolve 123 ozs. cyanide of potassium in 100 gallons of water; get one or two flat porous vessels, and place them in this solution to within half an inch of the mouth, and fill them to the same height with the solution; in these porous vessels place small plates or sheets of iron or copper, and connect them with the zinc terminal of a battery; in the large solution place a sheet of silver connected with the copper terminal of the battery. This arrangement being made at night, and the power employed being two of Hunsen's batteries or four Daniell's, the solution will be ready for use in the morning. A small quantity of solution for silvering may be made up from this description. A half ounce of silver to the gallon will do very well. A small quantity may be prepared in an hour.

(28) A. A. H. asks: 1. How can I plate silver without a battery? A. For silver plating on copper, use nitrate of silver and common salt, each 20 grains; cream of tartar, $\frac{3}{4}$ drachms. Mix. Moisten with cold water and rub on the article to be plated. 2. Can I make a solution by cutting silver in acid? A. Silver dissolves in dilute nitric acid.

(29) N. S. W. asks: 1. What is the office of the core of wires in an induction coil, as shown in p. 115, vol. 33? A. The object of the core of iron wires is to increase the inductive effect. 2. Where is the connection with the conductors? A. The primary wires are attached to the binding screws at the right of the instrument. 3. What is the necessity of insulated wire if the coil is divided by insulators? A. The wire must be insulated, otherwise the current would leap across from one turn to another. If you will read the article carefully, you will see the object of the secondary coil. 4. If a battery current is connected with the coil, what is the necessity of the current breaker? A. It is by alternately breaking and making contact with the battery that the secondary effects are produced. A constant current through the primary coil would produce no static effect upon the secondary. 5. If the copper wire be immersed in a solution of shellac, is that insulation sufficient for a coil? A. A shellac covering might answer, but silk would be better.

(30) F. C. says: How can I deodorize a swordfish's sword? A. Try washing it with a little benzole or carbolic acid.

(31) L. P. S. says: In your issue of August 28 (in answer to M. V. O., who asks: Does a fan blower require more power to drive it when the discharge pipe is open than when it is closed?) You answer: "The action is the same as in partially closing the discharge valve of a pump. If the same speed is maintained, the resistance is increased." This is contrary to experimental results. If M. V. O. will make his fan belt sufficiently slack to reduce the speed of his fan one quarter or one third, by slipping, when the valve is open, he will find, on shutting the valve, the fan will immediately resume its full speed. This, I think, is due to the changing of the course of the air as it rushes through the fan, from a straight-forward to a rotary motion, which takes considerable power; but when no air passes through the fan, that which is inclosed within it, after having received its initial momentum, keeps it up without any additional power except to overcome the friction on the inside of the air jacket. I have often tried this, and always found it to take more power when the blast is taken from the fan. A. We think you are quite right, when the gate is entirely closed. As to the effect when partially closed, we would like to hear from readers who have made experiments. We are glad you have called attention to the matter, for we always desire to give correct information, and in our answer to M. V. O. we had in mind the action of blowers producing positive blast.

(32) K. asks: Is there a more speedy method of reducing a leaf to its skeleton (without destroying the fiber) than by steeping in pure water for months: a method, by the way, tried by me without success? A. Steep the leaf in a little strong lime water for a short time; spraying the leaf with water will then remove all but the fibers.

(33) J. G. E. asks: Is there any way of making cloth impervious to dust? A. Cloths that have been rendered impervious to moisture are likewise impervious to dust. Pass the cloth through a weak solution of glue and alum; and after passing it between the rollers of an ordinary wringer to remove the superfluous moisture, dry it, first in the air and then in a warm room.

(34) V. L. C. asks: How can I make plaster casts for stereotyping, so that they will not crack when put into heated metal? A. After the plaster cast has hardened, it should be placed in a hot oven in order to drive off all the superfluous moisture. Plates prepared in this way do not crack.

(35) G. C. says: 1. My counter is badly corroded by the action of soda water, and fountains have to be tinned every 3 years. Is there any remedy for this common annoyance? A. You fail to state of what material your counter is composed. If of wood or marble, we would suggest the use of a glass plate. Porcelain or slate topped counters are best where there is a liability of their frequent contact with carbonic acid water. 2. Would a small quantity of soda put in the water before charging prevent the mischief? A. No.

(36) Z. asks: Please explain the electric action in the automatic railway signal in use upon the Boston and Albany Railways. A. The action is produced by the opening and closing of an electric circuit by the movements of the cars upon the rails, and causes the movement of an armature attached to an electromagnet, which strikes a bell.

(37) F. M. W. asks: What is the process for clarifying and purifying lard, grease, and tallow? A. They are subjected to the action of steam at a high pressure in large cylindrical iron vessels. The steam is made to enter the vessel from below in such a manner as to cause a constant agitation of the melted contents. The condensed steam, being heavier than the grease, falls to the bottom of the cylinder, carrying with it the greater part of the impurities, and is drawn off by suitable taps.

(38) W. H. B. says: In your last issue you recommend a correspondent to use iodine in olive oil to prevent the hair from falling out. Will it not discolor the hair and skin? A. Yes; but almost inappreciably, and for a short time only. The color is not permanent.

(39) J. T. asks: Is any portion of the human tooth ivory? A. No.

(40) G. W. S. asks: 1. What is soluble or water glass? A. Water glass is a variety of glass containing a large proportion of alkaline flux. It is quite soluble in boiling water. 2. Would it answer for making a smooth hard finish on wooden handles, and give a polished surface? A. Water glass might answer the purpose; but it is an efflorescent substance, and would finally become converted into a white powder, if exposed to the air.

What is put in glue size to give it body? A. A little flour and litharge are sometimes used.

(41) C. A. B. asks: What can soft sandstone be saturated with to make it impervious (or nearly so) to water? Coal tar would do but for the color. A. A solution of alum, glue, and litharge has been used for this purpose.

(42) S. A. T. asks: What will prevent the beard from splitting, so that it will grow long? A. Clip the ends frequently.

What makes Limburger cheese have such a very strong and offensive odor? A. Its putrescence.

(43) L. I. asks: Please give me an analysis of crude petroleum. A. Crude petroleum varies in density from 0.820 to 0.782, or 40° Baumé to 48° Baumé. It is a mixture of a great number of hydrocarbons, compounds of carbon and hydrogen, the average proportion of the two elements being: Carbon 85, hydrogen 15. These hydrocarbons differ from each other in volatility. Some are so volatile as to evaporate rapidly at ordinary temperatures, others require a temperature of 700° to 800° Fah. to vaporize them.

(44) G. B. asks: What is a good alloy, resembling silver in weight and appearance? A. Try the following: Tin $\frac{4}{5}$ lbs., bismuth, antimony, and lead, each $\frac{1}{5}$ lb.

(45) C. H. S. asks: How can I cover twine thread, etc., with metallic lead, so that on bending it will keep its shape? A. The process employed in manufacturing long lengths of lead pipe might advantageously be used for this purpose. In this the lead, in a molten condition, is forced by hydraulic pressure through a die, through the center of which a steel mandril, of the required size for the bore, passes. By a little alteration of the mechanism you might substitute twine or thread for the mandril, and decrease the size of the die.

(46) F. C. W. says: G. G. F. can remove glossy spots in black goods by rubbing them with a piece of cloth.

(47) M. W. W. says, in reply to numerous queries as to the size of axle spindles: The almost universal testimony is in favor, within certain ranges, of the large spindles, especially in common freight and farm wagons. This may not arise from the difference in the spindles, and probably does not, but from other causes. In practice, the small sized spindles are usually solid iron, and the spindles are turned, and the boxes bored to fit. The larger spindle is about twice the diameter for the same grade of wagon, that is, a $\frac{1}{2}$ inch solid iron spindle corresponds to a 3 inch timber skel, as it is termed, which is usually a cast iron timber fitted on to a wooden axle, not turned and with the boxes not turned, the fit being much looser than in the case of the solid iron spindle. This may have some effect, but I think the real cause is the greater stability of the wooden axle, retaining its set without springing, generally as long as it lasts; while it is probably rare to find solid iron axles that are not more or less sprung, when of course they run hard. This seems still more reasonable when it is considered that solid iron spindles (when the load is carried on springs, thus reducing the liability to spring the axle) seldom give any trouble. There is also some difference in weight in favor of the wooden axle, though hardly enough to justify the decided preference manifested for it.

(48) E. D. R. says, in answer to J. A. B., who asks if there is a seed called bird pepper: The pods thus called are the capsules and seeds of *capsicum annuum*, or cayenne pepper, and can be procured in almost any drug store under the name of bird pepper; mocking birds are extremely fond of them when fresh, and eat of them freely, hence the vulgar name. The best are the African bird peppers, and are the same as used for making pepper sauce.

MINERALS, ETC.—Specimens have been received from the following correspondents and examined, with the results stated:

D. D. W.—No gold or silver is present. There is a trace of arsenic. The specimen is shale inclosing a yellow powder consisting principally of silica, iron, lime, alumina, and potash.—M. C. S.—It is smoky quartz, of little or no value.—C. C. P.—It is marcasite.—W. W. J.—It is a variety of soft white clay.—A. J. H.—Your specimens have not been received. Forward other specimens, and we will examine them.—R. L.'s specimen has not been received.—No name.—A fine specimen of variegated red jasper or shale.

COMMUNICATIONS RECEIVED.

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

On Squaring the Circle. By E. C.
On Rapid Transit. By J. H. McH.
On the Extraction of Gold from Ores. By J. T.
On the Weather. By W. B.

Also inquiries and answers from the following:
A. A. A.—L. H. D.—W. M. R.—J. D. D.—J. J. M.—R. K.—A. G.—F. J. S.—G. B.—G. W.—F. K.—C. D.—F. D. C.—W. M. T.—A. T.—R. B.—E. B. B.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells an efficient rice-hulling machine? Whose is the best firebrick press? Whose is the best dog power, for churning and other light work? Whose is the best rack press for expressing seed oil?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,583.—GLASS DISH.—G. E. Hatch, East Cambridge, Ms.	
8,586 to 8,589.—CARPETS.—A. Heald, Philadelphia, Pa.	
8,590.—CARPET.—W. Kerr, Philadelphia, Pa.	
8,591.—BADGE.—J. S. Little, Newark, N. J.	
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5,124.—W. E. Andrew, New York city, U. S. Separating oleomargarin and stearin from fat. Sept. 4, 1875.	
5,125.—A. W. Richards, Indianapolis, Iowa, U. S. Perambulating cot. Sept. 4, 1875.	
5,126.—G. Campbell et al., Toronto, Ont. Fireproof shutter. Sept. 4, 1875.	
5,127.—A. Weir, Wellesley, Ont. Spinning wheel. Sept. 4, 1875.	
5,128.—G. S. Walker, Erie, Pa., U. S. Washing machine. Sept. 4, 1875.	
5,129.—W. Ball, New Vienna, Ohio, U. S. Canal boat. Sept. 4, 1875.	
5,130.—J. H. Myers, Montreal, P. Q. Shirt. Sept. 4, 1875.	
5,131.—J. Buechner, St. Paul, Minn., U. S. Picture exhibitor. Sept. 4, 1875.	
5,132.—J. W. H. Doubler, Philadelphia, Pa., U. S. Mechanical motor. Sept. 4, 1874.	
5,133.—O. Noack, Baltimore, Md., U. S. Crimping machine. Sept. 4, 1875.	
5,134.—G. J. Shimer, Milton, Pa., U. S. Cutter head. Sept. 4, 1875.	
5,135.—J. Armour, Hamilton City, Ont. Hose coupling. Sept. 4, 1875.	
5,136.—G. H. Steadman, Hopwell Cape, N. B. Railway snow shoveller. Sept. 7, 1875.	
5,137.—E. May, Montreal, P. Q. Elastic motor. Sept. 7, 1875.	
5,138.—J. S. Wetherell, New Market, Ont. Combined luggage box. Sept. 7, 1875.	
5,139.—G. R. Eager, Boston, Mass., U. S. Blouse, overall, or pantaloons garment. Sept. 7, 1875.	
5,140.—C. J. Addy et al., Boston, Mass., U. S. Sole edge trimming machine. Sept. 7, 1875.	
5,141.—J. Dilline, Limestoneville, Pa., U. S. Animal trap. Sept. 7, 1875.	
5,142.—S. Strunz, Pittsburgh, Pa., U. S. Soap. Sept. 7, 1875.	
5,143.—J. Russell, New York city, U. S. Horse shoe machine. Sept. 7, 1875.	
5,144.—P. K. Dealy, St. John, N. B. Locomotive ash pan cleaner and heater. Sept. 7, 1875.	
5,145.—L. C. Whitting, East Saginaw, Mich., U. S. Piano-forte pedal attachment. Sept. 7, 1875.	
5,146.—J. D. Smedley, Syracuse, N. Y., U. S. Chamber attachment to cooking stoves. Sept. 7, 1875.	

Advertisements.

Back Page \$1.00 a line.
Inside Page 75 cents a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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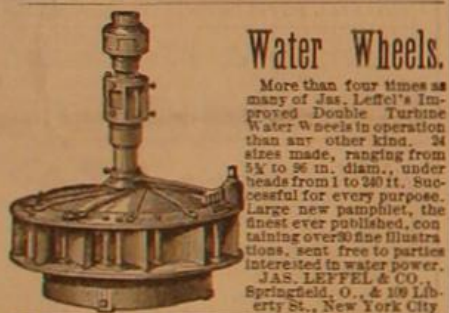
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IMPROVED DEODORIZING EXCAVATING APPARATUS.

We devote our initial page this week to engravings of an improved apparatus for removing any kind of thick, semi-liquid material, or fluids heavily laden with solid obstructions, from vaults or excavations. The widest application such a machine necessarily finds is in the cleaning of cesspools, and similar receptacles for refuse, for which work it is remarkably well adapted in construction. The device, as represented in Fig. 1, consists of a pump which raises the material and forces it into the tank. The air at the same time driven into the latter, escapes through a deodorizer shown at the front part of the truck, and is there deprived of all noxious emanations by percolation through a suitable chemical solution. In this last respect the apparatus differs from others, in which the deodorization is accomplished by forcing the air through burning charcoal; and among the advantages thus claimed to be realized, besides the more complete removal of foul smells, is the obviation of sparks from the furnace, which a strong blast might throw upon and thus endanger adjacent buildings.

The essential features of the system lie in the construction of the pump. This consists first of a barrel, mounted on trucks and provided with handles for convenience in transportation, and second, of a simple pump cylinder placed at right angles thereto and containing a piston operated by the lever shown in the hands of the figure. To each end of the barrel is connected a section of hose, by means of a simple and effective form of coupling. The pipe which leads from the vault is secured to the more elevated end of the barrel when the latter is placed for working, so that the natural tendency of the material is to flow directly into the pump. The other hose of course leads from the pump to the vat in which the refuse is carted away.

In all apparatus designed for pumping out the contents of cesspools, etc., the main difficulty encountered is to construct the valves so that they will allow of the passage of solid substances as large as the pump barrel will admit, and at the same time remain tight for fluids; and this without becoming choked so as to render necessary the repeated dismemberment of the machine in order to clear them. In tanneries, where similar material is dealt with, the old boot leg valve has long been employed; but to this the objection is urged that gravel or small solids are liable to fall between the sides of the valve and the barrel, and so ultimately to prevent the opening of the valve. To obviate this trouble the novel form of valve represented in Fig. 2 has been devised, and to this it is desired especially to direct the attention of the reader. It consists of a section of strong rubber tube, A, inserted into the barrel, B, for some distance from the end. This done, the lower edge of the tube at the end is brought up against the upper and opposite edge, and the two thicknesses of rubber are fastened together and to the inner periphery of the barrel. A metal strengthening plate is added to the valve, and to this is hinged the spoon-shaped piece, C.

From this construction it will be seen that the action of the pump must draw the material under the tube and between it and the barrel, and further that any solid capable of being pushed between these surfaces will easily pass through. The return stroke of the pump, forcing back on the valve, acts on the inside of the tube, B, pressing the same tightly against the entire periphery of the barrel. The object of the metal piece, C, is to receive the compact of hard substances and thus shield the rubber tube. The inventors inform us that, no matter how large the object which, at the

end of the up stroke of the pump, may remain caught between the outside of the tube and the inside of the barrel, the rubber on the down stroke will be forced around the obstruction, and sufficient surface will pack against the barrel to render the valve perfectly tight.

One of these valves is placed at the inlet orifice and the other at the outlet, each opening in the same direction, so that the up stroke of the pump which opens the inlet closes the outlet, and *vice versa*. No material passes through the piston, and only liquid matter comes in contact with that portion; sand, gravel, stones, etc., being heavier, fall to the bottom, thus avoiding all grinding of the cylinder, while

may be of equal strength with the pieces which they connect. 5. To place the fastenings in each piece of timber so that there shall be sufficient resistance to the giving way of the joint by the fastenings shearing or crushing their way through the timber.

The Sinking of the Vanguard.

One of the finest vessels in the British navy, the Vanguard, was recently sunk by her consort, the Iron Duke, through an accidental collision during a fog. The Vanguard, it seems, was leading, and, suddenly sighting a large merchantman ahead, in accordance with the usual rules of the road ported her helm. In so doing she presented her broadside to the Iron Duke, which, though rendered invisible by the fog, was closely following. Before the Vanguard could get out of the way, the Iron Duke crashed into her. Both vessels were heavily armored, and both especially built for ramming. The result was that the Iron Duke's prow cut into her consort's broadside as if it were so much paper. The strict discipline of the man-of-war averted what probably would have been, in a merchant passenger vessel, a fearful loss of life, as, in the very short time which intervened between the shock and the sinking of the ship, the entire crew of 450 men was safely removed in the boats.

The vessel cost, it is said, \$2,500,000, and this loss is still further increased by all the personal property of the crew sinking

with the ship. The casualty furnishes, however, an expensive but nevertheless valuable experiment as to the powers of the ram. The Vanguard is the first modern ironclad upon which the capabilities of this terrible weapon have been tested. Even the very heavy armor proved no protection to the blow delivered at the moderate speed of five knots per hour. The effect of impact, had the ironclad been driven at double or treble that speed, as she might be, can be imagined.

The Vanguard was well provided with compartments, but these, though airtight, and hence buoyant when sealed, were, at the time of the accident, not all closed. To those that were shut, the fact of the ship's remaining above water as long as she did (one hour) is due.

Dr. Leverett Bradley.

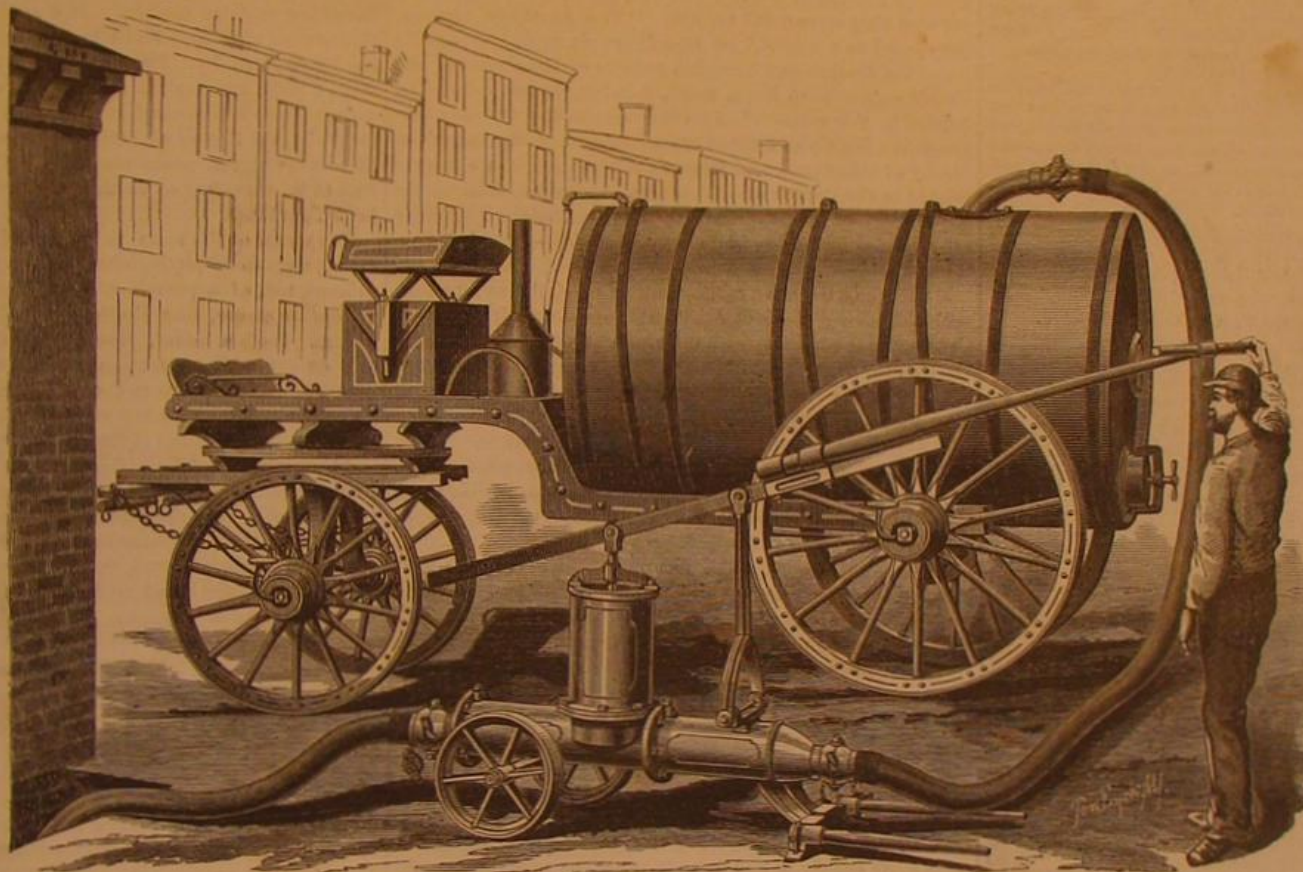
Dr. Leverett Bradley died recently in Jersey City, N. J., in the 77th year of his age.

For a number of years past Dr. Bradley has been well known as an electrician of considerable ability; but he is best known from the invention, which he patented in 1865, for winding helices with uncovered wire. In 1839 he secured a patent for an automatic telegraph apparatus, with which, on a short circuit, he succeeded in recording about 15,000 words per hour, but he was unable to practically work the apparatus on a telegraphic line of ordinary length.

In 1873, he obtained a patent for an apparatus for electric measurement, being a combination of a tangent galvanometer and rheostat, which proved very successful, and is now being much used in colleges and other institutions of learning as a means of instruction and experiment.

Professor Samuel D. Tillman, LL.D.

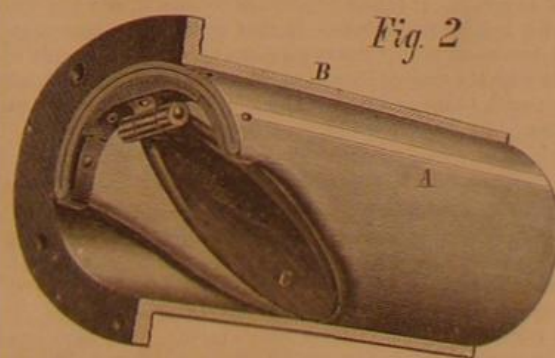
The death of Professor Tillman, which occurred on the 4th of September last, will be deplored not only by the members of the American Institute, with which society he has been identified for many years, but by scientific men throughout the country. Few men have attained so wide a knowledge of every branch of mechanical, scientific, and general learning; and few have worked more earnestly in behalf of the



JOHNSON AND NETTLETON'S DEODORIZING EXCAVATOR.

from their own gravity they move forward to the mouth of the second or outlet valve.

The inventors have exhibited to us huge stones and obstructions which it would appear must prove a stoppage to any pump, but which, they affirm, were easily drawn through.



The apparatus is now on exhibition at the American Institute Fair in this city, where it may be inspected. Patented by A. W. Johnson and U. A. Nettleton, June 15, 1875. For further information address the manufacturers, Messrs. Mathewman & Johnson, New Haven, Conn.

Joints in Carpentry.

Professor Rankine sums up the principles, which should be adhered to in designing joints and fastenings in carpentry, concisely as follows: 1. To cut the joints and arrange the fastenings so as to weaken the pieces of timber they connect as little as possible. 2. To place each abutting surface in joint as nearly as possible perpendicularly to the pressure which it has to transmit. 3. To proportion the area of each surface to the pressure which it has to bear, so that the timber may be safe against injury under the heaviest load which occurs in practice; and to form and fit every pair of such surfaces accurately, in order to distribute the stress uniformly. 4. To proportion the fastenings so that they

mechanic and the inventor, and toward the furtherance of scientific progress. Professor Tillman was a native of Utica, New York, and was born in 1803; he graduated at Union College, and subsequently studied law. About twenty years ago, he came to New York and devoted himself to scientific and literary pursuits. Becoming a member of the American Institute, he was elected corresponding secretary and also chairman of the Polytechnic Club, which positions he held at the time of his death. He edited the transactions of the Institute, published annually, and also wrote several essays, principally on musical and chemical subjects, which exhibited marked ability and originality of thought.

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THE RELATIONSHIPS OF NATIVE AMERICANS.

There has been so much wild guesswork indulged in, with regard to the origin and racial affinities of the natives of this part of the world, that any new attempt to determine who they were or where they came from is more apt to be received with derision than with over credulity. History, tradition, and archaeology have been appealed to, in turn and all together, to settle the question, but it has refused to be settled. Now the younger science of comparative philology essays the task, with, let us hope, a better promise of success.

The task is an enormous one, since all the dialects of America must first be compared with each other, then collectively with all the dialects of the old world, particularly with the little known dialects of the old world of antiquity. Unfortunately the task is too generally complicated with irrelevant questions of migration, points of original dispersion, routes, etc., questions which there can be little hope of answering save for the most recent of national origins and movements. It lies with geology—not history or philology—to tell where man originated, and when. In course of time, may be, traces of man's earliest migrations will be discovered; but for a long time, probably, the data for determining the order of his conquest of the earth must remain hidden under soil and sea. Certainly every attempt to account for the peopling of America by migrations along existing routes must be obviously absurd, since the evidences of man's presence here point to an age anterior to the geographical conditions by which those routes came into existence. Whether the new world was first settled from the old, the old from the new, or both from some continent now submerged, there is as yet no evidence for deciding. We doubt the possibility of determining absolutely the relationships even of those

comparatively modern races whose names appear in the songs and traditions of the early history.

Still, comparative philology has done much toward making out the affinities of existing races in both worlds with those that preceded them at the dawn of the historical period; and the linguistic connection between the native races of America and those of the eastern hemisphere seem to be far closer than has been supposed of late.

Señor Lopez, who has given much time to the study of the languages of South America, goes so far as to assert, in his *Races Aryennes du Pérou*, that the descendants of the Incas still speak an undeveloped Aryan tongue; and that their ancestors must have come from the same stock which furnished the great inflected languages of India and Europe, our own among them. He finds their language—the Quichua—still spoken over a large part of Ecuador, Peru, Bolivia, and the Argentine Republic—full of Aryan roots, though it remains at a pre-Aryan grammatical stage, the agglutinative. His inference is that, before the grammatical forms of Aryan speech had been developed, there had been a separation of the people speaking the yet undeveloped tongue, the portion represented by the ancient Peruvians falling—as all non-Aryan races have done—to carry on their linguistic changes to the inflected stage.

The author of the latest comparative study of the dialects of America, Robert Ellis, is quite willing to grant that the Aryans were akin to the ancient Peruvians (all languages pointing more or less clearly to a single original source), but not that they were next of kin. "The American nations, considered as a whole," he says (*Peruvia Scythica*, page 3), "and the Iberian and Turanian nations on the shores of the Pacific opposite to Peru, must, I think, stand before the Aryans in this respect." In other words the Quichua language is a highly developed representative of the American family of languages, and these as a whole are more nearly related to the Iberian and Turanian languages than to the Aryan. Indeed the Americans, the Iberians, and the Turanians are regarded by him as branches of one race—Rask's "Scythians."

Evidence of the close relationship of the Quichua language with the other dialects of America is found in their numerals. Comparing them again with the numerals of Africa, Asia, and Europe, the nearest parallels are found among the Turanians (Tungusians, Samoyeds, Turks, Chinese, Siamese, Malays, etc.), and the Iberians (Circassians, Georgians, Basques, etc.) The Aryan and Semitic parallels are more remote. "The Quichua numerals," says Mr. Ellis, "plainly connect the ancient Peruvians with the nations of the old world, their nearest kindred there appearing to be the Turanians, especially those of the yellow race."

The same is learned from a comparison of the personal pronouns of these different peoples; and similar testimony is borne by the parallels existing in American and Turanian languages between the forms of words for man, woman, head, hair, eye, nose, mouth, tongue, ear, hand, foot, bone, blood, sun, moon, star, sky, day, night, tree, stone, egg, bird, fish, ant, etc., words sure to be found in every language, however primitive, and of such common use that they are little likely to be lost or changed in course of centuries. The inference drawn from a comparison of this class of words, as found in dialects of every race and every part of the world, is that the ancestors of the Iberians, the Turanians, and the Americans were more closely united to each other, by race and speech, than either of them were to the Aryans, the Semites, or the Negroes. In other words any tribe of Indians is more directly related to the Chinese than these are to the Hindoos: more nearly related to the Basques than these are to their Spanish neighbors.

Supported as it is by much evidence drawn from the stores of archaeology, architecture, national customs, etc., this testimony of comparative philology seems worthy of a good deal of credit. If future researches sustain it, our fast-decaying Indians might boast—if they were able to appreciate the honor—of family ties of no mean order: with Etruria of old; with the mighty Empire of Genghis Khan in Marco Polo's day; with China and the rising empire of Japan in our own times.

AMATEUR ENGINEERING.

An effect of the widening use of steam machinery is that it tends to raise up a multitude of men who—trusting rather to that familiarity which breeds contempt than to the practical knowledge of the nature and properties of steam which every trustworthy engineer must have—are ever willing, if not eager, to step into the engineer's berth. They have seen an engine run, day in and day out. Perhaps they have helped occasionally to run one. At any rate, they have worked about an engine a good deal; and as the engineer does not impress them as a man of remarkable ability, they do not see why anybody cannot do as well as he. At least, they are confident that they can, and, in case of emergency, are willing to put their knowledge (or their lack of it) to a test.

When the emergency arises, employers are too apt to give such amateur engineers a chance to try their hand. The actual engineer is called off suddenly, is sick, or otherwise kept from his post. Somebody must take his place or every body must stop work. What shall be done?

Dick is handy. Not a regular engineer, to be sure, still a bright fellow who knows an engine well enough to keep it running if all goes right; and the particular engine, the engineer says, is in such good condition that it will almost run itself. So Dick is called in and the gap is filled. Some times the engineer is away longer than was anticipated; sometimes he never comes back. Dick has done well so far; he has gained some experience in caring for the engine; and if he is willing and modest in his charges—of course, he

won't expect a full fledged engineer's pay at first—his sudden promotion is likely to be a permanent one. He may turn out equal to every emergency; then, again, he may not.

It is not long since a case of the kind resulted, in our harbor, in the blowing-up of a crowded ferry boat. There was a terrible list of killed and wounded; and Dick (an illiterate negro) was returned to his proper place as deck hand or fireman. It was criminal, in the first place, to let him step out of it.

But a few weeks since an English manufactory was blown up, killing several workmen. The regular engineer was absent, sick; and the substitute, who succeeded in making such a mess with things, was one of the workmen, promoted for the occasion on the strength of his pretended ability to run an engine—ability gained from observation, apparently, since his engineering education was but the slightest, and his practice as limited as it was disastrous.

With characteristic deference to the rights of property, the coroner's jury in this case modestly suggested that, in future, the proprietors of the works would do well not to trust their boilers with any one in whose capacity they had not perfect confidence!

In a leading family paper we saw, the other day, a well written story, telling "How Tom became an Engineer." Tom was of the genus loafer: specific habitat, a country railway station. The height of his ambition was to run an engine. A commonplace lad would have gone to work in a locomotive shop, or, more modestly, would have begun by shoveling coal as fireman. Not so Tom. He was to be engineer or nothing. So he loafed about the station, watching his opportunity. His time came with a smash-up on the road, a relief train called for, and no engineer at hand. Of course Tom volunteered, was accepted, and performed his task with the *elan* of all great geniuses. Equally of course he was thereupon made master of an engine, and speedily rose to be president of as many railways as if his name had been Tom Scott.

The moral of the story is plain, and very encouraging to all boys given to loafing about railway stations. It is significant, too, of a prevalent belief that the art of managing an engine comes, like Dogberry's reading and writing—by nature. Such a belief, however covert, cannot prevail to any extent without frequent occasion for putting it into practice. With regard to the entrusting of boilers to incompetent amateurs, we have evidence for believing it far too common. The wonder is that more explosions do not occur, and the risk of serious accident from this source is likely to continue just so long as presumption and general smartness are allowed to take the place, even temporarily, of technical skill gained through patient and studious apprenticeship.

Steam is a clever giant, an obliging servant; but, like all giants, it will not stand fooling, and is obedient only when under the hand of a master.

TEASPOONFULS.

Everybody knows that cookery book recipes are rarely exact. They say what they do not mean, and do not say what they do; and in the majority of cases, leave no small amount to be interpolated or understood by the wisdom of the user. To them it is to be ascribed such standards of measure as the teaspoonful, and the teaspoonful or tablespoonful; and occasionally the exasperating pennyworth or hand-ful. So long as the cookery originators keep these standards to themselves—even if they must, in their multitudinous publications, inflict them on the unfortunate housewife—we shall not complain, because we are used to it; but is it not about time that some one's voice was lifted up in condemnation of the tablespoon and teaspoon being measures in physicians' prescriptions? Will some M.D. give us his idea of a teaspoonful? "A drachm," he will probably inform us. Then why not write drachm on the prescription? Because every one has teaspoons, and few have drachm measures, perhaps? See how absurd this is. We took occasion recently to ask a large silver ware dealer how many sizes of teaspoons were made. He could not answer us definitely, but he supposed more than a dozen. He showed us four teaspoons, of which one was fully twice the size of the other. One held fully a drachm and a half, the other perhaps two thirds of a drachm. These variations were in teaspoons known as teaspoons to the trade. When we consider that every thing smaller than a tablespoon, from a moderate sized dessert to the smallest coffee or berry spoon, is known to the average housewife as a teaspoon, the chances of still further variations are greatly increased. Again, the sizes of the spoons follow closely the prevailing fashions. At present, the style is large; fifteen years ago, it went to the other extreme. Consequently, a recipe in an old book which talks about teaspoonfuls is certainly unreliable now.

A manslaughter case came before a coroner's jury in England recently, on this very point. The prescription gave directions to give a child a teaspoonful of a drug of which a small quantity would not ordinarily be deadly. A big teaspoonful, probably half as much again as was contemplated by the prescriber, was administered, and the child died. The jury took these facts into consideration, and found a verdict accordingly, which absolved the person who followed the directions of the prescription from blame.

It is a very easy thing to abolish this arbitrary standard, since a simple and very excellent substitute is found in apothecaries marking the sides of their phials in drachms, etc., as they now do their glass measures. This might easily be done by projections on the glass, made during the shaping of the bottle. Then the patient can have the exact amount given to him in a teaspoon of any kind, shape, size, or pattern.

PROPORTIONS OF BOILERS.

A common question, among the many that are sent to us, is as follows: "What are the dimensions of a boiler suitable for an engine of a given horse power?" It is impossible to answer this question generally, from the fact that the economy of engines of different design varies so greatly. Thus, while a large engine of the most approved form may produce an indicated horse power with a consumption of 15 lbs. of steam per hour, it is not uncommon to see engines which require many times this amount. When the amount of steam required, however, is known, it is possible to give approximate figures for the dimensions of a boiler that will evaporate this amount of water, and an approximate estimate can also be made of the quantity of steam which will be required for any particular style of engine. We propose, in this article, to consider these questions in detail, and give plain rules, which will doubtless be of interest to very many of our readers. The data upon which these rules have been constructed are taken from the most reliable records at our command, and give the results of average performance; so that very good boilers will do much better than is indicated by the rules, and some few will fall below this standard. This, however, is to be expected from any general rules for cases of this nature.

A. Dimensions suitable for a boiler which is required to have a given evaporation:

(a) To ascertain the grate surface, in square feet: Divide the number of pounds of water to be evaporated per hour, from and at 212°, by 75, for cylinder boilers; by 77, for flue boilers; by 78, for tubular boilers; by 80, for locomotive and vertical boilers.

Evaporation "from and at 212°" signifies evaporation at atmospheric pressure, from feed water having a temperature of 212°. This is assumed as a convenient standard, since in practice the pressures at which evaporation takes place and the temperatures of the feed water are quite variable. Two tables are appended, by the aid of which the necessary reductions can readily be made. The second table is taken from Professor Rankine's "Treatise on the Steam Engine."

TABLE I.—PRESSURE AND TEMPERATURE OF STEAM.

Pressure by gage.	Temperature Fahrenheit.	Pressure by gage.	Temperature Fahrenheit.
0	212°	110	344°
10	239°	120	350°
20	250°	130	356°
30	257°	140	361°
40	267°	150	366°
50	274°	160	370°
60	280°	170	375°
70	287°	180	379°
80	294°	190	384°
90	301°	200	388°
100	308°		

TABLE II.—FACTORS OF EVAPORATION.

Temperature of the steam.	Temperature of the feed water.											
	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°	
212°	1.19	1.17	1.15	1.13	1.11	1.10	1.08	1.06	1.04	1.02	1.00	
230°	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	1.00	
248°	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	1.00	
266°	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	1.01	
284°	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	1.01	
302°	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	
320°	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	
338°	1.23	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	
356°	1.23	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	
374°	1.24	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	
392°	1.24	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	
410°	1.25	1.23	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	

The following examples will illustrate the use of these tables:

If a boiler evaporates 8½ lbs. of water per lb. of coal, the steam pressure being 150 lbs., and the temperature of the fuel water 120°, what is the equivalent evaporation from and at 212°? The temperature of the steam is 366°. According to table II., the factor of evaporation is about 1.15 (using the temperature of steam and feed water in the table, nearest to those given in the example). Hence the evaporation at and from 212° is 1.15 times 8½, or about 9½ lbs. of water per lb. of coal.

Suppose that a cylinder boiler is to be proportioned for an evaporation of 500 lbs. of water per hour, at a pressure of 75 lbs., the temperature of the feed water being 80°. The equivalent evaporation will be 1.17 times 500, or 585 lbs., and the grate surface 585 divided by 75, or 7½ square feet.

(b) To ascertain the heating surface in square feet: Multiply the grate surface by 11, for cylinder boilers; by 17, for flue boilers; by 30, for tubular, locomotive, and vertical boilers.

(c) To ascertain the cross section of flues or tubes in square feet: Multiply the grate surface by 0.134. This is an average value for good practice, and it can be varied between the limits of 0.125 and 0.143, as may be most convenient.

(d) To ascertain the length of boiler: Cylinder boilers should be from 10 to 12 times the diameter; flue boilers, from 5 to 6 times the diameter; tubular boilers, and shells of locomotive and vertical boilers, from 3 to 3½ times the diameter.

There is very great variation from these figures in practice; but the numbers given above represent the most general limits, so far as they can conveniently be classified. There are some other proportions which are of interest, such as area over bridge wall, and size of chimney. These may be given in a future article treating of the setting of boilers.

B. To ascertain the quantity of water that must be evaporated to supply an engine of a given horse power:

[In determining this quantity, the computations are made for small engines, such as were considered in the article on "The Power of Small Engines," page 33 of our current

volume; and in the use of the term "horse power," the effective power that can be exerted to produce useful work, and from which the power required to overcome the friction of the engine has been deducted, is to be understood.]

Multiply the number expressing the horse power of the given engine by the amount of water required per hour for one horse power, as given in the accompanying table:

Pressure of steam in boiler by gage.	Pounds of water per effective horse power per hour.	Pressure of steam in boiler by gage.	Pounds of water per effective horse power per hour.
10	118	60	75
15	111	70	71
20	105	80	68
25	100	90	65
30	93	100	63
40	84	120	61
50	79	150	58

The following example calls for the application of all the foregoing rules:

What are the dimensions of a tubular boiler for an engine that is to develop 4½ horse power, with a steam pressure of 100 lbs., the temperature of the feed water being 160°?

The equivalent evaporation required per horse power per hour is 1.1 times 63, or 69½ lbs. The total equivalent evaporation is 4½ times 69½, or about 312 lbs. Hence the grate surface, being the quotient arising from dividing 312 by 78, is 4 square feet. The heating surface is 30 times 4, or 120 square feet.

The cross section of the tubes should be about 0.536 square foot (4 times 0.134), or it should vary between the limits of 0.5 (4 times 0.125) and 0.572 (4 times 0.143) square foot.

SUSPENDED ANIMATION AS A PRESERVING AGENT.

Among the many experiments which have been made in order to discover some way of preserving fresh meat for an indefinite period of time, none have as yet been conducted, so far as we are aware, with the object of finding out how to keep the flesh other than in a dead state, to preserve, in other words, the living animal itself. A rather anomalous suggestion, the reader may say to himself, for will not the mere presence of life answer that end? Certainly, we reply, if the animal be fed and cared for, and that is not the question. The problem we set out with is: How can we box up an ox, for example, in the narrowest space, strike him into the hold of a vessel, pile other boxes of oxen on top of him like bales of goods, nail down the hatches, and transport our bovine cargo for a hundred days' voyage, and at the expiration of that time take out our animals, kill them, and proceed to eat them up?

In all original investigations, there is but one source for answers to our questions, and that is Mother Nature. What hints, then, will that venerable dame accord, which seem to bear on our subject, and through which at sometime perhaps a clue may be found leading to a solution? Three: first, the power which some animals have of rendering their natural prey utterly insensible for an indefinite period; second, the peculiar effect of cold on some of the lower animals, which reduces them to a state not death, nor yet the ordinary torpidity caused by low temperature in other organisms; third, hibernation. We propose to consider, briefly, each in turn.

There abounds in this country a peculiar species of wasp known as the "digger." The male insect does no work, but the female does the double duty of bearing offspring and providing for its wants. She begins by boring a hole in a clay bank, in order to form a nest, and then sets out on a hunt for the peculiar spider or other insect which forms her natural prey. Pouncing upon her victim, she pricks it very gently with her formidable sting. No sooner is the wound made than the assailed insect falls paralyzed; even the great tarantula succumbs as quickly as the tiniest spider. Seizing the apparently inanimate body, the digger flies off to her nest, therein deposits it, and, renewing her hunt, captures victim after victim, until a sufficient supply is secured to feed one of her larvae to maturity. Then she deposits her egg among the bodies, seals up the nest, sets to work on a new hole and a new hunt, and thus she continues until her stock of eggs is exhausted. In course of time the larvae, soft white maggots, appear; but before they are ready to form cocoons, several weeks must elapse, during which time their nourishment must be fresh meat. It has doubtless already been divined how beautifully Nature provides for this want, for were the captured insects shut up in the nest dead, they would speedily putrefy and be unfit for their purpose. Kept alive, however, though inert and senseless, they remain in natural condition indefinitely, or until eaten by the maggot; and this is the effect of the digger's sting. The wasp administers a hypodermic injection of something—some virus, perhaps, which paralyzes the brain and its sensory ganglia, while the spinal system remains awake. Nature suggests to us a definite question to be put to her, through the chemist and physiologist, namely: What substance, injected hypodermically into the veins of an ox or sheep will reduce the animal to the state of the digger's prey? What will produce complete anesthesia, to last as long as we choose, without causing death or injury?

To pass to the second hint: Dr. Grusselbake, Professor of Chemistry in the University of Upsala, Sweden, has succeeded, we are told by a foreign scientific contemporary, in so treating a little serpent, by cold, that the reptile, to all appearances, becomes dead, and as stiff and as rigid as stone. By rubbing it, however, with some stimulating substance, the reptile revives and becomes as lively as when captured over ten years ago. Now, this is not the effect of hibernation, for, as will be seen below, there is an entire absence of irritability—nor yet is it identical with the tor-

pidity produced by cold. It is a state difficult to explain, and is the same as that of several species of fish which, if completely congealed, die; but yet, when frozen stiff, possess sufficient vital action in the circulatory organs to ensure their revivification when thawed in warm water. What the condition is remains to be seen; and such an examination would lead us to the thought of whether there is not a point at which the higher animals may be brought to the same state. If there is, then can it be attained by the skillful use of chemical freezing mixtures in lieu of ice? Or, if an ox cannot thus be reduced, can he be rendered actually torpid by cold?

Lastly, we have to deal with the phenomenon of hibernation, or that peculiar lethargy into which certain animals fall, principally during winter. During this period no nutriment is required; the blood-making processes cease; respiration is very nearly or entirely suspended; the heart beats regularly, but the circulation is very slow; the blood, from the absence of respiration, is entirely venous. The muscular irritability of the left ventricle, highly increased, however, permits it to contract under the weak stimulus of the non-oxygenated blood; and it is this exaltation of a single vital property which preserves the animal life. Sensation and volition are quiescent. Respiration is, however, quickly excited by irritating the animal, and the call of hunger and the warmth of returning warm weather will cause a cessation of the lethargy. Hibernation is, however, not due to cold, since the tenrec, a nocturnal insectivorous mammal, passes three of the hottest months in the year in that condition; and the hedgehog, the dormouse, and the bat hibernate regularly every twenty-four hours. The influence of cold is due only to its tendency to produce sleep, to which state of the body hibernation is closely allied, differing only in degree. Most animals lay up a store of fat under the skin, which is slowly absorbed during the lethargy.

