SCIENTIFIC AMERICAN

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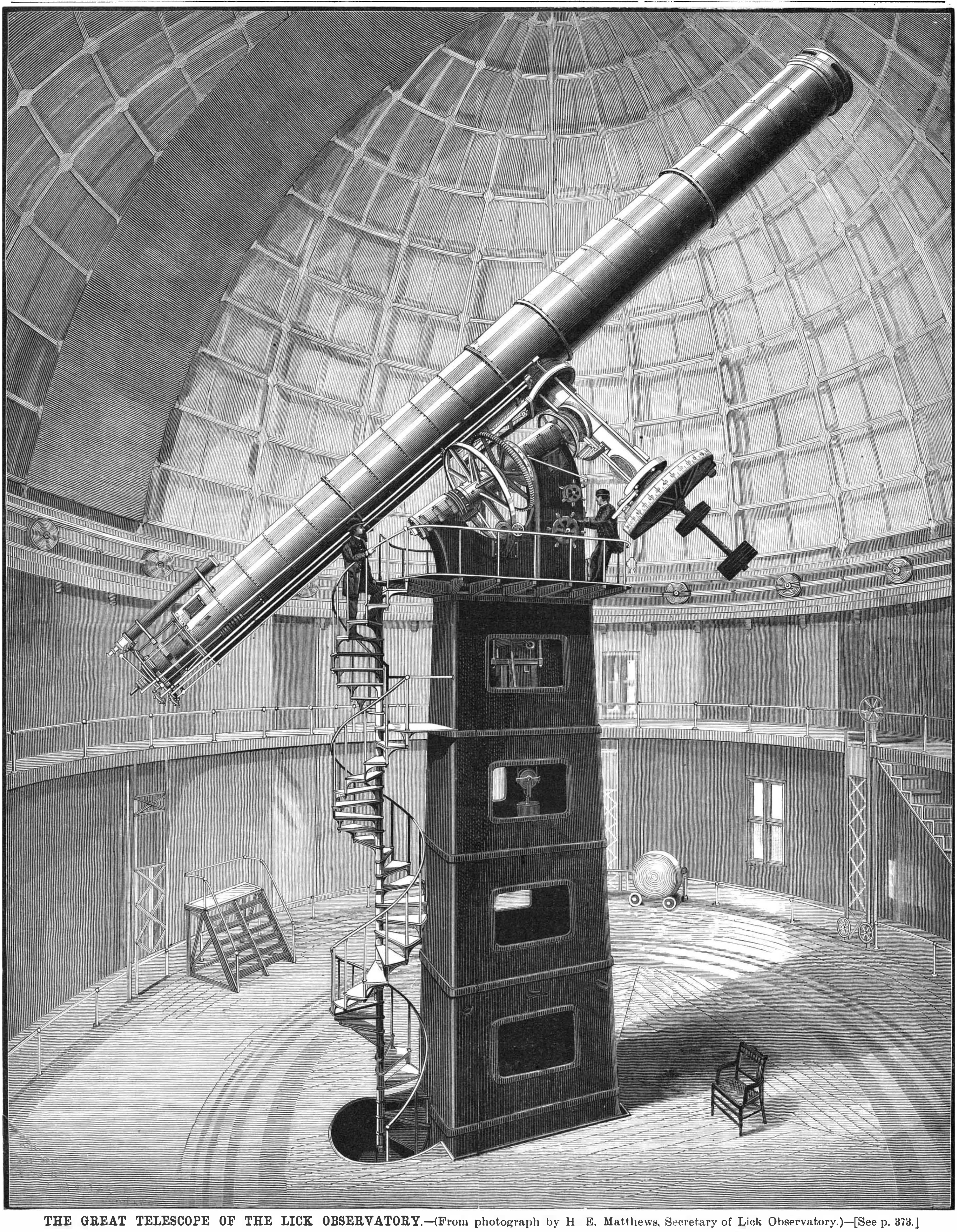

THE GREAT TELESCOPE OF THE LICK OBSERVATORY.—(From photograph by H E. Matthews, Secretary of Lick Observatory.)—[See p. 373.]

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NEW YORK, SATURDAY, JUNE 16, 1888.

**Contents.**

(Illustrated articles are marked with an asterisk.)



## TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 650

**For the Week Ending June 16, 1888.**

Price 10 cents. For sale by all newsdealers.



### Water Gas in Massachusetts.

For a number of years the Massachusetts law prohibited the manufacture of gas containing more than a defined percentage of carbonic oxide. As water gas under existing processes always contained more than this amount, the law amounted to a prohibition of all companies who would manufacture the new gas. A new bill has been recently passed by the legislature and signed by the governor, which places the matter in the hands of the gas commissioners of the State. They are permitted to license any existing company to make and sell water gas under such restrictions as to carbonic oxide as the commissioners may make.

A good story is told of one of the leading representatives of the coal gas interest. When the old law was in force, he appealed to the legislature to stop a new gas enterprise on the ground that it proposed to make water gas containing more than the legal percentage of carbonic oxide. The new company, however, had a process by which the carbonic oxide could be reduced to a very low limit. They at once met the issue raised by proposing to the legislature that it should enact a new law, placing the limit of carbonic oxide to be allowed at three per cent. As coal gas always contains more than this, the effect of such a law would be to close every gas works of any size in the State. This course was not followed, but the coal gas representative saw the point and was obliged to fight for the toleration of some reasonable amount of the obnoxious gas.

### Devastation by Crickets.

Accounts are published of the devastation caused by crickets in Algeria. The insects resemble but are not identical with either locusts or grasshoppers. Last year swarms of grasshoppers ravaged the colony. This year the crickets have taken their place. They spring like grasshoppers, but have a more rapid and sustained flight. They form clouds, which shut out the light of the sun. When they alight on the ground, they destroy every trace of vegetation. They sometimes fall exhausted on the ground in such numbers as to cover it with a layer of dead bodies, from which pestilential exhalations arise. The correspondent of a Paris newspaper, in a letter from Algeria, published lately, says that the railway trains have been stopped by the insects between Constantine and Batna.

The method still employed to check the evil in the African possessions of France is the old and expensive one of digging long trenches at a right angle to the advancing swarms, and placing on the most distant side a sort of fence, formed by a web of cloth. The advancing insects strike against the cloth, fall into the pit, and are there covered with lime or mould. The Algerian authorities have spent 700,000f. in destroying them, and now contemplate a further expenditure of 1,000,000f. to complete the work.

It was recently stated that the English authorities in Cyprus had traced the locusts in that island to their breeding places, and had there to a great extent succeeded in destoying them in germ, before they became developed into the destructive swarms which periodically devastated that island. As yet the French do not appear to have introduced this method into Algeria.

### Age of Progress.

The *Indian Spectator*, published at Bombay, repeats what is so often referred to in our newspapers, that this is a wonderful age as regards scientific discoveries. The telephone has become an old story, the microphone may soon be so. Recently we have had a number of important inventions. First, there is the happy method hit upon of so storing and shutting up water that it forces its way out at the exact moment it is most wanted. The especial merit of the mechanical arrangement here adopted is, that the fire which is to be extinguished itself liberates, as from a prison where it lay inert, the water that is needed to overpower it. One may well wonder how such a simple plan did not for so many generations suggest itself to the human mind.

There have been of late two notable inventions in connection with railways. One of them is destined to be of great practical good. When a train is in motion, a wagon or carriage is put in front a hundred yards or more in advance of the carriages. It is connected by wires with the carriages behind. If any accident happens on the way, this carriage in front, which is empty, bears the brunt, and at the same time communicates at once the danger to the train behind, and sets to work powerful brakes which check its speed. Only a few years ago nearly the whole of a railway train was precipitated headlong into a river from a bridge. The bridge was broken, but it was not known, hence the catastrophe. Similar calamities we have now the means of escaping. The other invention promises to enable us to send telegraphic messages while the train is in motion.

The art of photography is not at a standstill. Modes are discovered of reproducing one color after another of the original. Then, it may be so contrived now that the whole photographic apparatus can be carried in the pocket.

Indeed, this is an age of discoveries. It is not easy to say how the face of the earth may be transformed in a few generations by virtue of the advances made in science and art. "How much to do, how little done," comes home to our hearts when we contemplate the slow, the extremely slow, rate at which we in this country (India) are borrowing—let alone originating—new ideas.

### Filtration by Machinery.

At the meeting of the Society of Engineers on Monday, May 7—Mr. A. T. Walmisley (president) in the chair—a paper was read on "Filtration by Machinery," by Mr. Edward Perrett, Asso. M. Inst. C.E. The author first compared the processes of straining and filtering, and pointed out that in the latter process the mutual attraction of particles of matter, in addition to the straining action, causes the retention of the suspended material in a liquid passing through the filtering medium.