Whether it is open to discovery to find a way of making brutes hibernate, when that state is not peculiar to them, is a question difficult to consider in view of the little that is known regarding the trance condition in any organized being. It is a wise law of Nature which provides for the animal in seasons when its food is hard to obtain, or is absent altogether; and it is perhaps akin to that merciful interposition of insensibility which relieves the human being at instants of acute suffering.

Perhaps, some day, some one will find solutions to the questions suggested above. Perhaps we shall transport not merely living brutes, but living men. Imagine a military transport ship, with the soldiers stored in tiers with the beef and pork barrels. Perhaps Poe's sarcastic prediction, that the time will come when, sick of the turmoils and troubles of life in the nineteenth century, we will step across the street to our physician, and have our animation suspended, say for a hundred years or so, waking up in a new era, will, at some future period, be realized. There was a story once of an ancient German being found frozen in the snows of the arctic regions; and, on being thawed, his life returned. Another apocryphal yarn engendered the item in the papers that a live mastodon, preserved in the ice of Siberia since primeval days, had melted out and was roaming the wilderness of that country. Will these be realized? Edmond About's desiccated man with the broken ear, and Poe's revived mummy, are fancies absurd enough; but if we ever succeed in suspending sensation and volition at will in the animals next below us in the scale of creation, it is but a step to extend the same operation to ourselves.

SCIENTIFIC AND PRACTICAL INFORMATION.

BEES IN THE UNITED STATES.

The California *Agriculturist* says: There are two million bee hives in the United States. Every hive yields, on an average, a little over twenty-two pounds of honey. The average price at which honey is sold is twenty-five cents a pound; so that, after paying their own board, the bees present us with a revenue of \$8,000,000. To reckon in another way, they make a clear gift of over a pound of pure honey to every man, woman, and child in the vast domain of the United States. Over twenty-three and one third million pounds of wax are made and given to us by these industrious workers. The keeping of bees is one of the most profitable investments that our people can make of their money. The profits arising on the sale of surplus honey average from fifty to two hundred per cent on the capital invested.

CEMENT FOR TEETH.

A recipe for a new kind of cement for plugging hollow teeth is published by Ostermeier, as follows: 7 parts burnt lime and 16 parts glacial phosphoric acid are mixed together and pressed into the cavity, which has already been carefully dried.

A PHOTOGRAPHIC DIAGNOSIS.

Dr. Ullmann, teacher at the University of Vienna, lately read a paper before the Medical Society of Lower Austria, on the "Use of Photography in Medical Studies." He mentioned, on the authority of Dr. Vogel, that an eruption of small pox had been made evident by photography twenty-four hours before it actually came out. Although no one could as yet observe anything on the skin of the patient, the negative plates showed stains on the face which perfectly resembled the variolous exanthem, and twenty-four hours afterward the eruption became clearly evident.

THE California orange crop of last season, received at San Francisco, was the largest ever produced in the State and amounted to 5,280,000, principally grown in Los Angeles county. The annual requirements of the San Francisco market are over 10,000,000, of which 5,000,000 are imported from Tahiti and Mexico.

UNIVERSAL FIELD INSTRUMENT.

The instrument illustrated in our engravings, designed by Mr. R. Jahn, and manufactured by Messrs. Smith and Hansch, of Berlin, Germany, is intended for the solution of all problems on the field in surveying and leveling; horizontal and vertical points being fixed at one observation, and recorded on any desired scale, upon an index plate. In addition to the instrument itself, shown in Figs. 2 and 3, a plane table and signal staff are necessary. Two marks, z and y , are placed on the staff, the distance apart depending upon the scale to which the indications on the instrument are to be made.

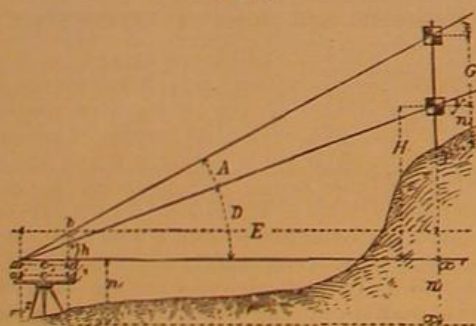
The construction is based on the two following equations: $C : c = E : e$, and $H : h = E : e$.

The values of these letters will be understood by reference to Fig. 1. In this figure, a' represents the indications on the plane table of a point, a ; x is the horizontal projection of a point, y , the position of which is the distance, H , above x' ; e is a length in the instrument itself; C the distance between z and y on the staff, as already mentioned. A specialty in the instrument is that the vertical portion, shown in Fig. 1 by $i b$, is, when the instrument is adjusted for the points, z and y , always parallel to that line, therefore an extension, d , of $i b$, corresponds to x' in the extension of $z h$. The height, H , represented in the instrument by h , can either be read from a scale or measured off.

To adjust the instrument it must first be set horizontally on the plane table by means of the screws, A and B (Fig. 2), the levels, E and E', being used for this purpose, the small screw, A, carrying a point at the end, being run out until the point at the end enters the table, and round this the instrument can be turned. The vertical frame, S S, is then shifted to the end of the bar, X, and until the small slide, e , is out of contact with the inner surface of F and K. The slide, V, carries upon it, connected by a small lever, K, the constant length piece, c , of the instrument, and which is formed of a steel plate.

If P, Fig. 1, represents the point of which the horizontal and vertical positions are to be ascertained, the staff is placed vertically over this point. The screw, G, Fig. 2, is then turned until the guides, F and K, are quite closed, that is, until the steel edges, with which the guides are provided, are in contact. The telescope is mounted on F in such a manner that its optical axis is parallel to the steel edge. By manipulating the coarse and fine adjustment screws, N and N', the bars, F and K, and with them the telescope, are raised until the cross wires coincide with the point, y , in which case the steel straight edge forms the upper side, $a i$, of the angle, D, and the base of angle, A, Fig. 1. Before and after each observation, the horizontality of the instrument should be verified by the spirit levels. By means of the screw, G, the telescope is set to the point, z , and in this position the steel straight edge and the optical axis coincide with the upper side of the angle, A, Fig. 1, while the straight, K, has retained its former position. By these operations the angles, D and A, are measured

Fig. 1



The frame, S S, is then run back, until the small steel plate, i , and the lever, R (which is always kept against it by means of a light spring, as shown in Fig. 3), come in contact with the straight edges. Care must be taken, in order to secure accurate results, that the pieces, i and R, only touch the steel edges, but are not pressed against them. When in this position the frame, S S, is clamped to the guide bar, x , by means of the set screw, V. On reference to Fig. 3, it will be seen that the lever, R, is extended in front of the frame, S S, and a similar extension forms a part of the slide, V, and the ends of both these pieces have a line marked across them horizontally. When fixed, as before mentioned, a fine adjustment for the frame, S S, can be made by means of a micrometer, U, and by this adjustment the lines on the ends of the pieces, R and V, can be brought into coincidence. Then the upper edge of X r will represent the position of the point, b , Fig. 1, and the lower edge of i , that of point, i , in Fig. 1, corresponding to the points, z and y . The instrument may now be checked for its horizontal adjustment; and if this be found correct, the head, P, of the spring pointer may be depressed, and will make a mark on the paper upon the plane table. The height of the point, y , is found by means of the vernier, t , on the vertical scale of S S, Fig. 3. In ascertaining the height of a point, two cases may be considered: either the height above a given datum line has to be ascertained, or the height of a point above the common horizon has to be found

In the first case it is only necessary to read the height upon the scale after each observation. To illustrate the second we will take an example. Let the height of the fixed point be 386.75 feet; the scale on the instrument has to be adjusted as follows: The staff has to be placed over the fixed point

responding with the figures 6.75. By this adjustment the instrument is set to the required scale, and heights of points recorded are read off without any calculation. The figure 3 (of the quantity 386.75) is added to the readings so long as the heights exceed 300 feet.

In ascertaining the differences in height between two stations, it is necessary to ascertain the height of the horizon of the instrument on the scale, Y. To do this, the steel edges of F and K are brought into contact, and these edges are adjusted horizontally by means of the spirit levels on the telescope, Fig. 2. The steel edge, F, is then lifted, and the scales on the frame, S S, are used as already explained; and when i is in contact with the steel edge, K, the reading on the scale gives the horizon of the axis of the instrument. In measuring differences of height with reference to a point already given, the situation plan is attached to the plane table, and the instrument is placed on the plan in such a manner that the point, d , is exactly over the given point, a . The telescope is then set to any point of the staff, say to y , the frame, S S, is shifted with its point, P, over the corresponding point on the plan, the slide, V, with the piece, i , is set in contact with the steel edge, K, and the height can then be read off the scale, Y Y.

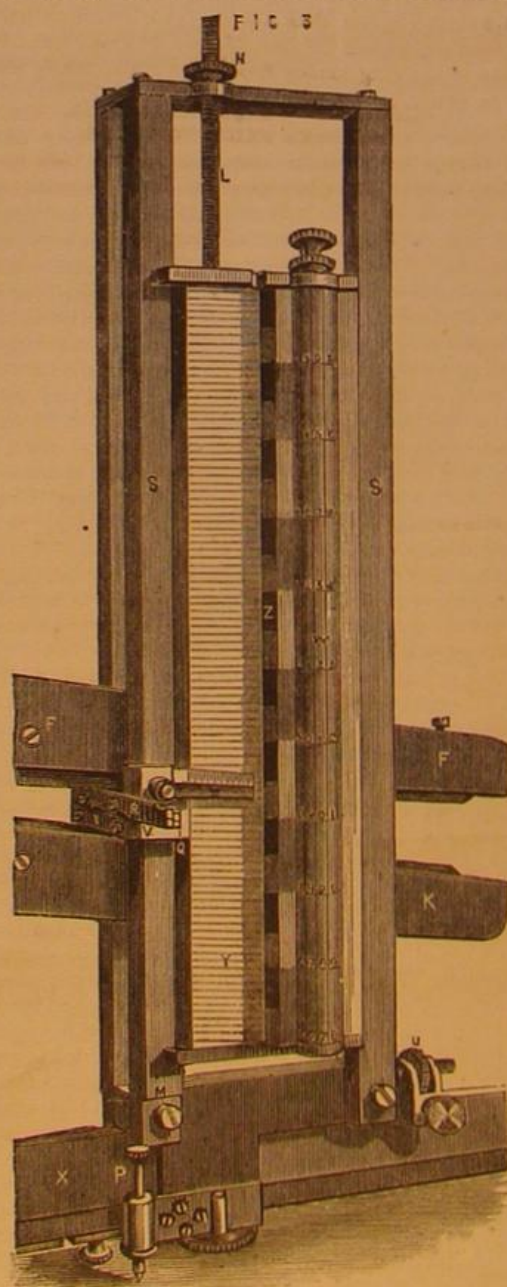
Special advantages are claimed for this instrument in preparing geological surveys, as by the same observation heights and distances can be recorded; and when a sufficient number of these have been laid down, strata lines can be plotted upon the field. For making transverse sections, it also affords special facilities, as the vertical heights, $y' y''$, are indicated on the table in horizontal distances corresponding to the real distances, thus avoiding the necessity of readings from the scale. The heights can afterwards be measured and written upon their respective lines.

If employed as an ordinary leveling instrument, no plane table is necessary, and it may be screwed upon a tripod and adjusted in the ordinary manner. The arrangement is such as has been already described, that any desired

JAHN'S UNIVERSAL SURVEYING INSTRUMENT.—Fig. 2

scales can be employed, the conditions regulating the employment of these scales being as follows: 1, the distance apart of the marks on the staff, and 2, the distance between the upper edge of the lever, V, and the bottom edge of the plate, i , when R is in such a position that the mark in front lines with the fixed mark on the slide, V. In the ratio $e : E = c : C$ the various parts may be adjusted to suit different conditions; but it is advisable, to insure accuracy, to keep C as large as possible, because the greater the angle of sight, the more certainty there is of accurate measurement. The most commonly used scales are supplied with the instrument, and the subjoined table gives the corresponding distances between the marks on the staff:

on the ground, and the situation of this point is recorded by the instrument as described, and marked on the paper by P, the frame, S S, being fixed to the guide bar, X. The scales shown in Fig. 3 are then shifted by means of the screw, L,



until, by using the scale, Z (for fifths and tenths), the reading 6.75 appears. The revolving scale, W, is then turned until the figure 8 appears adjacent to the scale, z , and coinciding with the bottom line of the division on the scale cor-

scales can be employed, the conditions regulating the employment of these scales being as follows: 1, the distance apart of the marks on the staff, and 2, the distance between the upper edge of the lever, V, and the bottom edge of the plate, i , when R is in such a position that the mark in front lines with the fixed mark on the slide, V. In the ratio $e : E = c : C$ the various parts may be adjusted to suit different conditions; but it is advisable, to insure accuracy, to keep C as large as possible, because the greater the angle of sight, the more certainty there is of accurate measurement. The most commonly used scales are supplied with the instrument, and the subjoined table gives the corresponding distances between the marks on the staff:

Scale.	Length of Constant c in millimeters (millimeter = 0.39 inch).	Distance apart of Signal Marks on Staff in meters (meter = 39.3 inches).
1: 200	15	3
1: 200	25	5
1: 500	10	5
1: 500	5	2.5
1: 1000	5	5
1: 2000	2.5	5

In changing the scales, all parts already described, which are connected with the slide, V, must be changed, and a new scale inserted in the frame, S S.

Both of the signal marks on the staff are adjustable, and are kept in the desired position by means of set screws. The degree of accuracy obtained with this instrument is stated to be quite sufficient for all practical purposes; and if the observer works with care, remarkable precision is obtained. The greatest source of error is caused by wear of the piece, c ; but this can be corrected by making allowance for the same in the distance between the marks on the staff.

Wind Instruments.

Dr. Burg, a French physician, has published a little book in which he endeavors to controvert, by reference to his own observations and personal experience, the notion commonly entertained that the use of wind instruments is injurious to individuals characterized by pectoral weakness. He remarks: "Many philanthropists, on seeing our young military musicians wield enormous wind instruments, have sorrowed over the few years the poor fellows have to live. Well, they are mistaken. All the men whose business it is to try the wind instruments made at the various factories before sending them off for sale are, without exception, free from pulmonary affections. I have known many who on entering on this calling were very delicate, and who, nevertheless, though their duty obliged them to blow for hours together, enjoyed perfect health after a certain time. I am myself an instance of this. My mother died of consumption, eight children of hers fell victims to the same disease, and only three of us survive—and we all three play wind instruments. The day is not far distant, perhaps, when physicians will have recourse to our dreaded art in order to conquer pulmonary diseases."

BATS are said to be inveterate enemies to mosquitoes. A gentleman in New Albany, Ind., it is said, keeps a bat in his bedroom during the season, to protect him from these pests

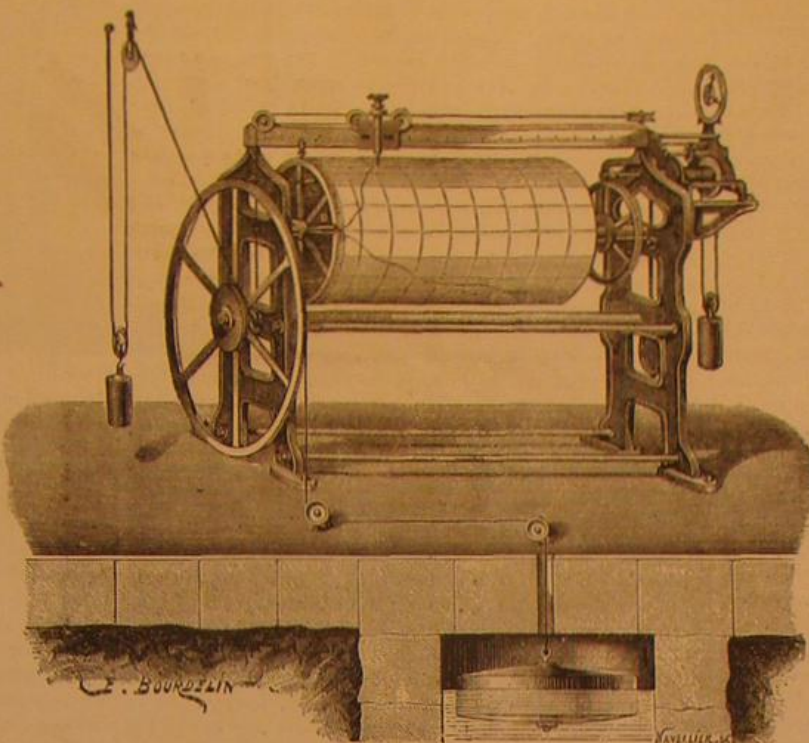
NEW TIDE AND RIVER GAGES.

The study of the variations of level of the ocean, and also of the rises and falls of rivers, canals, and streams, is an important adjunct of meteorological science, and is constantly followed in all countries in which regular observations of the weather and like natural phenomena have been established. We represent in the annexed engravings, for which we are indebted to *La Nature*, two new registering devices, one termed the maregraph, designed for tide measurements, the other the fluviograph, intended for similar examination of river and canal levels.

The maregraph (Fig. 1) is operated by an endless cord which connects with a float located in a suitable reservoir, into which the sea water enters. The changes of level of the water are registered on a large horizontal cylinder which is rotated by clock mechanism once in 24 hours. The cylinder is covered with a sheet of paper, changed fortnightly or monthly, and which is divided into longitudinal divisions, giving, on a reduced scale, the heights of the tides in meters and centimeters. A carriage, mounted on rollers upon a steel rule above the cylinder, carries a pencil, which is pressed against the paper by a spring. The carriage communicates by an endless cord with a small grooved wheel mounted on the shaft of the larger wheel which receives the motion of the float previously referred to.

On a third wheel, of medium diameter, is wound a cord, which is drawn by a weight in an opposite direction to that of the cord of the float. When, therefore, the float rises, the effect of the weight is to remove the shaft so as to take up the slack of the cord so that the latter is always kept taut. The pencil carriage is similarly actuated, and traces on the cylinder a mark of which the extremity is the maximum height of the water. If the level is constant, the carriage remains motionless, and the pencil traces on the cylinder a line parallel to the transverse divisions.

per, and to indicate the moment at which the apparatus should be started on its daily motion. An electric indicator serves to give warning of any desired level being reached by the water. The indicator is movable, and is set on a special rod on the rule at the point corresponding to the height of water to be denoted. When the carriage, on reaching that



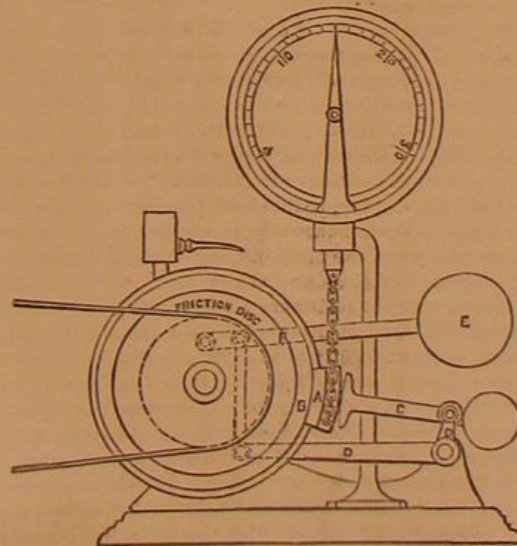
THE MAREGRAPH.—Fig. 1.

point, comes in contact with the indicator, the effect is to sound a bell.

The fluviograph (Fig. 2) is more compact in form than the instrument just described, owing to the cylinder being placed horizontally. By mechanism very similar to that of the maregraph, it registers, on marked paper, variations of level of the water, which, on a canal, may be used to indicate the passages of boats through locks. It also has an electric attachment for indicating certain levels, and also may be used as a watchman's time detector, by locking the door of the case and causing the watchman to press a button which makes a mark on the paper on certain divisions corresponding to the hours shown by the clock above. This apparatus has been successfully tested. It doubtless would prove valuable as a means of showing coming floods, and giving timely warning of the same.

IMPROVED FRICTION METER.

A friction meter and oil tester has recently been invented by Mr. Napier. This is a very delicate and accurate instru-



ment for ascertaining the lubricating properties of any material. The illustration above shows the general arrangement of these machines. The block, A, is pressed against the periphery of the wheel by an arm, C, which is a segment of a roller, balanced and pivoted on the short arm of the bell crank, D D, the long end of which is connected by a link to the lever, F, which has a weight, E, on the outer end of it; and a chain connects the friction block, A, to a spring balance. The wheel is to be made to turn to the right at any desired velocity of circumference, by means of a band from a lathe or otherwise, when the friction of the wheel on the friction block will tend to carry the latter along with the former; but it is prevented from doing so by the chain to the spring balance, which indicates the amount of the tendency of the block to move along the wheel, or, in other words, the total amount of friction on the rubbing surface.

In the best work, slates are secured by copper nails. Iron nails dipped in boiled oil to prevent their corroding may be used. The nails should have large heads, thin and flat, so that they may not prevent the slates from lying close. Every slate should be secured with two nails; and in fastening, care should be taken not to bend or strain the slates, or they will crack and fly under sudden changes of temperature.

CAPTAIN WEBB'S GREAT SWIMMING FEAT.

We have already chronicled Captain Webb's second attempt to swim across the British Channel, which was successful, being probably the greatest feat ever accomplished by a swimmer; and we publish herewith a portrait of the hero, and a chart showing the course of both attempts. The following facts are taken from *The Field*:

On the first occasion, when Webb left the water (see chart), he had been swimming 6 hours, 38 minutes, and 30 seconds, and had gone over 13½ miles of ground, and had been carried 9½ miles to the eastward of his course by the N. E. stream. On his successful voyage, he started 3½ hours before high water, which gave him 1½ hours of the S. W. stream, wherein he made 1½ miles of westing; 5½ hours N. E. stream caused him to make 8½ miles easting; 7½ hours S. W. stream took him 2½ miles to the westward of his course, and 7 hours N. E. stream drifted him 7½ miles to the eastward. It will thus be seen that he occupied three tides, in addition to 1½ hours S. W. stream at starting, and about 4 hour slack water at the finish under Calais pier, which protected him from the S. W. stream, then just beginning to ebb. His point of landing was 21½ miles distant, and the length of ground swum over was 39½ miles. Boyton, in his successful trip, paddled over about 29 miles of ground in 1 hour 33 minutes longer than Webb took to swim 10 miles further. As a performance of pluck and endurance, Boyton's is completely put in the shade by Webb's, though, on the score of utility, both may be placed on a par, as Boyton's suits are too expensive and require too much stowage room to come into general use, while swimmers of Webb's physique and courage will

never be rare ones. Boyton took repeated rests on the occasion of his first attempt, although only 15 hours in the water, while Webb hardly rested at all, in fact never for more than a minute or two at a time, and that only while treading water to take refreshment.



CAPTAIN MATTHEW WEBB.

Captain Webb is eminently a salt water swimmer. He progressed with a slow and steady breast stroke, on an average of twenty to the minute throughout, which would make him take about twenty-six thousand strokes during the 21½ hours. He possesses marvelous power in the legs and loins, while at the end of each stroke the soles of his feet emerge out of water. In fact, he altogether swims very high in the water, and his style would delight an Eton swimming master. The most extraordinary part of the feat is that the swimmer never complained of want of blood circulation

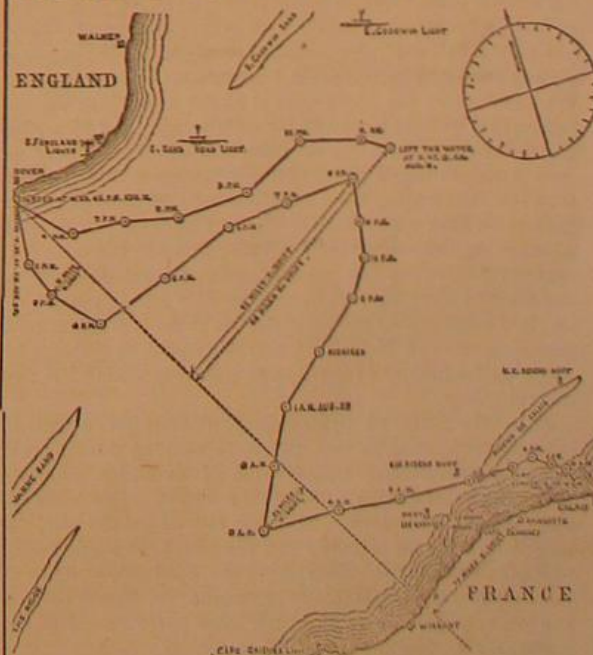
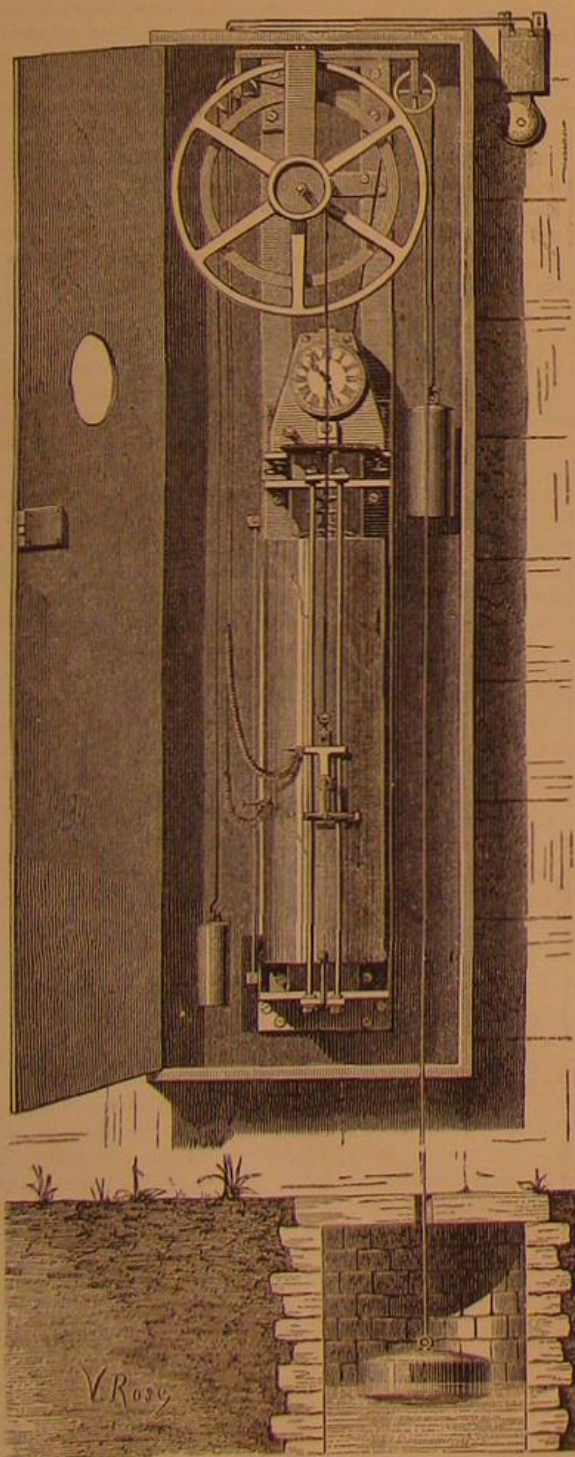


CHART OF CAPTAIN WEBB'S COURSE.

even at the last, after 21 hours immersion, but only of drowsiness from want of sleep and fatigue from prolonged ex-



THE FLUVIOGRAPH.—Fig. 2.

A dial placed above the mechanism shows the hour, and at the same time serves to regulate the changing of the pa-

erion. As regards immunity from cold, we think the well-rubbed-in porpoise oil was not without good effect, as the sailors who helped him into the carriage on Calais Sands described him as feeling like a lump of cold tallow, and they themselves got lubricated with the remains of the oil. Whether his heart and physique are in any way specially adapted to stand such long immersions can only be ascertained by medical examination.

Matthew Webb was born at Irongate, Shropshire, England, on January 19, 1848, and was therefore just over twenty-seven years and seven months of age when he started. He is 5 feet 8 inches high, measures 43 inches round the chest, and weighs about 203 lbs. He learnt to swim at seven years of age. In 1870 he dived under a ship—whereon he was rated—in the Suez Canal, and cleared a foul hawser. On April 23, 1873, when serving on board the Cunard steamer *Russia*, he leapt overboard to save the life of a hand who had fallen from aloft while the watch was taking in second reef in topsails, the ship being then running free under all press of steam and canvas. Of course it was a long time before she could be brought head to wind and a boat lowered. However, Webb was saved with difficulty, after having been upwards of half an hour in the water, although he failed to rescue his shipmate, who was probably stunned, and sank at once. A subscription of \$500 was collected for him on board, and he received three medals. When he first went to Dover to train for the present event, he successfully swam out to the N. E. Varne Buoy—more than half way across—by way of a feeler. The only things he suffered from, after his recent great feat, were an excoriated neck from constantly turning his head to protect a weak eye from the waves, and inflamed eyes from the salt.

In his training Captain Webb wisely took long and steady exercise in preference to sharp work. Being naturally a quiet and moderate liver, this came more easily to him, and very long walks, alternated with a three or four hours' swim, were the chief order of the day. In fact, when he dived, he was anything but a highly trained athlete in the usual acceptance of the term.

Correspondence.

What is the Electric Force?

To the Editor of the Scientific American:

In continuing the explanation of my views on this subject, commenced by me on page 196 of your current volume, allow me to say:

In the point of sound force, we have accurately determined the number of vibrations of matter per second necessary to the production of a certain sound; in that of light force, we have approximately estimated the number of vibrations, waves, or molecular motions per second necessary to the production of the various colors. In the point of heat force, we have determined that it exists in a certain violent molecular motion; and in the point of electric force, we have determined that it also exists in a certain molecular motion. And I may here mention, as being one of the strongest proofs, the fact that a current transmitted through a bar of iron will not disturb it, the fact that a current transmitted around it will not disturb it, and the fact that a current transmitted simultaneously through it and around it will cause it to twist in a very appreciable degree, which would not be the case unless the electric force consisted of molecular motion. If we were in possession of no other proof that the idea of a fluid flowing through an electric wire is a myth, we might easily be assured of it by the fact that molecular motion alone is the necessary condition of all other forces. This motion, beyond doubt, varies in intensity and form in different forces, but that it is the one condition of force there can be no doubt; and that the only difference between the forces is the difference between molecular actions may be accepted as a truism. To my mind the force of attraction of gravitation, and perhaps the more remarkable orbital motions of the planets, are forces to which the electric force bears no comparison. The electric force, in fact, is no more mysterious than is any other force. When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion, transmitting that signal as though he were transmitting it by applying a battery to a telegraph wire and thus setting the atomic particles in motion? Cannot one realize that, if there are bells at different places upon a long wire, the nearest bell will ring first and the most distant last? But no one would speak of a subtle fluid as the cause of the ringing, although there is just as much subtle fluid passing over the bell wire as there is when a telegraph operator in New York makes a signal in Chicago by applying the battery to the line of wire connecting the two distant places.

As in this force, so in electricity, nothing flows through the wire. There is, in fact, the most striking analogy between the molecular transmission of electricity and the molecular transmission of all other forces. The stronger and more rigid the lever, the larger and firmer the belt, the larger the tube for water or air, the better the transmission of the forces applied. The larger the conducting wire, the more perfect the transmission of the electric force; because the larger conductor we have, the more perfect must be the molecular motion.

We are now brought to consideration of one of the most important facts bearing upon the question of molecular motion and the theory of a subtle fluid. The force of the electric current is as the square of the distance or length of the

conductor. A battery is a constant generator of electric force. These are our premises, and it is not difficult to understand that if, as according to the subtle fluid theory, a wire have a certain capacity to hold that fluid, just as a tube has a certain capacity to hold a liquid, it cannot matter what the length of the wire may be. It is well known, also, that the resistance of a wire varies as the square of the diametric amount of metal. Therefore, in considering the electric force as a fluid, we are bound to consider the wire as a reservoir for that fluid. Now an immense quantity of electricity passes over a very small wire in a certain period of time; and a wire $\frac{1}{4}$ of an inch in diameter, the battery being of proper dimensions, will charge a condenser up to a certain point in one half the time that a wire of less diameter, composed of $\frac{1}{4}$ the diametric amount of metal will charge it, and in one fourth the time that a wire composed of one fourth the diametric amount of metal will charge it; but the smallest wire will charge it to its full capacity as well as the longest wire, merely requiring more time in proportion. Therefore, if a battery be attached to a wire 100 miles in length, the subtle fluid theory would, as soon as the battery should have sufficiently charged the wire, make it necessary that the strength of the electric force in the 100 miles of wire should be as great as though the wire were but a mile, or a few feet, even, in length. This statement cannot be controverted.

Very far from this, however, is the case. We may have our battery upon the wire for any length of time, and we shall find that the force of the electric current still varies as the square of the length of the wire. This, alone, utterly disproves the theory that, in transmitting a signal by telegraph, the wire is charged by a subtle fluid, and proves beyond doubt that the action of the battery is to impart a certain force to the atomic particles of the conductor, which act, each in turn, upon the next and the next, losing force in each successive action, just as we behold every day in the operation of all the forces surrounding us, as, for instance, the ripples occasioned by the dropping of a pebble into a still pond, widening and widening and decreasing in force and intensity as the square of the distance. In the molecular action, there must be a loss of force every time one atomic particle imparts the electric force to another. This we know is the case. According to the subtle fluid theory, this could not be the case.

Again, if we can prove, as in the case of light, that one transparent substance will transmit certain rays of light and not others, we prove that the transmission of the light force is due to molecular action, that the light force itself, in fact, is a certain molecular action. This will be conceded; and I suppose I need not at this point endeavor to prove that such is the case, as the facts have been set forth by students in this line of science, among them Professor Tyndall, in far weightier terms than I am able to command. The one and only deduction to be made from the results attained is that certain atomic conditions are necessary to the transmission of certain forces, and that certain substances are incapable of assuming the atomic conditions necessary to the transmission of certain forces. The same general law holds good in respect of the electric force.

Without entering into all details of the subject, it may be asserted that the very fact that one metal is a better conductor of electricity than another proves conclusively that the propagation of the electric force is dependent upon the atomic structure of the metals; that as its propagation is dependent upon this atomic structure, the propagation of the electric force is by the atomic or molecular action of the metals; and that as this is true, so the electric force is a certain molecular action. The conductivity of the metals is expressed by their resistance, the metal offering the least resistance to the propagation of the electric force being the best conductor. Thus with the resistance of silver expressed as 107, the resistance of quicksilver is 5,550, the latter metal, which is almost without tenuity of the atomic particles, being the poorer conductor, as would inevitably be the case under the molecular theory, and so would not be the case upon any other hypothesis. There are other causes, however, for the difference in the conductivity of different metals. Heat, we know, is a violent molecular motion. The electric force, being or consisting of a certain molecular action, should therefore be disturbed by the molecular action which constitutes heat; and we find that the resistance of a metal to the propagation of the electric force is increased by increase of temperature in the metal. The violence of the molecular action which is the electric force must be apparent to any one who witnesses the wonderful deflagrating effects of that force. Intense, we know, is the molecular action which constitutes heat; and it is a remarkable fact, as pointed out by Forbes, that the order of the metals as regards their conductivity for heat is the same as their order in conductivity of the electric force.

I will conclude the present article with one more argument in proof of the assertion that electricity is nothing more nor less than a certain condition of the atomic particles of matter.

The majority of the readers of the *SCIENTIFIC AMERICAN* have doubtless witnessed the discharge of electricity from a condenser, such as a Leyden jar, or from a battery or induction coil. They have beheld the brilliant sparks, and very many are cognizant of the fact that every spark is a particle of the metal of the discharging point heated to the state necessary to the production of the light witnessed. The electric light is not something which has passed over or through the wire, or something partaking of the nature of many metals which may compose the wire, but it is confined in kind to the properties of the metal composing the

discharging point. Thus of platinum, silver, iron, copper, &c.] which the discharging points may be composed, each gives its own peculiar light, no matter of what metal the greater length of the conducting wire may be composed; as, for instance, we may transmit the electric force through a hundred miles of copper or iron wire, and finally, when we get the discharge, it passes through a film of platinum $\frac{1}{10000}$ of an inch in thickness; but we get the same result in the kind of light produced as though the whole of the wire were platinum. Yet the electric force is the same no matter of what the conductor may be composed; and no reasoning can account for the projection of a flaming atom of matter from the discharging points, oftentimes with force sufficient to penetrate a piece of glass several inches in thickness, beyond the theory of intense molecular action.

The simple fact that the electric light which we witness is composed of the atomic particles of the conductor, heated to the state in which we observe them, and projected or following from the mass of the conductor, from one electrode to another (atomic particles which we know never have passed through the conducting wire, but have existed at and are wearing off from the terminal alone), proves beyond doubt that nothing that we witness in electrical phenomena has passed over the conducting wire in the sense of a current: that as this force is manifested at the distant end of the conductor in the shape of projected atomic particles of matter, it is clear that the electric force is a certain intensely active condition of the molecules of matter, which activity is set up by the violent action of acids upon metals or chemicals, by heat, or by friction, and transferred from one atom to another with inconceivable rapidity; and that as no heat can exist except by combustion or by friction (unless imparted heat, which is itself sustained by combustion or friction), the voltaic arc, the most intense heat, which is not sustained by combustion but exists in all its intensity in a vacuum, can only be the result of friction; and inasmuch as the mass of the metal is not subjected to friction, the friction can only exist in a violent action of the atomic particles of the metal.

Knowledge is of two kinds, positive and negative, namely, that which we know is, and that which we know must be, because it can be nothing else. It is more by the negative than by the positive reasoning that we can determine the nature of electricity. Deschanel, recognizing the crudities of the electric fluid theories, said of the positive and negative currents: "It is conceivable that the two electricities, instead of being two kinds of matter, may be two kinds of motion, or in some other way may be opposite states of one and the same substance." The reasoning by which we establish the verity of this conception is both positive and negative, and the reasoning of analogy.

Washington, D. C.

W. E. SAWYER.

Remarkable Explosion.

To the Editor of the Scientific American:

On August 28, a terrific explosion took place at the works of the Milburn Wagon Company at this place, under the following circumstances: The shop is cleared of shavings by a system of pipes and pneumatic fans. The magazine was located in the boiler room, and was about 25x10 feet, and 28 feet high. Near the top of the magazine was a 20 inch sheet iron pipe leading into the main chimney stack, and immediately under it was a second one, similar in all respects. These were used to take the fine dust out of the magazine. Six feet below them were four 12 inch pipes leading in to the furnaces, and entering under the grate bars. These had valves to them, and were mostly kept closed. The works were running at the time of the occurrence; and a fire had just been put in, and the door closed, when it "kicked," as the term is, and an explosion took place in the magazine, which completely wrecked the boiler room and magazine, tearing the roof off and blowing the wall down. Fortunately no one was injured.

This should be a warning to wood workers not to have direct communication between shaving magazines and furnaces, if fans are used, as few understand the explosive nature of the fine dust from woodworking machines.

Toledo, Ohio.

TOLEDO.

[We are exceedingly obliged for this note. We have often seen miniature explosions of the kind described by our correspondent, but have very seldom seen an account of one so violent. Our correspondent is deserving of great credit for the clear explanation which he has given.—EDS.]

The Solar Chronometer.

To the Editor of the Scientific American:

It may be interesting to your American readers to know that the solar chronometer illustrated in your issue of September 11 was invented by one of their number.

In 1868 I invented the same instrument, though in a slightly different form, and applied for a patent. The claim was rejected on the ground that the invention was not new. The "equation curve," which I constructed, was identical with the one illustrated, and was constructed as follows: A meridian is assumed as the axis of abscissas, and the equator as the axis of ordinates, their intersection being the origin of the curve. The sine of the sun's longitude is the abscissa and the equation of time is the ordinate for the corresponding point of the curve. The plus and minus signs to the equation of time project the curve on opposites of the axis of abscissas; but as the ordinates for two opposite points, in two opposite quadrants of longitude, are not equal, the curve is not symmetrical, though it is nearly so. Instead of reading the time on the meridian line, as in the ordinary dial, the time is read on the curve, at a point indicated by the declination of the sun shining through the lens. The reading,

being commenced at any point, is followed in retrograde order, from the right and over to the left, the curve being completed in one year. The time thus read is equated time. But all the elements that go to make up the equation of time are not considered in the construction of the curve, so the time is not strictly equated, though it is nearly so.

Moreover, the curve is not constant in its form; so that a dial, being made for one date, is not correct for a subsequent date, the error accumulating with time. This results from the fact that the equation of time depends on two elements, that have a relative motion with each other. That depending on the eccentricity of the earth's orbit runs forward in regard to longitude, while that depending on the obliquity of the earth's orbit with the earth's axis follows the line of equinox backwards in regard to longitude, these elements forming a complete revolution with regard to each other in about twenty thousand years or more. But as one of these elements has two zero points, or places where the equation of time is 0, and the other has four such points, and as in the course of one revolution each zero point of each element comes to or coincides with each zero point of the other element, we have eight oscillations of the equation of time in one of the revolutions, that is to say, in about 250 years the dial above referred to will have accumulated error to the amount of about thirty-four minutes of time.

Ferrysburg, Mich.

H. C. PEARSONS.

Ancient Human Remains in Texas.

To the Editor of the Scientific American:

Some eight miles distant from this place, while digging a well at a depth of thirty-six feet, a quantity of human bones were found. They were imbedded in a yellowish dry dust, which presented the appearance of decomposed bones and flesh. On digging further down, the bed was found to be twenty feet thick, bones occurring at intervals through the whole depth. Just below this stratum, and fifty-six feet from the surface, water was found in soft quicksand. The parties, not desiring to drink water from such a well, sunk another, about eighty yards distant from the first, with precisely similar discoveries. At thirty-six feet deep were found the bones they continued for twenty feet, and then water was found in the quicksand.

A thigh bone, a breast bone (half petrified), a jaw bone (with one tooth still in it) and a foot with all the bones complete, lying in position to show that they had not been disturbed since the flesh was decomposed, were found and taken out, also fragments of broken earthenware, without inscription or pictures.

The thirty-six feet of earth first gone through were clay and sand; and the position is on a hill, estimated to be 400 or 500 feet above the sea.

Whence came this tremendous deposit, and to what age did the bones belong? By what means were they so engulfed?

Huntsville, Walker county, Texas. W. T. ROBINSON.

The Supply of Gutta Percha.

To the Editor of the Scientific American:

I wish to call your attention to an item in your issue of July 3, which states that "gutta percha and india rubber are brought hither chiefly from Brazil and Columbia." For the past eighteen years, nearly all the gutta percha coming to this country has passed through our house; and instead of its being "brought here chiefly from Brazil and Columbia," not a particle has ever come from those sources. In fact the only region of production thus far discovered is the East India Islands, in the immediate vicinity of Singapore.

Gutta percha is wholly unlike rubber, the former being non-elastic as compared with rubber; although it is very plastic, and is readily worked into a variety of forms by means of hot water or steam. The principal uses to which gutta percha has been put, of late years, is for insulating telegraph cables, and for cementing. The total consumption of the United States is now comparatively insignificant, England quite monopolizing the cable business.

India rubber, on the contrary is collected in localities all around the globe, between the tropics, the best quality being found along the Amazon river and its tributaries. Brazil annually produces about 14,000,000 lbs. and the Central American States, Africa, and the East Indies together about 15,000,000 lbs. The consumption is about equally divided between the United States and Europe.

Boston, Mass.

GEORGE A. ALDEN.

Repairing the Independence Bell.

To the Editor of the Scientific American:

I think that I can suggest an improvement upon the method of Mr. Charles Smith, described in the SCIENTIFIC AMERICAN of September 11. I would follow his suggestions in cutting out the piece represented by the dotted lines. Then I would mold the bell with the side to be repaired upwards, placing under the cavity a piece of material that would not fuse at any heat that the job might require.

I would arrange a large receptacle or cavity in the sand at the mouth of the bell, for a large amount of surplus molten metal to fill. I would melt an abundant quantity of bell metal, as nearly similar in composition to that which the bell is composed of (the proportions can be ascertained by analysis). I would build on to the bell (around the cavity to be filled) with some infusible material, like plumbago, so that the metal could be cast above the surface, say half an inch or more. I would arrange material at the mouth of the bell, so as to close the channel and stop the flow of molten metal a little below the lower edge of the bell. I would fuse the metal, and heat it to a very high degree, then pour the

cavity full of molten metal, keeping a steady flow out until the sides of the recess were seen to be in a molten state; then I would instantly close the channel and stop the flow, when a perfect union would be made.

The recess could be superheated with a gas blowpipe flame, and the molten metal poured into it. Then the surplus metal could be removed, and the bell peal forth as clearly as in 1776.

I had a piece united to a broken press in the same manner, and it is a perfect union, with all the strength of solid cast iron, as it was before the break.

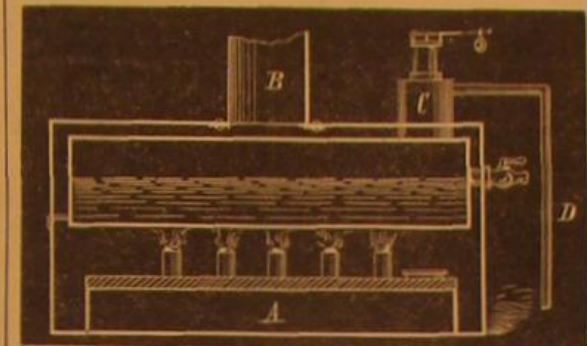
Beaver Falls, Pa.

J. E. EMERSON.

A New Small Steam Boiler.