After describing the early experiments made by him in filtering Thames water through filter bags such as are used for the filtration of sugar, Mr. Perrett called attention to the danger of using animal charcoal for the filtration of drinking water. This material has the power of taking out matter in an infinitely fine state of division, and even in solution, the charcoal becoming so charged with such matter that nothing short of subjecting the charcoal to a red heat is sufficient to thoroughly clean it. An animal charcoal filter with any system of washing will, he said, gradually accumulate the very fine matter, which may germinate, and at length be carried through with the filtered water. A filter with a granular medium (such as crushed retort coke), designed by the author, may be effectually cleaned by an upward stream of compressed air occasionally applied. This causes an agitation of the material, and the attrition loosens the dirt, which a small current of water washes away.

At a water works in South America where these filters are used, 20,000 gallons of river water are filtered per hour, the floor space covered being 37 feet by 7 feet 6 inches, or an average rate of nearly 100 gallons per square foot of filtering surface per hour. The purification of water containing organic matter by contact with iron was mentioned.

The original method of using Professor Bischof's "spongy iron" on a large scale was to mix the spongy iron with gravel, and to use this mixture as a filter bed, but it was found that the top surface became hard and impervious after a short time, and Mr. William Anderson introduced a machine to supersede these spongy iron filter beds. His revolving purifier causes ordinary iron borings to be mixed with the water as it passes through the machine, the water being afterward filtered through ordinary sand beds.

For the filtration of very muddy water for manufacturing purposes, sponge is used by the author. The machine consists of a cylindrical casing, in which sponge is compressed between two diaphragms, the lower diaphragm being movable, and attached to a piston rod, which passes through the top cover. To clean the sponge an up and down motion is given to the lower diaphragm or piston, thus alternately compressing and releasing the sponge. These filters will render Thames water in London clean enough for boiler feeding or other manufacturing purposes, at the rate of about 100 gallons per square foot of surface per hour. The precipitate resulting from the processes known as "softening" water is now generally extracted by filtration.

The material used for this purpose is the filter cloth referred to at the commencement of the paper, as the chalk deposit may accumulate to a considerable thickness before it becomes impervious. In this case the deposit is easily removed, and the author finds that simple external jets of water are sufficient for the purpose.

### Condensed Literature.

The tendency of the times, remarks the Norwich *Courier*, is toward condensation. We have condensed beef, a small portion of which, dissolved in hot water, gives one a draught containing as much nourishment as a whole beefsteak. We also have condensed milk, and condensed food of other kinds, which contain a maximum amount of the essential quality within a minimum amount of space. How far this tendency toward condensation will eventually carry men in the matter of food, it is difficult to predict. Perhaps the time will come when the art of extracting and condensing the active principle or essence of comestibles will be so advanced that one may be able to obtain in a small pellet as much refreshment and nourishment as he now obtains in a whole meal. Then, all the time now consumed by the good housewives in preparing breakfast, dinner, and supper, and by the business members of the family in going to and from and eating their meals, will be saved. There will be no roasting over the kitchen stove, no trouble washing dishes, no worry over a varied bill of fare, no agitation over broken china, etc. A person will carry a few food pills in his pocket, and when he grows hungry he will take one and swallow his whole meal at once. Perhaps.

### The Geographical Distribution of our Birds.

BY E. M. HASBROUCK.

The subject of geographical distribution is at present one of considerable interest to ornithologists, inasmuch as there has been comparatively little accomplished, although much work has been done. We are able to tell with a certain degree of accuracy in what part of North America each species may be found, and with most of our Eastern birds in just what localities they occur; but with a large part of the Western species the exact section or sections of country which they inhabit are still a matter of query. This is due to the fact that by far the larger part of the ornithological world is confined to eastern United States, and the birds of the West in consequence have received less attention.

To illustrate, take the A. O. U. check list, and open to any of the Western species, *i. e.*, Strickland's woodpecker (*Dryobates stricklandi*); the habitat given is: "Southern Arizona, south into New Mexico." This, as may be seen, is very vague and incomplete data. On going to Arizona or New Mexico for collecting purposes, one would have nothing whatever by which to be guided, as the species desired might be anywhere within a given area, or perhaps no nearer than fifty or a hundred miles, and still answer the description given in the check list. Or take the case of the violet-green swallow (*Tachycineta thalassina*); on consulting the "list" again, we shall find: "Western United States, from the eastern base of the Rocky Mountains to the Pacific, south to Guatemala."

It is in such cases as these that the so-called "local lists" are of such value, as with these arranged in proper order, one may turn at once to the locality he intends visiting, or the one nearest, and learn what species he may expect to find; or if desirous of securing some particular bird, can with a few moments' search find a locality in which that species is to be found. These local lists are being constantly published, nearly every issue of the various papers devoted to the study of birds contains one or more, but still more are wanted, and will be for a long time to come. It would hardly be safe to say just how many from each State would be needed to compile a good ornithological directory. One from each county at least would be indispensable, and in some cases, where the counties are extremely large and embrace varied portions of territory, two or even more might be needed to complete the data.

There are to-day in North America some hundreds of ornithologists, both professional and amateur, but the combined efforts of these and many more are needed before anything like such a work could be compiled. The same ignorance, only to a greater extent, prevails as to the distribution during the breeding season. A large part of the fauna retires to the Canadian provinces to rear its young, and here, owing to the scarcity of men with scientific training, very little work is done. Several competent scientists, prominent among whom is Mr. Montague Chamberlain, of St. John, N. B., are doing what they can to work up the Canadian fauna, but in a territory of such vastness and so thinly settled, it is evident that this part of the country at least will for a long time to come remain comparatively unworked.

It is in this work that the amateur can be of so much assistance, and can do so much effective work. Let each person interested in the study of birds make a list of those passing through that locality each spring and fall, and of those remaining there to breed, retaining it for several years for the purpose of making additions and corrections, and then, when he thinks he has compiled a pretty thorough list, send it to some good medium for publication. Such records, if carefully compiled, will, as I have said, greatly aid in the compilation of ornithological charts.

It may be of interest to some to know that the North American fauna is divided and subdivided into several groups, many of which, if not all, overlap each other to an appreciable extent, and just where and how far this conflict occurs is one of the most important and interesting subjects in the whole study of distribution.

These divisions are as follows:

| | | |
|---|---|---|
| North American fauna. | * Sub-tropical fauna. | Mexican.<br>Central American. |
| | United States fauna. | Pacific.<br>Rocky Mountain.<br>Mississippi Valley.<br>† Eastern. |
| | ‡ Canadian fauna. | Pacific.<br>Mississippi Valley (?).<br>Eastern. |
| | Arctic fauna. | |

These are the main divisions; they of course can be, and are, divided further for the sake of convenience into local faunas, such as the New England fauna, fauna of Long Island, fauna of the Gulf States, etc., but these are purely optional, and made only for describing the species found in certain localities. It will be readily seen that adjoining each other as they do, many species of each will, as I have said, encroach upon the territory of the other; and while this is noticeable in every case, it is astonishingly prominent with some.

For instance, it may be a source of surprise to know that the Canadian fauna is found in the Alleghany Mountains as far south as the Carolinas, while the Eastern fauna of the United States extends in turn into that of the Canadian, only not to so great a distance.

The Mississippi Valley fauna follows up the Ohio and Susquehanna rivers, and infringes on the Eastern fauna, while a number of rare semi-tropical birds have been taken in Texas and the Gulf States.

It will thus be seen how important and indispensable a large army of workers in this field is; no one, two, three, or hundred men can ever accomplish it, and unless all are willing to strive and contribute their mite, it practically never will be completed.

The study of the sea birds is undoubtedly the most difficult department in the whole field, as many of the species so nearly resemble each other that to distinguish them while flying is almost impossible, while to secure them for identification ranks next. Large numbers of the gulls and terns annually pass up the rivers and frequent the inland lakes, thus including themselves in the category of these particular regions, while many of the land birds visit and breed on the islands that are the homes of this race, and as a consequence are classed among the sea island dwellers as well as among the land. Occurrences of interest are never lacking, as one is apt at any time to secure a species new to a locality, possibly extending its range some distance beyond any previous record. One such instance will serve to illustrate. Some time ago a specimen of the evening grosbeak (*Coccothraustes vespertina*) was taken near Elmira, N. Y. Its capture extended the geographical range some hundreds of miles east. A big hue and cry was made by a certain gentleman who termed it useless and wanton slaughter, which, however, was not the case, as it benefited science to the degree I have named.

No one interested in this pursuit can afford to neglect making a list of the birds in their vicinity and comparing it with those from other localities, as not only is an incentive to work thus gained, but valuable information is added to the store of knowledge already acquired.

* The sub-tropical fauna properly has no place in the North American, but in the present article it is included for the purpose of illustration.

† It might be well to add that the southern part of Florida is decidedly tropical in its fauna, and that this tendency is felt along nearly the entire Gulf coast.

‡ By Canadian fauna is meant that of all the British provinces.

### Glazes for Porcelain Ware.

MM. Lauth and Dutailly have recently communicated to the French Chemical Society the results of their investigations on the red glazes which are produced on porcelain by means of copper and its salts. The color produced in this manner is of a much more permanent nature and of a far superior tint than that which is obtained when oxide of iron is used for the same purpose. This red color, when used for decorative work on ancient porcelain, is often accompanied with a blue coloring matter beneath the surface of the glaze. It appears that the secret attached to the production of these colors was known only to the Chinese until recently, and that the red, known as Tsi-houng, or *sang de bœuf*, could not be imitated by the French at the porcelain manufactory at Sevres. In 1852 MM. Ebelmen and Salvetat endeavored to reproduce these copper colors in France by making careful analyses of fragments of Chinese porcelain colored in this manner, and then imitating, in the composition of the glaze and clay employed, the Chinese specimens. The results of these earlier experiments are now in the ceramic museum at Sevres, and are the first examples of the kind produced in Europe.