To the Editor of the Scientific American:

For the benefit of amateur steamboat builders, I send a drawing of a boiler that has given the utmost satisfaction, being cheap and strong:



A is a lamp, with burners enough to heat the whole length of the boiler, which is of copper. The outer cover is of tin, and half an inch space should be left all round, between the boiler and the cover, to make a draft, which will find its exit through smoke pipe, B. C is a steam drum surmounted by a safety valve, and D the steam pipe. The oil or spirits in the lamp can be protected from heat by coating the upper surface of the lamp with plaster of Paris.

For an engine 1 inch by 1 inch, the boiler should be 9 inches long, and 4 inches wide.

A. M. BLUNT.

Scarborough, N. Y.

Repairing the Independence Bell.

To the Editor of the Scientific American:

There is another way to mend the Independence bell, of which Mr. Charles Smith speaks in your issue of September 11.

I saw in a foundry a cast iron wheel, laying on its side, the rim of which was broken in cooling; the ends were apart about $\frac{1}{4}$ inch. It was mended by placing a fire tile on the inside and on the outside of the rim, over the fracture. Sand was banked around the tiles, and a space made for pouring in hot metal; at the bottom was a small hole to allow the metal to run out. When all was ready, the pouring of hot metal through the fracture began, and continued a short time until the broken ends began to melt; the small hole at the bottom was then closed, and the fracture was filled. On examination, the joint proved good. Perhaps the bell can be repaired in the same way.

Dayton, Ohio.

J. H. B.

Effect of Magnetism on Watches.

To the Editor of the Scientific American:

A few weeks ago my watch, for the first time in ten years, refused to go. Up to then, it had kept correct time, and was then in good repair, having been recently cleaned. When it first began to stop I would start it by the key, and it would sometimes run a day; but finally it stopped entirely. I had it carefully examined by an expert, who, although he could find no cause, failed to make it run even for an hour.

I am running at my works a powerful magneto-electric machine for depositing copper; and having noticed that I could magnetize a piece of soft iron at a distance of at least six feet from the machine, so that it would lift and support the weight of a large nail, I became impressed with the idea that some of the steel parts of my watch had become permanently magnetized; so I made a watch repairer take it apart. Having some fine soft iron filings, I dipped the balance wheel, escapement wheel, lever, and hair spring into the filings; and each piece raised up at least one half its own weight of the filings, showing all the polar characteristics of the particles.

I have read of watches being spoiled by magnets, but had no idea that it was unsafe to go into a room containing a magnet.

The watchmaker thought he might "brush it off" for about a dollar: I let him brush on it three days as a lesson in magnetism, and then told him that nothing short of heating it red hot would demagnetize it. He put in new parts, including a new mainspring, which was also infected, and the watch now runs as well as ever.

496 Cherry street, New York city.

I. B. FULLER.

Terrestrial Magnetism.

To the Editor of the Scientific American:

In an article entitled "Terrestrial Magnetism" on page 164 of our current volume, I notice a statement which may mislead, and beg leave to correct it. "That the earth is not a great magnet, but that the phenomena of the magnetic needle are due to the electric earth currents which flow at right angles to the earth's axis." These two statements are contradictory. "The earth is a great magnet, and the

phenomena of the magnetic needle," etc., is the way it ought to have been put. For all our most recent knowledge tends to confirm Ampère's theory that a magnet is merely a closed circuit of electric currents acting parallel and in same direction, and not necessarily a mass of iron, nickel, or cobalt. So that the earth, being surrounded by such currents, is as much a magnet as the magnetic needle.

I. B. M.
Hoboken, N. J.

(For the Scientific American.)
Cotton Mathematics.

NUMBER II.

Deduction of a formula for the production, in hanks and lbs., of any weighted roller, the diameter of roller and its revolutions per minute being known.

Let D = diameter of roller in inches.

Let R = number of revolutions per minute.

Let S = decimal hank of sliver per lb.

Then: $3.1416 D =$ production in inches per revolution.

$3.1416 D R =$ " " " minute.

$60 \times 3.1416 D R = 188.496 D R =$ production in inches per hour.

The hank measures 30,240 inches:

Hence $\frac{188.496 D R}{30,240} = 0.006233 D R =$ hanks and decimals

of hank per hour; and for different times,

$0.03739 D R =$ hanks per 6 hours' work.

$0.04363 D R =$ " " 7 " "

$0.04986 D R =$ " " 8 " "

$0.05600 D R =$ " " 9 " "

$0.06233 D R =$ " " 10 " "

Application of the formula:

Suppose a drawing frame, whose front roll is $1\frac{1}{2}$ inches in diameter, makes 275 revolutions per minute: required the number of hanks produced in 8 hours of efficient work?

The 8 hour formula is $0.04986 D R$.

Substituting their values for D and R, $0.04986 \times 1.375 \times 275 = 18.85$ hanks of sliver produced in 8 hours of efficient work, and to find the number of pounds that should be produced, of $\frac{1}{4}$ hank sliver, under conditions specified:

$0.04986 \times 1.375 \times 275 = 18.85$

$\frac{0.125}{0.125} = \frac{18.85}{0.125} = 150.8$ lbs.

of $\frac{1}{4}$ hank sliver produced in 8 hours' work under conditions specified.

The formula may be used to indicate the number of revolutions required to produce any required length or weight of any desired sliver. Take for example the 8 hour formula, and suppose that:

D = $1\frac{1}{2}$ inches (= 1.375).

S = $\frac{1}{4}$ hank per lb. (= 0.125).

Time = 8 hours.

R to be ascertained by formula.

Length 18.85 hanks; then, by substitution, we have

$0.04986 \times 1.375 \times R = 18.85$, and $0.06855 R = 18.85$, and

$\frac{18.85}{0.06855} = 275$ revolutions of front roll required

to produce 18.85 hanks in 8 hours.

Again: Suppose the same conditions, but that 150.8 lbs. of $\frac{1}{4}$ hank sliver are required, instead of 18.85 hanks as above;

then $\frac{0.04986 \times 1.375 \times R}{0.125} = 150.8$ lbs., and $0.06855 R = 150.8$

$\times 0.125 = 18.85$, whence $R = \frac{18.85}{0.06855} = 275$ revolutions re-

quired.

Again: To show a convenient application of the formula, suppose that the calendar rolls of a finishing lap machine are 8 inches in diameter, and that 1,500 lbs. of lap, weighing $\frac{1}{4}$ lb. per yard, are wanted in 8 hours' work. To find the number of revolutions of calendar roll required:

The decimal hank of the lap will be (for $\frac{1}{4}$ lb. per yard)

0.001587 , so that

S = 0.001587,

D = 8,

R to be ascertained by formula.

By applying these values to the 8 hour formula, we have

$0.04986 \times 8 \times R = 1,500$, and $0.39888 R = 1,500 \times 0.001587 =$

$\frac{0.001587}{0.39888} = 2,380.5$

2,380.5; whence $R = \frac{2,380.5}{0.001587} = 5,967 +$ revolutions of calendar

roll required, say, 6 revolutions per minute.

Proof by another method:

1, 2—12 inches per foot

1—3 feet per yard

1, 2, 14—840 yards per hank

0.001587 hank per lb.

Revolutions per minute, 6—1.

Inches diameter of roll, 8—4.

Ratio, $\frac{3.1416 \times 0.4488}{0.2244 \times 0.0748}$

Minutes per hour, 60—1

Hours' work, 8.

$4 \times 0.0748 \times 8$

$\frac{0.001587}{0.001587} = 1,508$ lbs. lap, $\frac{1}{4}$ lb. per yard made in 8 hours,

the roll being 8 inches in diameter, and making 6 revolutions

per minute.

FORWARDS.

THE largest reflecting telescope at the Paris Observatory

is completed, although it will not be brought into use for

two or three months. The equilibrium of the tube is per-

fect, and it can be directed with the utmost facility on any

part of the heavens, although it weighs about six tons.

A COMPARATIVE trial of the relative advantages of dynam-

ite, gun cotton, and gunpowder was recently made at the

railway tunnel works under Clifton Down, England, with the

result of showing that dynamite is much superior to either

gun cotton or gunpowder.

IMPROVED ELLIPSOGRAPH.

We illustrate herewith a new and useful instrument for draftsmen, by means of which any figure, from a circle to a very flat ellipse, can be accurately and quickly described. At A are parallel rods, carrying a carriage, B, through which passes the main axis, C, to which is fastened the drawing arm, D, with a head for the pencil or pen point, secured by a binding screw. The head slides to any desired point on the arm, and is likewise secured by a binding screw. The crank arm, E, passes through the head of the main axis, and also, by a set screw, may be secured in any position. The crosshead, F, fits the crank arm, and carries the parallel motion rods, G, which are secured to steady pins on the frame. There are center points by which the machine is set over any desired line upon which the ellipse is to be drawn.

It operates as follows: The center points are placed upon the minor axis; the pen point is set at the extremity of the major axis, and fastened. The arm, D, is then turned to the minor axis, or 90°, and the pen point is set at its extremity, by means of the arm and by sliding the carriage upon the parallel rods. The crank arm is then clamped. By turning the crank, the point will describe the desired ellipse. It carries the pen at right angles to the drawing bar, so that it will draw an ink line as well as a pencil line.

Samples of the work of this machine, which have been transmitted for our inspection, show that the figures are perfectly drawn.

For further particulars address Messrs. W. L. Bramhall and W. W. Johnson, 607 Seventh street, Washington, D. C.

IMPROVED RAILWAY TIE.

The invention illustrated herewith is a new iron railway cross-tie, intended to replace the wooden tie usually employed. It is claimed to offer the advantages of permanence and indestructibility, and therefore to be much more economical than wood, the renewal of which, owing to its rapid deterioration, is a constant and large source of expense. A perspective view of the track secured in the tie is shown in Fig. 1, and a sectional view of the device is given in Fig. 2.

The body of the tie is made of a rolled iron girder of T cross section. It is proposed to cut the girders as they come from the rolls, while hot, and to stamp the lugs, A, at the same handling. It will be seen from Fig. 2 that these lugs, A, overlap the inner base flange of the rail, while the outside flanges are retained by the adjustable clamps, B. The tapering plates or wedges, C, pass under, and are guided and held by the bent lugs, D, and, by being driven inward, are tightened against clamps, B. The wedges are serrated on one edge, to prevent their tendency to work out through jolts and jars. In order to protect the ties against the weather, while still warm they are immersed in a bath of melted asphalt or other weatherproof substance.

The device shows strength, and apparently is neither difficult nor costly to manufacture. It would probably resist wear, and is as easily laid as a wooden tie.

Patented through the Scientific American Patent Agency, May 11, 1875. For further information address the inventor, Mr. Henry Reese, 209 W. Pratt street, Baltimore, Md.

The Weather Glass.

In compliance with the repeated request of some of our meteorologically inclined correspondents, we publish below instructions for the construction of the so-called chemical barometer or weather glass. The utility of this little instrument is based upon the varying solubility of certain salts under different atmospheric conditions of pressure, humidity, and temperature, and the employment of a menstruum of such a density that the slightest increase or decrease of the same will cause the newly formed crystals to rise or sink in the liquid. The instrument generally consists of a tube, from ten or twelve inches long, and from three quarters to one inch in diameter. It is closed at the lower end, and, after the solution has been poured in, the upper end is drawn out, by means of a spirit lamp or blowpipe, until the tube is hermetically sealed. When cooled, the point is broken off in such a manner that a minute hole is left, which suffices for the necessary communication between the contents of the tube and the external atmosphere. Another arrangement consists of a large test tube with a piece of bladder or caoutchouc tied over the mouth, and a small pinhole made through this covering; this arrangement, however, is not so satisfactory as the first, as the covering does not last very long. The solution may be made as follows: Take pure nitrate of potash (saltpeter) and chloride of ammonium (sal ammoniac) each 1 part, camphor 4 parts, strong alcohol 70 parts, dis-

tilled water 50 parts. Shake the alcohol and water well together, and dissolve in it the saltpeter and sal ammoniac, then, after having reduced the camphor by triturating it in a mortar with a few drops of the dilute spirit, add it to the rest of the solution, and heat gently over a water bath until complete solution is effected and the liquid is clear. When this is accomplished, pour the solution immediately into the tube,

in the door sill. It consists of flexible tubing, A, Fig. 2, made of rubber, felt, or similar material, through which runs a metal rod, B, the object of which is to keep the tubing in position. Metal fastenings, C, have a hook at one end which fits around the rod, and an eye at the other end, by which they are secured by screws or other simple means to the bottom of the door, as represented in Fig. 1. The strip, by bending, may be fitted to any depression in the sill, so as entirely to fill up the opening between the sill and door when the latter is shut, thus preventing the ingress of either wind or water.

The door, by its weight, on being shut, draws the rubber against the threshold, and on opening the dragging of the rubber across the threshold is prevented. The iron rod is made just the length of the door. The rubber tubing extends over one inch at each end, and rests against the casing.

The device is quite durable, is neat in appearance, and may be manufactured at a small cost.

Patented July 27, 1875. For further particulars relative to sale of rights or of entire patent, address the inventor, Mr. Frank Fleury, Springfield, Ill.

Ah Chu and his Salt.

B. writes as follows:

"Where is your salt, Ah Chu?" said I. Ah Chu had invited me to dine at his mess, to celebrate a Chinese festival, and, barring the chopsticks and some national dishes, which I did not venture upon, a capital dinner it was. Ah Chu and his messmates were working on a sugar plantation below New Orleans. Ah Chu passed a bottle with a quill fitted in the cork. 'Vinegar?'

'No; here is the vinegar,' said he, passing me a bottle exactly like the first. 'Me thought you asky for salt.' 'Salt it was,' said I. 'Well,' said Ah Chu, 'that is the salt me gave you first.' And sure enough it was; salt dissolved in water and used in a fluid state. 'So,' says Ah Chu, 'table salt is served in China.'

"For convenience of application, and exactness with which the seasoning can be regulated, give me liquid salt."

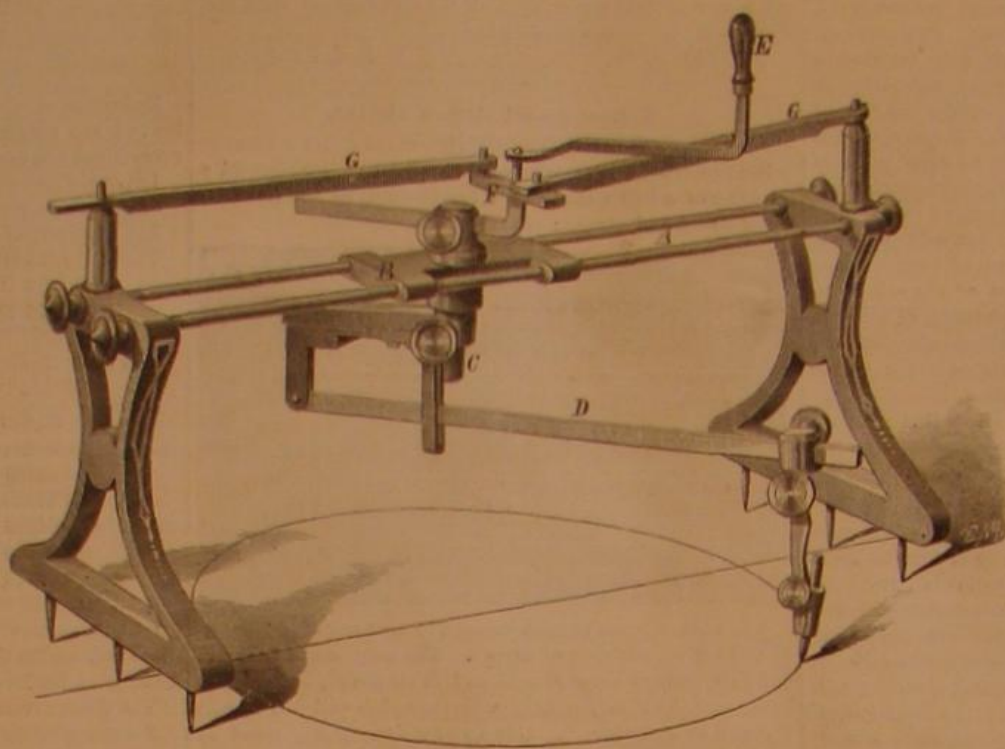
A Model Locomotive.

An ingenious mechanical curiosity has recently been shown to us by its maker, Mr. Joseph Butcher, of 43 Center street, this city. It is a miniature locomotive and tender, containing every portion found in the full sized machine, perfectly proportioned, capable of carrying a steam pressure of 75 lbs. to the square inch, and of running at a high rate of speed. An alcohol lamp, which, by its heat, generates an alcohol steam, which, in turn, is ignited under the boiler, heats the latter, which is supplied with water by feed pumps, perfect in every valve and connection. No less than 230 separate pieces enter into the construction of the cab alone. The model is admirable in mechanical execution, and, strange to say, is its maker's first effort at mechanical work, and has occupied his leisure hours, outside his regular trade of ornamental painting, for the past three years. The engine shows remarkable skill both in design and handiwork, and evinces the great patience and native mechanical genius of its constructor, who first made the tools he used in constructing his machine.

Velocity--Effects of its Increase and Arrest.

Mr. F. J. Bramwell, C. E., in a paper read at the recent meeting of the British Association, said: Gravity can put into our frames a velocity in one second amounting to 20 miles an hour without injury, therefore it is reasonable to suppose that that velocity may be taken out at the rate of two and a quarter miles per second with even less risk of injury; and if we want a proof of this, one might instance a swing at a fair. Take the case of a swing 30 feet long, rising to the horizontal at each vibration; when the swing is at the lowest point, it has a velocity of 45 feet per second, or 30 miles; one knows it will make this half vibration and will reach its highest point in less than 1½ seconds, so that a speed of 30 miles an hour is taken out at the rate of nearly 17 miles per second instead of the two and a quarter miles of the passenger train.

Another instance of rapid reduction of velocity without injury occurs in colliery winding. The Rosebridge Colliery, in the neighborhood of Wigan, is nearly half a mile, actually 806 yards deep; the winding is done under the minute or at an average rate of thirty miles an hour; but this includes the stopping and the starting; the maximum pace is equal to 58 miles an hour, and this 58 miles an hour is brought to rest in from 180 to 200 yards. There is thus, therefore, abundant evidence that the powers of brakes may be carried yet further than they have been without fear of injury to railway passengers from the sudden checking of momentum so long as the brakes are properly applied.



TOULMIN'S ELLIPSOGRAPH.

the mouth of which may then be closed as above directed, and the whole allowed to cool very slowly.

The indications that this little instrument gives are of this nature: If the atmosphere be dry and the weather promising, the solid matter will be found resting on the bottom of the tube, the supernatant liquid being perfectly clear; but on the approach of rain or wind, the solid matter will gradually rise, and small crystals of stellar formation will be found floating in the otherwise pellucid liquid. On the approach of strong winds, flakes of feather-like form will sometimes appear on the surface of the liquid; this often occurs several hours before the actual breaking out of the storm. In cold

Fig 1

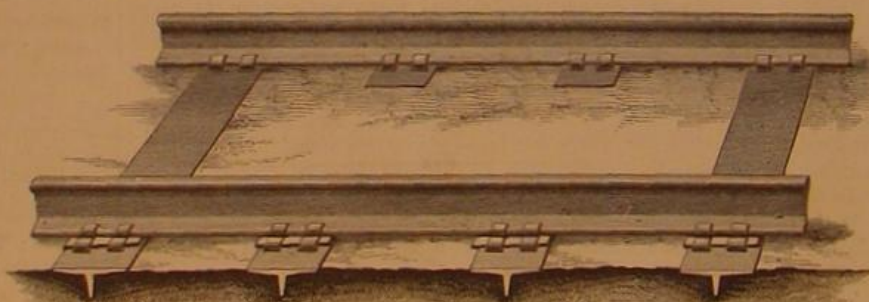


Fig 2



REESE'S RAILWAY TIE.

weather the liquid is rendered milky by the multitude of white stars constantly floating in it. The instruments are pretty ornaments, and their indications are always interesting and instructive.

FLEURY'S EUREKA WEATHERSTRIP.

The invention illustrated herewith is an improved weatherstrip, which may be adjusted to suit any depression worn

Fig 1



Fig 2



therstrip, which may be adjusted to suit any depression worn

THE CRESTED BLACK KITE.

The gardens of the Zoological Society, London, recently received specimens of a very rare Indian kite (the *baza lo-photes* of Cuvier). This bird had never been seen alive in England, and even in India is so sparsely distributed that Mr. Allan Hume, in his "Rough Notes on Indian Ornithology," states that he has never procured a specimen. Though nowhere common, it appears to have an extended range, being known in Ceylon, on the east coast of India, as well as in Lower Bengal, Assam, and British Burmah. Jerdon, in his "Birds of India," states that it is certainly very rare towards the south, but that it is occasionally killed at Calcutta, and is more frequently found in the lower Eastern Himalayas. It appears to be very insectivorous in its habits, and keeps to the forests and well wooded districts, taking only short flights. In its conformation it appears more nearly allied to the honey buzzard (*pernis*), of which a crested species exists in India, than to any of the other accipitrine birds. The plumage of the bird is remarkably handsome. The upper portions, including the long slender crest, the thighs, and the under tail and wing coverts, are a glossy green black. The outer webs of the wing feathers—those that are alone visible when the wing is closed—are deep chestnut. The scapular feathers form a conspicuous but broken white wing band. The under parts of the bird are chiefly white, with five or six broad bars of deep chestnut. The crest is generally carried in a drooping position, but the bird has the power of erecting it perpendicularly. In length the crested kite varies from thirteen to fourteen inches, the extent of its wing being thirty. The weight is about eight ounces. We regret to have to announce the death of all the three specimens almost immediately after they had been sketched.

THE FLORAKIN.

The florakin or lesser bustard (*otis tetrax*) is found on the plains in many parts of India, and is common in France; in the former country it is esteemed a most delicious bird for the table. The male bird, when in full plumage, is very handsome, being most beautifully marked; but the hen is much plainer, as is the case with nearly all female birds. They are to be found in pairs, and are very shy and wary, and hardly ever take to the wing if they can avoid doing so. Wherever florakin are found, sand grouse (*ptarmica bicinctus*), of which we gave an illustration and description on page 407, Vol. XXXII., may be seen.

The florakin resembles the large bustard (*otis tarda*) in his form and color, but is only 17 inches long. The head is reddish brown, the neck of the male being black, with a narrow white border above and below. The upper parts are mottled with the same colors, but with finer and more delicate lines. In the barren districts of Brittany (France), known as *les landes*, these birds may be seen in considerable numbers; and as the flesh is good eating, and may probably be improved by culture, it is somewhat remarkable that no attempts have been made to domesticate them.

American Refined Sugar.

The exportation of American refined sugar to this side is maintained with unrelaxed energy, and consequently displaces a given quantity of stoved sugar which would be ordinarily supplied from the warehouses of the British refiners. The total imports since this new and unexpected quarter for

supplies was opened have embraced 7,000 tons. It reflects no credit upon America, either as regards the act itself or the get-up of the article which she produces. All but the inexperienced, or not over-particular judges of quality and condition, pronounce the cut sugar as shockingly indifferent; and if it is to be viewed as a specimen of the best lump which the Yankee refiner can turn out, and their country-



THE CRESTED BLACK KITE.

men are pleased to use, we must frankly assert that we pity their taste. No first class family grocer in London—no, nor any folk in decent society—would look at the American loaf sugar as it now comes to hand; and in case our statement should be read by those who, from the nature of their retail trade, find it an article more suitable to sell than that chopped from bright English titlers, we simply ask them, as they do their friends and customers, to compare and judge for themselves. We need not be in suspense as to the verdict, for we are sure it will be in favor of the British manufacturer, who, in defiance of envious detractors, is still the refiner *par excellence*, albeit his functions in that respect have now almost entirely ceased. Unless checkmated by some

The Oldest Fair in the World.

In this season of industrial fairs, when Chicago, Cincinnati, Newark, New York, and other cities, are all vying with each other in the production of the finest exhibit of the practical results of the labors of American mechanics and inventors, it is interesting to note that, in a far distant quarter of the globe, another great fair has been in progress, which, in point of magnitude, probably equals all of the yearly expositions in the United States combined. The great fair of Nijni-Novgorod, in Russia, has quite recently closed its annual display—an exhibition which has been repeated every year for the past four centuries; and the merchants and producers of Siberia, of Persia, of China, and of Tartary have met the manufacturers of Western Russia, exchanged their raw produce for the manufactured goods of St. Petersburg, Moscow, and the west, and separated for another twelve months. The Fair, in fact, is a vast market, a temporary city, which began with the interchange of commodities between barbarians four hundred years ago at a location some eighty miles distant from Nijni Novgorod. After an existence of two centuries, during which period it absorbed into itself minor markets until it became the principal exchange of the empire, the fair was removed to its present site. Under the rule of Peter the Great, the government assumed its direc-

tion, which authority is still retained. Unlike the colossal and magnificent structures of iron and stone which we erect as the receptacles for our exhibited productions, the buildings of Nijni Novgorod bear a close resemblance to the labyrinth of streets and houses which, together, make up a Turkish bazaar. There is a broad open market place, rectangular in form, on which are constructed twelve rows of buildings, each some two stories in height, having broad verandahs to shelter the passers from sun and rain. These form parallel streets, some of which are nearly 120 feet in width. At the ends of the principal street, which is the broadest, are the government house and the cathedral, on the sides are shops and a chapel, near which are two high

towers, the raising or lowering of flags on which denote the opening or closing of the fair. One side of the rectangle containing the buildings rests on the river Volga; the other three are surrounded by a horseshoe-shaped moat, kept filled with water at an elevation of some eighteen feet above the river, as a precaution against fire. The edifices are built on iron stanchions in the majority of cases, and all that can be removed are taken away at the close of the fair. A large number of buildings, however, remain, and with remarkable strength withstand the great yearly inundation of the river, which submerges the whole locality, leaving only the tallest structures projecting above the waters, like a miniature Venice. It is a strange contrast; a busy



THE FLORAKIN OR LESSER BUSTARD.

deliberate or accidental means, the English market will in time be so inundated with sugar of inferior quality, from France and America, that finest loaf and other sugar will eventually become things of the past.—*London Grocer*.

[If the above statement is correct, if American refined sugars are really inferior to the English article, it behoves our refiners to call upon inventors to study out new methods of refining, by which the best products can be realized at the lowest cost.—EDS.]

THE fluidity of the Berlin iron, from which the finest and sharpest, although not strongest, castings are made, is attributed to the presence of arsenic in the iron.

town of 150,000 inhabitants, replete with goods of every description, from American wagons to Persian rugs, existing for about six weeks; and then, a few months later, nothing but a dreary waste of water fills its place. Although the number of visitors at any one time may not exceed 150,000, it is estimated that fully a million people come and go while the fair is in progress, and the value of goods which have actually changed hands during the fair just closed is computed at \$120,000,000.

The governor of the province supervises the management, aided by a committee chosen by the participants in the fair. The committee controls all government property, renting the same at a low rate. There are some curious regulations

as regards exhibitors, or rather sellers—for people come to sell then and there for cash—which are worth noting. For instance, each row of buildings is devoted to some especial kind of goods, and merchants, thus compelled to crowd together, are encouraged to compete with each other. To prevent monopolies and over-speculation, no merchant is permitted to hire more than three consecutive shops, nor can he occupy more than one shop unless they adjoin each other. No imposts or duties are levied, and the shops are usually let to the first comer, the government asking no other gain than the small rents, which together amount to but about \$120,000 a year. At the last fair, for this sum 6,086 shops were rented.

The contents of the markets are, of course, wonderfully heterogeneous. Machines bearing to us well known names of American firms are side by side with the curious products of Indian and Persian looms. There are furs and skins from Siberia, teas brought overland from China, cutlery from Sheffield, flax, wheat, the importations of the great houses of Moscow and St. Petersburg, and Russian iron, besides thousands of articles representing the chief industries of every nation on earth. There are usually immense amounts of iron, stored on a sandy island in the middle of the river Oka, about three quarters of a mile long, which is not only covered with water at certain seasons, but which changes its shape every year. It is said that the quantity of iron collected here, in bars and sheets, aggregates 90,000 tons, valued at over \$10,000,000. In quality it is said to be better than Lowmoor, and equal to the best Swedish. A tramway runs the whole length of the island.

It is difficult to believe that not only are all these vast stores filled and emptied in six weeks, but that the store-houses themselves are removed and that their sills are covered in spring by ten or twelve feet of water. On the occasion of the recent visit of the Duke of Edinburgh to the fair, the iron owners gave an entertainment in his honor, in a huge pavilion constructed entirely of their stock. The structure was in the form of a turreted palace. The turrets were built of bar iron (the bars being laid crosswise over each other, with the ends projecting) and surmounted by battlements, which were represented by iron buckets. The body of the castle was 100 feet long by 50 feet wide, and was made of sheet iron. Iron buckets and baskets, turned over, made very handsome ornaments around the arches of the doors and windows. The whole structure was completed in three days and three nights.

Common Sense in the Sick Room.

In a lecture delivered at the Bellevue Hospital Medical College, in this city, by A. B. Crosby, M. D., he says: There are certain elements of hygiene which it is very important that we should observe—whether the sick room contains a surgical or medical case—if we would reasonably expect to obtain the best possible results from treatment. In the first place the

TEMPERATURE

should ordinarily range from 65° to 70° Fah., and this should not be a mere matter of guess work, but should be ascertained by the thermometer. If the temperature is permitted to average much higher than this, all febrile disturbances will very likely be aggravated; and if the average is much lower, the patient in ordinary cases runs some risk of getting a chill, although very many times he may remain with safety in a room having a lower temperature, providing he is furnished with a plentiful supply of blankets.

FURNITURE OF THE ROOM.

The room which is selected for a sick room should be as far removed as possible from those ordinarily occupied by the family, in order that the patient may have the benefit of perfect quiet. It should be large, airy, and well lighted, and, if possible, should have a sunny exposure.

The wall of the sick room is a pretty important matter to the patient. If it is covered with one of those dreadfully variegated papers, which, alas! are regarded as ornamental, it will be found, especially if the patient is suffering from any disease in which there is abnormal exaltation of the brain, that it is a source of great annoyance, and may even be positively injurious. For, as his eyes run over these pictures, he will fancy that he sees images of various kinds, such as angels and demons alternating; indeed these figures will assume every conceivable form, and he becomes thoroughly worried in the attempt to disentangle the confusion.

The paper covering the wall should have a uniform, neutral tint, such as a light green, a delicate buff, or a very delicate slate color, a light green, perhaps, is as agreeable to the eyes as any color that can be selected, and it rests the eyes with a refreshing monotony. Such a uniform tint tends to healthy stupidity, and this leads to repose. The floor of the apartment should engage your attention.

The model sick room should never be carpeted, but ordinarily should have a hard wood floor, and this should be oiled and varnished. Upon such a floor may be spread as many pieces of carpeting, rugs, and mats as are desirable. These may be placed in front of the bed, over the parts which the nurse traverses while performing his or her duties at the doors, etc. Each morning, these can be quietly slid along the floor, taken out, and be thoroughly shaken and aired. After they are removed, the floor can be wiped off with a damp cloth or soft brush, and when dry, the rugs, etc., may be replaced.

The windows should also engage your attention. These should be so arranged as to admit abundance of light. Light is a normal stimulus to the human body, and we have no good health without it; you cannot grow healthy cabbages

in a dark cellar, nor can you any more easily cure invalids without the influence of sunlight. There are some acute diseases, during the progress of which it may be necessary to temper the light, but it should never be entirely shut out, for if you do you remove from the body one of its important natural stimuli.

The windows should never be surrounded by tapestry or decorations of any kind that are made of woolen stuff. A plain white shade is all that is requisite to temper the light and cut off outside objects from the patient's view, and the window frame should be free from lambrequins, hangings, etc., which may become impregnated with the germs of disease.

VENTILATION.

A healthy person requires two thousand cubic feet of breathing space, and the sick person under the same circumstances should have at least three or four thousand cubic feet. Then, again, the sick man should have the air changed twice as frequently as the man in health.

Ventilation requires the introduction and diffusion of an abundance of pure air at short intervals, and a corresponding removal of the air vitiated by respiration. The movement of air in the sick room should be imperceptible.

If the sick room is ventilated by a fireplace, we should always open a window at the top. If the room, on the contrary, is heated by a register, a window should always be raised at the bottom, since the hot air rises to the top of the room, creates a plenum, and so forces the air out at the bottom. There are three points to be observed in regard to the sick room.

Note, first, whether there is any perceptible odor, on entering the apartment from the open air; if so, ventilation is imperfect.

Make sure, in the second place, that there is a free inlet and outlet for the air.

And, thirdly, place an open mouthed bottle by the side of the bed at night. In the morning, before there is any opening of doors or windows, or any movements about the room, pour a little clear lime water into the bottle and shake it. If the air in the bottle is pure, the lime water will remain clear; but if otherwise, it will become milky in appearance, showing carbonic acid in the air, which has united with the lime, forming a white precipitate of the carbonate of lime.

PREPARATION OF GRUEL.

A man, simply because he is sick, is not to be starved, nor, on the other hand, can a man who is sick, as a rule, take such articles of food as a well man would be likely to take.

It may be doubtful whether a man, when first taken sick, should take a large quantity of food, but one of the articles which he may have is Indian gruel, if not made too strong. If, however, you give permission that the patient may have gruel to take, unless you give special directions as to how it shall be made, you will very commonly find that the nurse has prepared a fair specimen of Indian pudding, and has been administering that for gruel.

In making Indian gruel there should be no more than a dessert or table spoonful of the meal to a quart of water; and this should be boiled for a long time, keeping the quantity of water good throughout the entire boiling process.

Prepared in this manner, it may be made decidedly salt, and then administered to the patient during the first few days of his sickness.

USE OF MILK.

There is one article of diet which all persons may take under all conditions, and that is milk.

There are those who say they cannot take milk, that it makes them bilious, etc.; but that is not true. A person who is sick may take milk with the greatest possible advantage, because it contains, in a form easy of assimilation, all the elements essential for maintaining nutrition. It is the natural aliment of the young animal, and certainly answers a good purpose for the old animal, provided it is used properly. New milk, I do not hesitate to say, may be taken, as far as disease is concerned, in any and every condition. Perhaps it will require the addition of lime water, if marked acidity of the stomach is present; and perhaps a little gentian may be requisite to stimulate the stomach somewhat; and it may be necessary to give it in small quantities and repeat it often; but ice cold milk can be put into a very irritable stomach, if given in small quantities and at short intervals, with the happiest effects. We have now come to believe, contrary to the teaching of our fathers, that cold water, even ice cold water, is a most beneficial drink, and therefore permit our patients to have it as often as they may wish, provided too much is not taken at one time.

Now tea, which is a wholesome beverage, and, withal, contributes somewhat to scandal, is very comforting, especially to a sick woman, and may be given without harm, if it is sufficiently diluted with milk. When made very weak—just strong enough to give a flavor—well supplied with milk, and, perhaps, a little sugar, it gives the patient a trifle of nourishment in a very palatable form.

BEEF TEA.

If, however, you will make beef tea according to the directions I now give you, it will be found to be a most serviceable article among the dietetics of the sick room.

Take a pound of the very best beef that can be obtained in the market—the butcher will tell you that any kind of a piece answers to make beef tea of, but that is not true—cut it into small pieces the size of the end of the thumb, place it in a pint basin, cover with cold water, and then place the dish upon the back part of the range or stove, where the water will gradually get warmer and warmer, but will not reach the boiling point. Let it stand and simmer in this

manner two hours. Then bring it forward, and boil over a quick fire twenty minutes, and immediately after pour the fluid from the beef, at the same time allowing the little particles which become detached to flow off with it. Now, if there is any fat in the tea, it is well that it should be removed, for the reason that the bile and pancreatic secretion may be unable to emulsify it, and it may do more harm than good. If you wish to be very precise upon this point, the tea can be set aside, and when perfectly cold all the fat can be removed from the surface in a flake; or the fat may be taken up by dropping a piece of flannel upon it as it floats upon the surface of the warm tea.

It is not a good plan to strain the liquor, because this process will remove more or less of the little particles of beef, which are very essential to the value of the tea. It may now be salted, and given hot or cold, as the patient may wish; and it may be given as soon as the pulse indicates any diminution in the force of the heart's action. What becomes of this article of diet when taken into the stomach? The advocates of the worthlessness and non-essentiality of beef tea would answer that it makes but little difference. I believe, however, that it is mostly taken up by the gastric veins, and, at all events, that it is exceedingly palatable and nutritious, and does do something more than simply warm the stomach and make the patient happy for a short time.

In case the patient's stomach is very irritable, so that large quantities of any substance cannot be borne, you may resort to beef extract for nourishment.

The proper method of making this article is to take a pound of the best beef, cut it into small pieces, and place it in a good sized open mouthed bottle—a pickle jar is perhaps as convenient as any. Cork the bottle loosely, and then set it into a kettle of water, which is to be kept boiling for two hours. If the bottle is now removed, it will be found that it contains a considerable quantity of fluid, which may be turned off, and the beef subjected to slight pressure to remove still more.

In this fluid we have a concentrated article of nourishment, and it may be given, after it has been seasoned, either pure or diluted, according to the condition of the stomach. Beef extract is not nearly so palatable an article of food as rich beef tea, made in the manner described.

Electro-Harmonic System of Multiple Transmission.

During the past two weeks, Mr. Elisha Gray of Chicago, Ill., has been exhibiting his electro-harmonic apparatus in the Western Union Building, in this city. More than a year since we published an article descriptive of this curious discovery, so far as it had been developed at that time. Since then Mr. Gray has devoted the greater part of his time to the perfection of the apparatus, and has already succeeded in producing some very remarkable results. Mr. Gray's earlier experiments disclosed the fact that composite tones were as easily transmitted over a wire as single notes, and from this discovery he developed a system of multiple transmission, founded on this principle. The apparatus was tested experimentally on a wire between Boston and New York, on September 11, with very satisfactory results. Four separate communications were simultaneously transmitted from Boston, and copied from four sounders by a like number of receiving operators in New York. In the main the signals were perfectly received on all the instruments, the only apparent defect being a tendency to shorten them somewhat, a difficulty which can doubtless be overcome by a suitable modification of the transmitting apparatus.

The principle of the apparatus is a very simple one. The depression of each key sets a self-vibrating electrotome in operation, which is adjusted or tuned to vibrate at a certain rate, differing from that of any of the others, when under the influence of the electro-magnet controlled by its corresponding key. These several sets of electrical vibrations are transmitted through the circuit without interfering with each other, in the same manner that almost any number of different sets of sound waves may pass through the air without mingling. At the receiving station, each instrument is so adjusted as to respond to its own special sets of waves or vibrations without regard to others. By breaking and closing the circuit upon the transmitting electrotome, so as to form telegraphic signals, these are transmitted and taken up by the corresponding receiving apparatus.

It is not easy to fix a limit to the number of different communications that may be carried on over the same wire simultaneously, either in the same or opposite directions. The marked success which attended the operation of the principle through two hundred and forty miles of line, on September 11, seems to promise results in the future of the greatest value.—*Journal of the Telegraph.*

The Harmonic-Electric Telegraph.

The harmonic-electric telegraph invention (now commonly known as the telephone) of Mr. Elisha Gray, of Cleveland, is undoubtedly destined to prove a very useful and important one. On Friday of last week we saw four despatches transmitted simultaneously from Boston to this city, on one of the Western Union wires. It is believed, and with good reason, that at least sixteen messages can by this invention be transmitted simultaneously over a single wire. Mr. Gray has made a discovery and invention which will be likely eventually to revolutionize the present Morse telegraph system.—*The Telegrapher.*

THE recent storm in the Gulf of Mexico was the fiercest known in that vicinity for several years. At Galveston, Texas, it raged with great violence for three days, and the damage to property has been estimated as high as \$5,000,000. At Indianola, Texas, it is stated, 800 lives were lost.

THE FAIR OF THE AMERICAN INSTITUTE.

NEW ELECTRIC ENGINE.

A new electric engine, adapted to pumping water through a house or to any other light domestic work, is located among the housekeeping articles, and is well worth careful examination. Its construction is novel in many respects. One set of electric magnets is disposed in the direction of their length about an interior rotating cylinder or wheel. The other magnets are arranged in the interior of the stationary case, so that the construction is that of a number of horseshoe magnets, each having one stationary and one movable leg. The long faces of the magnets are serrated to the depth of $\frac{1}{4}$ inch, the indentations of the wheel magnets fitting into those of the case magnets. This, the inventor tells us, has been found, while increasing the area of the faces in contact twofold, largely at the same time to augment the power. The coils are wound lengthwise about the bars, and the yoke of the horseshoe is made directly beyond the outside coil, instead of at the further extremities of the bars, as is usually the case; so that a large portion of the metal core protrudes beyond the yoke. This arrangement, we are informed, has also been found to increase the power as high as 100 per cent. In a future issue we shall describe another electric machine exhibited by Mr. Charles A. Hussey and we shall probably refer to the machine under discussion in detail, and with reference to the new principles claimed to be involved, noting here only the facts given us. Of these the most remarkable are the large capacity of the machine (which contains a 5 inch magnet wheel and weighs but 15 pounds), 8,000 foot pounds per minute, and the statement that a 4-cup battery, costing for materials expended \$1.12, in connection with this apparatus drove a Howe sewing machine at 500 stitches per minute for 60 hours successively.

Builders, owners, and tenants of city houses will doubtless view with interest a

NEW SYSTEM OF PLASTERING

which is claimed to prevent the sudden and disastrous downfall of ceilings, so frequently occasioned by defects in the water pipes and consequent leakage or overflow. The invention consists of replacing the scratch coat and brown coat used in ordinary work by the combination of fibro-ligneous sheets with a cement composed of lime, sand, and plaster. The sheets are of a fabric resembling coarse bagging which is secured to the lathing, and the cement is supplied in the ordinary way. A hard finish coating completes the work.

A NEW FORM OF HAIR HEADER

is exhibited, which is an improvement on the similar apparatus shown at last year's fair. It consists of a vertical oscillating metal plate, the lower edge of which is provided with a rubber facing. Beneath is a horizontal vibrating plate having a rubber surface directly under the edge of the vertical plate. The tangled combings of long hair are placed between these moving portions; and by the rubber, engaging, when rubbed along contrary to the grain of or to the direction of the asperities on the hair, the "knotted and combined locks" are caused to part and separate. This hair header is called "magnetic," for no reason that we can perceive other than that given by the old lady who admired the noun "Mesopotamia," "it was such a nice, comforting word."

AN AID FOR GOING UP STAIRS.

Here is something for the denizen of the aerial flat, an invention supposed to bounce him up from one stair to another until he reaches the top of the flight, before he knows it. Each stair has a hinged lid and under each lid are some strong coiled springs. The inventor fails to say anything about the effect of his springs when a person runs down the steps. The idea suggests itself that an inexperienced user might try to go down two steps at a time, in which case his momentum would probably compress the spring sufficiently to jump him back three steps, and thus, by a kind of algebraic addition, he would find himself slowly retrograding in spite of his efforts to advance. There is food for sombre reflection in those spring stairs.

A NEW HYDRAULIC MOTOR

for sewing machines is exhibited, which is easily attached to the table of the apparatus and which is driven by the ordinary head of water in the service pipes. It consists simply of a winged wheel placed horizontally and enclosed in a case. Motion is governed by the treadle, and speed, of course, regulated by the water cock.

ANOTHER NOVELTY IN MOTORS

is a peculiar compression engine, driven by hot air, now in operation in the machine department. It consists of two cylinders, one for power, under which the fire is built, the other simply for compression. The latter has a water jacket, and both cylinders have pistons, or more properly, plungers. The piston of the compression cylinder passes through packing at the top of the same, but below fits loosely in the bore, so that the air compressed is at liberty to pass up around the piston, and to enter a connecting passage, which leads it into the power cylinder, where it is heated and expanded, and so lifts the piston. As the two pistons are set on cranks 180° apart, the down stroke of the power piston corresponds to the up stroke of the compression piston, so that the air, which just before has been expanded, is now returned to be recompressed and again used. Thus the air is merely shifted from one cylinder to the other, and its cooling or heating is quickly accomplished through its being exposed to the action of the cold water or the fire in thin annular sheets. The machine (1 horse power), we are told, burns very little fuel, one scuttful answering for an entire day. The expenditure of oil is also very small. This seems to be a very simple apparatus, and one well adapted for a large number of

light uses. It is almost entirely free from the disagreeable noise usually incident to caloric engines.

We notice a new

MACHINE FOR POLISHING MOLDING.

which seems to perform very good work. It has an adjustable table, carrying horizontal rubber rollers, which grasp the strip of molding and present it to the action of a reciprocating polisher. This last is a composition of fine emery, which is made in a plastic state and applied to a piece of molding similar to that to be polished. The result when the composition is hard is a perfect matrix, into which every indentation or projection of the molding fits. The cast is then mounted in a box and rubbed to and fro on the molding, as the latter, as already explained, is carried beneath it. The advantage gained is the increased sharpness and accuracy of the edges, and the thorough polishing of the whole work, a proceeding of some difficulty by the ordinary use of sand paper.

A new convenience for housekeepers is a combination

KITCHEN SAFE,

in which places are provided for a multiplicity of articles which generally go astray about the kitchen. Besides, it offers to the cook the same advantages as the prescription counter does to the druggist. There are drawers for the sugar, spices, and similar staple ingredients, a hinged dough board in the front, a convenient receptacle for flour or meal in the top (with a hopper below, fitted with a valve so that exactly as much flour as is needed may be measured off), a sifting arrangement, and plenty of extra closet room for the thousand little things needed in culinary operations. A

NEW ANTI-FRICTION METAL

has appeared, which, we suppose, is intended to rival the material which raised such a breeze among the fair officials last year. It differs, however, in that, instead of being inserted in the bearings, the bearings themselves are made of it. No machinery fitted with the substance is running as yet at the fair. The basis, according to the circulars, is black lead, which is another point of difference from its older competitor into the composition of which black lead enters very slightly, and in many cases not at all.