Other French chemists have since then attempted to improve on the first trials, and the problem has also been attacked by H. Seger, of the Berlin Porzellan-Fabrik and by H. Bunzli, at Krummnus, in Austria. MM. Lauth and Dutailly have established by their experiments that the maximum temperature which the Chinese red glazes can stand without losing their color approaches to that used for baking the new Sevres porcelain. By successively associating all the compounds capable of entering into the formation of a colorless glaze with oxide of copper, they have come to the following conclusions: That in the same series of glazes, those which produce the finest red color with copper compounds have the greatest amount of silica present, and that in a series of glazes of approximately the same degree of acidity, the best results are obtained when there is a large proportion of alkalies and a small percentage of alumina. They have further noticed that if the alkaline metals be increased in relation to the alkaline earths present, a finer red is produced, but at the same time the liability to break is increased. By employing boracic acid or borates this inconvenience may, in some measure, be prevented. Lime, magnesia, various fluorides, and lead and iron oxides have also been tried; but the results obtained by their use have not proved satisfactory.

A very good red glaze can be produced when zinc oxide and baryta are the bases present in the glaze. The copper can be introduced into the glaze in different ways. Oxalate of copper, simply mixed and not fused with the melt, gives good results; but if previously fused with the glaze, very satisfactory colors are produced. The quantity of copper salt employed depends on the time required for baking the porcelain, and also on the temperature of the furnace. Five per cent is the quantity which is recommended as the most suitable to use, and the addition of a small quantity of tin oxide is advantageous. The glaze which has given the best results has the following composition:

| | |
|---|---|
| Pegmatite | 31·17 |
| Sand | 36·37 |
| Fused borax | 12·98 |
| Dry carbonate of soda | 4·76 |
| Barium carbonate | 10·39 |
| Zinc oxide | 4·33 |

Corresponding to—

| | |
|---|---|
| Silica | 61·02 |
| Alumina | 5·85 |
| Alkaline oxides | 10·72 |
| Baryta | 8·42 |
| Zinc oxide | 4·51 |
| Boric acid | 9·48 |

This glaze has a degree of acidity represented by the number 5·39, that of the French glaze, No. 1, being 5·14. The bases are in the proportion which corresponds to the formula:

$$Al_2O_3, 3\ NaKO, BaO, ZnO.$$

By using this glaze with a similar one containing lime, MM. Lauth and Dutailly have succeeded in obtaining a great variety of colors on the same material, and in producing some effects on porcelain which have not hitherto been achieved.

### The New Justice of the Supreme Court from an Anthropological Point of View.

The appointment of Mr. Justice Lamar to a seat upon the bench of the Supreme Court of the United States marks an era in the history of our country. Every one recognizes this as true politically, but I speak of it anthropologically. Mr. Justice Lamar is said to be what is called in French "*visuaire*"—that is, mental impressions are received upon his brain with greater facility through the eye than through the ear. One who receives these impressions best through the ear is called an "*auditaire*." The "visuaire" understands the thought best by *seeing* the printed page, while the "auditaire" receives his best impression by hearing. In the Supreme Court the arguments of counsel are, of course, oral, and how Mr. Justice Lamar, with this peculiarity of mental organization, will adapt himself to his new position remains to be seen.

These differences in human mental organization are well known to anthropologists. As some men can understand better when they see, and others when they hear, so some can think better when they speak than when they write, while others are the contrary. Governor Corwin, of Ohio, was a notable illustration. Whether in the Senate, in the House of Representatives, at the bar, or on the stump, as an orator he was equaled by few and excelled by none. He thought well and clearly when on his feet. Amid all his wit and humor he was a most consummate logician, and could carry on the thread of an abstruse argument and support it by most cogent reasoning. But as governor or cabinet officer, his state papers were not above the ordinary. Taking a pen in his hand, his thoughts seemed to scatter, and his writing was commonplace. Addressing the multitude, his thoughts seemed to crystallize into most beautiful forms, and he spake as one inspired. The causes of these differences have never been discovered. They are suggested as a theme for the student—biologist or anthropologist—as instructive as they are interesting.—*Thos. Wilson, in American Naturalist.*

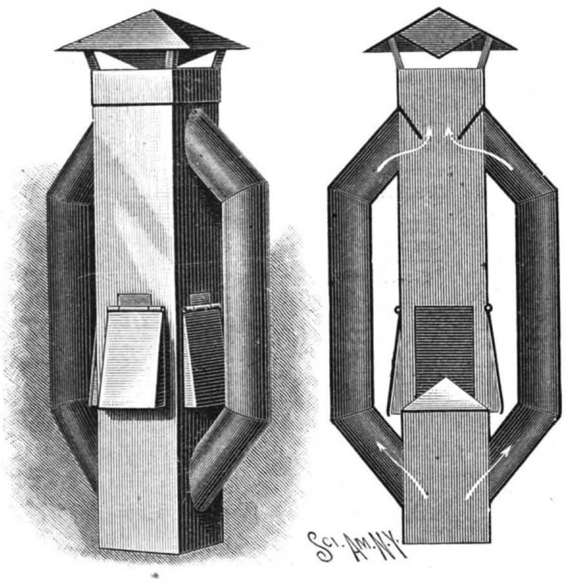
In view of the above, it might be well for the Senate to send over to the Smithsonian Institution and make a few anthropological inquiries concerning the new candidate for the Chief Justiceship, Mr. Fuller, of Illinois: Is he an "auditaire" or a "visuaire"?

### Compressed Gas.

It has been urged that the use of compressed gas for lighting cars is attended with the danger of the gas exploding in the event of a collision. The imaginary nature of this danger was shown by the recent accident on the Philadelphia & Reading, where an escape of compressed gas from a leaky hose simply burnt for a few moments without any explosion. Experience in Germany has been of a similar nature, and a recent collision near Birkenhead, England, between two trains lit with compressed gas was unaccompanied by any explosion. At the time of the collision between the Hoylake and Mersey tunnel trains, the gas in the latter was alight. The gas cylinders of the smashed coaches were taken from the debris and tested to a pressure of 150 lb. per sq. in., and they were found to be entirely uninjured beyond a few severe dents. The gas fittings of the remaining portion of both trains had not suffered in the least through the collision, and, with the exception of those in the smashed cars, not a single lamp glass was broken in either train.

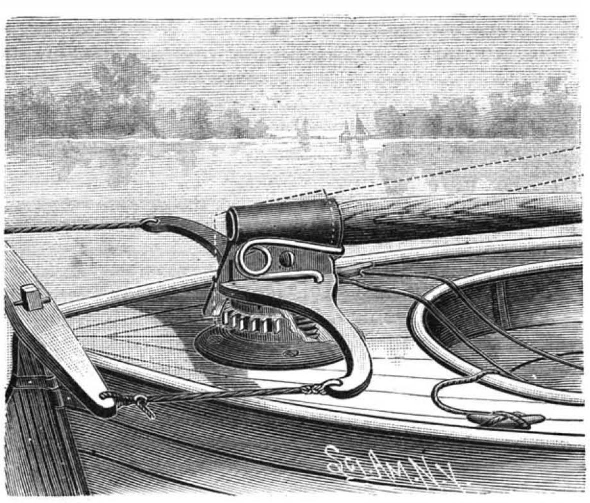
### AN IMPROVED CHIMNEY COWL AND VENTILATOR.

A cowl or ventilator constructed to fit upon the top of a chimney or ventilating flue, and prevent down currents from entering the pipes, is illustrated herewith, and has been patented by Mr. John D. Cashill, of Princeton, N. J. Its lower section is connected to the upper section by side pipes or flues outside of the



CASHILL'S CHIMNEY COWL AND VENTILATOR.

main body, providing a free passage for smoke and air from the bottom section to the top of the cowl, as shown by the arrows. The lower section is closed at the top, above the lower openings into the side pipes, and on each of the sides of the upper section is a hinged door opening to the outside air. Above the upper connections of the side pipes with the cowl, and partially closing the pipes, are deflecting plates, which serve to direct currents of air which may enter at the top past the pipe openings, and centrally down to an outlet by way of one of the hinged doors at the sides. There is an outwardly deflecting plate opposite each hinged door, the door to the windward always being closed by the outside air pressure on that side when the wind is blowing, while the opposite one opens freely, to allow

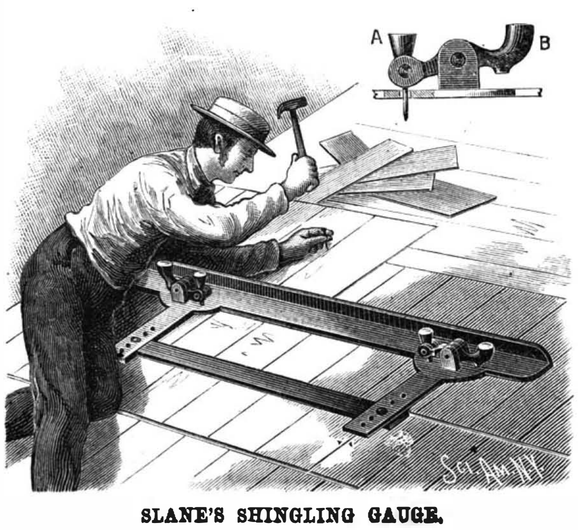


RUSHTON'S LOCKING STEERING GEAR.

of the escape of any air that may be drawn in at the top, and prevent down draught.

### AN IMPROVED SHINGLING GAUGE.

A gauge which is designed to enable a shingler to lay a large number of shingles without changing his position on the roof is illustrated herewith, and has been patented by Mr. McGuire Slane, of La Cinta, Territory of New Mexico. The body of the gauge is an angled bar having rearwardly extending arms with a series of apertures, through which are passed screws to secure another bar at the desired distance from the first bar, such distance representing the space between the lower ends of the successive rows of shingles. At the junction of the arms with the main bar are ears between




SLANE'S SHINGLING GAUGE.

which are pivoted levers, as shown in the small figure, the inner end of each lever being forked to receive a pin, A, these pins to be driven in to fix the gauge in position, while the outer end of the lever, B, is made in a form suitable to receive the blow of a hammer, whereby the pin, A, will be withdrawn when the position of the gauge is to be changed. The distance apart of the several rows of shingles is readily regulated by means of the different apertures in the arms, through which screws are passed to fix the position of the rear bar of the gauge, and two taps of a hammer are all that is necessary to remove the gauge and fix it in position again for laying a new row of shingles.

### The Electric Light in Medical Investigations.

The electric light is getting to play an important part in medical investigations. With a little "pea light" attached to the end of a slender rod, Sir Morell Mackenzie examines the throat of the German Emperor. The little battery that supplies the electricity hangs around the surgeon's neck. These little electric lights are becoming daily of more practical use. By their aid the surgeon pokes and peeks into places he otherwise would have to manipulate in "by the feel," and achieves results heretofore impossible.

### A DEVICE FOR LOCKING STEERING GEAR.

An invention providing steering gear for canoes and light sailing boats, which may be locked in any desired position, is illustrated herewith, and has been patented by Mr. John H. Rushton, of Canton, N. Y. A socket adapted to be attached to the deck of the boat is provided on its periphery with a series of teeth, the interior of the socket being screw-threaded, and fitted with a head having a threaded portion. The head carries horizontal arms with eyes at their extremities, which are connected by cords with levers attached to the rudder post. The head also has vertical ears between which is pivoted the flange of a tapered socket to receive the end of the tiller, there being integral with the flange a downwardly projecting arm adapted to engage the teeth on the periphery of the socket fixed to the deck. A double spring is arranged to bear on a shoulder on the lower part of the tiller socket in such way as to raise the tiller into the position shown in dotted lines whenever it is released by the steersman, the downward projection of the flange at the rear then engaging the teeth on the periphery of the socket fixed to the deck, and locking the tiller and rudder in position, the tiller being designed to move freely in either direction when held down to the position shown in full lines in the illustration.

### BINNS' PATENT BANDING SPINDLES.

The illustration shows a method for banding spindles, invented and recently patented by Mr. Leedham Binns, of the Binns' Patent Band Co., 5th and Berks Sts., Philadelphia. The drawing sufficiently indicates the nature and operation of the invention. The claim made for it is as follows:

"It takes 50 per cent less power to drive the spindles. This means a large item in coal, wear and tear on boilers, engines, shafting, belting and connections."

"A firm with 80,000 spindles banded on this plan will save about 300 horse power; allowing 3 pounds of coal per horse power per hour, would save over 1,200 tons of coal per annum, more or less, according to speed of spindles. It is impossible for a band to slip on the cylinder.

"There is double the amount of band contact given to each spindle. It requires less than half weight of banding to drive the spindles.

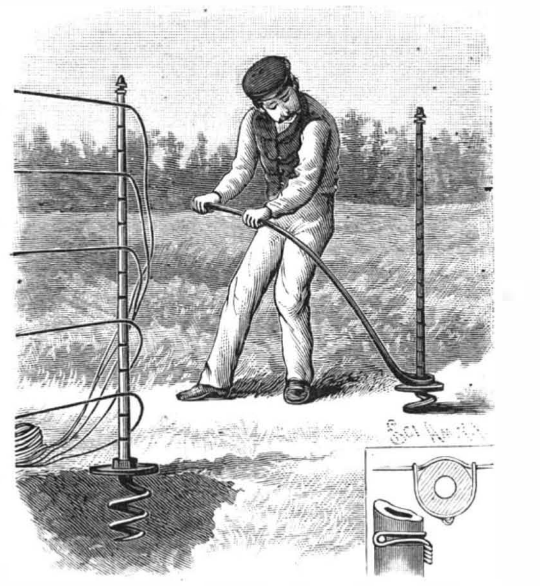
"It drives the spindles more perfectly and up to speed. It spins and twists the yarn more evenly. It requires less oil for lubrication, less wear and tear on the spindles and connections, and the highest rate of speed possible can be obtained."

Test spindles banded on this plan are running at 27,000 revolutions per minute; spinning cotton at 17,000 per minute. The royalty asked is 5 cents per spindle, for full term of patent, or 3 cents per spindle per annum, using without contract.

For further information, apply to the Binns' Patent Band Company, head office, Fifth and Berks Streets, Philadelphia, Pa., U. S. A.—*Textile Record.*

### AN IMPROVED FENCE AND FENCE POST.

An invention relating to wire fences, and more particularly to an improved form of post therefor, has been patented by Mr. George H. Guile, of Watertown, N. Y., and is illustrated herewith, the small figure showing the manner of attaching the fence wire to the post. The post is preferably made hollow, and tapering upwardly, its upper open end being closed by a knob or head, while at suitable intervals from top to bottom are annular grooves around its periphery, suitable for the running wires to lie therein against the post. The bottom of the post has a screw-threaded portion by which it screws into the socket of an enlarged upper portion or head of an involute helical or corkscrew-shaped point, this head having polygonal sides for the engagement of a wrench to force the screw into the ground, and the screw diminishing in size toward its point, so that it will not loosen the surrounding earth, but firmly and closely embed itself therein. The running wires are held or tied to the post by strips of wire or other flexible material, of band or loop form, the grooves maintaining the wire, in looped form, from any up and down slide. It is obvious that such a fence can be rapidly and easily set up, and, should the posi-

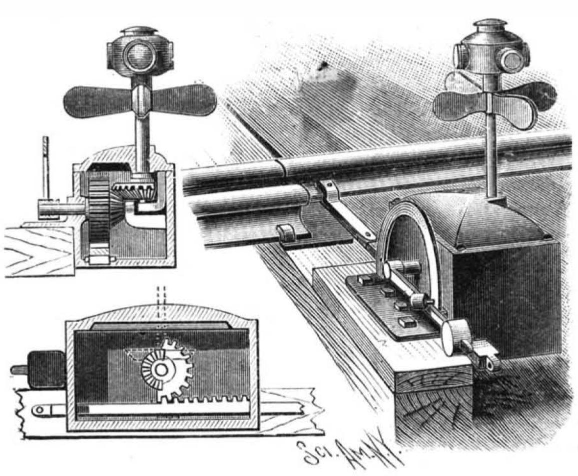


GUILE'S METALLIC FENCE AND FENCE POST.

tion of the posts be affected by frost, they can be readily readjusted without disengaging the wires.

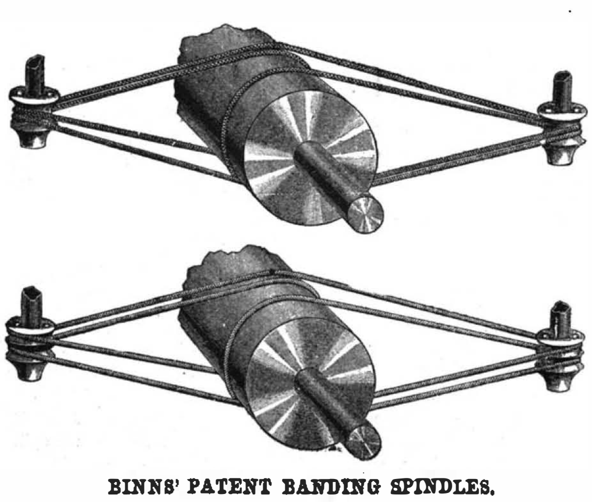
### IMPROVED RAILWAY SWITCH STAND AND SIGNAL.