[From the Engineering and Mining Journal.]

Extra Large Lap-Welded Tubes and Enamelled Water Pipes.

At a recent visit to the National Tube Works Company at McKeesport, Pa., we witnessed the operation of making lap-welded tubes of such a size and quality as to call for notice. The company makes these seamless tubes or pipes of any size up to fourteen inches diameter. And as every length is tested by hydraulic pressure before leaving the works, their strength and quality is fully guaranteed. They have been found admirably adapted to carrying water for the hydraulic mines of California, Nevada, and other Western States, and for waterworks which do not require larger mains than 14 inches. The company has just completed an order for the Virginia City and Gold Hill Water Company, of Nevada, of seven miles of 10 inch pipe, the most extensive order for a large size that, we believe, has ever been given in this country. These seamless pipes, even without coating, are more durable and are also less expensive than the riveted pipes; but the company applies a patent enamel to them that, it is claimed, makes them almost indestructible, and, indeed, the company is willing to guarantee their durability for any length of time. The appended reports by Dr. S. Dana Hayes, Massachusetts States Assayer and Chemist, and Professor Otto Wuth, of Pittsburgh, Pa., fully establish the claims of this pipe to durability. We commend it not only to our gas and water companies, but also to our mine owners and others who have to use or convey impure water, such, for example, as in many anthracite mines. These large pipes would make excellent screen shafts for our coal breakers, and the enamel would doubtless be of great advantage for coating the exposed iron work about the mines.

In bringing the matter to the consideration of "those whom it may concern," we believe we are doing consumers as well as manufacturers a service.

REPORTS.

"I have recently made a series of tests of your enamelled pipe, for the purpose of ascertaining its value as a service pipe for conveying water and other fluids, and now submit the following brief report of the results obtained:—

"Portions of the enamelled covering itself were first removed from several pieces and submitted to chemical analyses, to determine the presence of deleterious substances; but the results of these analyses are entirely negative, as there is nothing of this kind present. The pipe is made of wrought iron, covered, inside and outside, with an elastic, enamel-like material that does not contain any unwholesome or objectionable ingredients.

"Its durability was then tested by exposing different pieces of the pipe to the solvent action of hard, soft, and sea waters, alcohol, and other fluids, for many days, and finally those fluids were boiled in the pipe for several hours in each case—the object of this boiling being to obtain, as nearly as possible, in a comparatively short time, the effect produced in the pipe by long continued usage. These tests have been very complete, and I am quite surprised at the durability and power of resistance of the enamel covering, determined in this way. It has not failed in any trial with natural waters in my laboratory, and it has withstood the action of boiling corrosive fluids for a longer time than specimens of other water pipes now in common use.

"I commenced this investigation with some doubts about your enamelled pipe, but the severe tests which I have employed prove that it is perfectly harmless and possesses great durability, these being the properties of most importance in water pipe.

S. DANA HAYES,

State Assayer and Chemist, Massachusetts.

"I have made a complete series of tests in order to ascertain the quality of your patent enamelled pipe, and found that the enamel, covering perfectly both the inside and the outside of the wrought iron pipe, is not, in the least affected

by the action of alkalies, acids, salts of any composition, alcohol—in fact, any liquids which in practice are apt to be conveyed through the pipe. The enamel itself contains no deleterious substance whatever, and even if it did it would not make any difference, as not a trace of it will become soluble. Pipe so enamelled is especially adapted for water and gas.

O. WUTH."

Yankee Electrical Spread Eagleism.

"At the annual meeting of the British Association for the Advancement of Science, held at Bristol, on the 25th of August last, Sir John Hawkshaw, F. R. S., the newly elected President of the Association, as usual, delivered an address. In the course of this address he took occasion to review the history of the invention and progress of the electric telegraph. This portion of his speech is as perfect a specimen of the insular egotism for which his countrymen are noted as we have seen for some time. He completely ignores, in this connection, the discoveries and inventions made by Americans, merely incidentally referring, in a foot note, to the date of the first patent of Professor Morse, issued in October, 1837. With this exception no mention is made of any American; and so far as can be learned from his address, nothing has ever been done in this country for the development of electrical science or of the telegraph.

In view of the fact that the first practical telegraph line of any extent was built and operated in this country by Mr. Harrison Gray Dyar, in 1826, on Long Island, in this State, over which dispatches were actually transmitted, and that most of the more important telegraphic inventions and improvements have been made here, and by Americans, this omission is discreditable either to the speaker's fairness or to his intelligence. While we have no disposition to withhold from the many eminent electricians and telegraphic inventors of Great Britain the credit which is due them, we are certainly not willing to allow such a slight as that which President Hawkshaw has shown to go unnoticed or unrebuked.

It is in this country that most of the useful improvements and new adaptations of the telegraph have been made, and these have been gradually adopted in Europe until most of their telegraphs are worked upon American systems.

The comparatively slow and inefficient needle telegraph of William Fothergill Cooke, not "Wheatstone and Cooke," as President Hawkshaw has it, has been generally superseded, even in England, by the Morse system, and this is supplemented to some extent by the printing telegraph of Professor Hughes, an American, which is also very extensively used on the continent of Europe. The duplex system of Mr. Stearns, an American, is also being generally adopted on the English and Continental lines. The automatic system of Professor Wheatstone, which is highly praised, is known to be as much behind the American automatic system of Mr. Little, in successful operation in this country, as is the needle telegraph behind the Morse and printing telegraphs. The fire alarm telegraph system is the invention of Messrs. Farmer and Channing, both Americans; the quadruplex has been made practical by Americans; all the printing telegraph instruments which have proved of any value are the exclusive inventions of Americans; the quotation telegraph systems; the automatic fire telegraph system, by which instant notice is given of the commencement of fires, which has proved of great importance and value, is the invention of an American; the district telegraph system, by which messages can be summoned, policemen called, etc., has been invented and perfected by Americans; and the harmonic electric system, by which not merely four, but there is every reason to believe at least sixteen communications can be simultaneously transmitted through a single wire, is the invention of Mr. Elisha Gray, of Chicago, also an American.

Some of the first electricians of the world are also Americans. Professor Henry, of the Smithsonian Institute at Washington, an American, invented the intensity electromagnet, by which the transmission of telegraphic signals on long circuits became practicable. Messrs. Farmer, Channing, House, Page, the latter the inventor of the so-called Ruhmkorff coil, and many others eminent for ability as electricians, are Americans; but these are coolly ignored by the orator, who has never heard of any achievements in electrical science except those of certain British scientists whom he names, save by a few Germans, to whom he grudgingly accords some small credit.

In no other country has telegraphy acquired such perfection in actual use or been so universally adopted and used by the people as in the United States and Canada. More actual business is transmitted daily on a single circuit by two operators in this country than by four operators on two circuits on the English lines. Business is dribbled over the English lines slowly by means of needle telegraphs or by Morse registers, the use of which is universal there but exceptional here; and the automatic telegraph of Wheatstone gives a speed of seventy to eighty words per minute in actual business against 1,200 to 1,500 words per minute by the American automatic system. Only in cable telegraphy can any practical superiority be shown on the part of British electricians and telegraphers, and this arises from the fact that in the United States we have had no long submarine cables to operate. We consider it quite probable, however, that if the speed of transmission is hereafter materially increased over such lines it will be through American inventions, and had the cable telegraphs of the world centered in New York, as they have in London, we believe that our electricians would, before this time, have devised some method of transmitting through long submarine cables more than seventeen words per minute."—*The Telegrapher*.

If Sir John's address savors of egotism, nothing of the sort can be charged upon the *The Telegrapher*. The native modesty of the Yankee is proverbial, and the above prettily illustrates his method of practice.

DECISIONS OF THE COURTS.

United States Circuit Court—Northern District of New York.

PATENT CANNED GREEN CORN.—J. WINSLOW JONES *et al.*, vs. D. LEWIS MERRILL AND OTHERS, *et al.*—SAME vs. JOHN H. NOYES *et al.*—SAME vs. W. B. OSTRANDER *et al.*

Motions for preliminary injunctions to restrain alleged infringements of letters patent granted to John W. Jones, April 8, 1862, and May 13, 1862, for certain inventions of Isaac Winslow, relating to a new and useful improvement whereby corn in its green state is preserved in hermetically sealed cans. The first of the patents was for the product; the second, for the process.

[In equity.—Before WALLACE, J.]

Held:—An adjudication in favor of a patent at final hearing, and after full consideration of elaborate proofs touching the validity of the patent, must be held controlling upon an application for a preliminary injunction, unless cogent evidence is presented in addition to that which was found insufficient upon the final hearing.

While the fact that the defendant has obtained a patent for his process is not controlling in proceedings for an injunction, it is entitled to some weight.

The process covered by the patent of John W. Jones, assignee of Isaac Winslow, May 13, 1862, for preserving corn in its green state, involves three distinct features, each of which is essential to the result: First, separating the kernels from the cob; second, placing them in their natural juices in cans; third, sealing the cans hermetically and subjecting them to heat by water or steam until the kernels are thoroughly cooked.

This patent would not be infringed by a process in which the corn, whether on the ear or removed therefrom, is thoroughly cooked by the direct application of steam before it is canned.

Where it appeared that the defendants subjected their corn to the direct action of steam, or otherwise "cooked" it, before canning it, but heated it again in a steam bath after canning, a preliminary injunction under the Winslow patent was denied, although grave doubts were entertained as to whether that part of the defendants' process which was adopted prior to the canning was anything more than a colorable departure from the patented process.

Where defendants claimed to cook their corn in the ear thoroughly before subjecting it to heat in the sealed cans, but the printed label on their cans, prepared when they had no interest in warping the facts, stated that the corn was "cut from the cob while fresh and sealed at once, and then prepared by an entirely new process," etc.; held, that in proceedings for an injunction the defendants must be concluded by the statement they thus published to the world.

Where complainants were chargeable with knowledge of defendants' acts, but permitted them to continue their manufacture, and in response to an inquiry as to whether they regard defendants' process to be an infringement, returned an answer that led defendants to believe that they did not, an injunction was refused.

It is a general principle of equity jurisprudence that the court will not lend its extraordinary aid, by way of preliminary injunction, to any claimant who has encouraged or acquiesced in an infringement of his right, or unreasonably delayed in prosecuting for its violation.

Compensation for damages accrued and protection from future damages is all such a complainant is entitled to. This provided for by a bond.

W. H. Bright, W. H. Clifford, and E. W. Fox, for complainants.

Smith, Markham, & Smith, for Merrill & Soule.

Toner & Joslyn, for Noyes *et al.*

Sedgwick, Kennedy & Tracy, for Ostrander *et al.*

Recent American and Foreign Patents.

Improved Tram Stick.

John R. Byer, Attica, Mich., assignor to himself and Arthur H. Fish, same place.—The object is to improve the means for "tramming" the spindles and stones of grinding mills, and the device consists in a tram stick having an adjustable lever, to the end of which lever the "quill" is attached, and to the other end of which lever is an adjusting screw.

Improved Hose Coupling.

Mark M. Lewis, New York city, assignor to himself and Albert C. Aubrey, same place.—This is a hinged two-part tubular coupling, provided with flanges, grove, and rabbit, to enable it to be used independently, or with a middle-ribbed inner coupling.

Improved Railroad Gate.

John H. Eberhart, Sumter, S. C.—This invention consists of a pair of sliding gates meeting together at the middle of the way, which are coupled on each side by a bell crank and rods. There is a slide to be moved by the locomotive to open the gate when the locomotive approaches it, and to be closed by the rear car when the train passes away.

Improved Printing Press.

Calvert B. Cottrell, Westerly, R. I.—This relates to a graduated cam and segmental lever, which take the cylinder while in full speed from the bed, which is also in full speed, and stop it, while the bed continues its motion at full speed. They stop the cylinder, while the bed runs on, and without losing any time whatever on account of the stopping of the cylinder. Air springs are provided whose cylinders are on each end of the bed, while their stationary pistons are in corresponding positions on each end of the frame. These springs take up the momentum that is transferred thereto by the bed at each stoppage, and then retransfer the same at the start of the bed on its return in the opposite direction, thus allowing but little lost motion, and enabling the machine to be run much faster than usual, and with much less than the ordinary motive power.

Improved Car Starter.

Anthony A. Jones, Utica, N. Y., assignor to himself and Julius F. Chesebrough, same place.—This invention relates to the mode of connecting the foot rod which projects up through the platform of the car with the pawl, rod, and lever which operate the ratchet wheel mounted on the front axle. When the driver applies his foot to the plate on the rod, the horizontal arm of an elbow lever is depressed, thereby causing another rod to carry one or the other of the pawls into engagement with the ratchet. Simultaneously with this engagement, other devices act so that the pressure is thenceforth applied directly to the lever so long as it continues.

Improved Suspension Book Rack.

Frederick F. Hill, Essex, Conn.—This is an improved folding rack for books and ornaments, to be hung against a wall, so constructed that the shelves may be adjusted and secured at any desired distance apart.

Improved Wet and Dry Ore Crusher.

Henry Bolthoff, Central City, Col. Ter., assignor to himself and Charles F. Hendrie, same place.—A hollow cylinder revolves upon truck wheels placed in a frame. The motive power is applied to one of the truck wheel shafts, driving the mill by friction of the truck wheels on the periphery of the two heads, which are connected together by staves. The heads have a flange on the outer rim, and are protected from wear on the inner side by liners. For wet crushing, these staves are made watertight by the insertion of proper packing between them and at the ends, each stave having projecting ribs to hold the packing and stiffen the stave. Through the center of the cylinder, which is open, is placed a hollow pipe. Through this is fed the ore and water, the pipe having openings for the discharge of the same into the outside of the cylinder. Balls of cast iron are placed inside, and by the motion of the cylinder the ore and balls are brought into contact, and the crushing is done by concussion and abrasion; and when the ore is sufficiently fine to float, it rises to the top of the water and passes out in the form of pulp through registers on either side near the center into hoppers fastened to the stands; thence it passes in pipes to the amalgamating coppers, as used with stamps. For dry crushing, of course the ore, instead of discharging at the centers, discharges around the periphery through interstices between each stave, which are made much narrower than the wet mill stave, to give more discharging capacity, and are so shaped on the inside as to form corrugations, thus preventing packing of ore and balls, and thus aiding free discharge.

Improved Travelling Can.

Antoine Alexis Gervais, Paris, France, assignor to A. Gervais & Co., same place.—This relates to field cans in which are a chamber, having a fire grate or basket, an air channel, and a draft flue.

Improved Corn Sheller.

Hiram C. Creekmore and John W. McMillan, Salado, Tex.—This is a combination, with an inclined box, open on one side, of a cylinder or roller, to which saws and strips or bars are applied as means whereby the husks are stripped from the ears of corn, and the kernels removed as the ear passes through the box.

Improved Buckle Loop.

Frederick A. Neider, Madison, Ind.—This relates to an improved loop and buckle for carriage back stays and curtains, and consists of a flanged buckle-fastening plate tacked to the curtain or back stay, in connection with a sliding box fastened by the flanges and held in position by the buckles.

Improved Ventilator Cap.

Henry A. Gouge, New York city.—The base of the cap is secured to the upper end of the ventilator flue. The body of the cap is made of the same shape as the lower part, but larger, and is so arranged that its lower part may overlap the upper end of the lower part. The part is connected with, and supported from, the base part by bars. To the bars are secured the deflector, which is made in the form of two low pyramids, placed base to base. To the upper edge of the base part is attached the edge of a plate, which projects downward and outward until in line with the lower edge of the body, at which point it is bent inward and upward at an acute angle, thus forming an angular cornice around the top of the base. It is claimed that, no matter from what direction the wind blows, it not only cannot enter the flue, but actually induces an upward draft through the flue.

Improved Detachable Link for Chains.

Charles H. Gillingham and Albert L. Gillingham, Griggsville, Ill.—This detachable link for spur wheel chains will enable links to be quickly attached and detached, to lengthen and shorten the chain or to replace a broken or worn link with a new one. The invention consists in the body and a crosshead key, secured to each other detachably by a pin.

Improved Waterproofing Compound for Leather.

James Cuman, Brooklyn, N. Y.—This is a compound of paraffin, tallow, and resin, which are melted together, and with which the leather is impregnated.

Improved Traverse Motion.

Charles L. Noe, Bergen Point, N. J.—A master wheel, with two half circular cog rims in different planes, is arranged in combination with a train for turning a screw for working a traverse guide. In the train there are two pinions for transmitting the motion from the master wheel alternately in different directions, one taking it from one of the cog rims and the other taking it from the other rim. One of these pinions transmits the motion direct, while the other transmits it through the first pinion, so that one causes the screw to turn one way and the other turns it the other way, thus producing a continuous traverse of the guide forward and backward. The invention is applicable for bobbin winders for sewing machines, reels for fishing rods, and other spool or bobbin winding apparatus.

Improved Sad Iron.

Henry R. Robbins, Baltimore, Md.—This invention consists in a simple and ingenious device for the attachment of a handle to a sad iron, whereby it can be readily and easily detached from one iron and attached to another, thus making one handle answer for a number of irons.

Improved Steam Rock Drill.

Joseph C. Githens, New York city.—In describing this invention, on page 122 of our current volume, the following description of an essential part of the apparatus was omitted, owing to an error in the printed copy of the letters patent: The valve-shifting piston is made with hollow ends, a solid center and side ports, and is provided with a sliding band, made with ports at a greater distance apart longitudinally than the small holes or ports in combination with the cap of the steam chest, the sliding valve, the ports opening into the cylinder, and the piston.

Improved Screw Propeller.

Lewis C. Cary and George F. Cary, Portland, Me.—This is a combination of a hollow watertight protecting rim with the blades of a propeller. The protecting rim is constructed of a flat band, an oval band, and the stiffening rim. The object of the bands is to make the ring watertight and buoyant.

Improved Sleeve Button.

Jacob G. Missimer, Trenton, N. J.—The shank is bent at right angles to form a foot. In the outer side of the foot is formed a wide dovetailed groove, to receive a bar, which is made twice the length of the foot. The end of the bar and the foot are pushed through the button hole, which allows the shank to pass into the said button hole. The bar is then pushed forward and locked by a spring catch. To detach the button, a finger is inserted beneath the cuff, and the bar is pushed back, and the foot and bar are drawn out of the button hole.

Improved Gang Plow.

David A. Manuel, Napa, Cal.—The crank axle of the rear supporting wheel swings in a sleeve of the main beam. Both supporting wheels are applied by their crank axles in such a manner to the main beam that they run parallel to the line of draft. Two plows are firmly attached by clips to the main beam between the supporting wheels, and are adjustable thereon to different widths. A timble is swiveled to an extension of the rear crank arm, and travels in forward or backward direction on a screw sleeve, producing thereby the raising or lowering of the rear wheel by the swinging of the crank axle in the socket sleeve of the main beam, and the setting of the plows to any required depth. A hand lever moves the rear shaft, and lowers or raises thereby the crank axle and wheels, so as to regulate the working of the plows. The direction of the draft beam may, by adjusting nuts and brace, be changed slightly from the line of draft, and thereby the plows thrown to or from the land, as desired. The pole is secured into a tongue socket of the draft beam, and set at the front end to such height that the weight is taken off from the horses' necks.

Improved Cultivator Frame.

William M. Coston, Quitman, Mo.—This cultivator frame is so constructed that the seat support can be turned over forward, leaving the rear part of the frame wholly unobstructed, so that the machine can be used as a riding or walking cultivator, as desired.

Improved Electro-Magnetic Engine.

Charles A. Hussey, New York city.—This is an improved electro-magnetic engine for running sewing machines and other light machinery, by which the induction currents of the magnets and sparks at the commutator are entirely avoided, and a more perfect utilization of the battery current is produced. The essential features are the stationary magnets having radial arms with T-shaped ends, arranged in alternating position, so that the pole ends of one face the intermediate space between the pole ends of the other; the outer stationary magnets having widening pole ends of T-shape at right angles to the arms; the central revolving magnet provided with widening pole ends of double T-shape at right angles to the radial arms of the same, and the stationary and revolving magnets having radial arms and widening pole ends whose face width is somewhat larger than the distance between two adjoining pole extremities, so as to lap on the pole ends across the intermediate space.

Improved Paper Pulp Engine.

Alvin Gardner, Windsor, Canada.—A box of six sides has a tapering recess or well formed in its middle part, into which is fitted a tapering ring. In grooves in the face of the tapering ring are secured knives, which are set at an angle. In the cavity of the tapering ring is placed a beveled wheel, to the face of which are attached other inclined knives. To the top of the wheel is attached a scraper, by which the pulp is pushed outward toward the walls of the box. In using the engine, the wheel is raised, the rags to be cut are placed beneath it in the cavity of the ring, and the wheel is lowered upon them. As the wheel is revolved the rags are cut by the knives, the inclination of the said knives preventing the cut from being made short, and tending to produce a pulp with a longer fiber. The inclination of the arms tends to draw the pulp down through the wheel. The scraper enables the engine to be run more slowly, while at the same time producing a proper circulation of the pulp.

Improved Bilge Water Valve for Ships.

Joseph W. Hughes, Newburyport, Mass.—Stops are arranged between the timbers to hold the water in the bilge, and self-closing valves are applied to the stops to open and let the water in freely when the ship's sides rise, and close and retain it when they fall.

Improved Shutter Worker.

Jacob D. Hughson, Prairie City, Ill.—The invention consists of an elbow lever pivoted on the window sill inside of the lower sash, with its second joint arranged below the stop and above the sill, and connected by a link with a T-shaped lever. Said lever at one end is pivoted to the sill, and at the other is connected to the lower end of the blind, all in such manner that the blind can be opened and closed readily by merely swinging the first mentioned lever forward and backward. There are stops on a stop plate combined with this lever, so as to hold it for fastening the blind open or closed.

Fertilizer Distributor, Planter, and Cultivator.

Bolivar Scofield, Cartersville, Ga.—To the sand board and sway bar, between the frames, is secured a box, from which two spouts lead down nearly to the ground, the forward spout being intended to conduct the fertilizer to the ground, and the rear spout to conduct the seed to the ground. The front and rear sides of the box have semicircular notches formed in them to receive barrels designed to distribute guano or other fine fertilizer, and to distribute seed. Holes in the barrels may be partially covered to regulate the discharge, and the said barrels are rotated by suitable mechanism. The driver, by operating a lever with his foot, can adjust the three plows to work at any desired depth in the ground, or can raise them entirely away from the ground, as may be desired, and a harrow can be raised from the ground by and with the opening plow. The harrow removes lumps, clods, and rubbish, the opening plow opens a furrow to receive the fertilizer and seed, the fertilizer is deposited in the furrow through the spout close in the rear of the plow, the fertilizer is covered, and the furrow is partially filled by the covering plows. The seed is then deposited through the spout, and covered by a weighted plate.

Improved Bee Hive.

Samuel Hixson, West Newton, Pa.—This is a box hive having a moth trap in connection with the bee entrance. The bee entrance is on the under side of the removable trap, which is grooved on its under edge. The entrance of the moth miller is resisted by the bees, and she is driven to take refuge in one of the grooves, where she lays her eggs, and escapes from the open end of the groove. The worms that hatch from the eggs are easily kept from the bee entrance, and go the other way to gain an entrance to the hive, and, reaching the ends of the grooves, they drop off and fall to the ground.

Improved Colter Attachment.

John S. Johnson, Rockford, Ill.—This consists of devices to attach a revolving colter so that it can be readily adjusted as to height, to the width of the furrow, and to the line of draft.

Improved Locomotive Engine.

Thomas T. V. Smith, Yarmouth, N. S.—This is a modification of the present ordinary locomotive, so as to admit the use of a wider fire box, to enable broad gauge boilers with wide fire boxes to be readily and cheaply altered to the narrow gauge, and to admit the use of large locomotives on much narrower gages and cheaper railroads than is now practicable. It is proposed to do away with the ordinary truck in front, supporting the engine by the driving wheels, which are placed so far forward as to clear the fire box, and to introduce a second outside frame running back to the rear of the tender, resting in front on the inner frame, and working upon it with a truck center. The whole is, in fact, a composite carriage, in which the engine forms the front truck and the tender the hind truck. One feature in the invention is that the overhanging weight of the fire box rests on the outside frame, being free to work horizontally, to allow for the lateral play in passing curves.

Improved Mechanical Movement.

Philip Bellinger, Paoli, Ind.—The invention consists of alternately acting handle levers and treadles, which are applied to a double crank shaft with balance wheel, and also to a second crank shaft turning in pivoted bearings, with an equalizing attachment. The object is to change rotary reciprocating into rotary motion.

Improved Rattman's Boot Calk.

Rufus D. Gullford, St. Charles, Mich.—This calk is formed from rectangular pieces of sheet steel, struck up in suitable dies, whereby its corners are bent down to form spurs. The calk is secured to a boot or shoe sole by means of a screw.

Improved Rubber Drawers for Invalids.

Maria Bradley, New York city, N. Y.—This invention consists in rubber drawers for invalids, formed of a body open at the sides, and a tube formed integral with the drawers. The tube is made of such a length that it can be fed from the invalid to a vessel placed at the side or beneath the bed, to receive the urine as it flows out through said tube.

Improved Stop Motion for Steam Engines.

Thomas Evans, South Manchester, Conn.—This consists of an auxiliary steam cylinder, connected with the main steam pipe, and provided with a weighted valve, and a piston whose rod is connected with the cross head and an air valve of the condenser for interrupting the action of the main steam cylinder on the opening of the cylinder valve.

Improved Packing for Stuffing Boxes.

Richard Greenalch, Greenbush, assignor to himself and William Buchanan, Yonkers, N. Y.—This invention consists of rubber steam packing cut in long pieces shaped transversely to pack around the rod and fill the space between the rod and the box nicely, so that they receive the pressure of the gland in their lengthwise direction instead of crosswise, as commonly arranged.

Improved Chain Pump.

William Wehres, Evansville, Ind.—This fits to the barrel, and is also readily repaired by unscrewing the swivel connection with the chain. It is made of rubber and attached to a central bolt, to be held between a disk of the same and a binding swivel screwing thereon, the bolt and swivel turning readily in a swivel at the other end of the bucket. The pump barrel has a longitudinal water drop groove.

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Notes & Queries.

W. T. A. will find a description of rosin oil on p. 266, vol. 31.—L. H. R. and G. B. T. will find formulas for safety valves on p. 330, vol. 32.—H. J. C. will find a rule for ascertaining the increase of temperature of air by compression on p. 123, vol. 33.—A. E. B. can silver looking glass by the process given on p. 234, vol. 30.—L. M. P. will find directions for waterproofing paper on p. 146, vol. 31.—A. M. will find a recipe for a fine boot blacking on p. 280, vol. 31.—M. P. will find directions for bronzing brass castings on p. 283, vol. 31.—C. C. H. will find directions for annealing lamp chimneys on p. 42, vol. 26.—C. H. F. will find directions for photographing on wood in *Science Record* for 1874, pp. 187, 188.—B. C. will find full directions for molding rubber on p. 283, vol. 29.—H. P. D. will find directions for making a polishing starch on p. 263, vol. 31.—G. M. P. can repair rubber hose by the method described on p. 203, vol. 30.—G. A. P. can Japan small iron articles by the process described on p. 208, vol. 26.—W. R. McF. can rid his house of ants by the process given on p. 319, vol. 33.—A. D. S. & S. will find that a gold lacquer for brass is described on p. 322, vol. 30.—A. G. A. will find a recipe for marine glue on p. 43, vol. 32. Fish glue is described on p. 408, vol. 24.—B. F. will find directions for gilding picture frames on p. 347, vol. 31.—R. B. R. will find a formula for ascertaining the power of a windmill on p. 241, vol. 32.—E. R. A. E. H., and E. R. will find directions for preserving natural flowers on p. 266, vol. 31.—E. C. L. Jr. will find a description of the process of cutting gears on screw-cutting lathes on p. 187, vol. 29.—W. S. H. will find directions for putting gold lacquer on tin on p. 139, vol. 32.

(1) G. B. R. asks: If the electricity generated in a Rhumkorf coil were changed into electro-motive force, would there be a greater amount than was developed in the battery used to run the coil? A. There would not.

(2) F. G. asks: 1. In a copper and zinc battery, should a wire be attached to each of the plates, and the ends of the wires be connected; or should the wire leading from the copper plate be connected to the zinc by the binding screw? A. A wire should be connected to the copper and another to the zinc. 2. How is the circuit made? A. The circuit is made by connecting the two wires together. 3. When 1 part oil of vitriol to 10 or 12 parts water is used, how long is it before such battery is ready for use? A. The battery will be ready for use as soon as it is set up. 4. If the zinc weighs 1 lb., how much should the copper plate weigh? A. A thin sheet of copper will answer. 5. Can the copper plate in a battery be used a second time? A. Yes.

(3) F. G. S. asks: How long will a well tempered compass needle retain magnetism? A. It would depend upon the quality of the steel and the care with which it was used. It is impossible to state the time without knowledge of the facts.

(4) S. W. says: My battery jars are covered with a coating that breaks off and crumbles easily. It is white in the gravity batteries, and blue in the Daniell. What are the cause and the remedy? A. The white deposit is sulphate of zinc; cause of its formation is that the solution is saturated. Remedy, dilute the solution with water. By painting or greasing the top of the jar, the tendency to creep over will be removed.

(5) A. E. P. asks: 1. I propose laying a telegraph line, $\frac{3}{4}$ a mile long, with No. 23 wire. How many cells of Calaud's battery would it require to run it, the wire in the magnet being No. 21? A. Twelve. 2. Would it be better for that distance to use finer wire on the magnets? A. Yes. 3. What size would be best, and how much should be on each magnet, there being only two sounders in the circuit? A. Use 500 turns of No. 23.

(6) A. W. C. asks: What is the process of deodorizing alcohol? A. Spirit of wine, brandy, or alcohol distilled over soap lose their empyreumatic odors and tastes completely. At about 215° Fah. the soap retains neither alcohol nor wood spirit. The soap employed should contain no potassa; it must be a hard or soda soap, and ought to be completely free from fatty acids or fluids, otherwise it may render the product rancid and impure. Common soap made from olein and soda has satisfied all the conditions in practice. If this soap be employed, it will be better to add a little soda during the first distillation. Thirty-three pounds of soap is enough for 100 gallons of empyreumatic brandy. Attwood's patent alcohol is deodorized by distillation over permanganate of potash.

(7) J. A. asks: 1. How much (length or weight) fine wire is absolutely necessary for a machine to give a shock that can be sustained comfortably, say 200°? A. From 1 to 3 lbs. 2. Is it necessary to have two thicknesses of wire? A. Yes.

(8) L. K. Y. asks: How is wood naphtha made? A. See p. 128, vol. 33.

1. In what way is perchloride of iron made? A. Dissolve pure protoxide of iron in dilute muriatic acid, and crystallize the salt out by evaporation of the solvent. 2. How can I make nitrate of iron? A. Dissolve pure iron or its oxides in nitric acid until it will dissolve no more; filter the solution and evaporate to dryness over a water bath. The residue should be redissolved in hot water and the solution again filtered and evaporated as before, in order to remove any basic salt that may have formed, and as much of the superfluous nitric acid as possible.

What do you mean by a primary coil and a secondary coil? A. See p. 115, vol. 33.

(9) W. E. E. asks: What cement or putty is best to use on a chamfered slate joint which is

exposed to the sun's heat, cold, etc.? A. The form you have adopted for the joint is not very favorable for retaining the packing; a better form would be that of a plain butt joint, and this would be still better if provided with a firm blade between to receive the packing of each slab alone, independent of the adjacent one. We know of no cement that will answer your purpose so well as one formed in great part of asbestos. Of course the composition of the best of these, such as have been proved of value in practice, is not divulged by their proprietors. We understand, however, that they are furnished as articles of commerce.

(10) H. C. B. says: We have a dispute as follows: I affirm that to make an inside chaser from a hub to chase a right hand inside thread correctly, a left hand hub must be used, or, in other words, a right hand hub will make a left hand inside chaser. I do not affirm that the thread cannot be cut with either; but, that the thread may have the correct pitch, the left hand hub must be used. Am I right or wrong? A. Right. For complete explanation, see No. IV. of "Practical Mechanism."

(11) I. H. M. Jr. asks: How can I print from a plate of bichromated glue (acted on by a photographic negative) on common paper, with printer's ink? A. Coat evenly a glass plate with a strong solution of gelatin in water, and when dry, flow over this a filtered solution of bichromate of potassa in water. Expose this to strong sunlight for a short time. Repeat this operation—with gelatin and potash bichromate, as before—several times until a good background of insoluble gelatin bichromate is obtained. Then prepare the plate in a darkened room as at first, and expose under the negative as in solar printing; an exposure, with a good light, for from fifteen to twenty minutes is usually sufficient. On removing the negative, place the bichromate plate immediately in a large quantity of clean cold water in a dark place, and allow it to remain immersed several hours. The water should be changed in the mean time, in order that all the unchanged gelatin bichromate should be completely dissolved. The film may then be removed from the glass plate, dried, and mounted on a slab of lead or zinc for printing.

(12) A. B. C. asks: How can I toughen steel tools, such as gravers, etc., to make them retain a good sharp edge for cutting gold and other metals? A. If you use any of the best grades of tool steel, and leave them hardened right out, without drawing the temper at all, your gravers will stand and cut well.

(13) F. H. of Berlin, Germany, asks: Which electromagnets will be the strongest of these two: One has one coil of thick wire, and the other has two or more coils of thin wire wound around it. The sizes of the magnets as well as the weight of the copper in the wires are supposed to be the same in both cases, as well as the current used for magnetizing. A. Probably the single coil of thick wire. It would depend, however, upon the resistance of the wire and battery. When the resistance of the wire and battery are equal, the maximum magnetic effect is secured.

(14) L. N. B. asks: 1. How can I nickel plate bars of iron $3 \times 1\frac{1}{2}$ inches? A. Various solutions for nickel plating have been suggested, but perhaps one of the best, at least one highly recommended, is that containing the double salt of nickel and ammonium. This is prepared by dissolving 1 part by weight of sulphate of ammonia and 2 1/2 parts sulphate of nickel, in sufficient water to make a saturated solution, a little more water being added afterwards to prevent any tendency to crystallize. Considerable trouble is usually experienced by the amateur in his efforts to obtain a good deposit. The principal difficulty, however, consists in the management of the operation, and the necessity of employing a proper anode, which is rather hard to obtain. The anode should present a surface in excess, if anything, of that of the object to be coated, and the battery power must be carefully regulated to the work required. Unless this is done the deposit is apt to contain gas, which is always evolved in greater or less quantities with the deposition of nickel, and this is liable to make the deposit porous or flaky. A good plan is to use two or three Grove or Bunsen in series, until a slight coating is obtained, after which a single Smee cell, of proportions depending on the size of the object to be coated, should be used to complete the operation. It is well, also, to keep the solution alkaline by adding a little ammonia from time to time. 2. What battery is the best for such purposes? A. The Smee.

(15) V. C. asks: How must I proceed to repair the soldered parts of double-barreled guns, using no tools but the copper bit? A. Clean the parts to be soldered, and apply to them muriatic acid which has been killed with zinc. Warm the parts, and solder in the usual way with fine solder.

(16) G. A. says: In your paper on the slide valve, by Joshua Rose, he leads me to infer that an engine, when just beginning to take steam, should have its exhaust port about two thirds open. In looking at our valve and the ports in steam chest, I find that ours is not more than one fourth open. The engine makes a groaning noise when loaded or partly so. What had I better do to ease it a little? Would it be best to lengthen the valve? A. Your valve should be lengthened. At least $\frac{1}{4}$ inch more lap should be added to each end; this involves the necessity of a new eccentric to increase the valve travel, which should not be less in your case than $\frac{3}{16}$ inches.

(17) L. says: I have a lathe, the spindle of which revolves in a very soft and fusible alloy. As the bearing has worn out of true, I wish to cast a new one. What is a good alloy? A. You cannot do better than use the best grade of Labbitt metal; or mix and use the following: Zinc 17 parts, copper 1 part, antimony $\frac{1}{4}$ parts.

(18) H. S. asks: What is the pressure of water per foot of current of a river 10 feet deep, moving at 5 miles per hour? A. The pressure will vary with the depth, and may be best ascertained by making a piece of board a foot square, and suspending it like a swinging sign in the river current. A cord attached to opposite points of its surface and to a spring balance will practically answer your query.

(19) G. H. W. asks: Please give me the proper size of propeller, engine, and boiler for a boat 36 feet long, 6 feet wide, drawing $1\frac{1}{2}$ or 2 feet of water. I want the boat to go at a speed of 16 miles an hour. A. Most builders would hesitate to guarantee such a speed for so small a boat, at least without the inducement of an extraordinary price.

(20) E. P. says: In your issue of August 28 you say: "Ice boats very frequently travel faster than the wind that drives them." I, with several other engineers, would be glad if you would give us the facts or philosophy on which this statement is founded. In our view, it is plain that, if a boat moves faster than the air around it, its sails must displace the air in front of them. Now where does it get the force to do this? The proposition that a moving body which gets and retains its force and motion only from the moving air can do this, involving as it does the corollary that the pressure of the air in front of the sails is greater than the pressure behind them, appears to us to be an absurd idea which we cannot for a moment believe that you would entertain. A. This ice boat question has been frequently discussed in our columns, and explanations given with diagrams showing the lines of the forces and why the boat moves faster than the wind. Our esteemed correspondents are referred thereto.

Consult, for one example, page 170, vol. 28. But if any of them are unable by a study of the theory to satisfy themselves of the fact, we advise them to construct an ice boat this winter and try the experiment practically. They will find that, with a properly constructed machine, skilfully steered, in a wind moving say thirty miles an hour, they can travel from forty to fifty miles an hour, or more, according to the state of the ice. If prevented from experimenting, let them read the New York daily papers which in winter contain frequent accounts of ice boat regattas on the Hudson river, giving the velocity of the wind and the increased speed of the boats over the wind.

(21) J. M. G. asks: How can we Texas farmers destroy the countless swarms of rabbits which nearly destroy our growing crops of wheat, and make sad havoc among our garden stuff? A. Enclose a space with wire netting, leaving room for the rabbits to enter, and bait it with carrots. In the winter, large numbers can be attracted to a spot by this means.

(22) J. E. P. asks: Do you know of any preparation to cover a rough laid brick wall with in place of mastic? A. To stucco a rough brick wall, make a mortar consisting of 1 part lime to 2 parts sand; add water and work it up thoroughly. But to make reliable work, the lime and sand must be of the best, and properly prepared before being mixed. Take a good fresh stone lime; shake it just sufficient to make a fine dry powder and not a paste. Throw this powder against a $\frac{1}{4}$ inch mesh wire screen; what passes through is fit for use, the remainder should be rejected. The sand must be of the sharpest, screened to a uniformity of size, and washed thoroughly clean of all mud and dirt. Clean the wall of all loose dirt, mortar, etc., with a stiff broom. Then apply the mortar in two coats; the first a rough coat to bring the wall to a fair surface, and the second a finishing coat. Put on the second coat before the first is entirely dry. Also, put in a little cream water color, to as to set with the stucco. The wall should be protected at top by a projecting roof.

(23) J. V. H. says: I find that the lead pipe carrying off water from my bath and washstands is becoming clogged up. Can you tell me of a remedy? A. Pour a little strong ammonia down the pipe.

(24) F. L. says: 1. I have an engine 3×6 inches, and intend to run a propeller 30 inches in diameter. What size of boiler would be suitable? A. A tubular boiler 28 inches diameter by 4 feet high would probably be large enough. 2. I have an awning for a boat. How can I make it waterproof? A. Cover it first with a solution of soap, then with a solution of alum.

(25) E. G. A. says: I am continually seeing statements to the effect that, during a thunderstorm, the electricity passed down the lightning rod, escaping into the ground. Is not the reverse the case? Does not the electricity pass from the earth up the rod and neutralize the electricity of the cloud overhead? If not, why not put a ball on the upper end of the rod and point the lower, for has not experiment demonstrated that electricity will flow off a point with more rapidity than off a round surface, and the reverse in passing on? If this be not the case, what is the necessity of placing balls on the posts of an electrical machine and points on the ends of the spokes of an electrical wheel? A. It is conventionally assumed that the current always passes from positively to negatively electrified bodies, so that what we call its direction depends altogether upon which is the positive and which the negative body. As a matter of fact, the atmosphere is usually positive relatively to the earth; but it is evident that the action of the clouds upon each other, under the influence of different currents of air, may result in charging them with opposite electricities. When the conditions are favorable, they then act inductively on the earth, the positive cloud inducing a negative charge in the portion directly under its influence, and the negative cloud a positive charge. If a rod is present or the degree of electrification is sufficiently great, a discharge takes place from the earth to the cloud in one case, and vice versa

in the other. It is not correct, therefore, to say that the discharge is always in the same direction when referring to any one rod. Points receive and give off charges more readily than surfaces do. It is in consequence of this fact that round surfaces are used with the electrical machine, and points with lightning rods, the object being an accumulation of electricity in one case and its dissipation in the other.

(26) J. W. S. asks: How can I render pasteboard unflammable? A. Soak your pasteboard in a solution of tungstate of soda, and dry in the sun.

(27) E. G. A. asks: 1. Have there ever been any experiments made to ascertain the relative size of the atoms of various substances? Respecting the constitution, shape, size, and absolute weight of elementary atoms, chemists know nothing; but they have proved that the atoms of hydrogen are lighter than those of any other element, and they have discovered how many times heavier each elementary atom is than an atom of hydrogen. Thus, we know how many times heavier an atom of carbon is than an atom of hydrogen; and the so-called atomic weight of carbon is a statement of its atomic ratio. 2. Do all atoms weigh the same, or do they vary in different substances? For example, does one atom of aluminum weigh the same as one atom of platinum? A. They vary; hydrogen being 1, aluminum is 27.48, and platinum 197.88.

What do the best authorities decide is the cause of gravitation? A. It is an inherent property of every particle of matter in the universe to attract every other particle, with a force directly proportioned to the mass of the attracting particle, and inversely to the square of the distance between them. A satisfactory hypothesis has never been offered in explanation of the cause of this universal attractability of matter.

(28) B. asks: Can earth and calcareous sand, containing from 10 to 30 per cent of sulphur, be separated by any other method than the Sicilian kiln or calcoroni? If so, where can I find the process? A. Consult Wagner's "Chemical Technology," pp. 194 to 199. See also p. 298, vol. 31 of the SCIENTIFIC AMERICAN.

(29) S. L. L. says: I have been trying to obtain oxygen gas from water by means of sulphuric acid and chloride of lime. I knew that the sulphuric acid would unite with the lime, setting free the chlorine, which, uniting with the hydrogen of the water, would, I thought, permit the oxygen to pass through a capillary tube, and be shown by the application of flame. I saw the gas rise in the tube; but it would not affect the flame when a match was applied. What was the reason? A. Your reaction simply gives you sulphate of lime and chlorine water. Under the existing circumstances, the chlorine does not attack the hydrogen.

(30) G. L. asks: What is oxphosphate of iron? A. There is no such substance.

What is the process of condensing milk? A. See p. 343, vol. 33.

(31) C. P. W. says: I. What is the green substance that is formed when unbrowned coffee is put into the white of an egg? A. It is a compound resembling tannate of gelatin. 2. In Youmans' "Chemistry," it is stated that tea arrests transformation; in a work entitled "Foods," it is stated that tea hastens transformation. Which is correct? A. The best series of experiments on this point are by Julius Lehmann, who found that the use of tea and coffee as articles of diet appeared to exercise an important influence in retarding the waste of the tissues of the body.

(32) T. F. H. says: I have a set of silver articles with black wooden handles which have turned brown in color by being buried in a damp bank vault. What can I use to stain the handles black and restore the polish? The wood is very hard, I presume ebony. A. Dip the handles in a boiling solution of weak caustic alkali, to dissolve all the grease; dry, and apply a solution of nitrate of silver. It will be necessary, often, to apply two or more coats of the nitrate of silver.

(33) J. E. asks: Is there any perceptible shrinkage in gas in consequence of the gasometer pit leaking and being renewed with water? In other words, does fresh water require to be saturated to a certain degree with gas before the gas holder will rise, a portion of gas being absorbed every time more water is added? A. There will be a slight absorption of the gas by the water. The two principal ingredients of coal gas are hydrogen and marsh gas, and 1 cubic inch of water absorbs 0.0015 cubic inch of hydrogen, and 0.035 cubic inch of marsh gas. There will be no stoppage in the rising of the gas holder on account of this slight absorption.

(34) A. S. asks: What will remove mud spots from heavy black silk? A. The safest plan is to wash carefully with good soap.

(35) G. A. F. asks: 1. Is cow or horse manure better for lettuce, beets, cucumbers, etc., and why? A. The latter, as it is more highly nitrogenized. 2. In what kind of soil should musk melons be raised? A. A rich sandy soil.

I recently purchased a fine specimen of calamine, purporting to come from Arizona. Does that territory contain that mineral? A. If so, it must be in a new locality as yet unknown to mineralogists in the East.