A simple and positive device for operating a signal automatically as the switch is moved is illustrated herewith, and has been patented by Mr. Nathaniel W. Boyd, of Steelton, Pa. The apparatus is mounted on a single tie or sleeper to provide against uneven settling, and may be set up on either side of the track, or with either side presented to the track, all the principal operative portions, as shown in the sectional views, being inclosed in a tight case, to exclude dirt, snow, ice, and other obstructions. In the bottom of the casing are spaced ribs and a friction roller, upon which slides freely a racked bar, which projects through slots and



BOYD'S RAILWAY SWITCH STAND AND SIGNAL.

is connected with the switch bar. Through an aperture in the side of the casing projects a horizontal rock shaft having attached to its outer end a weighted hand lever, sliding on and guided by a segmental bar, near the extremities of which are apertures to receive a padlock, by which the lever may be locked to prevent its being raised or the operative parts of the device manipulated. Upon the inner end of the shaft is a segmental spur gear, meshing with the teeth of the racked bar, and a segmental bevel pinion meshing with a bevel pinion on a vertical signal shaft provided with a four-bladed semaphore and a signal lamp, the colored sides of the lantern corresponding with the colored wings of the day signal. In operation, when the lever makes a one-half revolution, the signal shaft is given but a one-quarter turn.



BINNS' PATENT BANDING SPINDLES.

### The First Yankee Engine.

In the biography and diary of Manasseh Cutler, LL.D., of Ipswich, Mass., just issued, is given a description of what is probably the first practical stationary steam engine used in the United States. It appears in the diary of Dr. Cutler as written when the impression was fresh in his mind. It may be called a "Yankee steam engine," having been made under the direction of a Rhode Island man and containing improvements upon its English prototypes. The diarist was on a chaise journey to New York, and his entry is of the date of June 17, 1787. He says:

"To go to the furnace and engine was nearly eight miles out of my way; but my curiosity was so much excited by the description of so singular a machine, the only one in America, that I could not deny myself the pleasure of viewing it. I arrived at the ore beds (iron ore) at 12 o'clock. The engine was at work raising water from a well 80 feet deep. The iron flue is 2½ feet wide by 6 feet long, with a square hearth at the mouth, secured from fire by large, thick iron plates. On the back part of the flue is a winding funnel, which passed into a chimney on the back part of the building.

"Above the flue is placed a wooden boiler, 6 feet in diameter, which is kept constantly full of water when the engine is in motion. The boiler rises above the first story of the building, much in the form of the large cisterns used in distilleries, where it receives, at the top, the condensing cylinder, 2½ feet in diameter, and which is made of plated iron.

"From the cylinder a large worm passes, with many windings, down to the boiler. The valve that passes into this cylinder is more than 2 feet in diameter, and rises and descends by means of an iron rod, made fast to one end of a large beam. Around the top of the boiler are numerous leaden pipes—some connected with the condenser and some not—furnished with stop cocks for admitting or excluding air or water, as necessary in working the machine; but they are too numerous and complicated to admit of any description from a mere point of view.

"A large reservoir of water is placed in the third loft of the house, constantly affording water to the works below, and as constantly supplied by a pump for the purpose, by the working of the machine.

"There are two large pumps in the well, which is 80 feet deep and 23 feet wide. The sides of the well are supported by large timbers, laid horizontal, so as to make the form of the well quintangular, and the ends of the timber are let into one another. The engine raises seven hogsheads of water in a minute, and the flue consumes two cords of wood in twenty-four hours.

"The immense weight of the beam, the cast iron wheels, large chains, and other weighty parts of the works occasion a most tremendous noise and trembling of the large building in which it is erected when the machine is in motion. By the sides of the well from which the water is drawn are two other wells, 70 feet deep. These are sunk down in the bed of the ore, and in these are the workmen, ten or twelve in number, who are digging ore.

"The large beam is a massive piece of timber, nearly 4 feet in diameter and 20 feet long, being two very large oak timbers nicely forged together. It moves on a large iron bolt in the center, like the beams of a scale, and has two arching timbers at each end, forming the segments of a circle, along which two chains of a prodigious size play as the beam moves.

"One of these chains lead to the piston or valve of the condenser, and the other, at the opposite end, to the pumps in the well. There are four cold water pipes, one feeding pipe, and one venting pipe. By the same motion of the beam which raises the water out of the well, all these pipes open or close by means of stop cocks or valves, as the design of them require.

"The ore is raised in three large buckets, which hold about one ton weight, let down and drawn up by large chains, carried from the well to a large capstan, which is constantly turned by an ox. As one bucket rises another descends. These wells are kept dry by the water continually drawing off into the well where the pumps are fixed, and the pumps keep the water below the height where the men work.

"This curious machine was made under the direction of Mr. Joseph Brown, of Providence, and is a standing proof of the abilities of the able philosopher. The invention was not new, but he has made many valuable improvements in simplifying and making the working of it more convenient above what has been done in Europe. It has cost upward of £1,000 sterling."—*Boston Advertiser.*

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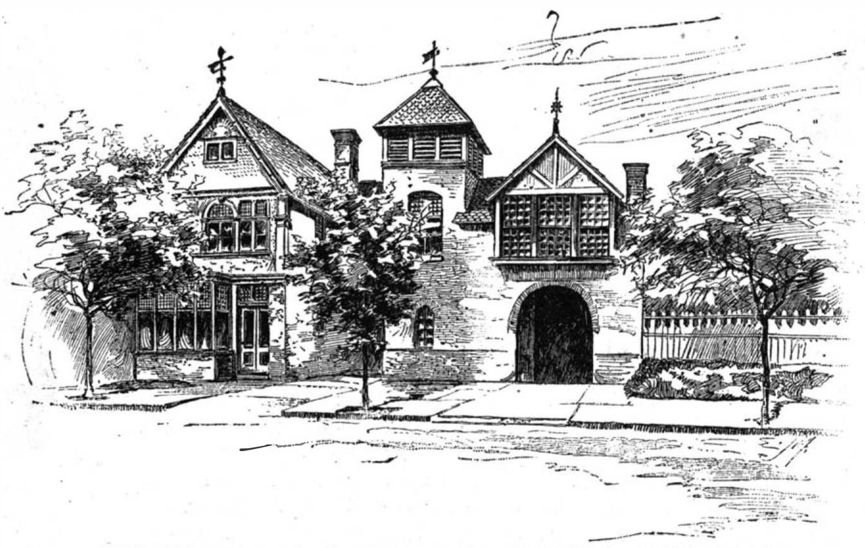
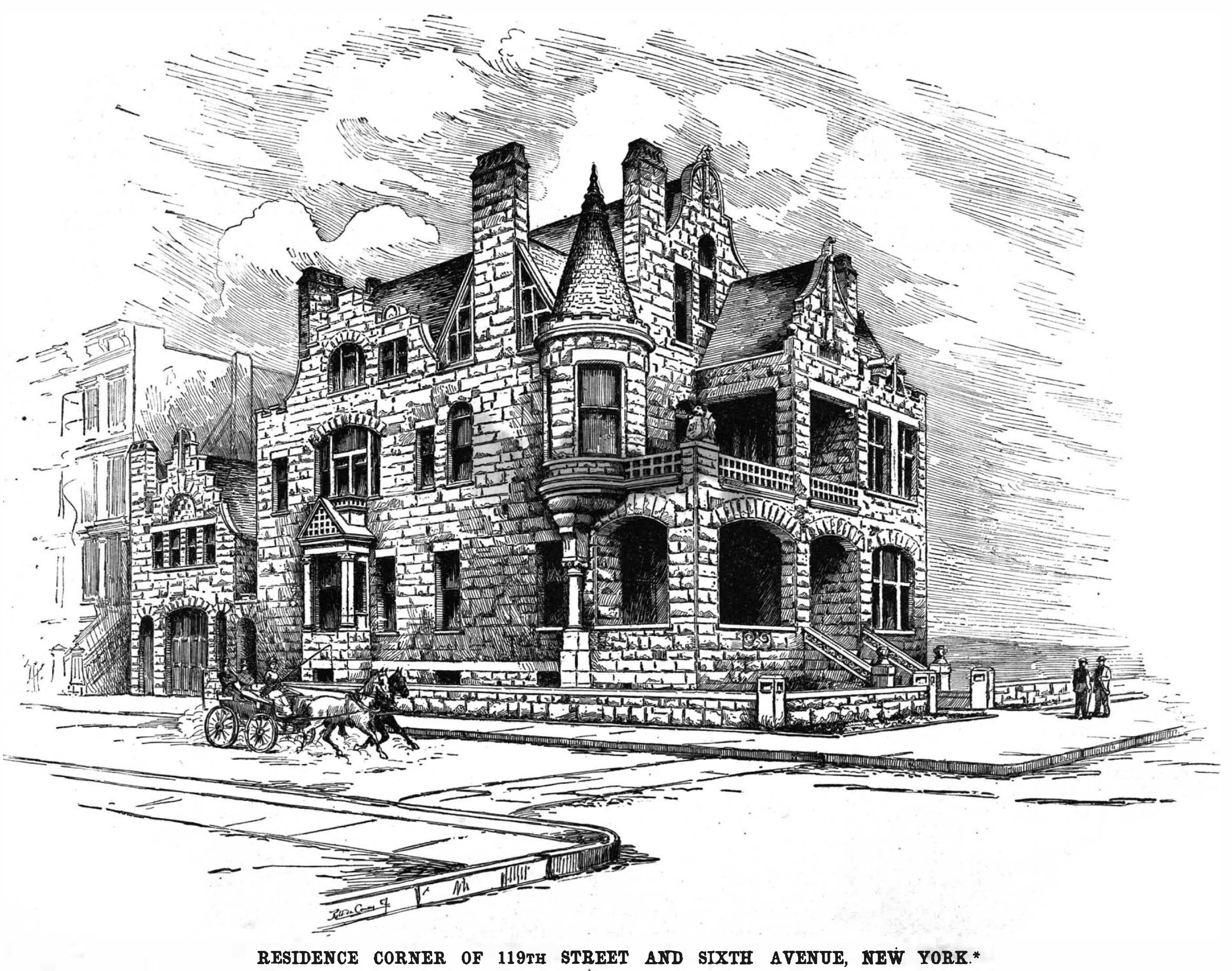
THE largest railroad station is St. Pancras, London, 700 ft. long, 243 wide, 100 high, covering 10 acres.



DESIGN FOR A STORE AND STABLE ADJOINING.*

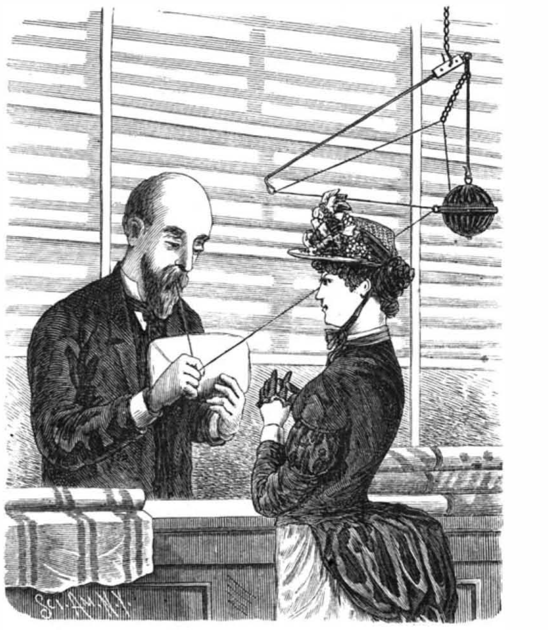
* This engraving represents a beautiful private residence, erected last year, at the corner of Sixth Avenue and 119th Street, in this city, and the illustration is taken from the July, 1887, number of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN. The design for the store and stable appeared in the June, 1887, number of the same publication, and also in the *Sanitary Engineer*. The arrangement of the store and stable together will suggest to the country merchant a degree of convenience which but a few are accustomed to, and the general reader will accord to the architect much and deserved credit for producing such a picturesque and well adapted design for so useful and, at the same time, inexpensive structure. In this connection, we beg to call the attention of any reader of the SCIENTIFIC AMERICAN who is about to erect any kind of a building to the fact that he will find, in the back numbers of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN, engravings and specifications of almost every kind of a structure, from a cheap rustic well house to a church edifice costing many thousands of dollars. Thirty-two numbers have been published, and single copies, or the entire number, may be had at the office of this paper and of all news dealers. Price 25 cents each number.—ED.



RESIDENCE CORNER OF 119TH STREET AND SIXTH AVENUE, NEW YORK.*

### AN IMPROVED TWINE HOLDER.

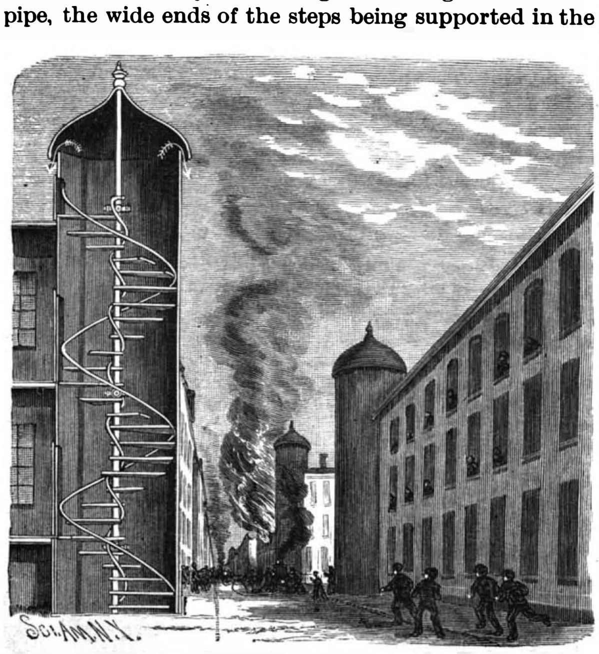
A device which provides means whereby a cord hanging from a holder will, when snapped, be automatically lifted from the table or counter, and which is equally adapted for use with either fine, medium, or coarse cord, is illustrated herewith, and has been patented by Mr. Jonathan Hill, of No. 238 East Fifty-second Street, New York City. A lifting arm or rod, preferably of wire, with its outer end bent and formed into an eye, its inner end also having an eye, and fitted near thereto with a rectangular sleeve having a series of apertures, is attached to a chain suspended from the ceiling by a hook entering one of the apertures of the sleeve. The twine holder is suspended by a rod and two or three links from the eye on the inner end of the lifting rod, thus holding the latter up at a pretty sharp angle. The twine is passed from its cup or holder, up through the last link of a short guide chain, through the eye on the outer end of the lifting arm, and down through an eye attached to the holder, so that its lower end will be in reach from the counter. In drawing the cord for use, the lifting arm is pulled downward, as shown in the illustration, but when the cord below is broken, and it send released, the weight of the holder upon the short arm of the lever causes the lifting arm to ascend, taking the end of the cord up with it and from off the counter.



HILL'S TWINE HOLDER.

### AN IMPROVED FIRE ESCAPE.

A construction designed to form a permanent and efficient fire escape, whereby also the firemen may readily ascend to any floor of a burning building, and water may be supplied thereto through a stand pipe, is illustrated herewith, and has been patented by Mr. William McMullin, of No. 89 Madison Street, Chicago, Ill. A well is built partly in and partly outside of the wall of the building, preferably of common hard-burned brick, and has at its base a fireproof door, with other similar doors leading out upon each floor. The walls of the well are designed to rise about six feet above the roof, and be covered with a fireproof hood, with openings at its lower edges for the escape of smoke, as indicated by the arrows. A water pipe resting upon a solid base is vertically supported centrally within the well, with nozzles at each floor for hose connections, and a spiral stairway is constructed about the pipe, each step being more or less triangular in shape, and having at its inner end an integral eye, adapted to be entered over the central pipe. A platform is constructed for each floor landing, and the rise of the steps and platforms are both regulated by metal rings encircling the central pipe, the wide ends of the steps being supported in the wall of the well, so that the steps serve as braces therefor. A railing is provided for each side of this spiral stairway, to facilitate ascent and descent, and the entire well or tower is constructed independent of the walls of the building, being designed to stand if the building should fall.



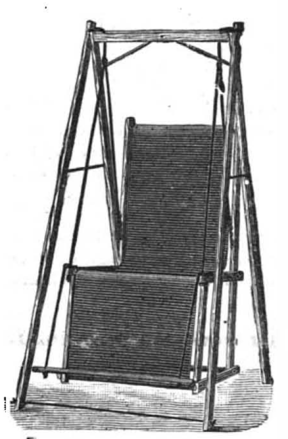
McMULLIN'S FIRE ESCAPE.

### A Floating Sawmill.

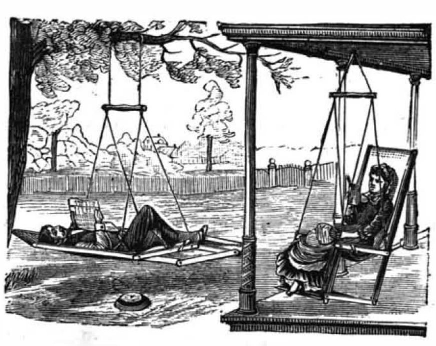
Along the bayous and lagoons of Florida grows some of the finest timber in the South, much of it in places considered entirely inaccessible until J. L. Maul & Son hit upon the plan of constructing a floating sawmill. This idea they carried into execution, and their mammoth mill, which now lies off the banks of Burton & Harrison's hammock, near Palatka, is, according to the *Southern Lumberman*, a marvel of mechanical ingenuity. It has a length of eighty and a breadth of forty feet, and is so solidly built that the motion of the machinery has no more effect upon it than if it were built upon the solid land. Although it stands five feet high out of the water, its draught is only about a foot and a half, which permits it to be taken into the shallowest lagoons, where timber could not be floated. It is equipped with the latest machinery, planer, box header, shingle saws, and a fine forty horse power engine and boiler. On the hurricane deck is the cabin and office for the proprietor, while the cook house, where the men board, is in a corner of the main deck, which is otherwise free for the piling of lumber, the machinery being all below it. This floating mill has so far proved eminently successful, exceeding the expectations of the proprietors in this respect, and is probably the pioneer of numerous craft of the same kind.