(36) C. L. asks: What are the methods of obtaining the silicic acid and aluminum ethers? I believe they were discovered some few years ago (6 or 7) by Mr. Theophile Zehewskofski. A. Dibasic silicate of ethyl ($\text{C}_2\text{H}_5\text{O}_2\text{Si}_2\text{O}_5$) is formed by adding alcohol gradually to chloride of silicon. A powerful reaction occurs; hydrochloric acid is evolved in abundance, and a colorless liquid is obtained, which, when submitted to distillation, at first evolves hydrochloric acid; but the boiling

point rises rapidly until it reaches 330°F ., at which temperature pure dibasic silicate of ethyl distills over. It is a limpid liquid, of a pleasant ethereal odor, and a hot taste resembling that of pepper. It is combustible, and burns with a flame of dazzling whiteness, depositing pulverulent silica. The composition of this body is remarkable, 4 volumes of vapor being produced from the compound, $\text{C}_2\text{H}_5\text{O}_2\text{Si}_2\text{O}_5$; favoring the hypothesis of the tetratomic character of silicon, with an atomic weight of $\text{Si}=28$. This ether is not miscible with water, but is decomposed by it, with the separation of gelatinous hydrate of silica. Silicic ether ($\text{C}_2\text{H}_5\text{O}_2\text{Si}_2\text{O}_5$) is a second ether, containing only half the quantity of oxide of ethyl that is present in the foregoing compound. It may be procured by acting upon alcohol of specific gravity 0.833 with chloride of silicon, and distilling. The dibasic silicate is formed at the same time, and the first portions of the distillate consist entirely of this compound; but by degrees the boiling point becomes higher, and when it reaches 660°F ., the pure monosilicate passes over. The dibasic silicate of ethyl, in fact, transformed into the monobasic silicate by the action of the water present in the dilute alcohol, occasioning the decomposition of the dibasic silicate into the monosilicate, while alcohol is set free. If more water be added, a viscous compound is obtained, which, according to Ebelman, contains a third ether, with twice as much silicic acid as the foregoing one. Aluminic ether or aluminum ethyl, Dr. Cossa states, can be prepared by causing aluminum to act upon stannic ether. For further particulars of processes, consult Wurtz' *Dictionnaire du Chimie*, vol. 1, p. 1352.

(37) J. E. L. says: I have an article of pearlash containing 14 per cent of phosphate of potash. What will be the most economical process for separating it from the carbonate? I desire to get a perfectly pure carbonate, and to utilize the phosphate. A. It cannot be done cheaply. It would be necessary to convert one of these soluble bodies into an insoluble, and then reconvert it into the original condition.

(38) H. R. P. asks: What effect does chocolate have on the system? A. Chocolate, when properly prepared, is considered by physicians as a very wholesome and nutritious substance.

(39) J. H. M. asks: Can ammonia be distilled or obtained from common sea weed? A. Ammonia can be obtained by distillation, in closed vessels, of organic matters containing nitrogen. A large amount is obtained from the refuse product of the distillation of coal for the manufacture of gas. Among the products are water and a considerable quantity of carbonate and hydrosulphate of ammonia; the ammoniacal salts become dissolved in the water, and constitute the ammoniacal liquor of the gas works; this liquor is saturated with sulphuric or hydrochloric acid, and thus the sulphate or muriate of ammonia of commerce is procured.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. W. H.—No. 1 is impure limestone. No. 2 is argillaceous shale colored by red oxide of iron (the blue portions by carbonate of copper in traces). In some pieces the amount of iron is considerable. No. 3 is the same, but with less iron.—J. M. H.—You had better consult the druggist from whom you obtained the pills.—J. R.—No. 1 is sulphide of lead with silice. It has been fused previously. Of No. 2 the part insoluble in acid is silice; the remainder is composed principally of iron with some alumina. No. 3 is quartz and sulphide of iron. No. 4 did not arrive. No. 5 is sulphide of iron partly altered to oxide.—B. F.—No. 1 is chlorite rock. No. 2 is quartz rock. No. 3 is steatite rock with quartz vein. No. 4 is talcose schist. No. 5 is talcose schist with talc. No. 6 is quartz with chlorite and decomposed micaceous schist. No. 7 is quartz rock. No. 8 did not arrive. No. 9 is a jaspery quartz. No. 10 is quartz rock with traces of iron and manganese. Although some of these specimens have the appearance of gold bearing rocks, the fact could be ascertained only by assay on a considerable quantity of ore.—G. P. L. R.—No. 1 is decomposed granite. No. 2 is white porcelain clay.—A. W. D.—It is hornblende, containing silica, alumina, lime, magnesia, and iron, but is not of value.—J. B.—It is milk quartz and is not valuable.—A. J. G.—Gold is not present.—G. H. C.—It is pyrites.—P. H. L. and J. I.—It is iron pyrites, of little value.—C. R. T.—It owes its peculiar character to a large percentage of red oxide of iron.—A. T. H.—It is a variety of granite rock, and may be used in building.

COMMUNICATIONS RECEIVED.

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

On Cotton Mathematics. By H. V. M.
On a Power Manual. By A. S. R.
On Astronomical Calculations. By S. D. S.
On Heating Churches. By J. L. S.
On Wagon Wheels. By P. K. W., and by G. A. G. Jr.
On the Keely Motor. By F. W. Jr.
On Electric Force. By F. S. P.

Also inquiries and answers from the following:
J. B. N.—J. B.—E. L. E.—W. R. H.—G. E.—I. E. 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.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket,

as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best washing machine? Whose is the best cross-cut saw? Why do not makers of magic lanterns advertise in the SCIENTIFIC AMERICAN? Is there a really fireproof and burglar-proof iron safe? What does a Rhuemkorf coil, capable of giving a 12-inch spark, cost?" All such personal inquiries are printed, as will be observed. In the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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DESIGNS PATENTED.

8,811.—TYPER.—H. H. H. Philadelphia, Pa.
8,812.—BOA.—G. H. H. Philadelphia, Pa.
8,813.—TRIMMING.—G. H. H. Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$1.
On each Trade mark.....	\$2.
On filing each application for a Patent (17 years).....	\$10
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
September 8 to 14, 1875.

- 5,147.—J. Hall, Toronto, Ont. Revolving reel bake ovens. Sept. 8, 1875.
5,148.—G. H. Jones, Rose, N. Y., U. S. Mold for casting turbines. Sept. 8, 1875.
5,149.—H. Wheeler, Bell Ewart, Ont. Extension stove leg. Sept. 8, 1875.
5,150.—P. S. Laurent et al., Sherbrooke, P. Q. Stove heater. Sept. 8, 1875.
5,151.—W. A. McChute, Pittsfield, Ill., U. S. Seed drill. Sept. 8, 1875.
5,152.—C. Hood, Hartford, Conn., U. S. Combined ladder and wash bench. Sept. 8, 1875.
5,153.—C. Boeckh, Toronto, Ont. Fiber and bristle combing machine. Sept. 8, 1875.
5,154.—J. H. Sheldon, Chicago, Ill., U. S. Illuminating gas. Sept. 8, 1875.
5,155.—G. H. Thompson, Oneida, Ont., et al. Device to prevent horses from jumping over fences. Sept. 10, 1875.
5,156.—J. D. Mann, Kentville, N. S. Snow plow. Sept. 10, 1875.
5,157.—J. Guest, Jr., Merrickville, Ont. Churn power. Sept. 10, 1875.
5,158.—H. Gillechrist, Louisville, Ky., U. S. Extension ladder. Sept. 10, 1875.
5,159.—J. Edgar, New York city, U. S. Coal shovel. Sept. 10, 1875.
5,160.—J. W. Mann, Woodhouse, Ont. Seed sower. Sept. 10, 1875.
5,161.—F. M. Gardner, Hornellsville, N. Y., U. S. Lifting attachment for shovels and forks. Sept. 10, 1875.
5,162.—C. B. Long, Worcester, Mass., U. S. Machine for crimping leather. Sept. 10, 1875.
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5,164.—L. Glynn, Cambridgeport, Mass., U. S. Pipe wrench. Sept. 10, 1875.
5,165.—H. W. White, Oskaloosa, Iowa, U. S. Guitar head. Sept. 10, 1875.
5,166.—H. W. White, Oskaloosa, Iowa, U. S. Chin rests for violins. Sept. 10, 1875.
5,167.—A. Manbré, Penze, England. Process of extracting sugar, etc. Sept. 10, 1875.
5,168.—J. Commins, Charleston, S. C., U. S. Composition for kindling fires. Sept. 10, 1875.
5,169.—A. F. Skidmore et al., Litchfield, Minn., U. S. Machine for cutting hoops. Sept. 10, 1875.
5,170.—I. C. Richardson, Nashua, N. H., U. S. Steam heating apparatus. Sept. 10, 1875.
5,171.—E. B. White, Arkona, Ont. Barrel and circular box. Sept. 10, 1875.
5,172.—H. Wanby, Toronto, Ont. Stone pipe stone mold. Sept. 13, 1875.
5,173.—E. Middle, Carlin, Nevada, U. S. Hydraulic jack. Sept. 14, 1875.
5,174.—J. Rice, Black Brook, N. B. Roller hoisting apparatus. Sept. 14, 1875.
5,175.—J. Regan, Ottawa, Ont. Framings and molds to make wells, drains, etc. Sept. 14, 1875.
5,176.—J. B. Clark, Plantville, Conn., U. S. Dies for heading and squaring bolts. Sept. 14, 1875.

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Vol. XXXIII.—No. 16.
(NEW SERIES.)

NEW YORK, OCTOBER 16, 1875.

\$3.20 per Annum.
(POSTAGE PREPAID.)

THE EIGHTY-TUN GUNS.

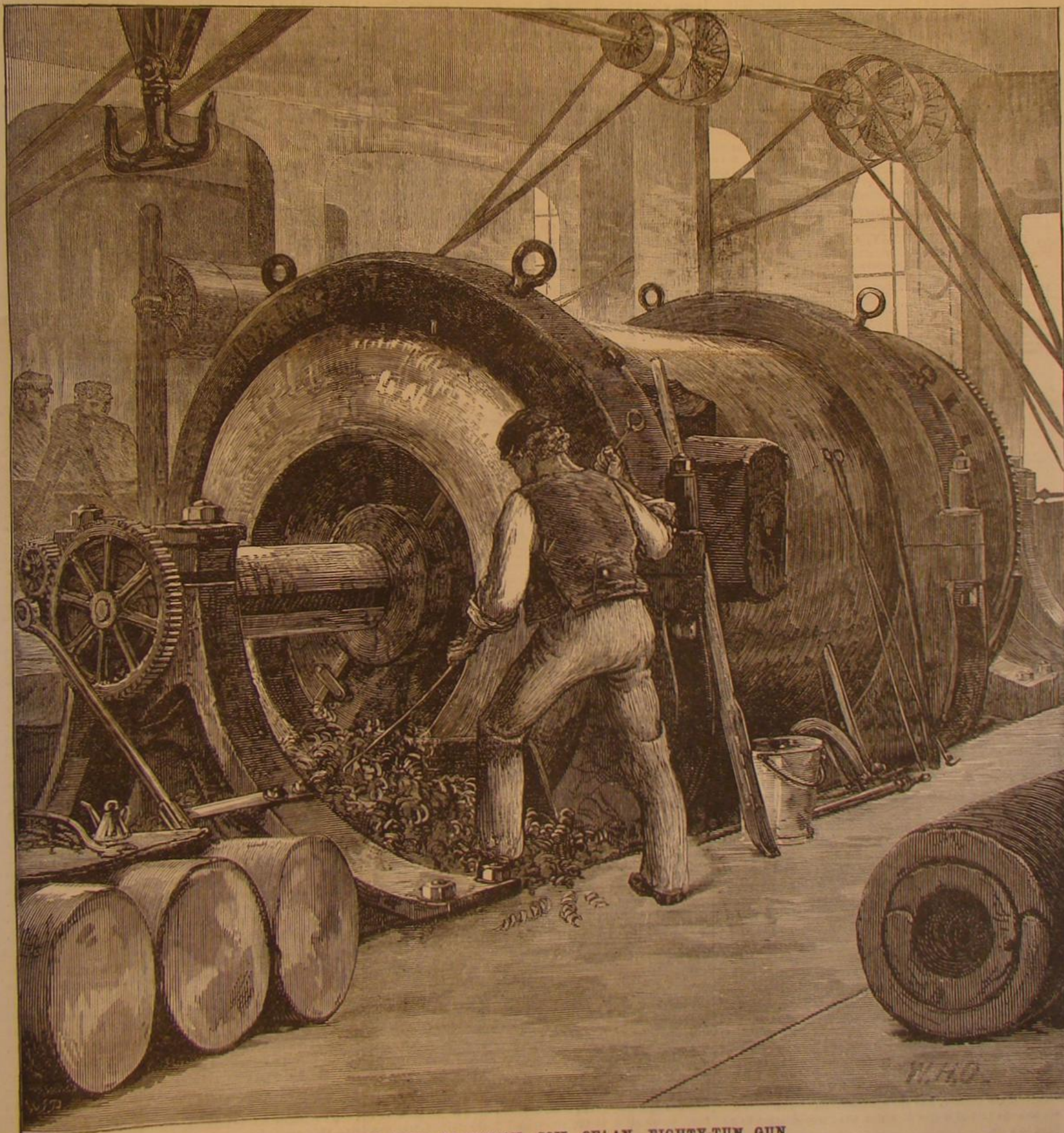
We have on several occasions mentioned the Fraser system of ordnance, which is now adopted in England for artillery of all sizes. The innermost part of the tube is made of steel of the finest quality, and the gun is then built up of wrought iron. The construction of the largest weapons by this means is a Cyclopean labor, and a steam hammer and anvil of unprecedented size have recently been erected at Woolwich for the purpose. The trunnions of the largest guns, each of which weighs eighty-one tons when finished, are made in a piece with a wrought iron coil; this coil is then bored out

by a gigantic apparatus, as depicted in our engraving, and shrunk on to the gun, that is, it is heated red hot and put on in its place, its shrinkage in cooling binding it on the gun with tremendous force.

It will seem in our engraving, that borings of unusual magnitude are cut away by the boring bar. The thickness of the excised pieces shows that a tool of excellent form and of most tenacious material is at work.

The news of the completion of the large gun has arrived. The original design has been somewhat departed from, and the dimensions of the finished weapon are: Length 33 feet,

external diameter, 2 feet at the muzzle and about 6 feet at the breech. Internally the bore measures 27 feet, and in its present state will just admit a projectile 14½ inches in thickness. It is, however, proposed to enlarge this bore, after the proper caliber has been found by experiments, and it is not unlikely that the gun will eventually have a bore of 16 inches. It is rifled in eleven grooves, and the spiral increases as the shot travels along the gun, commencing with nothing in the powder chamber and leaving the muzzle with a twist of 1 in 35. The shot will therefore turn scarcely once on its axis inside the gun, but this has been proved ample to give



BORING THE TRUNNION COIL OF AN EIGHTY-TUN GUN

It the necessary rotation to the end of its journey. The weight of the gun is a trifle over eighty-one tons; but it is to be known in the service as the 80-ton gun. It has been constructed of eight separate wrought iron coils, fitted and shrunk one into the other on the Fraser system.

The projectiles with which it will be proved correspond in size, but not in shape, with the shot and shell with which it will be fired on service. They have been cast in the shell foundry of the Royal Laboratory, and are great bolts of solid iron, each weighing 1,300 lbs. They are flat-headed, and filled with a great number of studs to fit the grooves of the rifling. Special rammers, sponges, and other apparatus have been provided for the proof of the gun, a truck has been constructed to carry the shot, with a special contrivance for lifting it to the mouth of the gun, and the government manufacturers of gunpowder have even provided a special powder. The powder, in its way, is as remarkable as the gun. Each grain of it is a cube an inch and a half in diameter, and the cartridge, which will be 250 lbs. of this powder, will be a large bolster, about the size of an ordinary man. It is proposed to increase the powder charge, if necessary, to 300 lbs.; but this, like the caliber of the gun and the weight of the shot, will abide the result of experiments.

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VOLUME XXXIII, No. 16. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, OCTOBER 16, 1875.

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THE FALL RIVER STRIKE.

During the middle of last summer, the proprietors of the great cotton mills at Fall River, Mass., finding that they had a large accumulation of stock on hand, and seeing that through the general depression of values and reigning dullness in trade, it would be impossible to continue operations as heretofore, notified their working people that either a reduction of wages must be made or the mills would have to stop. The proposed reduction amounted to one ninth the price then paid for piece work. The operatives in answer declined to agree to such retrenchments, but, not wishing to precipitate any open conflict with their employers, compromised matters by taking a "vacation." The mills accordingly ceased work, and the employees have waited in idleness for the arrival of better times. The vacation has now expired. The prices of the large quantities of goods woven before have not advanced, nor does there seem any likelihood of their so doing, while a loss of a million dollars is estimated to have accrued to the city of Fall River through the cessation of work. The mill owners not only, therefore, are unable to go back to old wages, but several declare heavy losses, and advocate closing of the factories for a still longer period.

The workmen, toward the close of their vacation, during which time they or the majority of them had drawn support from the unions, began to realize that, by their self-enforced idleness, they had actually lost a greater proportion of their wages than would have been the case had they accepted the reduced pay. They further saw that winter was approaching, and that the union funds were getting low, and consequently the three classes of which they were composed, the weavers, the carders, and the spinners, met together to settle on some rate of wages at which they would agree to return to work.

But when the workmen came to the factories and announced their intention of coming back to work, the employers, to their astonishment, not only declined to pay more than the reduced wages, but produced an agreement for the workman to sign preliminary to being hired, which provides: 1, that he will not belong to, or be influenced by the action of, any association which assumes to govern the rights of any person to labor for whom and for what he pleases, and 2, that, in case of his desiring to leave employment, he will give ten days' notice. In connection with this, we may mention that there is already a law in Massachusetts which holds manufacturers liable in case of the discharge of an employee without notice, except for incapacity or misconduct. The operatives regarded the proposed agreement as a great injustice, and made riotous demonstrations. At one time troops were under arms, threats to burn the mills were freely circulated, and strong police reinforcements were sent to Fall River from Boston. The number of operatives involved, from 12,000 to 15,000 people, added to the gravity of the crisis.

The whole difficulty hinged on the trade union question. By the discordant element which, it appears, rules in these societies, the idleness of the summer was precipitated, and by them the recent difficulties were fomented, since all accounts agree in stating that hundreds of men were ready and willing to accept the terms of the employers, but were withheld by sheer menace and personal intimidation. That for any manufacturer to refuse to employ union men is a harsh proceeding, we cannot agree. Such is already the rule in some of our largest iron and steel working establishments, and no one is injured thereby.

While we hope that the law will be vigorously enforced against all rioters, we cannot but feel a genuine sympathy for the workmen who have allowed themselves to be led into the difficulty. Their losses will be heavy and severe, and their chances of bettering themselves are palpably hopeless, for it is asserted that mills closed or mills working make little difference to the proprietors during the present state of trade, and while such large stocks are already on hand.

The strike is now over, and all, or very nearly all, the mills have their full complements of workers, who have accepted employment under the conditions above noted. The 15,000 laborers who took part in the uprising have, through their two months "vacation," lost over a million of dollars. Such are the results of the strike.

MENDING A FIFTEEN-INCH SHAFT AT SEA.

An excellent piece of mechanical work was recently accomplished aboard the steamer Ethiopia, of the Anchor line, in

Fig. 3.

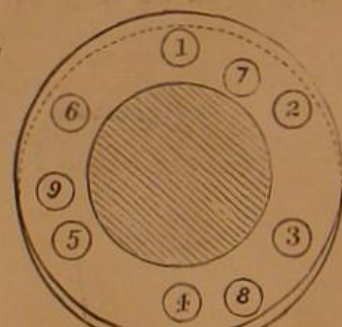


Fig. 2.

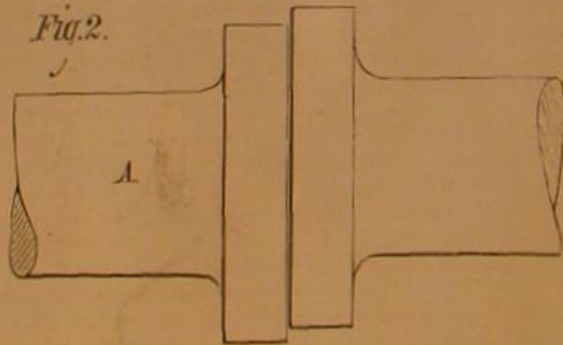
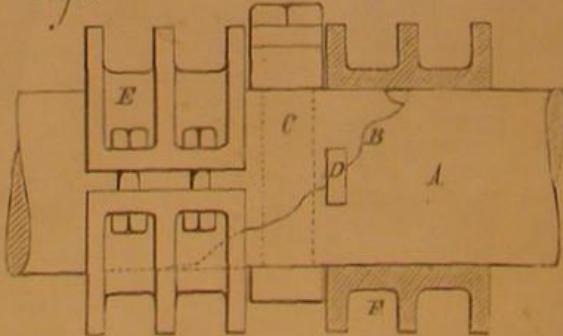


Fig. 1.



the course of that vessel's last voyage to this port. After a heavy gale, and when 1,500 miles from Queenstown, the 15-inch propeller shaft broke in a diagonal fracture. Owing to the confined space of the alley through which the shaft runs, it was very difficult to get at the break, and utterly impossible to use cranes or tackles for handling the immense weight. How the work was accomplished is represented in the annexed engraving (drawn on a scale of $\frac{1}{4}$ of an inch to 1 foot), in which A is the shaft, and B, the line of fracture. The broken parts were raised by a jack screw, the edges

smoothed, and a four inch hole bored through the opposing portions, and into the aperture a bolt, C, was tightly fitted. Four steel drivers, D, four inches long and one and a quarter inches broad, and three quarters of an inch thick, were sunk into the shaft, flush with its surface, just across the line of fracture, serving to bind the parts more closely together. Large clamps, E, were then bolted on the shaft, holding the steel drivers in place, binding the whole together tightly. A still worse difficulty presented itself in the springing or bending of the shaft. Three men, with all the power they could get out of a jackscrew, were not able to reduce the part, which was bent more than a quarter of an inch. So badly bent was the length of shaft behind the break that it was found impossible to couple them together as before, the faces of the coupling refusing to coincide, as shown in Fig. 2, by about $2\frac{1}{2}$ inches. The shaft, therefore, had to be bolted in this position; and as the old holes, Nos. 1, 2, 3, 4, 5, and 6, in Fig. 3, in the couplings would not correspond, one of the couplings had to be turned around, and three new holes, Nos. 7, 8, and 9, three inches in diameter and five inches through, had to be bored. Two of the bearings and plunger blocks under the shaft were broken, and a new support had to be devised. The work was carried on night and day and after eight and a half days, the job was complete.

To Chief Engineer Murray, of the Ethiopia, through whose skill and ingenuity the very difficult operation was accomplished, the credit of the same is due. So thoroughly was the work done that it has been deemed safe to dispatch the vessel on her return trip to Glasgow without any material alterations in the shaft and its fastening.

A DISASTROUS CYCLONE.

One of the most disastrous storms that has ever visited our coast recently swept over a portion of Texas and South-western Louisiana, destroying hundreds of lives and an immense amount of property. The hurricane took its rise in the Bahama Islands, and, crossing the Gulf of Mexico in a parabolic track, struck the Texan coast, curved back, and finally emerged from the Gulf at Key West, and passed off to the east in the direction of the Gulf Stream. The city of Indianola, situated about 120 miles southwest of Galveston and built on a sandy waste which slopes slightly to the water's edge, was almost totally destroyed, but five houses being left standing. In Matagorda, forty miles eastward, four houses only now remain. Velasco in Brazoria county was utterly swept away. San Bernard was completely submerged by the tremendous floods. The towns of Cedar Lake and Salina were washed away with all their inhabitants. Morgan's Flat met a like fate. Of Lynchburg and San Jacinto but little remains; and in Galveston, enormous damages, though less than those inflicted on the other towns, were caused by the floods, which rolled over the island on which the city is located. The total loss of life is unknown, and doubtless will so remain; but the lowest estimates place it at from three to four hundred persons.

Little has been positively determined regarding the cause of these cyclones. From actual observation, it appears that they may originate wherever a lower stratum of warm, moist air is rapidly elevated above the sea level. In this moist air an immense mechanical power is stored up; and when condensation caused by its elevation occurs, its moist vapor turns into rain, hail, or snow, and an influx of air from all sides rushes in to fill the partial vacuum thus formed. It has been proved that this influx toward a central region is immediately followed by the formation of a whirl, the subsequent development of which is due to further supplies of moist air. The cyclone then moves towards the quarter in which, for the longest time, the warmest and moistest air has been rising and producing the heaviest cloud and rainfall, and its tendency as a whole is to travel away from the equator: hence the parabolic course so plainly shown in the recent case. Applying known theories to the circumstances of the latter, there is no difficulty in accounting for the storm. The weather reports published, for the two days preceding that on which the fury of the cyclone broke upon Indianola, show warm rainy weather in the Gulf and a prevalence of strong northerly and northeasterly winds on the south Atlantic seaboard. Hurricanes have repeatedly been known to originate in Florida when a cold wind from the north has swept into the warm, moist air there prevalent, and this one is without doubt due to the same cause. The cold air elevated the warm atmosphere; and probably other circumstances being favorable, the cyclone was generated and took the course already specified. The Signal Bureau reports that the lowest barometer noted was 28.99 inches, with the maximum velocity of wind of 86 miles per hour, at the same period. The terrible effect of the hurricane may be judged from the fact that the prairies south of Indianola are literally strewn with thousands of drowned cattle, deposited by the subsidence of the floods which swept them away. Several light coasting steamers have also been found ten miles inland, left high and dry by the receding waters.

THE POSTAL LAWS—AMENDMENTS NEEDED.

Owing to increase of postage on newspapers and other transient matter by the enactment of a change in our postal laws at the end of our last Congress, it is no longer feasible for publishers to advertise their publications by mailing and prepaying postage on copies of their papers as specimens, and sending them to non-subscribers.

Last autumn we mailed several tons in weight of the SCIENTIFIC AMERICAN to persons throughout the country, in which we paid over \$5,000 postage. The circulation of the same number this year would cost for postage \$7,500. We have concluded not to print an edition for gratuitous circulation this year, in consequence of this increase of postal charges.

The Post Office Department, in consequence, loses \$5,000, which it would have received but for the change in the rate. This is but a small item, to be sure, to so large a department as the General Post Office, but be it remembered that this loss is from only one concern, while there are probably others who will do the same to a greater or less extent: which in the aggregate is likely to reduce the Post Office revenue very largely. It is hoped that, on the convening of our next Congress, one of its first acts will be to amend the postal law, so that the tax upon publishers and the public shall not be more oppressive than it was under the old law.

Newspaper and other publishers should commence early to agitate a reform in this matter. It will not do to take a retrograde step in the matter of cheap postage. Persons who have been in the habit of advertising in our usual special edition, referred to, are advised to avail themselves of the advertising pages of our regular edition to announce their fall business. The circulation of the SCIENTIFIC AMERICAN has never been so large at this season of the year as now, by several thousands. The number of regular subscribers at this time exceeds that of last year by over four thousand, making an aggregate issue of not less than 44,000 every week, and it frequently reaches as high as 50,000.

CONSERVATISM VERSUS PROGRESS.

Extreme opposing parties of conservatives and progressists are found in the field of Science, as well as in politics and religion. Their continual strife is mutually beneficial, each serving as a check on the other. Without conservatism, the world would certainly rush into all kinds of new theories, such as those in which men of a progressive turn of mind are very apt to indulge; while without men of progress and improvement, the world would stand still, and no advance would be possible. It is doubtful which of the two would be the more deplorable state of society.

History abounds with records of this strife between conservatism and progress: but in no field has the latter been so successful as in that of Science, for the simple reason that its triumphs, which are only to be achieved by the labor of research, are based on positive facts, which no opposition of conservatism can upset; and the benefit of this opposition consists only in the prevention of a too rash acceptance of theories, before they are sufficiently based on such facts as make them incontrovertible.

We will take a few illustrations from the fields of astronomy and geology, and remind the reader that there was a time when the whole human race considered our earth to be flat, and to consist of three connected continents—Europe, Asia, and Africa—with some islands in the inland seas, and many others surrounding the continents, all being situated in a boundless ocean, the limits of which were unknown, and their investigation seriously dreaded. The ancient astronomers who announced the rotundity of the earth were not believed, especially when contradicted by the theological priests, who then, as well as later, arrogated to themselves the enforcement of any peculiar doctrines which best suited their self-interest. But ultimately progressive Science prevailed, and conservative theology had to acknowledge that it had been in the wrong.

Next came the doctrine of the motion of the earth. The history of the persecution of the great Galileo is of so comparatively recent a date that, looking at the progress of the present day, it is almost incredible that only two centuries ago the everlasting and important truth of the earth's motion was denied, and condemned as ungodly, by the whole Christian priesthood, Protestant as well as Roman Catholic. But notwithstanding that this good man was compelled, when weakened by age and persecution, to swear to the falsehoods of the priests, the truth has been demonstrated, and progressive Science was again victorious over conservative theology.

Afterwards—toward the end of the eighteenth and beginning of the nineteenth century—came the doctrine of the great antiquity of the earth; while the accumulating evidences of its existence for millions of years, gathered by the then young science of geology, compelled all clear-minded and well informed persons to reject the popular idea, which we inherited from the Mosaic theology, that the whole earth was scarcely 6,000 years old, and was made in six days. As the evidence of the rocks proved that millions upon millions of years have elapsed during its transformation from a highly heated globe to its present condition, the better informed theologians did not combat the scientific conclusion; but the less informed priests, not worthy of the name of theologians, attempted some show of resistance to this phase of progress. But the time of persecution had passed, and priestly influence had been curtailed; so that this opposition was comparatively feeble, and utterly unable to stay the diffusion of the truth.

Still the idea that at least the human race was only about 6,000 years old was adhered to, and theologians made a kind of armistice, surrendering the theory of the six days of creation, and admitting the possibility of a creation and development lasting for millions of years, while still maintaining that 6,000 years was the antiquity of the human race. Unfortunately for them, about fifty years ago facts commenced to accumulate, proving that man has existed at least 100,000 years. The discovery that a glacial epoch took place at this time, and the relation of this grand and important event to the human race, and the accumulating proofs of man's existence immediately after, and even perhaps during or before the glacial period, are sufficient to settle this point; and society no longer heeds the opinions of any theologians who deny these demonstrated facts.

But the most serious blow to Jewish and Christian orthodox conservatism is the modern theory concerning the primi-

tive condition of man. All the geological records found tend to show, more and more, that the first existing men, instead of having fallen from a perfect condition, had improved from the lowest state, and that the first man was a perfect savage, such as we find nowadays in some of the isolated islands of the Australian archipelago, where, for want of conflict, there was no cause for progress, the inferior men not being exterminated by the superior, a destructive process to which much human improvement is due. Progressive Science teaches that the modern civilized and enlightened society has slowly been developed from a primitive savage and ignorant condition.

The final strife of the present day, closely allied to the last mentioned theory of the continual improvement of mankind, is the evolution theory, now carried to its furthest extent. It ascribes the origin of man not only to an inferior human race, but to still lower types, now extinguished; nay, even ascribes the origin of all living beings to a single original type or even cell. It does not teach that man descends from a monkey, as the enemies of progress falsely accuse the evolutionists of maintaining, but that man is closely allied to the whole animal creation, as proved by comparative anatomy, by embryology, by the geological record, and even by psychological and ontological researches, and studies of the mind and instinct of animals, coming thus to the conclusion that the past man may have as well been evolved from a lower prototype as have been created out of dirt. Human pride is perhaps generally at the bottom of the opposition to this doctrine, as the proof of man's origin among lower beings tends, in a certain sense, to abate his arrogance; but on the other hand, man may be proud of what his race has accomplished in a short period of time, if in the beginning he sprang from a condition so low.

THE FAIR OF THE AMERICAN INSTITUTE.

To any one unconversant with machinery, we can readily imagine that the performances of an apparatus which throws out bundles of

KINDLING WOOD.

neatly tied, at the rate of 400 per hour, must be a source of considerable astonishment; and hence the expression of wonder, which comes over the face of the throng which is constantly gathered about the machine, while amusing to contemplate, is quite to be expected. To gather an idea of this curious device, the reader must imagine four horizontal bars arranged as spokes, placed equidistant about a rotating hub. Each bar has at its extremity a circular vertical frame, of a depth equal to the length of a stick of kindling wood. In each frame or cylinder works a follower, moving outward. An immense hopper filled with the sticks is provided with three openings, at each of which a boy is stationed. Boy No. 1 fills the frame nearest him loosely with wood. The bars then rotate so as to bring that frame opposite boy No. 2, whose business it is to pack in more sticks, so as to make the bundle a little tighter; then boy No. 3, when the same frame reaches him, shoves in the little sticks which complete and wedge the bundle tight. Of course, as fast as one frame departs from each operator another takes its place, and the operations above described are repeated. After leaving boy No. 3, the frame comes opposite a rod controlled by mechanism from the center, which pushes the bundle out of the frame and between a pair of vertical semi-circular jaws which come together, tightly compressing the bundle. Then a piece of annealed iron wire is led from a reel through a pair of small vertical clamps, and pushed from underneath up into the jaws, the inner periphery of which it follows, thus encircling the bundle. The end comes back to the clamp, between which a central piece then rises, grasps the wire, twists the ends together, and a knife at the same time cuts the wire off. By this time another bundle has arrived, which pushes the now tied bundle out of the opening jaws, and takes its place to undergo the same fastening. The machine is really a study for the mechanic. One gear wheel in particular, which communicates motion to the frame bars and at the same time operates the knife cam and the wire-twisting device, is a remarkable example of adaptive ingenuity. The inventor, Mr. F. Myers of this city, tells us that the apparatus easily accomplishes the work of fifteen boys, and runs ordinarily at the rate of 4,000 bundles per day of ten hours.

Another novel machine is one for

MAKING WIRE FENCE.

an inexpensive and excellent form of enclosure, which deserves to be popular among farmers. The wire, led from a series of reels, is brought up and under two sets of vertical hammers, the latter actuated, one set at a time, by cam mechanism. The uprights which support the wire are of wood, and are laid, one at a time, on the projections of endless bands, which carry them under the wire and beneath the hammers. Under the first row of hammers are guides which conduct copper staples, one at a time, over each intersection of wire and post. Then the first hammers fall and drive the staples partially in, and the second hammers, as the fence is carried along, deliver their blow and complete the insertion. There are six wires, and the pickets are four feet in length. The fence can be made with 15 or 30 pickets to the rod, and is usually formed in sections of ten rods each. It appears to be very strong. It is portable, and can be rolled and secured as easily as so much carpet. Farmers who use it might thus readily, on moving from one residence to another, take up their fences and transport them with their other farm appurtenances. Mr. A. C. Betts is the inventor, and he says that the machine will make 400 rods of fence per day.

AN ELECTRICAL COPYING MACHINE.

The invention of Mr. T. A. Edison, the well known electri-

cian, is a novelty in apparatus of this description. A small battery of considerable intensity transmits its current to a pair of miniature electro-magnets mounted on the end of a pointed metal rod, which serves as a writing instrument. The magnets cause the rotation of a bit of iron, the motion of which is regulated by a minute fly wheel, and the result of the rapid interruption of the current is a series of sparks from the end of the instrument, which penetrate the paper written upon, and so convert the latter into a stencil plate of the characters inscribed. It only remains to put clean paper under that marked, and pass a roller charged with a prepared ink over the latter, to make as many copies of the writing as is desired, the ink passing through the holes made by the passage of the spark.

We have had sewing machines without number, button-hole and knitting machines of all descriptions, but now something entirely new is added to the mechanical part of the sewing room in the shape of

A DARNING MACHINE.

Imagine, ye mothers of large families, who ruefully contemplate dilapidated socks by the dozen, after the week's washing, with visions of strained eyes and tired backs floating across your minds: imagine a little apparatus infinitely more simple than the sewing machine, which repairs the hugest darn in much less time than we can describe the operation, and far more neatly than you can do it with all your years of practice. This is what it is. Two small plates, one stationary and the other movable, are placed one above the other. The faces are corrugated, and between them the "holy" portion of the stocking is laid. Twelve long eye pointed needles are arranged side by side in a frame, which last is carried forward so that the needles penetrate opposite edges of the hole, passing in the corrugations between the plates. Hinged just in front of the plate is an upright bar, and on this is a crosspiece carrying twelve knobs. The yarn is secured to an end knob, and then, with a bit of flat wire, pushed through the needle eyes. Then the loop between each needle is caught by the hand and hooked over the opposite knob, so that each needle carries really two threads. Now the needles are carried back to their first position, and, in so doing, they draw the threads, which slip off the knobs through the edges of the fabric. A little push forward again brings the sharp rear edges of the needle eye against the threads, cutting all at once. This is repeated until the darn is finished, and beautifully finished it is. The inventor is Mr. O. S. Hosmer of Boston, and we predict for him the blessings of the entire feminine community. The cost of the machine is but ten dollars.

A NEW ELECTRIC MOTOR.

The invention of Mr. C. A. Hussey of this city, is at work driving a sewing machine. The engine, which is quite small, is operated by five Bunsen cells, and its movements are controlled by a simple device by connecting or disconnecting a greater or less number of elements. The machine is driven at the rate of 500 stitches per minute. Mr. Hussey's engine combines several new and excellent improvements, mention of which lack of space just at present compels us to defer to another issue.

SCIENTIFIC AND PRACTICAL INFORMATION.

AMERICAN COMPETITION.

United States hardware producers do not seem inclined to limit their competition with English manufacturers either in this country or in foreign markets by offering American made goods. When these cannot be sold in England at a good profit, current action of individual firms seem to point to the probability of United States makers starting manufacturing upon our own shores. Messrs. Hussey, Binns, and Co., of Pittsburgh, have during the past twelve months been making—but only since last spring been selling—what they term a "plain black solid cast steel shovel." Their patent consists mainly in combining the iron straps with the pan of the shovel when the steel is run into the mold. Shaping and shearing, and even hardening, is done mostly under the drop hammer, to the exclusion of all but a minimum of manual labor. The result is a good tool produced at a cost that leaves a profit with which even American manufacturers ought to be satisfied; but large as these profits are, they will be increased when the existing facilities of the makers are supplemented by a 24-pot Siemens furnace which is being laid down. On behalf of Messrs. Hussey, inquiries are now being made in our own hardware districts by a gentleman who has recently come to England. His report will determine the American firm whether they shall start a works in England, or offer here their process upon royalty or purchase. The inquiries are conclusive that the process can be carried on in this country at a cost greatly under that entailed in the States; and that both throughout the export and also the home market the common iron and iron-steeld goods are giving way before those made wholly of steel. The Americans have furnished our agriculturists with some excellent forks, and their axes are unrivaled; yet the English makers of edge tools keep mostly well employed. If under these circumstances, our transatlantic cousins will, at an equally moderate price, put into the hands of our navvies, our miners, and our farm laborers a shovel which shall be equally good, they have our best wishes for their success in every legitimate effort which on this side they may put forth.—*The Engineer.*

INTERNAL PARASITES OF THE HOUSE FLY.

A correspondent of *Nature* writes that he saw a small, decrepit house fly making its way across a sheet of paper, when three minute, active animals, apparently beetles, tumbled out of it; they were light brown in color and resembled aphids in shape, and were of about the size of a medium pin hole.

IMPROVED ICE-MAKING MACHINE.

The following is an explanation of the mode of working this machine, which will be readily understood on referring to the illustration: The refrigerator, A, a copper tubular vessel, is charged with the requisite supply of liquid ether, which, by the action of the vacuum pump, B, is evaporated, drawn away in the form of vapor, and passed into the copper tubular condenser, C, where, under a slight pressure and by the aid of a stream of water, it is again reduced to its liquid state, and then returned through the ether meter, D, to the refrigerator, A, to be re-evaporated. Thus the same ether is used continuously, with inappreciable loss. The ether meter, D, regulates the flow of the liquid ether to the refrigerator, rendering the machine self-acting. The hand pump, F, and condenser, G, in connection with it, are valuable in economizing ether to the utmost degree, as without them much would be blown into the air and wasted. No machine is complete without these adjuncts. To utilize the cold produced by the evaporation of the ether for the purpose of making ice, an uncongealable liquid, such as very strong brine, is forced by the pump, E, through the tubes of the refrigerator, A, parting with its heat to the ether vapor on its passage, and leaving that vessel at a temperature many degrees below freezing point, to be used in the freezing tanks as described below. For the manufacture of pure transparent ice in large blocks the machine is provided with a large tank—or several tanks, according to the size of machine—which is filled with the pure water to be frozen. In this tank a number of hollow metal cells or slabs are fitted, and connected to each other and to the refrigerator of the machine, A. Through these cells the cold brine, after leaving the refrigerator at a temperature of from 14° to 20° Fah., is continually circulated, causing the pure water in the tank to congeal on each of their surfaces until a sufficient thickness of ice has been obtained, when the blocks are readily removed by a very simple arrangement. To make perfectly clear ice, it is imperative that the fixed air contained in the water be allowed to escape freely during the freezing process, and to attain this end the tank is fitted with moving arms or agitators, which are caused to move slowly up and down or to and fro between the cells in the pure water, keeping it constantly agitated, and so facilitating the expulsion of the air. By this process perfectly transparent ice is produced in any quantity and in any climate, in blocks about 4 feet x 3 feet, and 4 inches to 12 inches thick. It is found that, after attaining a thickness of 4 inches, the ice does not form so quickly, and therefore the production of the machines is somewhat less when the thickness of the blocks is increased; but this is overcome and the efficiency of the machine maintained by a simple arrangement, by which two blocks are frozen together after a thickness of 4 inches to 6 inches has been attained, and a block of transparent ice 8 or 12 inches thick is produced in half the time required by any other process.

TWO-STORY RAILWAY CARS.

Since April 1, 1873, there has been in force a new federal law, concerning the building and working of all railways on Swiss territory. The extent of working railways in the Confederation at present amounts to about 1,000 English miles, while about one half this length is at the present time either building or concessioned. There are no State railways in Switzerland, the lines having been promoted mainly by private enterprise, and aided, in many cases, by governmental, or rather cantonal, subventions. Most of the new lines will open up shorter routes towards the International Gothard line now in course of construction, and these are therefore being made, like the rest of the Swiss lines, of the standard gage, namely, 4 feet 8½ inches. The Swiss are now also building meter (39.3 inches) gage lines, a width which has been found amply sufficient in many parts of this country for local traffic.

With the marked predilection that has sprung up in Switzerland, both among the companies and the public, in favor of two-storied cars for branch line service, the federal inspectors for railways have set themselves to the task of studying this question, and the design of a four-wheeled standard gage car, of which we annex engravings, is the result of these studies. Twelve cars on this plan are now building at the Swiss railway carriage and wagon works of Neuhausen, Fribourg, and Bern.

As will be seen, the cars are constructed on the so-called semi-American type, with platforms at each end, and with a central passage all along the train, such as has been stipu-

tained, but in addition the vessel is more easily steered, and there is little or no vibration felt, while it is next to impossible to foul the screw. Another and, in one sense, most important fact was also discovered while the Bruiser was at sea, namely, that when pitching in heavy seas the engine worked as smoothly as in fine weather, the cause being attributable to the fact that when the stern is lifted the casing holds a quantity of water which offers sufficient resistance to the motion of the propeller to prevent the engines racing.

International Patent Laws.

Mr. Lloyd Wise argues in favor of the following, among other points, as a basis for an international patent law:

"Every application for letters patent should undergo examination, limited to the questions whether the specifications are clear and whether the invention is open to objection as being contrary to morality, or wanting in novelty, regard being had to prior publications in the patent office.

Should the result of the examination as to novelty be unfavorable, the applicant should be nevertheless entitled to obtain his patent, subject to the insertion in his specification of an acknowledgment of the existence of the prior matter found and pointed out by the patent office officials, with a clear statement of what he nevertheless claims.

Patents should be refused only in cases of fraud or where the invention is contrary to morality. Other points should be left to be adjudicated upon by the courts only, in case the validity of the patent should come into question.

There should be no publication of any report or opinion of the examining authorities as respects any application for a patent, saving reports of proceedings in disputed cases.

Thus on the one hand applicants who had been anticipated would be saved the useless expenditure they might incur if left in ignorance of the fact; and on the other hand, they could not become sufferers by reason of any erroneous judgment of the examining authorities. Moreover, the public would be amply protected by having all the facts (and facts only) placed in juxtaposition before them in the specification.

Where the examining authorities have the power of refusing an application for a patent on the ground of want of novelty, there must always be considerable risk of injustice to the inventor, there being in many instances scope for diversity of opinion. Nor is the difficulty obviated by providing means of appeal. Appeals are somewhat costly consequently, in a pecuniary sense might in the long run prevail over right.