### THE WHITE MOUNTAIN HAMMOCK CHAIR.

A strong and simple hammock chair, designed for use in the house, or on the lawn or in camp, is shown in the accompanying illustrations, the smaller figure representing it suspended in a stand, as adapted for use in places where the usual mode of suspending it cannot be followed. Its construction is such that it can be readily balanced in all positions, without needing fastenings to keep it in place, and the foot rest can be adjusted to suit the tallest or shortest persons. The seat is made of strong canvas, and the chair will easily support the heaviest person, while it is so light that an invalid can easily carry it. This hammock chair, with its stand, can be readily removed from place to place, so that the occupant may always choose a resting place in the shade, while it can be quickly taken apart and folded in a compact, portable package for transportation. The Alford & Berkele Co., of No. 77 Chambers Street, New York City, are the manufacturers' agents, and will supply any additional information desired.



HAMMOCK CHAIR STAND.



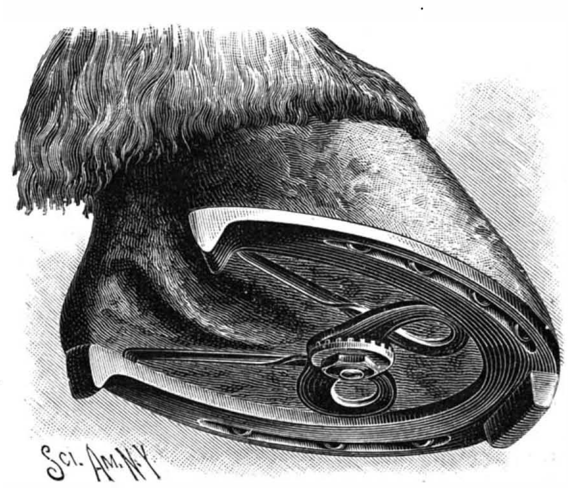
A SELF-ADJUSTING HAMMOCK CHAIR.

### The Gramophone.

At a recent meeting of the Franklin Institute, Philadelphia, Mr. Emile Berliner, of Washington, read a paper on his lately invented apparatus for recording and reproducing musical sounds and speech, called the "gramophone." Mr. Berliner gave a historical sketch of the progress of invention in this field and a detailed description of his own method and apparatus. The speaker illustrated his paper with the aid of the lantern and by the exhibition of the apparatus. He demonstrated its capabilities by recording on one of his prepared zinc plates several songs and speeches, etching the plate, and reproducing the songs and words then and there. Several etched record plates, prepared previous to the meeting, were likewise presented, and the reproducing apparatus faithfully emitted the songs and spoken words recorded upon them. The reproduction was loud enough to be distinctly audible all over the lecture room. The music could be easily recognized. Speech, though not so clearly rendered, was for the most part intelligible.

### AN IMPROVED HOOF EXPANDER.

A device adapted to be placed within the hoofs of horses, inside the shoes, to prevent the contraction of the hoofs and to expand them, is illustrated herewith, and has been patented by Mr. Lawrence Monahan, Jr., of Morris Plains, N. J. It has a thin head, adapted to be received between the toe and the shoe, a pair of spring legs fixed to the head and arranged to be seated on opposite sides of the frog, with laterally projecting prongs to be forced into the sides of the heel by the tension of the spring legs. Instead of making hoof expanders in various sizes to fit different hoofs, as heretofore, the device covered by this invention can be readily adjusted to suit a hoof of any size, the legs, with their respective spring curls, forming two separate sections, on the inner extremities of which are reverse toothed clutch disks, made to interlock with each other, and having central pivot holes with a pivot bolt having a clamp nut on its threaded end. The expander is applied by introducing the spring curls between the toe of the hoof and the shoe, when the legs are sprung to allow the prongs to enter the sides of the heel, and the clamp nut is screwed up to lock the two clutch disks together and hold the pronged legs in position.



MONAHAN'S HOOF EXPANDER.

### AN IMPROVED WINDOW VENTILATOR.

A guard and sash rest, to be applied on the lower portion of a window casing, enabling the lower sash to be supported at such height as will give efficient ventilation through the then separated sash rails, has been patented by Mr. Charles R. Long, of Louisville, Ky., and is illustrated herewith, the arrows indicating the incoming air currents. A pair of weather strips or sections are adapted to rest by their bottom edges on the edge of the window casing, just inside of its grooved sashway, one of these sections having an outwardly extended rib or strip, with dovetailed tongues and grooves designed to engage corresponding dovetailed tongues and grooves in the other section, and permit the longitudinal sliding of one strip upon the other, for extension or contraction, to correspond with the widths of various windows. This strip extends into the vertical plane of the sash, and serves when in position as a support for the sash, the upper edge of both weather strips extending above the rest strip. Lying against the outer face of the weather strips at their end portions, and projecting slightly beyond the ends, blocks about the width of the sash groove are adjustably attached, to permit of being raised or lowered sufficiently to bring their lower edges to the bottom of the grooved sashway when the weather strips are resting on the edge thereof, such adjustment being effected by thumb screws. By still further lowering these end blocks in relation to the weather strips, the latter may be held to support the sash and leave a space along the bottom edge of the strips through which air may enter.

LONG'S WINDOW VENTILATOR.

## THE THIRTY-SIX INCH EQUATORIAL TELESCOPE OF THE LICK OBSERVATORY.

BY JAMES E. KEELER.

The great telescope of the Lick Observatory was mounted in the south dome on Mt. Hamilton in the early part of the present year, and is now, so far as the work of the builder is concerned, practically complated. There still remains the adjustment of all its complicated details, which properly devolves upon the astronomers who are to use the instrument, and the gradual perfecting of which will doubtless extend over a period of many weeks or even months.

The history of this great undertaking, from the conception of the original idea in the restless brain of James Lick to the completion of the actual instrument in brass and steel on the summit of Mt. Hamilton, is so well known that I shall not further revert to it, but confine the present article to a description of the telescope and the machinery necessary for its operation, as they now stand in the dome of the observatory.

The pier of the telescope is a rectangular cast iron column weighing 20 tons, built up of four sections rigidly bolted together. The thickness of the iron is about 1¼ inches. The lower section, which at the floor level is 9 by 5 feet, expands into a broad base, 16 feet long and 10 feet wide, resting upon the solid masonry foundation which forms the tomb of James Lick. This casting weighs 5 tons, and is the heaviest single piece hauled to the summit in the construction of the observatory. On top of the pier is a balcony, surrounding the massive head piece which forms the support for the polar axis. The upper section of the pier, 4 by 8 feet at the top, contains the driving clock. A light iron spiral staircase, running from the base of the pier on the south to the balcony, gives access to the clock room and machinery above, and adds greatly to the appearance of the mounting.

The weight of the pier is distributed over a number of heavy steel screws in the base, which afford means for the exact adjustment of the polar axis, but it is possible that, after this adjustment is perfected, the base will be set in cement and the pier permanently fixed in position.

The telescope is intended to be moved by an assistant stationed on the balcony which surrounds the top of the pier. In the specifications for the construction of the mounting, most of the following mechanical movements or conveniences are called for.

An observer at the eye end can:

1. Clamp in declination.
2. Give slow motion in declination.
3. Read the declination circle (two verniers).
4. Clamp in right ascension.
5. Give slow motion in right ascension.
6. Stop or start the clock.
7. Read the right ascension circle (one microscope).

An assistant on the balcony can:

8. Clamp in declination.
9. Give quick motion in declination.
10. Give slow motion in declination.
11. Clamp in right ascension.
12. Give quick motion in right ascension.
13. Give slow motion in right ascension.
14. Stop or start the clock.
15. Read the right ascension circle (two microscopes).
16. Read a dial showing the approximate declination.

The arrangement of the various devices by which these movements are effected was left to the makers, Warner & Swasey, who designed the entire mounting, with the exception of the eye end, which was made essentially from plans prepared by Professor Langley and Professor Holden. The telescope can also be moved quickly in the ordinary way by the observer at the eye end, although, as the whole train of gearing extending to the balcony must then be set in motion, this cannot be done as easily as if the quick motions had not been provided. A pressure of 10 lb. on the spokes of the quick motion wheel on the balcony will move the telescope in right ascension; a pressure of 20 lb. is required for the motion in declination. The telescope can be reversed, or the same star brought into the field on opposite sides of the pier, in a little over two minutes.

The polar axis is a finely finished shaft of steel, 12 inches in diameter and 10 feet long, weighing 2,800 lb. It is pierced centrally by a 6 inch hole, through which passes a shaft for communicating the motions in declination to the telescope from the balcony. The polar axis turns in bearings of Babbitt metal, but the greater part of the weight on its upper end (some 14 tons) is supported by a collar containing hard steel rollers encircling the axis just outside of the upper bearing, and carried by a lever which leads down into the hollow head piece and can be adjusted for tension. The lower end of the axis is turned to a flat surface, and the thrust of about 8 tons is taken by two rows of hard steel balls rolling in concentric grooves. To the upper end of the axis is bolted the cast iron cylindrical case, 9 feet in length, which contains the bearings of the declination axis.