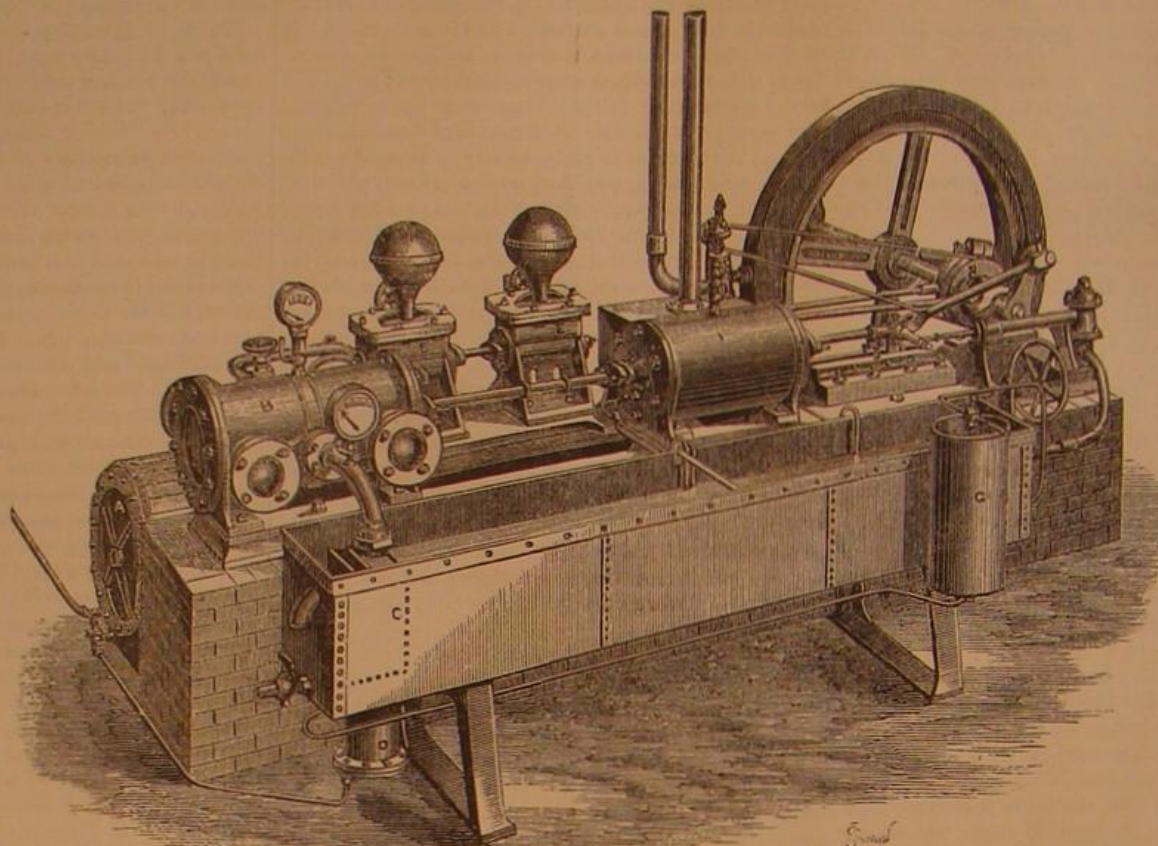
Moreover, where the power of refusal obtains, as in the United States, there results a widespread idea that a patent once granted is practically indefeasible. Of course, people well acquainted with the law know better, but I am for the moment speaking of members of the outside public who may nevertheless have interests at stake.

Now I think the plan above proposed, while securing justice alike to the inventor and the public, would not be liable to such misinterpretation.

Provisional protection should be granted for twelve months at a nominal cost, to allow time, not only for perfecting the invention, so that it may be properly and fully described in the complete specification, but also for obtaining, if needful, the co-operation of capitalists."

The Oil Diagonometer.

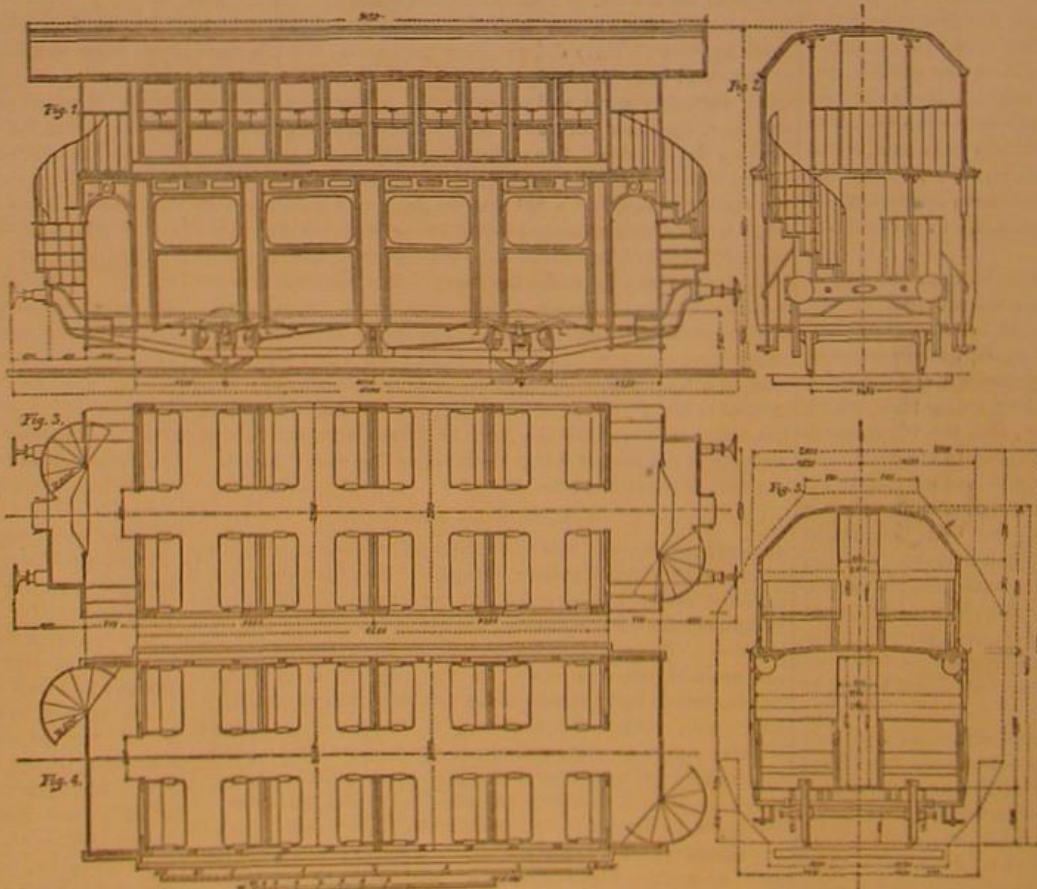
Professor Palmieri has discovered a new instrument which he calls a diagonometer, and which is constructed for the rapid examination of oils and textures by means of electricity. What the apparatus will do, Professor Palmieri details thus: 1. It will show the quality of olive oil. 2. It will distinguish olive oil from seed oil. 3. It will indicate whether olive oil, although of the best appearance, has been mixed with seed oil. 4. It will show the quality of seed oils. 5. Finally, it will indicate the presence of cotton in silken or woollen textures.



SIDDELEY AND MACKAY'S ICE-MAKING MACHINE.

lated by the new regulations. The staircases admit of very ready access to the upper story without interfering in the least either with the central passage or with the end platforms. Each story contains 32 first and second class seats, arranged on double-seated benches, while two more seats are provided for on the upper balconies, making thus 66 seats in all.

The other peculiarities of these fine cars will be gleaned from our engraving, and therefore we need say little about them. They are well suited for use in summer weather.



TWO-STORY RAILROAD CARS FOR SWISS BRANCH LINES.

The carriages are very solidly constructed, and weigh empty 10 tons, equivalent to 3 cwt. per passenger, while they cost \$2,250 a piece, making \$34 per seat.

Griffiths' Propeller.

The trials of the British iron steamer Bruiser, with a casing over the propeller, on Mr. Griffiths' plan, have yielded very satisfactory results. Not only is an increased speed ob-

LIQUID CARBONIC ACID AS A MOTOR.

In the search for cheap motive power, to which inventors of all classes are more or less giving their attention, the utilization of carbonic acid gas has been suggested, and practised to some extent, notably in the propulsion of submarine movable torpedoes. The Lay torpedo, of which some time ago we published a description, was driven and steered by this gas, compressed into a liquid state. The advantages offered, as compared with compressed air, are that, by the use of the liquid, a much larger quantity of motive power can be stored in the same space, allowing the employment of smaller and thicker vessels; and of the gases that may be liquefied, carbonic acid can be prepared most cheaply and readily. There are two methods by which carbonic acid gas may be reduced to a liquid state, first, by the aid of the pressure of the gas as it is evolved; secondly, by mechanical compression. The first process necessitates the repeated charging of a reservoir, producing a series of condensations; but in each charging a large quantity of gas is lost, since all that does not condense must be blown off in order that the generator may be refilled. The apparatus is simple but troublesome to work.

By the second method, which is in every way preferable, the gas is compressed, into a receiver immersed in a cooling mixture, by a condensing pump. This plan is that adopted by the United States Torpedo Station, at Newport, R. I., for the generation of the large amount of liquid (some 700 lbs.) needed to fill the flasks of the Lay torpedo. The apparatus used, while in principle very similar to that employed in the manufacture of soda water, is especially adapted to the work of producing the gas under very heavy pressures by many novel and important alterations. Its construction will be understood from the annexed engraving, which, with the facts given herewith, we extract from a paper prepared by Mr. Walter N. Hill, S. B., chemist of the

Torpedo Station, and published under the auspices of the Ordnance Department of the Navy.

There are two generators, A, so that while one is in action the other may be emptied and recharged. These are of cast iron, and receive the marble dust and water. The wheel, E, serves to rotate an agitator within the cylinder. The sulphuric acid is contained in the smaller vessels, B, and admitted to the generators by valves operated by levers, a. C C simply contain water for washing the gas. The acid, admitted from B, acts upon the marble dust and generates carbonic acid gas, which passes up the lead pipe, b, to the cross, c. To this last are attached a pressure gage, d, and a tube leading to B, serving to equalize the pressure in that vessel. To the lower branch of the cross is attached a pipe which extends to the bottom of vessel, C, through the water of which the gas bubbles up, and finally is led away by pipe, e, to the receiver G. In this receptacle a supply of gas is kept, from which the pump can draft for a short time, if for any reasons both generators should be out of action. Also, if priming occurs, the material carried over remains in the vessel and can easily be removed. The gage, f, marks the pressure of the gas which the pump is taking.

From the receiving vessel, the gas traverses a coil of lead pipe, H, which is surrounded by ice water, thence goes through an empty vessel, I, which catches any foreign matter carried over, and finally escapes by the pipe, i, to the pump. The latter resembles in form the Burleigh air compressor. The steam cylinder, J, is 15 x 7 inches, and there are two compressing cylinders, k k, of steel, each 2½ inches in diameter by 10 inches stroke, provided with steel pistons in which are small steel valves opening inwards. The rods are driven by connecting rods and cranks from the crank shaft of the steam cylinder, and the gas cylinders are well jacketed, as shown broken away at K. The gas enters the bottoms of the cylinders; and as the valves in the pistons close on the

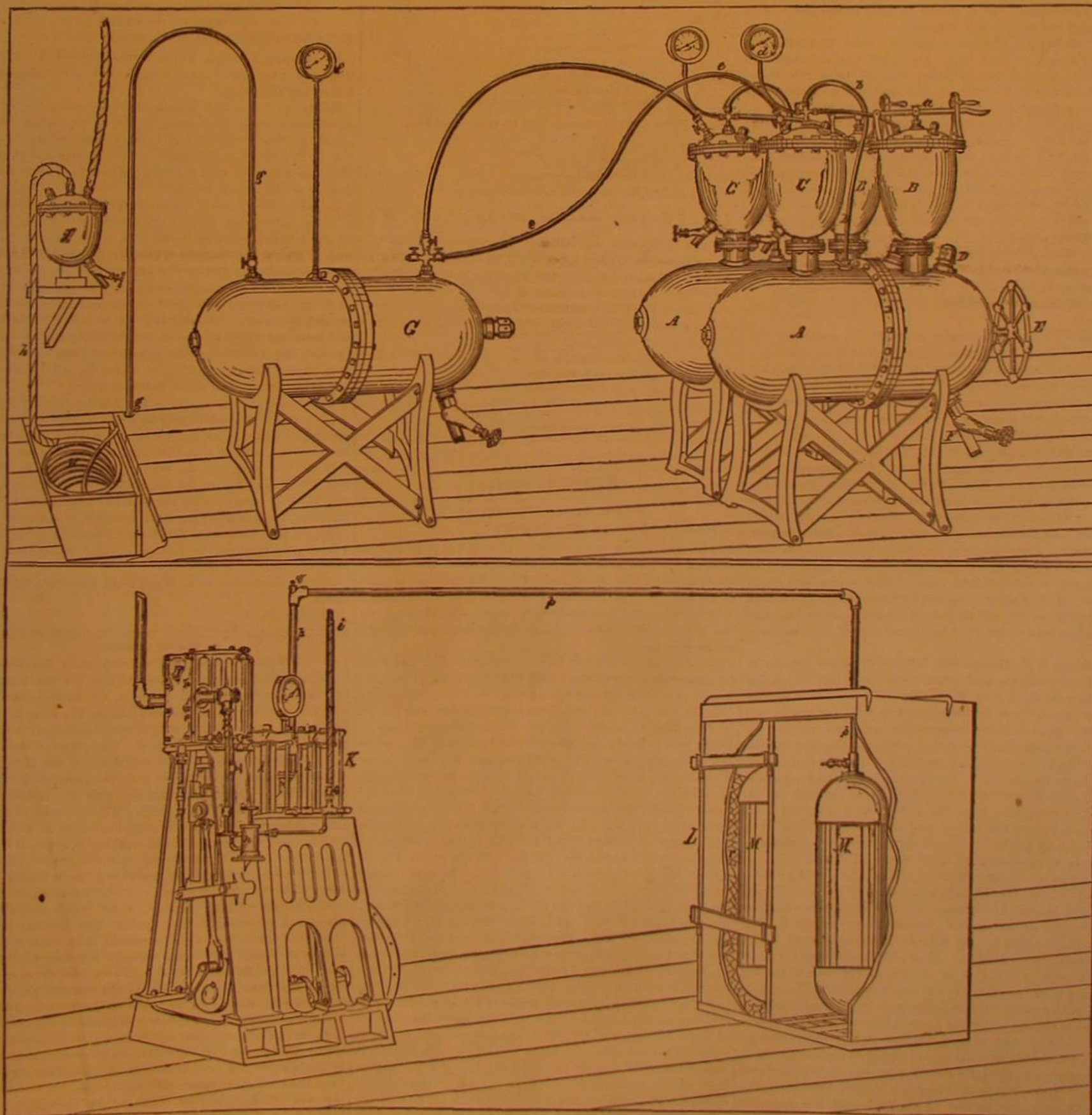
up stroke, the gas above is compressed and forced into the composition boxes, L. Thence it passes to an oil drip box, m, and thence by heavy pipes to the receivers, N, which are surrounded by freezing mixture, the drainage from which is carried to the coil, H.

One of the most important features of the apparatus is the supplying of the gas at high pressure, averaging 100 lbs. per square inch, to the pump. If the gas were drawn from the generator at atmospheric pressure, it would have to be compressed to 1/10 its bulk to average 600 lbs., the pressure of liquefaction; but if taken at 100 lbs. only to 1/5. In addition, the strain on the pump is greatly diminished.

It is estimated that the cost of gas made by the machine described, under favorable conditions, will not be greater than 15 cents a lb. This mode of preparing the liquid is not available on board ship, nor is it suitable to localities where ice is not attainable.

Mr. Hill has, however, devised another improvement, where-in the use of ice and salt is done away with, and a more uniform cooling of the receivers obtained. By means of an air compressor, air is compressed into a strong tank at 70 to 80 lbs. per square inch. This is used to drive the pump. By a simple arrangement, the exhaust from the driving cylinder of the latter is used to keep the flask, receiving the compressed gas, cold, the vessel being placed in sea water, which may easily be reduced in temperature below 32° Fah.

Liquid carbonic acid has a tension, at -4° Fah., of 322.5 pounds per square inch, and at 94° Fah. of 1,200 lbs. Under ordinary circumstances, the highest temperature above mentioned may be attained, and the corresponding pressure reached, so that the proper construction of vessels for containing it is a matter of considerable moment. After experimenting, the flasks found most satisfactory were those made of fine sheet steel (0.045 inch thick) in successive layers,



MANUFACTURE OF LIQUID CARBONIC ACID FOR MOTIVE PURPOSES.

four being commonly employed. The sheets are wrapped so as to break joints around a cylinder, and the last one or shell is lapped and riveted. Then all are made into a solid cylinder by means of pure tin, which is melted and worked in from the inside with the aid of gas blowpipes. The heads are made of cup-shaped pieces of steel, placed one within the other and sweated together with tin. The lengths of the flasks vary from 7 to 4 feet, and the diameters are 12 inches along the body and 13½ inches at the heads. One flask which was tested to destruction gave way under a pressure of 3,136 lbs. per square inch. The total strains borne are calculated as follows: At 1,200 lbs., longitudinal strain, 19,104 lbs.; tangential strain, 38,800 lbs. At 1,365 lbs., longitudinal strain, 21,731 lbs.; tangential strain, 44,152 lbs.

Very probably it will yet be found that liquid carbonic acid will receive many applications as a source of motive power. It has only to be made cheaply, and it will be extensively used.

The Palace Hotel.

Visitors to San Francisco will hereafter be struck with a new and conspicuous feature in the face of the young giant town. Seven stories high, with a base of 96,250 square feet, at the corner of Market and New Montgomery streets, now looms up the Palace Hotel. Its huge brick walls are ribbed from top to bottom with tiers of bay windows, and spotted like the sides of an ironclad with bolt heads that clinch the great rods running over and under and through and through the building, making it a kind of Cyclopean open work iron safe, filled in and lined with fireproof brick, where all treasure of human life and limb should be secure against fire or earthquake while the Peninsula stands. It is, indeed, to this element of security that we would draw special attention, while so many buildings are going up today in our great cities, which are a disgrace in flimsy and tawdry pretension, and a danger in their inflammable and carelessly thrown together materials.

The whole work of constructing this hotel was done by the day's work and not by the piece, and so done carefully and well. Seventy-one partition walls of brick run from the foundation up through the roof, and two feet above it, and the roof is of tin. There are four artesian wells, two in each outer court, with a tested capacity of 28,000 gallons of water per hour. Under the center court is a 630,000 gallon reservoir, with walls of brick and cement five feet thick and buttressed. On the roof are seven tanks of boiler iron, with an aggregate capacity of 128,000 gallons. Seven steam pumps force this water through the whole house by a system of arteries and mains, with 392 outlets in the corridors, provided in each case with three inch hose, from 10 to 100 feet in length, with nozzles. Under the sidewalks without the building, there are eight four inch fire mains connecting with the city water, by means of which the city engines can, if found necessary at any time, force water into the hotel mains.

In every room and passage there is an automatic fire alarm, by which any extraordinary heat will be instantly and noisily known at the central office of the hotel; and six watchmen will patrol day and night every part of the structure, and touch, half hour by half hour, at seventy-nine stations, which will report by electricity and fix the place and time of a dereliction of duty.

Through the heart of the hotel from top to bottom runs a fire brick tunnel, within which is a solid brick and iron staircase opening on each floor. In five like tunnels are five elevators, run by hydraulic power, besides six additional stairways from garret to basement. Wood is avoided where possible. In the construction of kitchen, oven room, bakery, store rooms, steam pump room, water heating room, coal vaults, ash vaults and shafts, and corridors, wood is supplanted by asphaltum and marble, iron beams, and brick arches. If the Palace Hotel can burn, the lessons of Chicago and Boston are lost, and all human precaution is vain against fire in this year of our Lord eighteen hundred and seventy-five.

Architect J. P. Gaynor was instructed by the owners to travel and study the best hotels elsewhere before submitting his plans for the Palace Hotel, and Warren Leland—mine host of the old New York Metropolitan Hotel, of the Leland family, famous as hotel keepers—was appointed lessee of the house, and manager of all things. The sunning and ventilation of the 755 rooms for guests are excellent, every room opening on the open light, having a fire place, and a separate flue of four by eight inches running clear through to the roof. Every second room has a bath room attached, most rooms are twenty feet square, and none of a less size than sixteen by sixteen feet. Two thousand and forty-two ventilating tubes open outward on the roof of the hotel.

Three great cañons or courts, cut down from roof to base, air and lighten the mountain building. The center court measures 144 by 84 feet, is covered with glass, made brilliant by the lights of the pillared verandahs surrounding it, floor above floor; with a tropical garden, fountains, statues, an instrumental band of music in the evenings, and a circular carriage drive fifty-four feet in diameter. Opening upon this "garden floor" there is an "arcade promenade," four yards wide, with a show window looking on the promenade from each of the stores under the hotel. Letter tubes, pneumatic dispatch tubes, and electric bells knit all this miniature Palais Royal and the hotel into one body of wonderful life.

Ministering to the 1,200 guests that can be accommodated are four clerks, two book keepers, a French head cook who is a brilliant particular star in his profession, five assistant cooks of rising name, and three specialists—namely, a chief confectioner from Milan, a chief baker from Vienna, and

"Muffin Tom" from New York, an old negro the fame of whose egg muffins and corn bread has made him the aristocrat of his race for the last half century from Charleston to Long Branch. The 150 waiters are to be negroes also. Forty chambermaids and a host of Chinese will see that the beds and bed linen are white and fresh. This is the kind of hotel we keep in San Francisco.

From China and India and Japan a stream of invalids and visitors pours yearly in upon this city, the great sanitarium of the future for the languid oriental world. From the islands of the peaceful sea, from our own east and north, from Spanish America, a great host shall make a Babel of the Palace Hotel, whose builders have not been confounded. Its white towering walls, dotted with the gilded iron bolts that bind the great rods of the building together, shall be familiar to strange eyes from far lands. The sick down easter shall abandon his nutmegs of wood and satisfy his soul with the grapes and the oranges of our State; yellow aristocrats from Siam and tawny revolutionists from Bogota shall join hands and pass the sirup over the steaming triumphs of Muffin Tom.

We have seven big world wonders now: the Bay of San Francisco, the Central Pacific Railroad, the Big Trees, the Bonanza, Yosemite, the Geysers, the Palace Hotel—and Assessor Rosener.—*Overland Monthly.*

Scientific Courtship.

Young Molly met Christopher down by the farm,
With his analysis
And his catalysis
And his dialysis.
What would he do there?
He came down to woo there,
He came down to sue there,
To bill and to coo there,
Not to fill all her soul with alarm.

O! Science, 'tis thus that a fair maid you win,
With parthenogenesis
And alterogenesis
And heterogenesis
And other such things;
For Love, he has wings
And with him he brings
Full many such things
In the ears of fair maidens to din.

Young Christopher came with his finest brochures,
On trilobites
And troglodytes,
Theodolites
And such delights,
And he said, my dear, these are yours.
Yes, they're yours.
Love may come and love may go,
Science endures.

The heart is a stubborn thing,
And conical in shape;
A remnant which with us we bring
From our ancestral ape.
It drives the blood to Molly's cheeks,
She opens her ruby lips and speaks:
Her mitral valve plays
In the wildest of ways;
Her columna carnea,
Gives her an idea
By the way that it acts;
And, accepting the facts,
She then and there agrees to become
The partner of his scientific home.

—*Journal of Applied Chemistry.*

Correspondence.

Steam Boiler Phenomena.

To the Editor of the Scientific American:

In your article on this subject on page 193 of your current volume, you give a very interesting account of the result of injecting water into overheated boilers. The account is more valuable than usual, for the conditions seem to have been carefully observed and the results noted; and although, as you observe, they seem to be contradictory, I believe they can be explained.

In *calore, vis*—in heat is force or energy. This has been for many years my maxim; and from this point, I will endeavor to explain the two phenomena.

In the first case, the boiler was absolutely dry, and heated to from 600° to 1,000° Fah., the steam pressure being 0. Water was injected, and the pressure suddenly rose to 190 lbs. per square inch. The conditions are then as follows: An unknown quantity of water is brought in contact with an unknown quantity of iron heated to from 600° to 1,000° Fah. If, now, the arrangement of the injection pipe and pump were such that 1 lb. water injected at the first stroke would come in contact with 9 lbs. iron heated to 600° Fah., the water would absorb the heat and cool the iron. The resultant temperature would be 300° Fah. As each square foot of the iron in such boilers weighs about 12 lbs., and as the water injected by the first stroke may, and usually would, come in contact with a much larger surface than 1 square foot to each lb. of water injected, it is evident that the water would be heated to a higher degree of temperature, and steam of a higher pressure would be formed. If the quantity of water injected is small, and the heated surface with which it comes in contact large, an enormous pressure can be suddenly created in a confined space. If, on the other hand, the quantity of water is large, and the surface of the iron with which it comes in contact small, the water will be heated less; and, if heated below the boiling point, no steam is formed, as the limit of the capacity of the water to absorb heat is not reached. If, therefore, the first boiler were set so that the injected water could spread over a large surface, a sudden and high pressure would be the result; and if set so that the

water could come in contact with a small quantity of iron, that is, lower at the end at which the water is injected, very little pressure would be produced, and the heat in the iron would be gradually absorbed by the water without any injurious results.

In the second case, the conditions were similar, and "an independent pump was at hand, and was put on with a full supply of feed. The steam rose to 20 lbs. by the gage, and as suddenly fell, the steam gage indicating a complete or partial vacuum." Reasoning from numerous practical experiments, I conclude that, at the first stroke of the pump, a quantity of water was driven over sufficient surface to heat the same suddenly, and thus produce the steam pressure indicated by the gage; and the second or subsequent stroke injected a quantity of water into the steam, and condensed the same, thus producing a vacuum. If the feed end of the second boiler were lower (as it should be) than the other end, and the feed pipe entered the end of the boiler some distance above the plate, a full supply of water would produce this result.

If heat be force, a boiler heated to 1,000° Fah. contains an immense quantity of stored-up energy; and a quantity of water less than one tenth in weight of the heated iron will become the agent through which this energy is exerted, by absorbing the heat and being changed from a cohesive fluid to an expanding gas, and thus exert an enormous and (if suddenly liberated) dangerous force. When, however, the same quantity of heated iron is brought in contact with a much larger quantity of water, the great capacity of water for heat compared with that of the iron (12 to 100) will absorb the heat without producing even steam.

Experiments of the above kind should never be attempted, as it is criminal to thus risk life and property; the fires should have been hauled in both cases, and the boilers gradually cooled.

Boston, Mass.

JOSEPH A. MILLER.

The Keely Gas.

To the Editor of the Scientific American:

In the communication headed "The Keely Gas," the author is laboring under some mistakes. I will endeavor to correct his statements.

He states: "It is well known that the molecules of all substances increase or decrease in size in proportion to the specific gravity of the substance, the lighter substance containing the larger molecules." I need hardly say that, if this were true, and were known to be true, it would at once dispose of the atomic theory.

As for his experimental proof: If (as I suspect) he uses oil as being lighter than water, I am not at all surprised at his result; for the adhesion of oil to a smooth surface is far greater than that of water; so that, on pouring on the oil, it would immediately flow to the glass and cause overflow of the contents. Your correspondent may try the experiment of filling two equal and similar glass vessels with oil and water respectively. He will find that he will be enabled to add more water than oil before overflow. Let him, however, use absolute alcohol (specific gravity 0.8), and he will find that, to two similar glassfuls of water, he will be able to add more alcohol than water before overflow.

In the case of heavy liquids, the heavier the liquid, the greater the volume which may be added without altering the apparent volume. Let him try mercury, and the result will be the same as if he had added an equal volume of water.

In his last paragraph he says: "For it is plain that it would be impossible for the larger atoms of molecules of the cold vapor to pass between the smaller molecules of metal." However, unfortunately for this conclusion, it is known that hydrogen penetrates iron, that the products of combustion in a stove pass through the iron casing, and that gold is pervious to water.

I do not intend this to be in any way a defence of the Keely motor.

Hoboken, N. J.

W. B. M.

A Water Motor.

At the Sulzbach Altenwald Colliery, near Saarbrücken, Prussia, machinery has been established for the transmission of power from a steam engine at the surface, by a column of water circulating under pressure, the circumstances of the case not admitting of the establishment of a direct-acting steam pump under ground. The mine is sunk 306 yards below the surface. The piston rod of the high pressure engine above is connected with the pressure plungers, each of which plungers is connected with the underground engine by a tube filled with water. The last mentioned engine consists of four pressure pumps arranged in pairs, and between each pair is placed the working plunger of one of the mine pumps. When the engine on the surface acts, the power is transmitted by one pressure plunger through one water tube to a pair of pressure pumps under ground, and thence to one working plunger, which either aspirates or forces air, according to its position. The opposite pair of pumps and connections work conversely. The water is forced into an air vessel, and thence through the rising main 303 yards in height, in one lift to the surface. On the change of stroke, the water in the cylinder of the pressure pump rises in the second water tube and follows the retiring pressure plunger at the surface, the power supplied by the descent of water in one column being sufficient, with the exception of a slight allowance for friction, to effect its return in the other. If the cataract pauses of the engine at the surface are not too long, the discharge is practically continuous. The *Engineering and Mining Journal*, from whose translation of the German description we condense the above, adds that, at the Phoenix mine in Cornwall, England, an arrangement of simi-

lar description, consisting of a plunger attached to the main pumping engine, connected by a length of tube with a water pressure engine in another shaft, has been at work for the last ten years.

PRACTICAL MECHANISM.

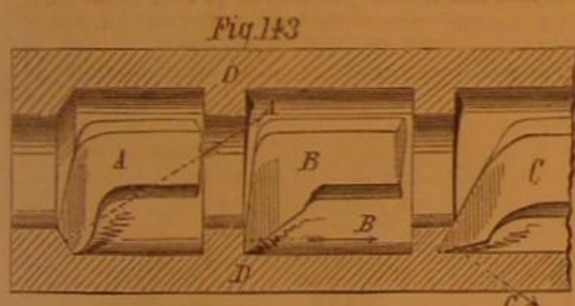
BY JOSHUA ROSE.

NUMBER XXXIII.

BORING TOOLS FOR LATHE WORK.

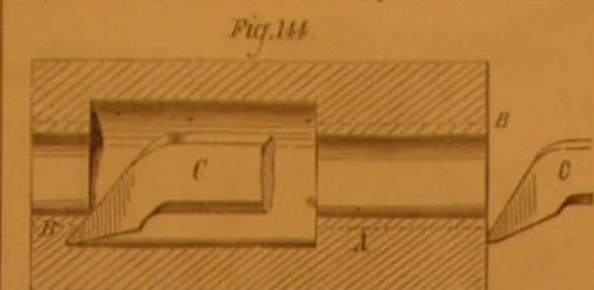
Boring tools for use on lathe work require to be shaped with greater exactitude than any other lathe tools, for the reason that they are sligher in body in proportion to the duty required of them than any other; and as a rule, the cutting edges standing further out from the tool post or clamp, the body of the tool is more subject to spring from the strain of the cut. It is obvious that, if the hole to be bored out is a long one, the cutting edge of the tool will become dull at the end of the hole as compared to what it was at the commencement (a remark which, of course, applies to all tools); but in tools, stout in proportion to the duty required of them, and held close in to the tool post, the effect of the slight wear of the cutting edge, due to a finishing cut, is not practically appreciable. In the case of a boring tool, however, the distance of the cutting edge from the tool post renders the slightest variation in the cutting capability of the tool sufficient to affect the work, as may be experienced by boring out a hole half of its length, and then merely exerting a pressure on the body of the tool, as near the entrance of the hole as possible, with the fingers, when the size of the last half of the hole will be found to have varied according to the direction in which the pressure was placed. As a result of this extreme sensitiveness to spring, the tool is apt to spring away from the cut as the boring proceeds, thus leaving the hole smaller at the back than at the front end. To remedy this defect, several very fine finishing cuts may be taken; but a better plan is to so shape the tool that its spring will be in a direction the least liable to affect the size of the bore of the work.

The pressure on the cutting edge of a tool acts in two directions, the one vertical, the other lateral. The downward pressure remains at all times the same; the lateral pressure varies according to the direction of the plane of the cutting edge of the tool to the line or direction in which the tool travels: the general direction of the pressure being at a right angle to the general direction of the plane of the cutting edge. For example, the lateral pressure, and hence the spring of the various tools, shown in Fig. 143, will be in each case in the direction denoted by the dotted lines. D is a section of a piece of metal requiring the three inside

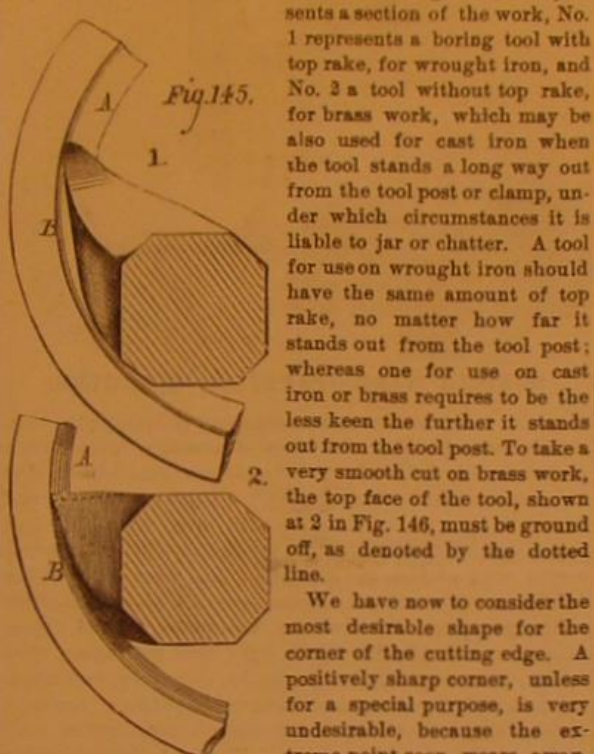


collars to be cut out; A, B, and C are variously shaped boring tools, from which it will be seen that A would leave the cut in proportion as it suffered from spring, which would increase as the tool edge became dull, and that the cut forms a wedge, tending to force the tool towards the center of the work. B would neither spring into nor away from the cut, but would simply require more power to feed it as the edge became dulled; while C would have a tendency to run into the cut in proportion as it springs; and as the tool edge became dull, it would force the tool point deeper and deeper into the cut until something gave way. Now, in addition to this consideration of spring, we have the relative keenness of the tools, it being obvious at a glance that (independent of any top rake or lip) C is the keenest, and A the least keen tool; and since wrought iron requires the keenest, cast iron a medium, and brass the least keen tool, it follows that we may accept, as a rule, C for wrought iron, B for cast iron, and A for brass work. To this rule there are, however, variations to be made to suit exceptional cases, such for instance as when a hole terminates in solid metal and has a flat bottom, in which case the tool, B (slightly modified towards the form of tool, C), must be employed. Or suppose a hole in cast iron to be, as is often the case, very hard at and near the surface of the metal. Tool, A, would commence cutting the hard surface and, becoming dull, would spring away from the cut in spite of all that could be done to prevent it; while tool, B, would commence to cut both the hard and the soft metal together, the cutting edge wearing rapidly away where it came into contact with the hard surface of the metal; and these conditions would, in both cases, continue during the whole operation of boring, rendering it difficult and tardy. But if the tool, C, were employed, the point of the tool would commence cutting the soft part of the metal first, and would undermine the hard surface, and (from the pressure) break it instead of cutting it away, as shown in Fig. 144, in which A represents a piece of metal to be bored, the bore being hard to the depth of the dotted lines, B, C is the tool shown as it would commence to cut, and also as it would operate while in full operation. After the hard surface is removed, tool B, in Fig. 143, may be employed to finish the boring, the point being ground a little more rounded. The objection to tool, C, in

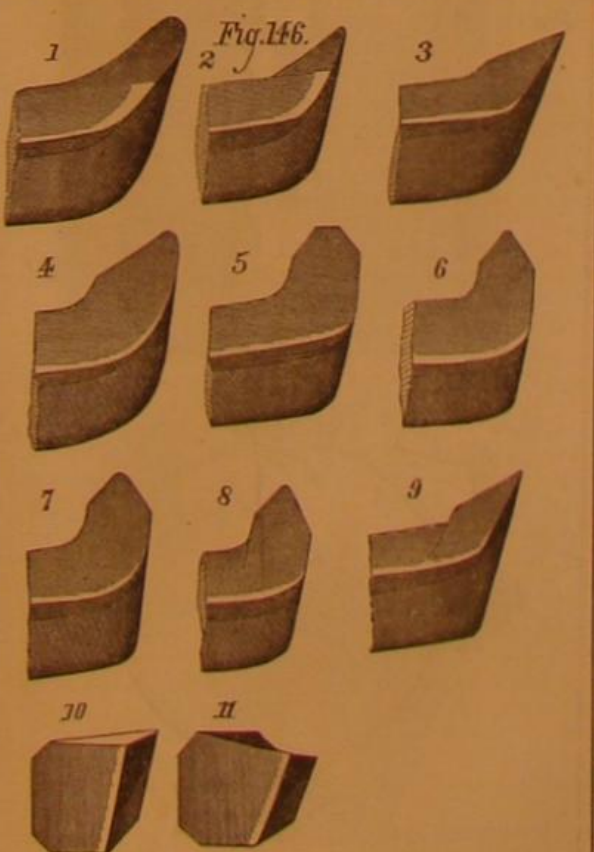
Fig. 143, for employment upon cast iron or brass, is that, in consequence of its excessive keenness, it is liable to jar or chatter. Tool, B, in Fig. 143, may be given top rake and employed to cut out a square corner, or it may, if not ground too keen, be used upon brass; but it is liable, in such case, to jar or chatter, unless the top face is ground away. Here, then, we come to the consideration of top rake, that is, the shape of the top face of the tool, our previous remarks hav-



ing had no reference to that part of the subject. The application of top rake or lip to a boring tool lessens the strain due to severing the metal; by presenting a keener cutting edge, it lessens the tendency to lateral spring, and increases that to vertical spring, and is beneficial in all cases in which it can be employed. Upon wrought iron and steel it is indispensable; upon cast it may be employed to a limited degree; and upon brass it is inadmissible by reason of its causing the tool to either jar or chatter. In Fig. 145, B represents a section of the work, No. 1 represents a boring tool with top rake, for wrought iron, and No. 2 a tool without top rake, for brass work, which may be also used for cast iron when the tool stands a long way out from the tool post or clamp, under which circumstances it is liable to jar or chatter. A tool for use on wrought iron should have the same amount of top rake, no matter how far it stands out from the tool post; whereas one for use on cast iron or brass requires to be the less keen the further it stands out from the tool post. To take a very smooth cut on brass work, the top face of the tool, shown at 2 in Fig. 146, must be ground off, as denoted by the dotted line.



We have now to consider the most desirable shape for the corner of the cutting edge. A positively sharp corner, unless for a special purpose, is very undesirable, because the extreme point soon wears away, leaving the cutting qualification of the tool almost destroyed, and because it leaves the work rough, and can only be employed with a very fine feed. It may be accepted as a general rule that, for roughing cuts, the corner should be sufficiently rounded to give strength to the tool point; while, in finishing cuts, the point may be made as round as possible without causing the tool to jar or chatter. Now, since the tendency of the tool to jar or chatter depends upon four points, namely, the distance it stands out from the tool post, the amount of top rake, the acuteness or keenness of the



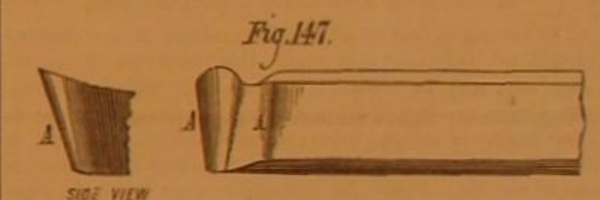
general outline of the tool, and the shape of the cutting corner, it will readily be perceived that considerable judgment

is required to determine the most desirable form for any particular conditions, and that it is only by understanding the principles governing the conditions that a tool to suit them may be at once formed. In Fig. 146 will be found the various forms of boring tools for ordinary use. No. 1 is for use when the conditions admit of a heavy cut on wrought iron. No. 2 is for use on wrought iron when the tool stands so far from the tool post as to be necessarily subject to spring. No. 3 is to cut out a square corner at the bottom of a hole in wrought iron. No. 4 is for taking out a heavy cut in cast iron. No. 5 is for taking out a finishing cut in cast iron when the tool is proportionally stout, and hence not liable to spring or chatter: the point being flat, the cutting being performed by the front corner, and the back part being adjusted to merely scrape. No. 6 is for use on cast iron under conditions in which the tool is liable to jar or spring. No. 7 is for taking out heavy cuts in brass when the conditions are favorable. No. 8 is for brass work, either roughing out or finishing, when the tool stands far out from the tool post, or is slight in proportion to its duty. No. 9 is for taking out a sharp corner in brass work. No. 10 is an end view of No. 7, and No. 11 an end view of Nos. 8 and 9. The tools for wrought iron will answer equally well for steel or for copper.

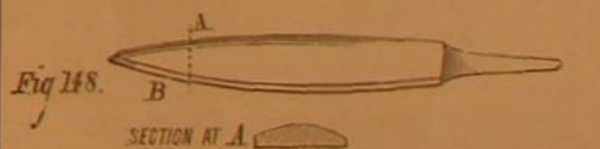
An inspection of all these tools will disclose that the tool point is more rounded for favorable conditions, that is, when the body of the tool is stout, and the cutting edge is not held far out from the tool post; that, to prevent jarring, the point of the tool is made less round, which is done to reduce the cutting surface of the tool edge (since it is apparent that, with a given depth of cut, the round pointed tool will present the most cutting edge to the cut); and that, to further prevent jarring or chattering, the leading part of the cutting edge is ground at an angle; while, as another precaution against that evil, the general form of the tool is varied from that of tool, C, in Fig. 143, towards that of tool, A, in the same figure; while for brass work, no top rake or lip is employed, but the tool is beveled off to suit those cases in which it is liable to excessive spring. It is obvious that the feed may be coarser for a round-nosed than for a more acute tool, and that, the rounder the nose, the smoother the cut (with the same rate of feed) will be.

All boring tools for heavy duty may be hardened right out, that is, not tempered at all, while those slight in form at the cutting edges should be tempered to a straw color.

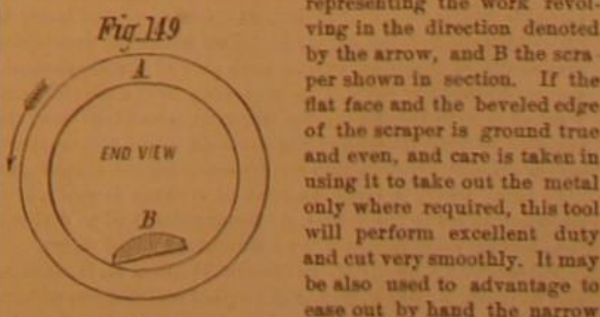
The side faces of the tool marked A, in both views of Fig. 147, may be beveled just sufficiently to well clear the feed of



the cut when used on wrought and cast iron, and ground further back, that is, with more angle, for use on brass, especially if there is a tendency to jar or chatter. The straighter, however, these side faces can be kept, the better the cutting edges are supported by the metal behind them, and the longer they will stand without regrinding. When boring light brass work, it is well to hold a brush near the entrance of the hole, to prevent the turnings from flying about the shop; while cutting tools for outside brass work may have a split leather washer forced over the body near the cutting end for the same purpose. After a piece of brass or cast iron work has been bored and taken out of the lathe, and is found on trial to fit a little too tight, it may, if it is difficult to chuck it true again, be eased by a half round scraper, as follows: Take an old half round smooth file and grind the edges at an angle, as shown in Fig. 148, B forming the cutting edge. Then re-chuck the work in the lathe as nearly



true as possible, and revolve the work at such a speed that the scraper will cut at about 380 feet per minute; then apply the scraper by hand in the position shown in Fig. 149, A A



representing the work revolving in the direction denoted by the arrow, and B the scraper shown in section. If the flat face and the beveled edge of the scraper is ground true and even, and care is taken in using it to take out the metal only where required, this tool will perform excellent duty and cut very smoothly. It may be also used to advantage to ease out by hand the narrow places of a hole that is oval, or the small end of one that is taper and requires to be made parallel. The smoothness of its work is much improved by smoothing its edge upon an oilstone. Here it may be well to state that the application of an oilstone to the cutting edges of a boring tool increases its tendency to chatter; if, therefore, a hole requires to be made unusually smooth, the tool must be given less top rake and may then be oilstoned. In many cases a tool may be prevented from chattering by holding it with the fingers as near the entrance of the hole as possible.

IMPROVED TIRE-UPSETTING MACHINE.

We illustrate herewith a new machine for upsetting or shortening wagon tires or iron bars. It may be operated by one man, and is so constructed as to be capable of doing the heaviest work without danger of breakage or strain in any part. It is quite simple and may be secured on any convenient support.

The stand, which may be of wood or iron, has on each side iron straps, which support the stationary head, A, and guide the hinged head, B. The stationary head is also attached to the end of the stand, and both heads are placed across the bars. C, Fig. 2, is a flange on each head, against which the adjusting blocks, D, are placed. E and F, Fig. 1, are gripping jaws, pivoted one on each head, and provided with lever handles. Said jaws are connected by a jointed bar, G, so that by operating jaw, E, the power is applied to the jaw, F. The last mentioned jaw strikes the tire, H, first, gripping the same; and the power being continued, the jaw, E, seizes the tire also. The tire being in a heated state, is firmly held between the jaws by the operator, so that it can have no longitudinal motion. With his left hand, the operator then grasps the cam lever, I, and forces the movable jaw and head toward the other jaw. This causes the jointed bar, G, to turn outward on its hinge, and completes the operation of upsetting the tire. J is the anvil, which is fastened between the jaws, and on which the tire rests. As soon as the cam lever is applied, the lever of the gripping jaw, E, may be released, so that the right hand of the operator is at liberty to use a hammer in order to press down the tire in case it bends upwards from the anvil, as might occur when the tire is a light one, or to apply both hands on the cam lever, so obtaining a better purchase for upsetting a heavy tire. The back movement of the movable jaw and head is produced by the spring, K.

Patented through the Scientific American Patent Agency, March 10, 1874, by M. Schou. For further particulars address Messrs. Combs & Bawden, sole manufacturers, Freehold, N. J.

HENNAMAN AND SHAW'S BOILING POT.

The accompanying illustration represents a new cooking utensil for boiling, so constructed that two kinds of vegetables, etc., may be cooked in it at once, without mixing. Housekeepers who find it necessary to economize space on their ranges or cooking stoves, or to whom it is an object to facilitate their culinary operations, will doubtless appreciate the advantages offered. An ordinary iron pot forms the outer vessel. Inside is set a perforated holder, A, in which the articles to be cooked are placed. On each side of the holder



is a vertical flanged groove, and in said groove is held a detachable perforated diaphragm, B. On top of the latter is hinged a semicircular cover, C. Two kinds of vegetables may easily be prepared, one on each side of the diaphragm, and by turning the cover, C, successively over each side, and holding it with the hand, the separate chambers may be emptied without mingling their contents. The two compartments are easily thrown into one by removing the diaphragm.

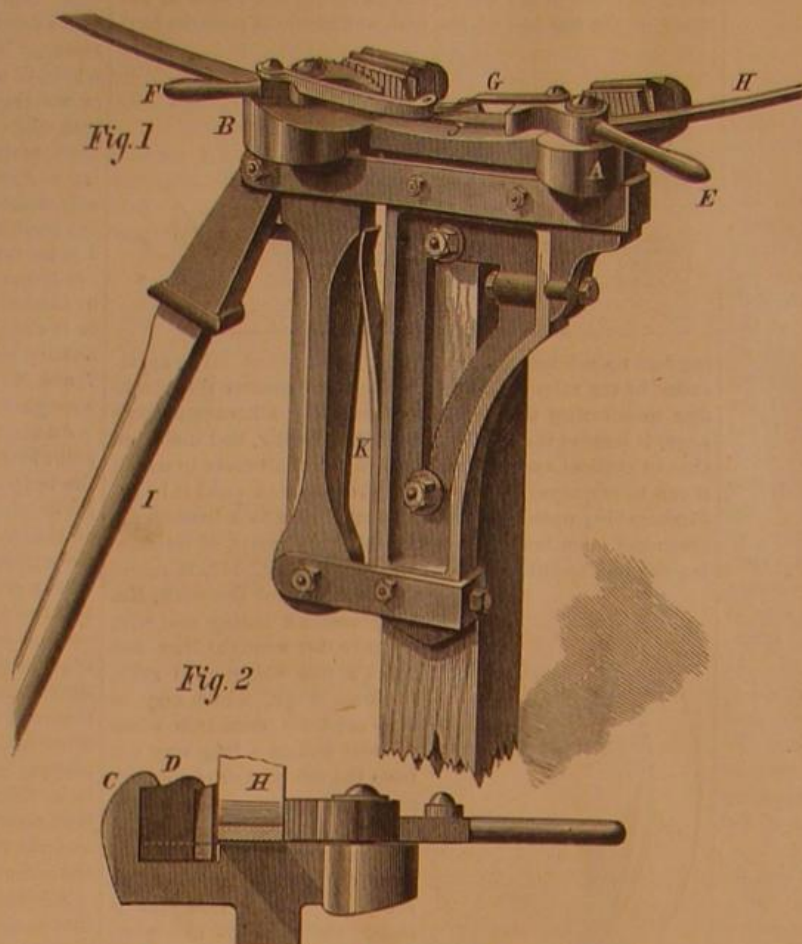
In cases where a large amount of cooking is done, it is proposed to make the vessel, A, rectangular, and to divide it into several compartments, by a number of diaphragms.

Patented July 27, 1875, to Messrs. William H. Hennaman and William F. Shaw, Jr. For further information address the last mentioned inventor, 19 South Chester street, Baltimore, Md.

Scientific Apparatus Exhibition.

The British government intends to have an exhibition of scientific apparatus, to be held at South Kensington, London, in 1876, the present arrangements being that it is to be opened on April 1. The Committee of Council on Education, Science, and Art Department have just issued a kind of syllabus, indicating the articles that will be admissible. The exhibits are to include such instruments and apparatus as

are employed for scientific research, experiment, and pupil teaching. It is also intended to include matters that will illustrate the progress of Science and its technical applications, with others of a more special kind, but of general interest and value. In cases where original apparatus, etc., cannot be sent, models, drawings, and photographs will be ad-

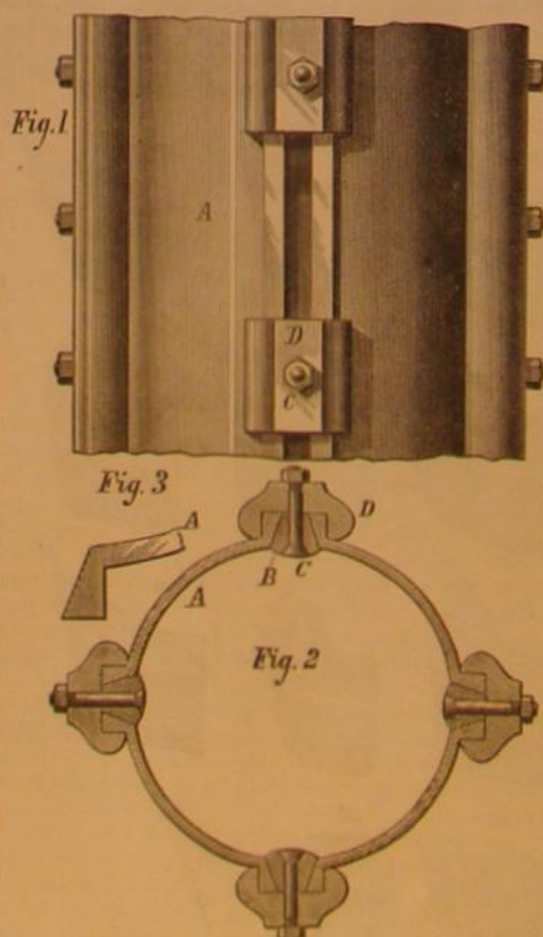


SCHOU'S TIRE-UPSETTING MACHINE.

mitted. In certain cases apparatus may be arranged in such successive order that the steps of scientific investigation may be readily followed. A valuable provision will be that of, as far as found practicable, systematically explaining and illustrating the use of the apparatus, etc. The committee appeal to those institutions or individuals who possess instruments, etc., of historic interest to lend them. The entire exhibition will consist of eighteen sections, embracing arithmetic, geometry, measurement, kinematics, statics, dynamics, molecular physics, sound, light, heat, magnetism, electricity, astronomy, applied mechanics, chemistry, meteorology, geography, geology and mining, mineralogy, crystallography, etc., and biology. Instruments representing each of these subjects will be shown. The committee selected to carry out the object of the exhibition embraces some of the most eminent men in each department above named, the engineering branch being specially well represented.

IMPROVED METALLIC COLUMN.

What with the extension of one elevated railway already



in existence, and the construction of new ones in New York city (these projects being most favored just now as the solutions of the rapid transit problem, and hence there being a

fair probability of their being undertaken) the attention of engineers will ere long be directed to the determination of the simplest and strongest methods of erecting such structures. Iron, in most cases, will be the material employed for the supports of the raised track, so that we may expect that all the various modes of building hollow columns of that metal, now in existence, will be subject to careful scrutiny, and perhaps to actual tests for strength, etc. The invention which we illustrate, in the annexed engravings, belongs to the above category, and therefore possesses a timely interest. It is a new segmental metallic column which is both simple and strong, and offers exceptional facilities for splicing. A perspective view is given in Fig. 1, and transverse sections in Figs. 2 and 3. The sides of the column consist of four or more rolled plate segments, A, having a flange on these outer edges. These flanges, as shown in Fig. 3, are thicker at their outer portions than at their bases. Their inner sides are straight and outer sides beveled. When two of the segments are brought together to form a column, wedge-shaped blocks, B, are placed between the beveled sides of the flanges, so as to hold the segments a suitable distance apart. Headed screw bolts, C, are then passed outward through the blocks, between the flanges, and through clamps, D, Fig. 2, which fit over and entirely cover the flanges on the outside. By screwing up the nuts, the wedges, B, are drawn in between the segments so as to force them apart and thus cause the clamps, D, to grasp the sides of the flanges, holding them very firmly together. In order to save the material, the wedges may be made as short as possible, while the clamps may either be constructed the full length of the column, or in short sections like the wedges. By properly clamping over the main body of the column, one of the segments may be removed, when the structure is in position in a bridge or building, so that the interior of the column may be painted as often as is necessary.

Splices may very easily be made by allowing the clamps to extend from ten to twelve inches beyond one set of segments in order to grasp the flanges of another set. The clamps are rolled, and the wedges are castings. In putting a column together, the wedges are all attached to the clamps with nuts slack, then slipped lengthwise over the flanges, when the nuts are finally tightened.

Patented August 31, 1875. For further particulars address the inventor, Mr. Charles H. Leidy, Norristown, Pa.

THE GRANGE FARM MILL.

To save one tenth of all the grain used on a farm or in a



stable is no small economy; but the inventor of the device illustrated herewith believes that such saving may be effected through the use of a simple and well made mill (properly actuated by horse, wind, water, or some other cheap power that is everywhere available) for grinding the corn, oats, barley, and other cereals fed to the cattle and horses. Such a mill, suitable for all such purposes, he claims to have produced. Its form and construction will readily be comprehended from the illustration, rendering detailed description unnecessary. It is strong and compact, and is provided with a conveniently located driving pulley, to which the power is applied. The grinding plates are self-sharpening and will last a long time, costing but little to replace when worn out.

The inventor adds that any one having any kind of power at his command will find the mill a good source of income, if the machine be used for grinding wheat for others. Any one owning a horse which is idle a portion of the time might thus utilize the animal for light and profitable labor.

Patented through the Scientific American Patent Agency. For further information and for mills, address Mr. H. H. Swift, Millbrook, N. Y.

THE GREAT SPOTTED IRIS.

The family of *iridaceae* are renowned for their graceful beauty, from the wild iris, commonly called blue flag (*flor de luce*, *flor de Louis*, the armorial device of the kings of France since Louis VII.'s time) to the great spotted iris, of which we herewith give an engraving. The *iris versicolor* is a widely distributed plant, its flowers (on stems sometimes 3 feet high) being visible in damp places in early summer; the root of this plant is diuretic and cathartic, and is prepared for medical purposes by some pharmacists. There is also a yellowish or reddish brown species, *i. cuprea*, common in Illinois and other States. The well known orris root of the drug stores is the product of *i. Florentina*, *i. pallida*, and *i. Germanica*, which grow wild in Europe.

Iris susiana, the mourning iris, as it is sometimes called, has flowers very large in size, dotted, and striped with purple on a gray ground. In northern climates it needs to be protected in winter. Being one of the very finest of the genus, it will well repay the amateur for his care and attention; and it is readily hybridized, many varieties having been produced which are only locally known and have never been classified by botanists. Another kind well worth attention is the *iris Persica*, the blossom of which is of a pearly white hue, exhaling a very delicate perfume. This latter is well adapted for indoor growth.

Our engraving shows an unusually fine specimen of *i. susiana*, grown in the gardens of the Archbishop of Canterbury, England; but the blossom is three times as large as we have represented it. The best way to grow these beautiful flowers is in a large isolated bed, oval or circular in outline. The soil should be rich and open in texture, and well drained, for the sake of a few of the more delicate species; most of the kinds grow freely enough in stiff, coldish soil. The plants vary in size from *i. pallida* and *i. ochroleuca*, 3 or 4 feet high, down to some not 6 inches high, as *i. cristata*. They vary strikingly in color and markings too, so that an attraction of no mean order is a well planted and well arranged mass of irises alone. A few of the finer lilies, however, may be placed among them with good effect; and round the margins, in early spring, bulbous flowers may be dotted.

Rokitansky's Farewell Address.

On the 16th of July the distinguished anatomist and pathologist Rokitansky delivered, in the University of Vienna, his valedictory address before retiring from the professorship. It is a vigorous and thoughtful production, rich with the wisdom of wide experience. He entitles it his "Legacy to his Scholars." Various questions of the day are touched upon. One of his warnings is against admission of woman to equality with man; another, against an excess of competition in life; and a more urgent one, against modern individualism, which shows itself in the ruthless pursuit of personal objects, and in the readiness with which the ethics of the day excuse all manner of wrong-doing, out of a misplaced sympathy, or a belief that nothing is in itself bad.—*Medical and Surgical Reporter*.

CUPRESSUS NUTKAENSIS.

The northwestern shores of this continent, especially in



CONES AND LEAVES OF CUPRESSUS NUTKAENSIS.

the vicinity of Nootka Sound, Observatory Inlet, and the Island of Sitka, are the exclusive habitat of this remarkable species of cypress. When the late Dr. Fischer first saw it, he noted it down as a *thujopsis*, so much does it resemble that genus in habit and foliage. Later authors, however, prominent among whom is Mr. Gordon, have determined that the tree is most properly classed among the *cupressineae*,

in the sub-order *chamaecyparids*, which is distinguished from *cupressus* proper by having only two seeds under each scale of the cone, whereas the true *cupressus* has several. In St. Petersburg the young plants have been raised in the open air, a sufficient indication of their hardiness. Under favorable conditions, the tree attains in its native habitats a height of 80 to 100 feet, with a bole of over 4 feet in diameter, perfectly straight, and covered with a smooth, soft, dark colored bark. The branches spread very much, and are sub-divided into a vast number of smaller pendent ramifications, which in old trees are thickly covered with a highly aromatic resinous exudation. The leaves, in shape, arrangement, and



THE GREAT SPOTTED IRIS.

color, bear a remarkable resemblance to those of *thujopsis*, being a little brighter, perhaps, and with somewhat less of bluish reflection. The cones (of which we give an illustration) are solitary, almost sessile, or borne on very short stalks, and are covered with a glaucous pubescence; they are about the size of large peas. If a twig or branch of this tree is broken or bruised, it exhales a very powerful balsamic odor, and the wood, which produces white and soft timber, also yields in great abundance a very aromatic gum, which, in its appearance and scent, has a strong resemblance to Canada balsam. The tree is, on account of this property, known on the continent as the *sapin aromatique*.

CALADIUM CULTURE.

The caladium is undoubtedly one of the most ornamental and attractive of our fine foliaged stove plants, and few con-



CALADIUM BELMEYEI AS A VASE PLANT.

vey a better idea of the luxuriance and splendor of tropical

undergrowth to those who have never been in tropical regions. This plant is not difficult to grow to perfection if it is treated liberally, and care taken to prevent the plants getting a check at any time, which is almost certain to arrest the development of the leaves before they have attained their full size; and no satisfactory growth is made after that. The roots should be shaken out carefully about the beginning of March, and the largest selected and potted, two, three, four, or more in a pot, according to the size of the bulbs and the variety. Large single roots of *c. esculentum* will sometimes require a 12 or 14 inch pot at the first; while the little argyrites, when grown for neat specimens, will only want a 3 or 4 inch pot for a number of its little bulbs at the first shift. The pots should be carefully crocked, but not too deeply, and a soil consisting of two thirds light turfy loam, one of well rotted leaf mold and cow dung, and a considerable addition of silver or common clean river sand, according as the loam is light or heavy, will suit them well. The bottom layer of soil may be made moderately firm with the fingers; but, on the whole, they should be rather loosely potted, seeing that long fleshy roots, that give massive leaves and not flowers, are what should be encouraged. After potting, they should be plunged in a bottom heat of about 75°, to begin with, in a stove or warm pit, and very slightly watered at first—or, indeed, not at all for a time, if the bulbs have been dried off during the winter, in which case they are exceedingly apt to rot off as soon as committed to the moist soil again. The roots will grow faster than the leaves at first; but when the first leaves do appear, the plants may be copiously watered, for, though the caladium is not an aquatic, it delights in abundance of moisture. As regards top heat, a general and moist stove temperature will suit them well, according to the season of the year, and they must be kept in a good light, not far from the glass, and subjected to a free circulation of warm air, and shaded carefully on sunny days with thin canvas.

In potting, see that the roots are not disturbed in the least; only remove the crocks. Pot carefully, leaving plenty of room for watering, and restore the plants to their former quarters, until they have got established, when they may be moved into the plant stove or house where they are to be displayed during the summer. Here they must not be neglected, or be allowed to become dry or shaded; they must have room, light, and air, and frequent waterings with weak liquid manure. With this treatment they will grow apace. Any flowers they throw up must be pinched out at an early stage, faded leaves cut off, and everything done to keep up and prolong a vigorous growth until the plants show a natural disposition to go to rest in autumn.

THE FLAMINGO PLANT.

At a recent exhibition of the Royal Botanic Society, a vigorous specimen of the flamingo plant, *anthurium scherzerianum*, bearing four remarkable large spathes, was exhibited. Our illustration, sketched at the time when it was exhibited, will give our readers some idea of the appearance of this large-spathed variety, which, for healthy luxuriance, we have never seen exceeded. The broad flat spathes were fully 5 inches in length and 4½ inches in breadth, and attracted much attention. In color these spathes were not so brilliant as those



THE FLAMINGO PLANT.

of some of the other varieties exhibited on that occasion; but perhaps spathes produced under more favorable circumstances, as regards weather, may be brighter. Like all other cultivated plants raised from seed, this anthurium is very variable in color; and this variety is now augmented by the introduction of a whitish-spathed kind.

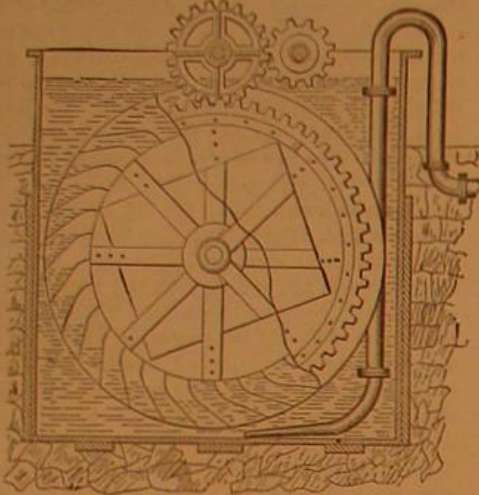
ATMOSPHERIC MACHINERY.

The various inventions below described, selected from Knight's "New Mechanical Dictionary," published by Messrs. J. B. Ford & Co., of this city, have been grouped together as devices in which the atmosphere is, by some means, brought into employment. In one case it is used as a means of transmitting power, in another it is mingled with steam, adding to its expansive force, and so through quite a variety of interesting instances.

CALLE'S AERO-DYNAMIC WHEEL.

This is a curious invention, by which compressed air is

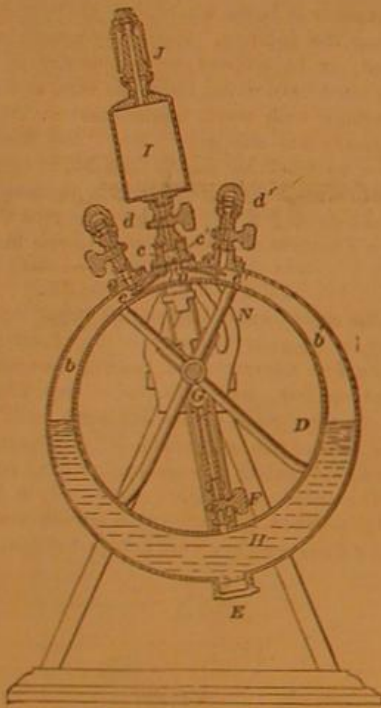
Fig. 1.



Calle's Aero-dynamic Wheel.

made to transmit the power. It consists mainly of a wheel, Fig. 1, fitted with buckets, similar to those in any ordinary water wheel and completely immersed in a tank filled with water. The wheel carries a toothed inner rim which works a pinion on the transmission shaft. The air is introduced under the bottom of the wheel, through a curved pipe. The air thus blown into the buckets has naturally a tendency to

Fig. 2.



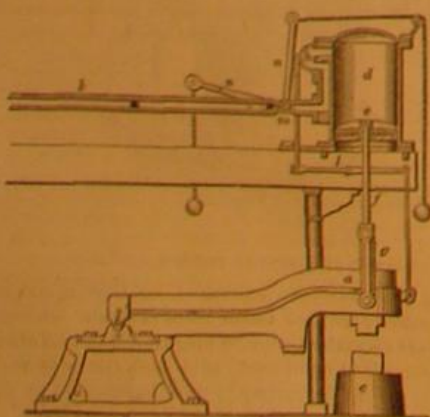
Cabell's Atmospheric Alarm-Whistle.

gain the surface of the water with a force equivalent to the weight of displaced water, and this upward tendency causes the rotation of the wheel, and at the same time brings back the discharged buckets successively before the pipe orifice. In a practical test of this invention, it was found that 83 per cent of the power of the 9½ horse power blowing engine was thus transmitted to the wheel, and this through a pipe 510 feet long having 14 elbows.

CABELL'S ATMOSPHERIC ALARM WHISTLE.

represented in Fig. 2, is used as a nautical alarm to warn ships from shoals or dangerous coasts. It is sounded by the alternate eduction and induction of air from and into an annular chamber, which is partially filled with water, and oscillates by the

Fig. 3.



Hague's Atmospheric Hammer.

motion of the vessel, assisted by other power, if necessary. The motion may be made to work an air pump to

Fig. 4.



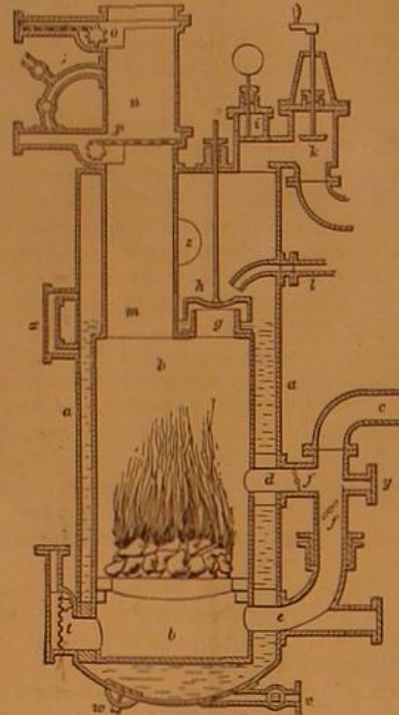
Bevan's Air-Cushion for Pipes.

increase the energy of the blast, or its effectiveness may be augmented by gas, generated by chemical means in the chamber. The chamber, D, has air spaces, bb', communicating by valve, c c', on each side of the dividing plate, a, with the blast whistle, J. dd' are vacuum whistles, which act alternately as the chamber sways in one direction and the other, supplying air to that side of the chamber which is abandoned by the water. The funnel, G, is the means of supplying the chamber, D, with water.

HAGUE'S ATMOSPHERIC HAMMER,

shown in Fig. 3, is so constructed that the helve of the hammer is raised by the pressure of the atmosphere beneath a piston above the helve, the air being exhausted from above the piston by means of a pump. The hammer falls by its

Fig. 5.



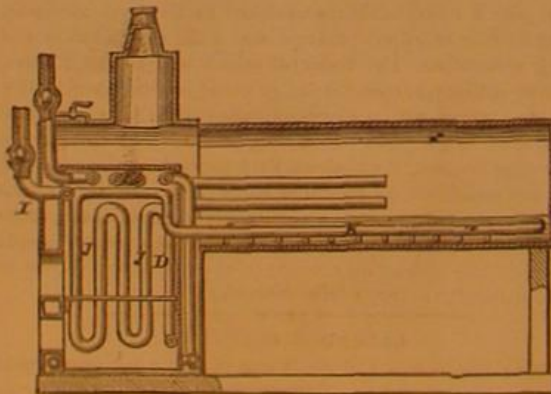
Bennett's Aero-steam Engine.

own weight when air is admitted above the piston. This last is done automatically on the piston reaching the end of its up stroke. An

AIR CUSHION FOR PIPES

is represented in Fig. 4. The object is to avoid the jar

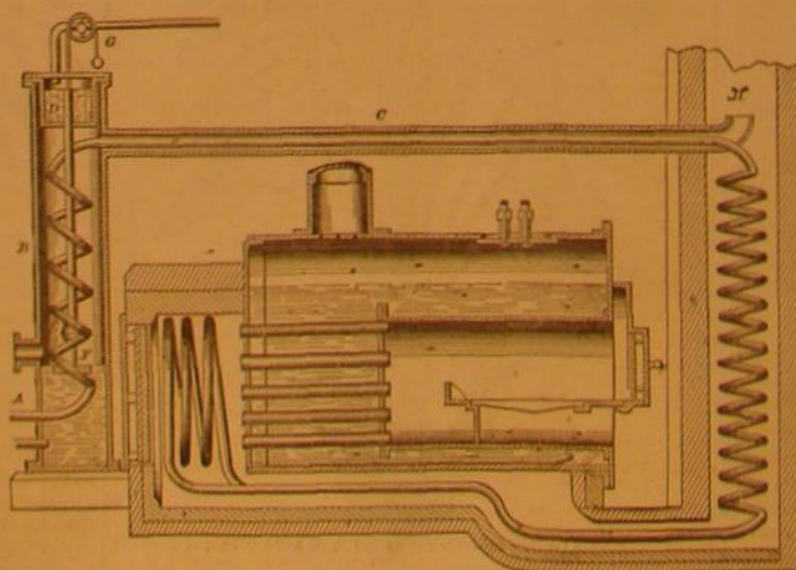
Fig. 6.



Tanger's Steam-Generator.

which occurs when a column of water in motion is suddenly arrested. As a means of imprisoning the air which is gradually absorbed in the water, and thus allowing the latter to contract and expand when the jar comes, a ball of India

Fig. 7.



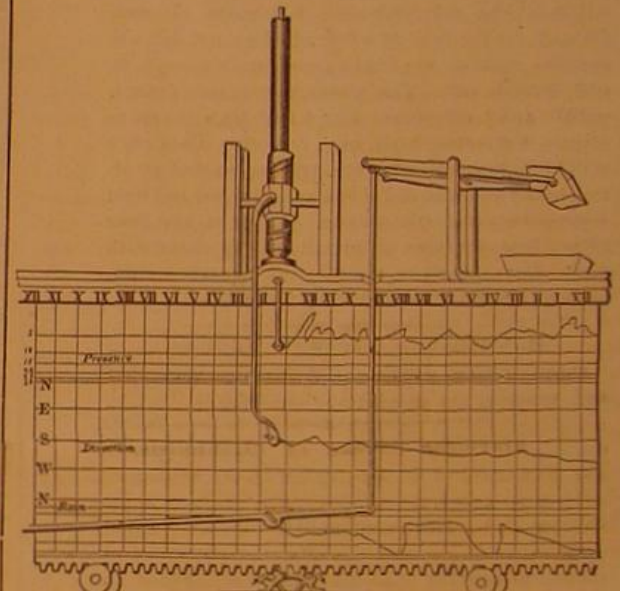
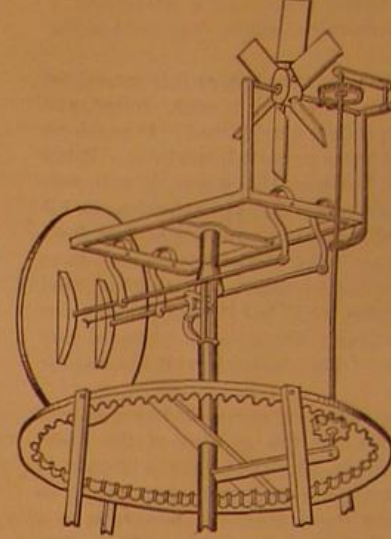
Watson's Aero-steam Engine Boiler.

rubber is inserted in the pipe. The sack or ball is placed in an enlargement of the pipe and so gaged as not to stop the flow. A continuous tube, of the same material and containing air, is also arranged in the water pipe.

AERO-STEAM BOILERS.

Bennett's aero-steam boiler, which is represented in Fig. 5, is so constructed that an incoming charge of air is conducted to the furnace and made the means of maintaining combustion under pressure. The furnace is airtight, and the volatile results pass through the steam boiler, are washed

Fig. 8.

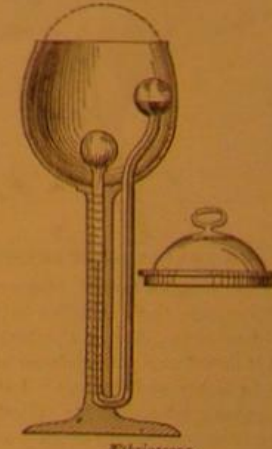


Ouler's Anemometer.

and pass fully saturated to the cylinder. The expansive power of combined heated air and steam is, therefore, used to drive the piston. a is the outer shell of the boiler. b is a cylinder forming the fire box and ash pit, placed therein and entirely surrounded by water. The tube, c, is connected to a blower, and has two branches, one, d, admitting air to the fire box, the other, e, to the ash pit. ff are dampers in each branch. The smoke and heated air escape by the passage, g, which is covered with a valve, h, so that the gases, etc., are compelled to pass through water, thus becoming washed. k is the pipe leading to the engine. l is the feed water pipe. m is the fuel pipe, having a hopper, n, and closed by two valves, o and p. When the engine is set to work, it forces air into the furnace both above and below the fuel at each stroke, which, having no vent to escape but at the valve, h, accumulates in the furnace until its pressure somewhat exceeds that of the steam upon the valve, h, when the latter is lifted and, the hot air, as before described, mixes with the steam.

Tanger's steam generator is represented in Fig. 6. The air is injected into the pipes D and I, by means of a force pump, and, after being heated while passing through the convolutions of the

Fig. 9.



Adriestop.

pipes, F and J, is forced into the boiler by nipples, as shown at K.

Warsop's aero-steam boiler, shown in Fig. 7, is started by steam in the ordinary manner. A single-acting air pump, worked from the crank shaft, compresses air to a little more than the boiler pressure. The air then passes through a long circuit of straight and coiled pipe, which traverses the exhaust conduit, makes several spiral coils in the chimney, then descends at one side of the fire box, is exposed to the full fire, and finally passes by a valved opening into the boiler at the bottom of the water space. The air escapes into the water through perforations in the pipe.

Fig. 8 represents

OSTLER'S ANEMOMETER,

an instrument intended to measure the force of the wind, and hence one of the most necessary aids to the meteorologist. The device is considered to be one of the most perfect yet invented, as it not only denotes changes in the force and velocity of the wind, but keeps a record of the same. The essential part is a plate, having its face constantly presented to the wind, by a set of vanes, at right angles to it. The force of the wind on the plate causes it to move an arm carrying a pencil, which makes a mark on a sheet of paper especially ruled for the purpose, having separate compartments for registering the force and duration of the wind, and a third to show the amount of rain. The paper is slowly moved by clockwork. The pencil approaches or recedes from the edge of the paper, as the wind varies in force, while a similar pencil attachment, to an arm connected by a spiral worm and nut to the guide vanes above mentioned, registers the direction of the wind in the center compartment. The rain gage is attached to a bent lever, also carrying a pencil, which is drawn toward the center of the paper as the gage becomes filled with water, thus indicating the amount of rain. When the gage is completely full, it tilts, empties itself, and the record commences afresh.

THE ANTHRIDSCOPE

is another meteorological instrument, and is designed for measuring the degrees of cold arising from exposure under different conditions of the sky. As represented in Fig. 9, a highly polished metallic cup or concave mirror is placed upon a pedestal, and a differential thermometer is arranged within it, so that one of the bulbs of the thermometer shall be exactly in one focus of the mirror. The other bulb, being not in either focus, is not affected by the pulsations, the effects of which on the cup are concentrated upon the first bulb, the air in which being suddenly contracted upon its exposure to a clear sky, the liquid in that branch of the stem is caused to rise. The cup is kept covered with a metal plate, except at the moments of observation.

Alarming Spread of Trichinosis.

The *Transactions of the Indiana State Medical Society*, 1875, contain a report on trichinosis, by Dr. George Sutton, of Aurora, Ind., which contains the following alarming observations:

From microscopic examination of pork killed in South-eastern Indiana, we have found from three to sixteen per cent of the hogs affected with trichina, the number of hogs diseased varying greatly in different localities.

"That over five millions of hogs are slaughtered and packed in the Western States, not including those which are put up for family use by the farmers: that if four per cent of this pork is diseased, which we believe to be a low estimate, we have two hundred and twenty-one thousand four hundred and eighty-four diseased hogs put annually upon the market; or, at an average of two hundred pounds to the hog, forty-four millions two hundred and ninety-six thousand eight hundred pounds of diseased meat, every ounce of which, under favorable circumstances, is capable of producing disease.

"That from the cases of trichinosis that came under our observation, and the *post mortem* examinations, and the effects upon the dog that was fed on the diseased meat, we have come to the conclusion that ninety per cent of disease produced from eating trichinous pork appears either as gastro-enteritis, or as a diarrhoea or dysentery, and not more than ten per cent as the fully developed form of trichinosis, in which the muscular system becomes affected.

"That as diarrhoea, dysentery, and enteritis rank high as causes of mortality in the United States, these diseases causing thirty-one thousand one hundred and fifty-three deaths in 1870, as shown by the last census reports: and as we have seen that a large amount of trichinous pork, capable of producing these diseases, is among the principal articles of food in our country: we think it more than probable that trichinosis have a much greater influence in the etiology of this class of diseases than has been recognized by the profession.

"That it is highly probable that, when the fact becomes more generally known that so large a percentage of pork is swarming with trichina, capable of producing disease, it may have an effect upon the use of this meat, and consequently affect the sale, to some extent, of one of the principal articles of commerce in the West."

MESSRS. VOLNEY W. MASON & CO., Providence, R. I., have been regular advertisers in the *SCIENTIFIC AMERICAN* for a number of years. In a business letter from them a few days ago, they make the following unsolicited statement: "Our advertising in the *SCIENTIFIC AMERICAN* has been most profitable of any, owing to its circulation among the best class of American manufacturers and mechanics, as well as manufacturers in other countries. In a recent trip to Europe, the writer found it was taken regularly and referred to, for improvements and purchasing, by the most extensive manufacturers abroad."

Sight from Science.

Dr. Wm. Hunt, in the *Philadelphia Medical Times*, says: "A man recently walked into my office with a freedom that suggested nothing about eyes, and said: 'Are you Dr. Hunt? I have never had a good look at you, and wish to see you. I am here on business, and am going away to-night. I owe you much, and will never forget you; but may be you can do something more for me. Do you remember S—, of Illinois, upon whose eyes you operated at Wills Hospital in 1858?' I said, 'Certainly I do.' 'Well,' said he, 'I am the man.' Now, I am not going to relate here an ordinary case of successful cataract operation; but the history is this. S. was the son of a farmer; was fourteen years old when he was brought to Wills. He was practically blind from birth. There is some discrepancy in statement as to the early condition of his eyes; but, at all events, he had no recollection of ever having seen. He was healthy in other respects; had never been to a school for the blind, but was bright, as people usually are who have to feel their way through the world. Dense white capsular cataracts occupied the pupils of both eyes. There was great nystagmus or oscillation of the eyeballs. The boy was etherized, and I performed extraction, making the corneal incisions with a lance-shaped knife, and removing the cataracts with the fine hooks and forceps of the eye case.

The bodies of the lenses, if there had ever been any, were absorbed, as the opaque material seemed to be merely thick membranous substance.

The boy did well, the wounds healing nicely; but when we exposed him to light we found that we had a veritable Casper Hauser to observe! He was a grand confirmation of touch being the master sense, and the only one by which we originally establish our relations with the external world.

He could have given a direct answer to the question of Molyneux to Locke: "Whether a blind man who has learned the difference between a cube and a sphere by the touch can, on being suddenly restored to sight, distinguish between them by the aid of the newly acquired sense only?" Locke answered, theoretically: No! S. answered, practically and decidedly: No! He obtained no knowledge at first, by the eyes, of shapes, distances, sizes, extension, or consistence of objects; of color, of course, he had no idea. Everything, distant or near, appeared to be striking against him, or to be within him. Restrain his arms and hands, and he stumbled about worse, if anything, than before he was operated upon. Encouragement would cause him to move with care, but he was very much afraid. In fact, his sensations were more painful than pleasant, notwithstanding the good promise of the operation. He had to learn as a babe learns, who, in early life, grasps with equal confidence for the moon or its mother's breast. Its early days are occupied with a constant automatic struggle in correcting, by the touch, the deceit of the eye. By-and-by experience settles the question, and it soon gives up its vain endeavors.

The nystagmus in S. continued, and doubtless added to his confusion of vision. In this condition his father took him home. I heard of him now and then as making some good progress, and then lost all knowledge of him. And now, on the 3d day of December, 1874, he walks into my office. His sight is good for all ordinary purposes; the nystagmus is gone, he distinguishes shapes, sizes, distances, and color without difficulty. He told me he was a long time in learning how to see, and at eighteen he went to school and learned to read with ease.

Dear me! when will people be satisfied? I said in the beginning of this note that he wanted me, if possible, to do something more for him. Well, he said he was in winter a herder on the prairie, and he now could not see a horse more than half a mile off, and he would like some far-reaching glasses so as to be able to take in six hundred head of cattle at once!"

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

In washing calicoes in which the colors are not fast, be careful not to boil them; but wash in the usual way with soap, and rinse in hard water. For dark colored goods, add a little salt to the water; for light, a little vinegar.

In tempering long taps, to keep them straight, take a bucket of clean water and stir it around with a stick or hammer handle until a center is formed; then plunge the tap, already heated, endwise in the center, allowing it to cool before taking it out of the water.

The following is a simple but sure way to tell good from bad eggs: Put them in water enough to cover them. All that lay flat, as they would on a smooth surface out of water, are good. Those of which the big end rises are bad. The vessel used should have a smooth, level bottom.

In cases of a sudden jar, knock, or jam of the hand or fingers, immediately after the blow press the injured part, with the uninjured hand, say between the thumb and forefinger, and gradually let up on it. It will nearly always remove the pain, and generally any swelling, that might occur under the circumstances.

In making whiffletrees, they will be stronger if the front side of the whiffletree is nearest the heart timber and the back side toward the bark; they will retain their shape longer if the timber be split in this direction, across the grain of the wood.

DECISIONS OF THE COURTS.

United States Circuit Court,--Southern District of New York.

PATENT COTTON BALE TIE.—CHAS. G. JOHNSON vs. IRA BRARD. [In equity.—Before Woodruff, Cir. J.—April, 1875.] This was a suit in equity for an alleged infringement of letters patent of the United States for bale ties, granted to Charles G. Johnson as assignee of Charles Swett, May 7, 1872. This patent was a reissue of an earlier patent granted the same patentee October 23, 1866 (antedated April 23, 1866) upon an

application originally filed in the Patent Office in the year 1864. At the time of the reissue the drawing was amended to conform to the model as it then was. The defendant in the suit set up that this change was unwarranted and nullified the patent.

A duplicate of the model conforming in all essential particulars to the drawing of the reissue, and certified to by the Commissioner of Patents several months subsequently to the date of the reissue, was put in evidence by the complainant.

After the proofs were closed the defendant moved to open the record for the introduction of testimony to prove the condition of the model at the time when it was filed in the Patent Office, as well as at the time of the grant of the original patent, it being alleged in support of the motion that the defendant had discovered, after the proofs were closed, that the model had been changed after its filing in the Patent Office, and that, originally, and even as late as October 23, 1866, it was in the condition shown in the drawing of the original patent.

This motion first came up in an interlocutory proceeding, and, after argument by counsel, was denied upon the ground that the essence of the allegation in the grant of the reissue, and in a collateral proceeding like a suit for infringement, the question of fraud could not be inquired into.

When the case came on for final hearing, the motion was renewed. The question having been argued at considerable length, the court took it under advisement and rendered a decision in favor of permitting the introduction of testimony as to the condition of the original model.

The parties therupon stipulated, for the purposes of the suit, a state of facts regarding the former condition of the model, and the case proceeded to a final hearing.

The conclusions of the court were expressed as follows:

Woodruff, Cir. J. My conclusions in this case are, first, that Charles Swett, the person named in the bill of complaint as assignee of the complainant, and therein alleged to be the inventor of the invention and improvement for which the letters patent therein mentioned were issued to the complainant, was not the inventor of any tie or mode of fastening cotton bale ties made or used by the defendant herein; nor any tie or mode of fastening cotton bale ties which is substantially the same in construction, or operation, or substantially the same way as the tie made and used by the said defendant.

Second, that neither the original patent issued to the said complainant on the 23d of October, 1866, upon or for the alleged invention of Charles Swett, in the said bill of complaint mentioned, nor the specification annexed thereto, nor the model of the alleged invention, nor any record of such invention in any manner shows, claims, intimates, or suggests a tie or method of fastening cotton bale ties which is substantially the same in construction or operation as the tie made and used by the defendant herein.

Third, that the practicability of employing the tie or method of fastening made and used by the defendant was not conceived by the said Swett, nor by the complainant until after the said original patent was issued, and was borrowed from the suggestions of other parties.

Fourth, that if the reissued patent granted to the complainant dated May 7, 1872, and the claims made in the specification annexed thereto, must be construed so as to include (as the patented invention) the tie or method of fastening used by the defendant and called the "Eureka tie," such reissue is invalid.

Fifth, that the defendant has not, by making, selling, and using the said Eureka tie, infringed any right of the complainant, and such making, selling, and using is no infringement of any exclusive privilege legally vested in the complainant, or to which he is in any manner entitled.

The state of these conclusions is sufficient to enable counsel to prepare a decree in such more technical or specific form, if any, as may be proper.

The state of my health forbids that I should attempt an elaborate discussion of the various points very ably presented by the counsel for the respective parties.

Let the bill of complaint be dismissed with costs. [Samuel A. Duncanson and Geo. Gifford, for complainant. J. H. B. Latrobe and Geo. Waring, for defendant.]

United States Circuit Court--Western District of Pennsylvania.

RIGHTS OF PATENT ASSIGNMENT.—HENRY C. MEYER, FREDERICK E. SMYTH, AND SAMUEL J. SNIFEN vs. GEORGE C. BAILEY AND S. A. BAILEY.

[In equity.—Before McKennan, Cir. J.—Decided May Term, 1875.]

1. An assignee, under the patent act of 1836, is one who has transferred to him in writing the whole interest of the patent, or an undivided part of such whole interest, in every portion of the United States.

2. A grantee is one who has transferred to him in writing the exclusive right under the patent to make and use, and to grant to others to make and use, the thing patented, within and throughout some specified portion of the United States.

3. If a part of the whole patent has been vested in another, so as to constitute him an assignee within the meaning of the statute, an efficacious surrender can be made only by the concurrence of both of the owners of the patent; but this may be manifested by the assignee by his direct co-operation in the surrender, or his subsequent ratification of it.

4. The owner of an exclusive territorial right under a patent may ratify a reissue thereof in which he did not join, by making an assignment under such reissue.

5. It is not essential to the validity of a reissued patent that a transferee of an interest in the original patent, who is not an assignee within the meaning of the statute, concur in the surrender.

6. Nor is it necessary to aver in a bill brought under a reissued patent that the grantee of a territorial right acted with the patentee in the surrender of the original patent or concurred in the reissue thereof.

7. M., the patentee, assigned the State of Pennsylvania to B., and afterwards released the patent. Subsequently to the release, B. assigned his title to an interest in the State of Pennsylvania, except as to certain counties, under the released patent, to the complainants, who, under the title thus acquired, filed a bill in equity against the defendants. Defendants demurred on the ground that B.'s interest was outstanding at the time of the surrender and that he did not appear to have been a party to or to have assented to or approved of the surrender, and therefore the reissue was void; held, that B. was not an assignee within the meaning of the statute, and therefore it was not necessary for him to concur in the surrender in order to give validity to the reissue.

8. The bill sets out complainant's title to the exclusive right, title, and interest under the patent, to the State of Pennsylvania, excepting certain counties, and then avers that the defendants "are now constructing, using, and vending" the infringing goods "in the western district of Pennsylvania," concluding the averment as follows: "All of which acts and doings are in violation of the exclusive rights and privileges, so as aforesaid vested in your orators, under and by virtue of the said recited released letters patent." Held, that these averments, taken in connection with statement of complainants' title, necessarily import a charge of infringement after the grant to the complainants; and, also, within the territory covered by the grant.

This was a bill in equity to restrain the infringement of letters patent granted to John G. Murdock, on the 26th day of May, 1863, for improvement in hydrants, and released May 11, 1869.

Murdock, on the 18th of September, 1867, assigned the full and exclusive right in the State of Pennsylvania, under the original patent, to one Augustus Baerle. Subsequently, on the 11th day of May, 1869, Murdock surrendered the original patent and received a reissue thereof. On the 27th day of January, 1875, Baerle assigned the entire title to and interest in the State of Pennsylvania, under the released letters patent, excepting certain counties, to the complainants.

George C. Bailey, one of the respondents, demurred to the bill on three grounds, which are fully stated in the opinion.

The case came up on the demurrer, which was overruled by the court, and the defendant was ordered to answer.

[W. Jackson and T. B. Kerr, for complainants. G. H. Christy, for respondents.]

NEW BOOKS AND PUBLICATIONS.

EXPLORATION OF THE COLORADO RIVER OF THE WEST AND ITS TRIBUTARIES, Explored in 1869, 1870, 1871, 1872, under the Direction of the Smithsonian Institution. Washington, D. C.: Government Printing Office.

This very handsome volume is one of the most important contributions to our national geography which has yet been made. The exploring party, under the direction of Professor J. W. Powell, have done their laborious but interesting work with thoroughness; and the narrative, kept in the form of a diary, is written with care and minuteness, and in a facile and agreeable style. The illustrations are striking, the grandeur of the subjects being almost unparalleled, and are very well executed: the "Bird's Eye View of the Grand Cañon" being a most successful piece of drawing. We should be glad to hear that this book, which has been printed by direction of Congress can be obtained by the public at a moderate price.

A MANUAL OF METALLURGY. By William Henry Greenwood, F.C.S., Associate of the Royal School of Mines, etc. Volume II. Illustrated by Sixty-seven Engravings. Price \$1.50. New York city: G. P. Putnam's Sons, Fourth avenue and 23d street.

This volume completes a very excellent treatise, on a subject which has not hitherto been dealt with in a popular manner, the first part of which has already been noticed in these columns. We commend the whole manual to scientists, teachers, and students.

LOCKWOOD'S DIRECTORY OF THE PAPER MANUFACTURERS IN THE United States and Canada, and of Dealers in Paper and Paper Materials, Wholesale Stationers, and Publishers in the Principal Cities, for 1875-1876. Price \$5.00. New York city: Howard Lockwood, Stationers' Exchange, 74 Duane street.

This is a trustworthy and well compiled manual of the personality of the paper trade, and contains some valuable statistical information, obtained by the expenditure of much labor. Mr. Lockwood is also the publisher of the "Paper Trade Journal," issued fortnightly, at \$2.50 per annum, and of the "American Stationer," another semi-monthly publication, price \$2.00, and other trade publications. These and other issues from the same establishment are largely patronized by the trade to whom they are addressed, and have a high reputation for their useful and correct information.

THE SEMI-TROPICAL, a Monthly Journal, devoted to Southern Agriculture, Horticulture, and Immigration. Terms \$3.00 a year. Volume I, No. 1. Jacksonville, Fla.: Charles W. Blew.

A creditable commencement of a serial of much local interest, which we trust will obtain a permanent footing among our magazine literature.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 3 to September 26, 1875, inclusive.

ANCHOR.—J. S. Williams, Riverton, N. J.
 BRACE, ETC.—J. Y. Smith (Pittsburgh, Pa.), London, England.
 CARPET LOOM, ETC.—E. B. Bigelow, Boston, Mass.
 CINDER SIFTER.—J. Sutton, Islip, N. Y.
 CIRCUIT CLOSER.—D. Rousseau, New York city.
 CLEANING FABRICS, ETC.—G. F. Blake, Boston, Mass.
 CUTTING PAPER, ETC.—A. Campbell, Brooklyn, N. Y.
 CUTTING PAPER, ETC.—S. D. Tucker, New York city.
 CUTTING SCREW TAPS, ETC.—H. E. Boyd, Pittsburgh, Pa.
 ELECTRIC SIGNAL.—D. Rousseau, New York city.
 EXPLOSIVES, ETC.—C. F. W. E. Dittmar, Mass.
 FARM REGISTER.—W. H. Hordum et al., New York city.
 FIRE-LIGHTER.—J. D. Husbands, Jr., St. Louis, Mo.
 FOLDING PAPER, ETC.—C. Chambers, Jr., Philadelphia, Pa.
 HARVESTER PITMAN.—G. W. Harrison, Lansing, Mich.
 HOE.—M. Johnson et al., Lockport, N. Y.
 LIFE-PRESERVING BED.—A. G. Haskell, Mass.
 LIQUID METER.—H. S. Maxon, Brooklyn, N. Y.
 MAKING FELTING, ETC.—L. W. Whipple, New York city.
 MEASURING ROLLS OF CLOTH.—S. C. Talcott, Ashtabula, Ohio.
 OPERATING PROPELLERS, ETC.—G. B. Moore, Westford, Mass.
 PILED FABRIC LOOM.—E. B. Bigelow, Boston, Mass.
 PIPE-BENDING MANDREL.—M. L. Orem, Philadelphia, Pa.
 PNEUMATIC BRAKE.—H. F. Knapp, New York city.
 PRESERVING FRUIT, ETC.—K. H. Loomis (of New York city), London, Eng.
 PROJECTILE.—L. W. Broadwell, Vienna, Austria.
 RAILWAY TICKET, ETC.—J. H. Ross, Buffalo, N. Y. (Two patents.)
 REFRIGERATOR, ETC.—D. McG. Foster (of Brooklyn, N. Y.), Liverpool, Eng.
 ROLLING MILL.—I. Hahn, Pittsburgh, Pa.
 SHEAF-BINDING MACHINE.—W. A. Wood, Roostick Falls, N. Y.
 SPARK ARRESTER.—W. H. Halsted, Trenton, N. J.

Recent American and Foreign Patents.

Improved Press.

Charles S. Swan, Tamaroa, Ill.—In this invention, the follower is arranged in a horizontal case, and worked by the toggle-jointed bars and drums, as in other presses now made. A vertical beater case and beater compress the hay, etc., to a considerable extent before it is acted upon by the press, so as to increase the efficiency of the press; and to raise it, an extension of the shaft by which the drums are worked is arranged above the sweep, with a drum on it carrying a block at the periphery, to which a rope is attached. This block is capable of sliding freely around the drum, being connected to it by lugs or projections, fitted in grooves in it, so arranged as to hold it on, while allowing it to slide freely. This block is held, when the beater is to be raised, by a pawl and catch. The pawl is pivoted to the drum, so as to swing around and allow the block to escape when it is released by the catch, and it is returned to and engaged with the catch by the spring. The catch is raised to release the pawl by pressing under a stationary cam in the cross-tree above. The shaft is mounted in a step or socket in the top of the sweep, so that it can be lifted out, and it is provided with a lever to lift it out and let it rest while the drums are kept in motion for working the follower. A yoke holds it out of gear. The lower portion of the beater case is provided with a removable front, and arranged on pivots so as to swing forward when the front is removed, and dump the hay into the horizontal case.

Improved Tunneling Machine.

Oliney B. Dowd, New York city.—This machine is designed mainly for tunneling under the beds of rivers, where the material is soft and liable to cave and crush in; and the invention consists of a cylindrical case, with a head at the front end, out of which projects at the center a revolving shaft carrying a cutting and scraping arm, which breaks and cuts down the earth, and forces it into the case through an opening at the bottom of the head. The shaft carrying the arm is hollow, and the arm is also hollow and suitably perforated to allow of softening the earth with water, by forcing the water out through the shaft. There is a pipe discharging through the head at the top for watering the earth in that way, to render it sufficiently fluid to be forced out through pipes. In the bottom of the case is an oblique opening, through which a large tube may be projected to sink a hole below the line of the tunnel by working through the tube to sink a boulder or other solid object out of the case. The case is to be forced along as fast as the earth is removed in advance of it, and it is to be followed up by the wall of the tunnel, which is to be built along at the same time as the work progresses, keeping the rear open end packed with the wall of the tunnel, and so as to exclude water and mud or silt from settling into the case. There is a pipe for discharging the silt, etc., by hydraulic pressure.

Improved Tuning Pin for Pianofortes.

Julius M. Branig, New York city.—The object of this invention is to enable the tuning pins of a pianoforte or other instrument to be firmly secured in place in such a way that they may be detached and again inserted without loosening them or injuring their screw threads. The invention consists in an open bushing, made of brass or other metal softer than the tuning pins, and a wedge, in combination with the plate and the tuning pins. The holes in the iron plate or frame of the pianoforte are made larger than the pins, and have the bushing inserted in them around the said pins. The bushing is made open at one side, and of such a size that its edges will not quite meet around the pin. A wedge is driven into a notch in the plate at the outer side of the bushing. The wedge forces the middle part of the bushing inward against the pin, so that the bushing may always bear against the pin in at least three points, so as to support it firmly. The soft metal bushing enables the pin to be put in and taken out without injuring its threads, and also beds it firmly in the plate.

Improved Cotton Planter.

James B. Onan, Pecan Point, Ark.—The dropping cylinder is formed of two short cylindrical vessels, made open at one end and closed at the other. They are placed upon the shaft with their open ends toward each other, and are connected together so as to be at such a distance apart as to leave sufficient space for the seed to pass out in the desired quantity. To the opener is attached a short chain, which passes back through the furrow directly beneath the discharge opening of the cylinder, so as to spread the seed along the drill as it is discharged from said cylinder.

Improved Car Coupling.

Archibald Smith, Omaha, Neb.—The invention consists of a draw-head divided by a central vertical partition into separate cavities, to one of which a wedge-shaped link bar is secured by pivot pin and spring, while to the adjoining cavity with tapering mouth a wedge-shaped and spring-cushioned friction plate is applied. The latter is retained by a lever pin that binds into step-shaped recesses at the back of the friction plate, to hold the same in coupled and uncoupled position. The lever pin is adjusted by a slotted top guide and set screw into fixed position to secure the lever pin and link bar rigidly in position. The entering coupling bar carries the lever pin into vertical position and strikes against the rear part of the friction plate, so as to cause the swinging in and sliding back of the same into the cavity, producing the dropping of the lever pin into the recesses, and the coupling of the link bar by its wedge action and that of the friction plate.

Improved Sulky Plow.

Eli W. Russell, Ashley, Mo.—By suitable construction, by pressing the upper end of the lever downward the plow will be swung to the rearward to withdraw it from the ground; and at the same time, and by the same movement, it will be raised from the ground. The upper end of the lever, when lowered, is caught and held by a spring catch, so as to support the plow above the ground for any required length of time, for convenience in passing to and from the field and from place to place.

Improved Heel Plate.

George Dunlop, Williamsburgh, N. Y.—This is an improved plate for attachment to the heels of gaiters and other boots and shoes, which shall be so constructed that it may be adjusted or turned, as it wears, to keep the heel straight.

Improved Oil Stoves.

Frederick Gates, Frankfort, N. Y.—The case that incloses the lamp and its chimney is made rectangular in form, and is closed by a door made of perforated sheet metal, to allow air to pass through it. To the inner surface of the case is secured a hollow deflector, to deflect the air and cause it to pass down into the lamp, and then up into the cones of the lamp burners. A portion of the air passes through the cavity of the deflector and is projected against the lamp chimney. In the top of the case are formed boiler holes to receive the cooking vessels. Between the boiler holes are attached deflectors, which are made V-shaped to divide the current of heated air. Plates attached to the top plate project down a little below air holes, so that the heated air, after passing up to the boiler holes, must descend a little before it can escape through the air holes, so that there will always be a stratum of hot air in the upper part of the case. When the stove is to be used for baking or roasting purposes, a grate is placed upon the top plate of the case, and has provided short feet to raise it a little above the said top plate. In this case the grate is surrounded by a box, the walls of which are made double to prevent the too rapid radiation of heat, and which is provided with suitable devices for maintaining a circulation.

The same inventor has also devised another oil stove, so constructed as to prevent the oil from becoming heated. The upper compartment of the lamp is open at the top, and is partially filled with plaster of Paris, saturated and kept saturated with water to protect the oil chamber from heat. The entire lamp is inclosed with a case, open at both ends, and upon the upper edge of which is placed a plate, in the middle part of which is formed a hole to receive the vessel in which the cooking is to be done. In the lower part of the case is formed a ring of openings to admit air to support combustion. Into the case, just above the top of the lamp, is fitted a hollow ring, which acts as a deflector to cause the air to pass down through the outer part of a plate, while another portion of the air will pass through the holes in a lower plate of the ring, and will be projected against, and will rise around, the chimney, and will thus become heated, and will carry up the heat to assist in the cooking.

Improved Log Turner.

Henry Knowlton, Otter Lake, Mich.—This is a device for turning logs upon the sawmill carriage in such a way as to save the carriage from jar. In using the device, a shaft is turned to raise a lever into an erect position, with its straight edge against the flat side of the log. A bar is then drawn over the top of the log, and its hook is driven into said log. The shaft is then turned in the other direction, which draws the lever back, turning the log. The log is then pushed back upon the head block and secured.

Improved Fireplace Grate.

John Bawden, Freehold, N. J.—A fireplace grate of the usual shape is cast at its grate-supporting bottom part with a longitudinal connecting bar. The bar is provided with a central semicircular supporting part, that extends toward the rear of the fireplace, for preventing the grate from tilting toward the rear of the fireplace. A front lip of the grate rests on an inside projecting shoulder of the bottom frame, until, by inserting a handle into a perforated lug of the grate, the contact of the lips may be interrupted, and the grate be shaken from one side to the other for dropping the ashes.

Improved Burial Case.

David W. Hunt, San Francisco, Cal.—This coffin is furnished upon its bottom with cells for retaining dirt or an equivalent absorbent beneath the body.

Improved Spring Power Regulator.

Orrin Collier, Sacramento, Cal.—A brake lever has a forked end for pressing against a band wheel, each side of the face in which is the groove for the band. The lever between its forks contains a spring for bearing with an elastic pressure. The lever has an elbow, which is pivoted to the frame, and an arm extends nearly down to the floor, and terminates in a foot piece, located so that the operator may conveniently rest the foot on it. Under the foot piece a spring is attached to it, and arranged so that by pressing on the floor it lifts the lever and presses the brake on the wheel, and slows the motion or stops it altogether, according to the force with which it is allowed to act.

Improved Machine for Making Split Keys.

Willard H. Fox, New Haven, Conn.—This invention comprises pushers and formers, in combination with bending dies of peculiar construction, whereby flat pieces of metal for split keys will be bent double, with the usual ring at the bow, by being pushed through the dies edgewise. The invention also comprises a contrivance whereby a number of pushers and dies, together with cutters for cutting long strips into suitable lengths for the keys, are organized in one machine.

Process of Coloring Enamelled Photographs.

William W. Williams, Houston, Tex.—This process of coloring enamelled photographs consists in first pasting on a glass plate, coated with dry layers of collodion and another material, a transparent photograph, then backing it with layers of transparent paper, and then laying colors thereon in the usual manner.

Improved Boot.

Harry Hall, Pontiac, Mich., assignor to himself and Henry H. Wilson, of same place.—Flat wires made of steel, whalebone, or other suitable material, are inserted beneath supporters, between the rows of stitching and the seam, and are secured, when made of steel, at their upper and lower ends by rivets, the said wires being of such a length as to extend from the top of the boot leg to a little below the top of the counter.

Improved Glass Monument.

Anselm Pfeiffer, New York city.—This is an improved monument, which may be ornamented to any desired extent, and which may also be used as a receptacle for flowers, wreaths, and other tokens of remembrance placed upon the grave, to protect them from the weather. It is formed essentially of glass set in a suitable metal, wood, or stone frame work.

Improved Washing Machine.

Thomas McGuire Morris, Wabash, Ind., assignor to himself and Freeman Alger, same place.—In this machine, the oscillating rubber will adjust itself to the thickness of the clothes to be operated upon. It may be operated either with or without a cover, and will allow the stationary rubber to be removed for convenience in cleaning the suds box. There is a semicircular bottom for the suds box, formed of detachable blocks with a corrugated rubbing surface.

Improved Trucks for Moving and Carrying Rails, etc.

Charles W. Carter, Terre Haute, Ind., assignor to himself and George W. Travis, Cape Girardeau, Mo.—In using the truck, it is backed up to the object to be carried, and a bar is raised until hooks rest against the side of the object, and at the same time a rod is drawn upward, so that the hook may pass over and take hold of the said object. The bar is then lowered, which raises the load above the wheels, and it may then be transferred laterally by drawing the truck.

The same inventor has also patented another truck, for picking up and carrying car axles provided with wheels, railroad rails, bars, shafts, bundles of iron, and other heavy objects. Hooks are caused to drop over the axle, and a handle is lowered, which raises the wheels of the car axle away from the ground, and allows the axle to be conveniently transported wherever desired. In the same way, bent lever jaws are opened and lowered to grasp and pick up a railroad rail or other object to be carried.

Improved Children's Carriage.

Henry C. Moody, Oswego, N. Y.—This invention consists in attaching a bent rod to the lower edge of the corner curtains of the carriage. The rod preserves the desired form of the curtains, preventing their edges turning up or wrinkling, and enables them to be neatly and expeditiously folded and secured to the top.

Improved Refrigerator.

Henry H. Barnes, Brooklyn, N. Y.—This invention consists of a refrigerator with an ice receptacle and a series of milk and butter coolers, having separately hinged lids, the coolers being so arranged therein that the cold air can circulate around the sides and bottom of the cooling vessels.

Improved Planing Clamp.

James Hastings, Elizabethport, N. J.—In using the clamp for planing a vessel, the plank is placed upon the ribs in its proper place. Hooks are then secured to the rib in such a position that the forward end of a screw may rest against the outer side of the plank. The screw is then turned forward to force the plank against the ribs, which brings its outer edge opposite the forward end of another screw. The screw is then turned forward to force the inner edge of the plank close up against the edge of the preceding plank, and the said plank is then spiked to the ribs. When the second screw is operated to force the plank edgewise against the edge of the preceding plank, a grooved bar moves with the plank and slides upon a crosshead, and thus prevents the first screw from being strained or bent.

Improved Car Coupling.

Henry C. Hervey and George H. Abrams, Athens, N. Y.—When the cars are run together, the entering link pushes a dog back and passes it, when the said dog instantly drops through the link, and the cars are coupled. With this construction also, when the cars are coupled, the forward edge of the dog rests against a solid shoulder of the bumper head, both above and below the link, so as to have a firm support. In the upper part of the cavity of the bumper head is secured a spring, the forward part of which is slotted to receive the dog, and its forward ends are bent upward, so as to serve as guides to the link in passing to its place in said bumper head.

Combined Cistern Valve and Overflow Pipe.

Bernard McGrann and John Solis, New York city.—A socket, which is secured in the bottom of the cistern, serves as a seat for the valve, and has a bar to serve as a guide for the valve stem. The valve stem is made hollow, so as to serve as an overflow pipe to prevent the water from rising any higher in the cistern than the upper end of the said hollow valve stem.

Improved Chimney Cowl.

Emanuel Cole, New York city.—This cowl is made of sheet metal, and is secured, by a chimney connecting tube and cap piece, rigidly to the crown of the chimney. A series of vertical partitions run at equal distance from each other in diametrical direction from the end of the chimney tube, and form, with the straight top and bottom plates, a number of channels, that taper toward the communicating apertures around the end of the chimney tube. The wind passes readily along the radiating channels from whatever direction the same may come, and then across the chimney tube to the diametrically opposite channel, which assists, by its widening shape, the passage of the wind, and creates also, by the cross draft, a supplementary draft in the chimney, and thereby the escape of the smoke with the wind. A central diaphragm is attached above the chimney tube to conduct any entering rain sidewise to be collected at the bottom of the chamber, and discharge through an exit spout to the outside.

Improved Boiler Cleaner.

Thomas O. Kemp, Beamsville, Canada.—This is a combination, with boiler and superposed reservoir, of pipes provided with stop cocks, one having mouths at the surface of the boiler water, and the other more deeply down into said water. The water level may vary to any ordinary extent and the desired effect still be maintained, namely, a current drawing from the surface of the water.

Improved Scaffold Clamp.

William C. Fellows, Toledo, Ohio, assignor to himself and Charles Whittingham, same place.—A roller acts along inclines of a block to clamp the block fast. The roller is applied by means of a bolt which connects the two ends of the yoke. The clamp binds better because of the more free movement of the roller along the block than the sliding bolt; and, by reason of the curves of the block whereon the roller works, the action is more prompt and certain.

Improved Square.

William H. Walker, Charleston, S. C.—The wood pieces of the head are connected to the tongue by bolts which move in slots around the axis, whereas an auxiliary head is pivoted to the tongue, and the parts thereof are pivoted together. Braces are pivoted to the auxiliary head, and the wood head is also fastened to them. This arrangement makes a more accurate instrument than when the two parts of the head are pivoted to the tongue separately. The head auxiliary is arranged in the groove of the principal head, into which the braces and the tongue fold.

Improved Clasp for Ladies' Dress Supporter.

Egerton A. Bliss, Jersey City, N. J.—The clasp is made of a doubled wire, having arms that proceed from the ring in which the chain is held, are held at their crossing by a band, and then turned inwardly to form reversed hooks, the inwardly bent clamping ends being in the same plane with the shank. The hook is fastened in the lady's belt or girdle, and connected with the clasp by a chain, the dress being lifted from a point below the pendant clasp, and secured therein.

Improved Paper Bag Holder.

George H. Cleveland, Camden, Me.—To a plate of heavy brass is attached a pointed rod, of such a length as to be capable of holding a hundred paper bags. A plate of spring brass is swiveled to the upper part of the heavy plate, and is bent twice at an angle, so as to bring its lower end into such a position as to receive a pointed rod. In using the device the lower end of the plate is sprung off the point of the rod, and is turned to one side, so as to leave the rod free. The bags or wrapping paper are then placed upon the rod, a few at a time, until the whole hundred have been placed upon it, by forcing the said rod through the said bags as near their edge as will hold them securely, and so near the edge that each bag may be torn off easily and without injuring the bag for use.

Business and Personal

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25 per cent. saving in fuel, or an equal amount of extra power guaranteed, by applying the R. S. Condenser. T. Sault, Consulting Eng'r, Gen. Agt., New Haven, Ct.

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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., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List rec. Goodnow & Wightman, 35 Cornhill, Boston, Mass.

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

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

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Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

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For Sale—Numerous Second Hand Machinist Tools. Catalogue sent. F. Weller, 23 Chambers St., N. Y.

Wanted—To buy a good patent or patentable article to manufacture. Send description and price to J. H. Heasin, 144 Superior St., Cleveland, Ohio.

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For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Testing Machine for Bar Iron—Will test section of 12 square inches. For sale by Denmead & Son, Baltimore, Md.

Wanted—One 2 spindle Edging Machine. Address, with description and price. P. O. Box 235, New Haven, Conn.

Enterprise Mfg Co., Philadelphia, Pa., Patented Hardware Manufacturers and Iron Founders. Small gray iron castings, warranted soft and smooth, made to order, and patented articles of merit manufactured on royalty.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the Boiler, used by all boiler makers who have seen it, \$15. Hildard & Holland, 62 Gold St., New York.

Amateurs and Artisans, see advertisement, page 231. Fleetwood Scroll Saw, Trump Bro's, Manufacturers, Wilmington, Del.

Electric Burglar Alarms and Private House Annunciators; Call, Servants' & Stable Bells; Cheap Telegraphs; Batteries of all kinds. G. W. Stockly, Cleveland, O.

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American Metaline Co., 61 Warren St., N.Y. City.

Genuine Concord Axes—Brown, Fisherville, N.H.

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Barry Capping Machine for Canning Establishments. T. R. Bailey & Vail, Lockport, N. Y.

For 12, 15, 18 and 19 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Notes & Queries

A. K. will find a description of wire rope transportation on p. 370, vol. 31.—R. J. will find a recipe for mica varnish on p. 241, vol. 32.—J. T. will find directions for preserving shingles on p. 123, vol. 32.—F. D. H. will find that an inoxidizable white metal is described on p. 113, vol. 32.

(1) U. N. O. says: I have used a paste or glue that is used by the various express companies, that is excellent for all purposes such as attaching labels, etc. It is a dry brownish powder, and is prepared for use by pouring hot water on it; it looks like pulverized gum arabic. Can you tell me what it is? A. We are unable from your indefinite description to tell of what it is composed. If you consider it to be gum arabic ($C_{12}H_{22}O_{11}$), test it as follows: A solution of it in water is precipitated, by alcohol and by ether, in white flocculi, or, if dilute, in the form of a milky turbidity. If boiled with dilute sulphuric acid, it is gradually converted into dextrin, and then into a fermentable variety of sugar. 2. Please give a recipe for good paste for labels, that will set quickly and stand exposure to weather. A. Dissolve gum sandarac and mastic, of each 2 ozs., in 1 pint spirit of wine, adding about 1 oz. clear turpentine. Then take equal parts of isinglass and parchment glue; and having beaten the isinglass into small bits, and reduced the glue to the same state, pour the solution of the gums upon them, and melt the whole in a vessel well covered, avoiding as great a heat as that of boiling water. When melted, strain the glue through a coarse linen cloth, and then put it again over the fire. This preparation may be best managed by hanging the vessel in boiling water, which will prevent the matter burning on the surface of the vessel, and the spirit of wine from taking fire.

(2) R. S. S. asks: Can you give me an account of the process of making ferro-manganese? A. You will find an article describing the process in the *Journal of the Franklin Institute* for May, 1874.

(3) G. G. asks: What will remove the tarnish from plated goods that have turned dark, probably from the action of gas? A. Steep the plated ware in soap lye for 2 hours; then cover it over with whitening, wet with vinegar, so that it may stick well upon it and dry it by the fire; by thus drying, the whitening is removed from the crevices without the least difficulty. Rub off the whitening and pass over it with dry bran; the silver will look exceedingly bright.

(4) J. G. W. asks: 1. Will galvanized iron tubing in a boiled well be durable? Would the water from such a well be wholesome? A. The use of galvanized iron pipes for family water supply is not desirable. For a short pump, if the water is pure, and the precaution is taken not to use water that has stood long in the pipes, perhaps no bad effects would result. But there have been repeated examples of poisoning from the use of galvanized iron conducting pipes. In a case at Portsmouth, N. H., a family of four persons were thus poisoned, and Dr. Jackson found four grains of oxide of zinc in the water. In another case, near Boston, where the house was piped with galvanized iron pipes, one of the young members of the family died, and a post mortem examination revealed the presence of oxide of zinc in the stomach and other organs. Death was directly attributed to the use of the above pipes. They are made by heating and dipping the iron pipes in melted zinc.

(5) E. M. K. asks: Why does water shorten a rope? A. We were under the impression that wetting a rope exposed to strain causes it to stretch.

(6) S. S. says: A. says that there is no power required to raise water to the pump, that the atmosphere does part of the pumping. B. says it requires just as much power to raise water 1 foot below the pump as it does to force the water 1 foot above the pump. B. contends that, in our case, the pump being 21 feet above the water, it requires the atmosphere in the pump to be reduced to about 5 lbs. to the square inch in order to let the water flow in; and he also contends that, to do this, he has to add 10 lbs. additional weight or power to his plunger to reduce the air. Which is right? A. B., certainly; if the pressure of the air forces the water into the pump barrel, that pressure must first be removed.

(7) J. S. G. asks: Can we, by continued observation, see the whole surface of the moon, or do we always see only the one half? A. We only see one half for reason that the moon turns once on its axis in the time of making a revolution in its orbit.

(8) W. S. S. asks: What is your method of getting the foundation bolts of an engine in the proper place, supposing we have our center line on the bed plate template all right? What is the best mode of getting a right angle line from that, so that the back box will be in its right place when it is over the foundation bolts? A. Make holes in the template corresponding to those in the bed plate, and put in the holding down bolts, with packing blocks under the top nuts, making the distance from bottom of template to top of packing blocks equal to thickness of bed plate at bolt holes. Then arrange the template in position, and level it, placing it so that the under side is where the bottom of the bed plate is to be. Proceed to

build the foundation, first anchoring the bolts at the bottom, and building them into the masonry, as the work proceeds. In this way, when the work is done, you will have the bolts firmly secured in the proper positions.

(9) A. D. B. asks: What internal atmospheric pressure can I with safety put on an ordinary linseed oil barrel, holding about 40 gallons? A. We think you can safely use a pressure of 10 or 12 lbs. per square inch. Perhaps some of our readers have data in relation to the matter, which they will send.

(10) H. L. says: Please tell me the number of square inches bearing surface of the ordinary screw propeller, such as is in use on the Erie canal? A. To determine the surface of a propeller, form its development or view of the blades if flattened down on a plane surface. Then its area can be found by the rules for irregular figures. Any calculation of the probable slip of a new form of propeller will be of very little value, unless verified by experiment.

(11) W. P. says: A friend claims that it is impossible that salt water, taken from the ocean, can be made fit for drinking by working it by steam through a filtering bag, or some other way so as to take the salt taste from it. Is this so? A. Salt water is very commonly prepared for drinking by evaporating it, and condensing the steam. Nearly all ocean steamers are fitted with fresh water condensers.

(12) J. C. M. says: 1. I propose to build a boat, 30 feet over all, 15 feet keel, 15 inches beam, 15 inches deep, of $\frac{1}{4}$ inch selected pine. On each side will be a smaller airtight boat, 10 feet long, 6 inches beam, 4 inches deep, connected by iron arms $\frac{1}{4} \times 1$ inch, 4 feet long, to the main boat, which is for one person, decked over and containing 8 watertight compartments, with the cockpit amidships. I have an engine $1\frac{1}{4}$ inches stroke $1\frac{1}{2}$ inches bore, tested to 600 lbs. per inch. Would it run the boat, and at what speed? A. Yes, at 4 or 5 miles an hour. 2. What dimensions of wheel and how much steam should I use? A. Wheel 18 inches in diameter; steam pressure 100 lbs. 3. Could I make a coil of gas pipe in a drum of sheet iron answer for a boiler, and how small should it be? A. We think you will have difficulty with this arrangement. 4. Could I use gas made from zinc and blue vitriol for fuel, and would I need a retort? A. We advise you to design your boiler for the use of coal or charcoal.

(13) C. S. says: 1. I am running a portable engine, and drawing water from a well slightly impregnated with salt. Will it injure the boiler? A. It will form scale in the boiler. 2. Do not ocean steamers use salt water? A. Ocean steamers are ordinarily fitted with surface condensers, for the purpose of supplying as far as possible fresh water to the boilers.

(14) R. C. P. says: I have a large upright boiler that leaks badly; leakage is caused by scale. It thinks it is becoming loose and falling on the crown sheet; but the flues stand so close that it is impossible to get a scraper through them. Will anything dissolve it, so that it could be washed out with a hose? A. On hauling the fire at night let the water remain in the boiler until morning, or until it is quite cool. Then run it out and wash out the boiler, in all parts inaccessible by hand, with a stream of water from a hose. By repeating this operation several times, at intervals of a few days, you may succeed in removing the scale. Possibly, however, you may find it necessary to use some preparation, such as carbonate of soda, in the feed water. These remarks will also serve as an answer to G. S., who sent us a small package of scale, which seems to be mostly composed of mud.

(15) J. A. asks: With two steam gages, one connected to boiler and one connected to steam pipe, some 300 yards distant from boiler, both gages being on a level, should there be any difference in the indications? A. The pressure would be less in the more remote gage on account of the pressure required to give the steam motion, and the losses from radiation and condensation.

(16) M. F. P. says: I am making a boiler of 6 inch wrought iron pipe of three sections each, 18 inches long, with 6 inch flues in each. I connect them at top and bottom to a three-sided casting with a core of 1 inch square, which gives a good circulation at the top and bottom, each with the other, and I enclose all three in an iron jacket, connected at the top with the smoke bonnet and stack; the grate is 15 inches in diameter; the heat goes up through the flues and the space around the cylinders. Is it a good plan, and will it drive a cylinder 3x5 at 40 lbs.? A steam dome is also placed on the top for superheating the steam. A. The idea strikes us quite favorably. We would be glad to have an account of your experience.

(17) S. W. asks: 1. What proportions of copper and zinc make the strongest brass? A. Take, by weight, 25 parts copper, 2 of zinc, and $\frac{1}{4}$ of tin. 2. What can I use as a flux for brass, to make it flow freely, and cast smooth and solid small articles? A. Melt the copper first, then add the tin, using a mixture of potash and soda as a flux; add the zinc last.

(18) C. W. says: Does the cone form of the tread of the car wheel produce oscillation of the car? A. The oscillation is due to irregularities in the track, and to the fact that there is necessarily some play between the tracks and the flanges of the wheels. The most successful preventives of oscillation seem to be close coupling of cars, weight of cars and trucks, an increase of the number of wheels for a truck, and the use of an improved form of springs between car bodies and trucks.

(19) R. M. says: 1. I have a hand power jig saw, that I turn by a crank. I can saw hard 2 inch oak rather easily, but the work becomes tiresome when done for half a day at a time. Can I

use some motor besides steam? A. An air or gas engine would answer your purpose. 2. I have thought that, if a tank were built 30 feet above the earth, to hold 100 barrels of water, and the water came down through a tube to a small water wheel, a pump pumping some of it back into the tank, power enough could be realized to drive the saw. Would this do? A. The water project is too nearly of the nature of a power creator to be successful.

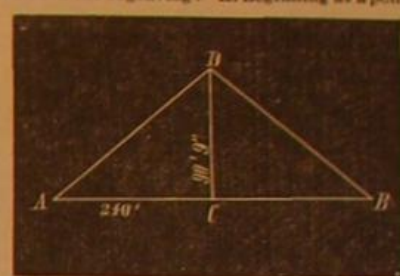
(20) C. S. asks: Is there to be a canal across the Isthmus of Panama? A. The matter is only discussed, as yet.

Is there any paint made that is better and as cheap as white lead and oil, for the outside of houses? A. We would be obliged to decide upon the claims of a number of rival manufacturers, to answer this question; and we do not care to make such a distinction in these columns.

Do you think the engineer's trade a good trade to learn? A. The trade which has numbered in its ranks such men as Watt, Rankine, Brunel, and a host of others whom the world delights to honor, needs no eulogy from us.

(21) F. H. D. asks: Why is not towing canal boats in trains practised on the Erie canal? A. It is not advisable, principally on account of the large number of locks.

(22) C. S. asks: What is a proper description to be given in a deed of a piece of land, as shown in the engraving? A. Beginning at a point,



A (state how determined) running thence southerly in a straight line to a point distant 240 feet, thence in a northeasterly direction in a straight line to a point distant easterly in a straight line 90 feet from the middle point of the line running southerly from the point or place of beginning, thence in a northwesterly direction in a straight line to the point or place of beginning.

(23) S. T. J. says: Vapor of ammonia has been tried as a motor. Can you inform me where in it needs practical improvement? A. So far as we know, the ammonia engine has been pretty well worked out in principle, and it only requires perfection in matters of detail and construction. You will find a very interesting discussion of the theory and description of such engines in Dr. Barnard's masterly "Report on the Paris Exposition."

(24) M. C. K. asks: Is there any more heat in steam at a high pressure than at a low pressure? A. The total heat in 1 lb. of steam increases with the temperature, at the rate of $\frac{1}{300}$ of a unit for each degree Fah.

(25) S. E. S. asks: 1. What is the metal composition used in making small toy engine cylinders? A. We believe it is a kind of type metal composed of lead and antimony. 2. Will solder, used for soldering tin, do for soldering sheet iron also? A. No. Use a solder composed of equal parts of copper and zinc.

(26) A. B. W. asks: 1. How are electroplating and silvering done? A. For gilding, see No. 28 on this page. Silver solution is prepared with least trouble by dissolving cyanide of potassium in water ($\frac{1}{4}$ oz. to the pint), and adding the silver by the battery process. This is done by placing a sheet of silver and a porous cup in the cyanide solution; the silver is then connected to the positive pole of a battery, and an iron or copper rod, placed in the porous cup, is connected with the negative pole. The porous cup also contains some of the cyanide solution. When a deposit begins to form on the metal in the cup, the solution is of the right strength. One or two Daniell cells form sufficient battery power; if gas is given off, reduce the strength sufficiently to prevent its evolution. Work at a temperature of about 60° or 70° Fah. 2. How is silvering on glass done, to make mirrors? A. Bottger gives the following method for silvering on glass: Nitrate of silver is dissolved in distilled water, and ammonia added to the solution till the precipitate first thrown down is almost entirely redissolved. The solution is filtered and diluted so that about $\frac{1}{10}$ of a quart contains 15-18 grains nitrate of silver. Next, 30-36 grains nitrate of silver is dissolved in a little water and poured into about a quart of boiling water 25-6 grains Rochelle salt is added, and the mixture boiled a short time, till the precipitate contained in it becomes gray, and it is then filtered hot. The glass plates, thoroughly cleaned with nitric acid, caustic soda, or alcohol, are placed in a shallow vessel and covered a quarter or half an inch deep with equal volumes of the two solutions. In an hour the reduction will be complete. The plates are then washed and the operation repeated until a sufficient coating of silver is obtained. When the silvered surfaces are dry, they may be cautiously polished with the palm of the hand. If the silver is only required as a coating of the back surface, this polishing is, of course, superfluous. In this case, also, the operation may be shortened by heating the solutions to about 58° Fah. before mixing. The silver may then be varnished over as a protection. When prepared, the solution will keep about a month in a dark place.

(27) E. J. W. says: Will steam, when exhausted into a cistern through a number of small holes in a coiled pipe, heat the water to a higher degree of heat than it does when exhausted through a straight pipe into the cistern, and why

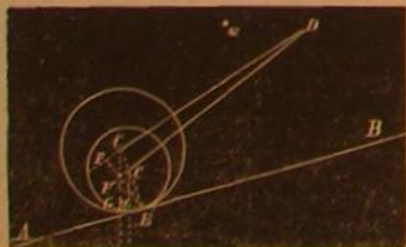
A. The principal difference will be that, in the first case, the steam will be condensed more rapidly; so that, using the same size of pipe and steam pressure in each case, the water will be heated the most, in a given time, in the first case.

(28) H. C. F. asks: 1. How can I make a solution for plating with a battery out of old gold rings? A. Add one volume of nitric to three of muriatic acid and dissolve the rings in the menstruum so formed. When this has been done, drive off any free acid that may remain by gently heating the whole. No yellow powder should result from the operation; if it does, a drop or two more of acid must be added to redissolve it. The solution should then be much diluted, and cyanide of potassium added as long as any precipitate is formed. Separate this from the liquid, wash, and redissolve it in cyanide of potassium, and the solution is ready for use. About half an ounce of the precipitate to a gallon of the cyanide (water and cyanide) is a good working strength. One Since cell is sufficient to cause the deposit. The solution should be heated to about 130° Fahr., and pure fine gold is needed for the anode. By properly regulating the battery power and heat, the color of the gold may be considerably modified. As cyanide of potassium is a deadly poison, too much care cannot be exercised in handling it. 2. Can I plate articles that have been nickel-plated with such a solution? A. Yes. 3. Would 5 cells Daniell's battery be sufficient? A. Five cells of Daniell's battery would probably cause the evolution of gas, which is to be carefully avoided. One cell in good condition would do well.

(29) S. A. T. says: In an old building in Philadelphia resides a man about 75 years of age, who has been at work on a machine composed of levers, without springs or weights, for years. He is very eccentric, lives alone, and no person knows who he is or whence he came. The machine is nearly all composed of wood; it is completed, and has been running for weeks. He is now building one very much larger, from which he intends deriving power. The man is not a man to deceive any one, and there is nothing about the machine hidden from view. I understand that the man has been working at this problem for 40 years. When I say "he has a machine which supplies its own power," I say what my eyes tell me. I am no believer in perpetual motion; but what is this? A. This is the old story that we have heard so often. We have in our possession numerous circulars, describing just such wonderful inventions and endowed by the most wonderful names, but they do not seem to have much effect upon our views, and we are constrained to think that, while your eyes may be all right, you did not use them as judiciously as was desirable, directing them by your reason.

(30) C. W. P. says: I have two iron tanks in the top of my house, holding 125 barrels each. One is for soft water, the other for drinking purposes. What is the best paint or composition to coat them with to keep them from rusting? White lead will not do. A. Trautwein says: "White lead applied directly to the iron requires incessant renewal, and probably exerts a corrosive effect. It may, however, be applied over the more durable colors when appearance requires it. Red lead is said to be very durable, when pure. An instance is recorded of pump rods, in a well 200 feet deep, near London, which, having first been thus painted, were in use for 45 years, and at the expiration of that time their weight was found to be precisely the same as when new; thus showing that rust had not affected them." A slate paint is sometimes used to coat the interior of tanks. Iron, well cleaned and washed with hot linseed oil, will sometimes be thus preserved from rusting.

(31) N. G. W. says, in commenting on M. W. W.'s answer to the question why a given load can be moved up a given incline on a small wheeled truck with less power than would be necessary to move the same load up the same incline on a large wheeled truck: Let P =power, W =weight, R =radius of wheel, b =angle of inclination of road= $E C G$, a =angle made by line of traction, $D C$, with road= $F E C$. E is the center of moments. The



power, P , acts to raise the weight, W , over the point, P ; the weight, W , resists the action. $F E$, the lever arm of $P=R \sin a$. $G E$, the lever arm of $W=R \cos b$. Writing out the equation by moments, we have $P R \sin a = W R \cos b$, or (reducing) we have $P \sin a = W \cos b$, that is, the power multiplied by the sine of the angle made by the line of traction with the road is equal to the weight multiplied by $\cos$ angle of inclination of the road. The angle, a , varies inversely as R ; hence, as the wheel becomes smaller, the angle, a , increases, as is shown in the figure. The sine of an angle varies directly as the angle, consequently, as a increases, $\sin a$ increases. Resuming the last equation: Considering the weight constant and the angle of inclination of the road also, it would follow, to keep up the equality, that, as the diameter of the wheel is diminished, less power would be required to move a given weight up a given incline.

MINERALS, ETC.—Specimens have been received from the following correspondents and examined, with the results stated:

J. N. D.—Both are argillaceous shale, containing a small amount of micaceous red oxide of iron.

E. McD.—No. 1 contains iron and manganese, along with silver and alumina. No. 2 is galena with a small percentage of iron. It is not arsenical. No. 3 is plumbago with siliceous and lime. No. 4 is silica and alumina, iron in small amount, and lime.—J. H. P.—The smaller piece contains galena, pyrite, talc and quartzite. The larger is galena in limestone rock.—E. W. W.—No. 1 is iron pyrites which has lost a part of its sulphur and been partly converted into oxide of iron. No. 2 is excellent iron ore. It contains neither black lead nor quicksilver.—H. L. C.—They are of two kinds. The glossy kind is quartz, the waxy variety is chalcedony. Tampa Bay, Fla., has long been celebrated for the chalcedony found near it.—R. W. Z.—No. 1 is zinc ore. No. 2 is willamite. No. 3 is mica schist, containing a small amount of red hematite. No. 4 is calamine. No. 5 is strontianite. No. 6 is calamine.—C. H. P.—It is probably a siliceous scoria, its density being only 2.14. Besides siliceous, of which it is mostly composed, it contains iron, lime, and carbonaceous matter.—J. J. F.'s specimen, supposed to contain silver, did not arrive.—C. A. W.—The clay contains silica, alumina, lime, iron (as sesquioxide), magnesia, potash, and traces of soda. The above ingredients are arranged in order of the amounts as existing in the specimens sent.—W. H. G.—We find none of the precious metals present. It is a deposit of carbonate of lime and magnesia upon quartz. It contains about 10 per cent of sesquioxide of iron.—C. W.—It is a fossil belemnite. These curious fossils vary in size and form; some are small, delicate, transparent like amber; others are opaque, and from ten to twelve inches in length. They are very common, having been met with in all ages and countries, and giving rise to much speculation as to their real character.—C. B. K.'s and D. M. S.'s minerals did not come to hand.—A. M. D.—No. 1 is a handsome chrysolite, which is a silky variety of fibrous serpentine. No. 2 is hornblende. No. 3 is beryl.—J. L.—The water has been examined. It has taken up alumina, lime, and organic matter. The latter is to be dreaded; and it would be safer to boil the water before using.—A. B. P.—Nos. 1, 2, 3, and 4 (both hard and soft) are varieties of shale rock containing an amount of oxide of iron. By fluxing, No. 1 gives a black slag. They are not entitled to the name of iron ores. The paints are others of inferior quality. No. 5 is impure iron alum.—A. B. P.—The two bottles labeled No. 1 and those marked Nos. 2 and 3 contain lime and alumina with organic matters. In No. 3, the two latter substances are in considerable quantity, and there is likewise present a large percentage of iron.

COMMUNICATIONS RECEIVED.

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

On Large and Small Wagon Wheels. By M. G. P.
On the Tides in the Gulf of Mexico. By W.
On a New Explosive. By E. G. A.
On Steam Boiler Phenomena. By L. M. K.
On State Laws regarding Patents. By W. W.
Also inquiries and answers from the following:
A. G.—J. W. D.—P. S.—C. L.—D. F.—A. L.—J. B.—
F. J. C.—J. R. N.—A. W.—E. J. N.—S. M. 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 inquiries analogous to the following are sent: "Whose is the best process of making gas from petroleum? Who publishes working drawings of steam engines? Whose is the best steam siphon valve? Whose is the best machine for reducing sand and small gravel to a fine powder?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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5,647.—MEDAL.—W. B. Cunningham et al., Phila., Pa.
5,648.—PLANOFORTE LENS.—C. E. Hoffmeister, N. Y. city.
5,649.—CASTING.—A. P. Reger, Philadelphia, Pa.
5,650.—GRIDIRON.—W. P. Warren, Troy, N. Y.
5,651.—CAPS.—M. Isidor et al., New York city.
5,652.—WAIST BELT.—W. C. Shlmonck, Washington, D. C.
5,653.—BACK COMB.—W. C. Shlmonck, Washington, D. C.
5,654.—FAN.—H. B. Sommer, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each caveat..... \$1.00
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On appeal to Commissioner of Patents..... \$20
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On application for Design (7 years)..... \$15
On application for Design (14 years)..... \$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
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5,178.—H. Bolton, Elizabethtown, Ont. Potato digger. Sept. 14, 1875.
5,179.—J. A. MacKinnon, Sandwich, Ont. Whiffletree. Sept. 14, 1875.
5,180.—W. R. Fenerty, Halifax, N. S. File and tool handle. Sept. 20, 1875.
5,181.—G. Keely, London, Ont. Feather-renovating machine. Sept. 20, 1875.
5,182.—J. W. Johnson et al., Towanda, Pa., U. S. Grain separator. Sept. 20, 1875.
5,183.—G. H. Bliss, West Stockbridge, Mass., U. S. Culinary apparatus. Sept. 20, 1875.
5,184.—A. Cunningham, Milwaukee, Wis., U. S. Saw mill dog. Sept. 20, 1875.
5,185.—F. K. Kalbfleisch, New York city, U. S. Carriage for acids. Sept. 20, 1875.
5,186.—G. Walling, Port Henry, Ont. Suction meal and flour-saving fan. Sept. 20, 1875.

Advertisements.

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