The declination axis is 10 feet long and 10 inches in diameter, and is also made of steel. To one end is bolted the cast iron central section of the telescope tube. The other end is just outside of the 6 foot declination coarse circle, and carries indexes which point out the approximate declination. The coarse circle is fixed to the declination axis case, and supports the rod which carries the weights for counterpoising the tube. This rod is made of a brass tube shrunk on to a steel core, and the weights, which are in the form of circular disks, travel on a thread cut in the brass. Each disk is 2 feet in diameter and weighs 240 lb. Eight of these disks are required to counterpoise the telescope.

As the indexes of the coarse circle cannot always be conveniently read from the balcony, a dial is fixed to the sleeve of the declination axis where it can always be seen by the assistant, and its pointer shows the declination of the telescope equally with the coarse circle.

The bearing of the declination axis toward the telescope is relieved of the weight of the tube and its attachments (about 4½ tons) by a double counterpoise lever, one end of which carries a collar with steel rollers, like that on the polar axis, the other an annular iron casting weighing 500 lb., which surrounds the sleeve of the declination axis just inside the coarse circle. The steel rollers embrace the axis close to the telescope tube, and as the counterpoise levers are always parallel to the axis, they relieve the same proportion of the pressure on the inner bearing in every position of the telescope.

The center of motion of the telescope, or intersection of the polar and declination axes, is 37 feet 10 inches above the masonry foundation. The sight line of the telescope is 5½ feet from the center of motion, and the end of the rod for counterpoising the tube 12 feet.

The tube is made of hard steel plates riveted together. It was shipped in four sections (besides the cast iron central section), which are connected by bolts through flanges at their extremities. The plates near the middie of the tube are 3/16 inch thick, and the thickness of the sheets diminishes toward the ends, where it is ⅛ inch. The tube is 52 feet long, 4 feet in diameter in the middle, and tapers to a little over 3 feet at the ends. In the shops of the makers it was tested by placing a ton on each end when supported in the middle, and in other ways, the greatest deflection produced being about one-eighth of an inch. The inside of the tube is well blackened and provided with numerous diaphragms, which can be removed when it necessary to work in the interior. It was a curious sight during the erection of the instrument to see a number of painters and other workmen emerging from the end of the tube, like humble-bees swarming out of a hollow stalk.

The object glass, by Alvan Clark & Sons, is secured to a flange on the outer end of the tube in the usual manner. Its clear aperture is 36 inches, and the distance of the focal plane from the back surface of the flint lens is 56 feet. The lenses are 6½ inches apart, and the total thickness of glass traversed by a ray of light is about 2¼ inches. The weight of the objective in its cell is 530 lb. An ingenious machine was devised by Captain Floyd for mounting the objective and photographic lens.

The tail piece at the eye end of the telescope is surrounded by a revolving jacket, provided with position circle, clamp, and slow motion screws, for carrying the spectroscope and other accessory instruments. Clamps on opposite sides of the jacket receive two hollow brass rods 6 feet long and 3 inches in diameter, and any apparatus attached to these can be rotated easily and yet firmly about the axis of the telescope.

The draw tube at the eye end is 8 inches in diameter, and is focused by a wheel surrounding and concentric with the tube. This wheel acts upon three screws, parallel to the telescope axis, which move the draw tube in or out, and allow the heavy micrometer or other instrument to be adjusted to the proper focus with great ease and accuracy. The eye end is surrounded by a steel ring 39 inches in diameter, to which lead all the clamps, slow motions, and other contrivances operated by the observer. The spokes of the right ascension wheels are notched, so that they can be distinguished from the declination wheels in the dark.

There are three finders of 2¾, 4 and 6 inches aperture, and in addition to these, brackets to which the objective and eye end of the 12 inch equatorial can be attached when a finder of great power is desired. The makers are providing a double slide micrometer eyepiece for this or the 6 inch finder, which will enable the great telescope to be pointed at a faint object by means of any neighboring bright star—a contrivance especially valuable for photographic work.

The three microscopes for reading the finely divided circles from the eye end (two for declination and one for right ascension) also pass through this ring. By turning a switch close to the eyepiece of the corresponding microscope, the circle to be read is illuminated by an incandescent electric lamp. Attached to the ring are also a small sidereal clock, a telegraph key for recording the time of an observation, and an electric switch for starting or stopping the driving clock.

A cable containing nine wires for the electric lights, switches, and key leads from the pier to the eye end. It was not considered advisable to introduce the complicated contact apparatus which would be required to make the proper connections through wheels on the axes, and a simple cable is employed, but two safety plugs are inserted where it crosses between moving parts, and their parts can be easily reinserted in case they should draw when the telescope is inadvertently turned too far in one direction.

The driving clock in the top section of the pier is, on a large scale, essentially the same as the clocks employed by Warner & Swasey on their smaller equatorials and chronographs, except that it has an electric control, by which its rate is kept in agreement with that of a standard astronomical clock. One of the arbors which turns in one minute is converted into a chronograph, and connected with the system of electric circuits at the switch board in the long hall of the observatory. The electric control is operated by the relay points of this chronograph, so that any clock recording on the chronograph regulates the driving clock of the telescope. The clock can thus be controlled equally well on either sidereal or mean solar time.

The equipment for photographic work is very complete. The photographic corrector is a meniscus of crown glass, 33 inches in clear aperture, and weighing in its cell 150 lb. When in use it is placed in front of the visual objective, and the focus of the combination thus formed is about 10 feet above the eye end. At this point a large aperture is cut in the telescope tube, giving access to a plate holder capable of taking a dry plate 20 inches square or any smaller size, and provided with all the necessary adjustments. An image of the moon formed here is about 5½ inches in diameter. Instead of a dry plate, a board holding an enlarging lens can be inserted in the plate holder, and a magnified image of a planet projected into a small box camera screwed to the draw tube at the eye end.

The system of counterpoising differs considerably from that used for small instruments. On account of the size of all the parts, it would be very troublesome to readjust the balance by shifting the position of the counterpoises when any change of weight is made. The telescope therefore always carries its maximum load, and when an accessory instrument is added, its equivalent in weight is taken off at the same place.

The most important of the accessory instruments are a filar micrometer by Fauth & Co. and a large spectroscope by Brashear, both admirable specimens of the instrument maker's art.

A few words about the surroundings of the telescope may be in place here. The steel dome, 75 feet 4 inches in diameter, was made by the Union Iron Works of San Francisco. The weight of its moving parts is 100 tons. It is rotated on the plan devised by Captain Floyd and Mr. Fraser, by an endless wire rope which passes around the circumference of the dome, over guiding pulleys, and around a grooved wheel turned by a hydraulic motor in the basement. The dome can be turned completely around in nine minutes.

The slit for observing is 9½ feet wide. It is closed by two steel shutters weighing 15 tons, which are opened by an endless rope hanging inside the upper gallery. A pull of 5 lb. is sufficient to move the shutters.

The hydraulic elevating floor weighs 26 tons, is 61½ feet in diameter, and is movable between fixed galleries through a range of 16½ feet. It is operated by four telescoping hydraulic rams, which have replaced the motors formerly employed for the purpose, their motion having been found inconveniently slow. The motors are retained, however, and can be connected in place of the rams whenever desired. By means of the rams, the floor can be raised in a little less than ten minutes, and lowered in four, with an expenditure of 300 gallons of water. The floor is counterpoised by eight heavy blocks of iron, which slide in vertical columns and relieve the rams of all but two tons of the weight to be lifted. The waste water from the rams and motors runs into a reservoir forty feet below the level of the observatory, whence it is pumped by a windmill back into the high service reservoir which supplies the pressure.

Two small hand wheels on the elevating floor control the hydraulic machinery in the basement. The direction of the motion imparted to the machinery is determined by the direction in which the wheels are turned, the rapidity by the number of turns given to them, thus securing a perfect control. The dome continues to turn as long as its wheel is displaced from the normal position; but in order to avoid accidents to the telescope, the mechanism of the other wheel is so contrived that the floor rises or falls only when the wheel is turning, and stops when the wheel is stopped.

The interior of the dome is beautiful and impressive. The walls are of California redwood, handsomely finished with a dead surface to prevent annoying reflections. The elevating floor and galleries are laid in narrow concentric rings, with ornamental borders of walnut and cherry. The dome overhead is painted pale pea green, the edges of the girders and intercostals and the square tie plates salmon pink, giving an appearance of airiness and lightness to the structure which is in harmony with its movable character.

The somber black with which the great instrument in the center is painted, relieved from absolute deadness by the polished brass work of the fittings, increases the ponderous aspect of the telescope and asserts the dignity of its purpose. I have always been interested in observing the impression made by the interior of the dome on the many visitors who come to the observatory. Even the habitually frivolous become thoughtful when they enter the presence of the great telescope.

It is as yet much too soon to attempt any judgment as to the success with which this instrument will meet the different requirements which have been laid down for it. The great size which makes it most valuable for one class of work renders it unsuitable for another. But few observations have been made; no photographs have been taken, except for correcting the figure of the lens; but the glass has been tested officially by Prof. Newcomb, and pronounced by him and by the Clarks themselves to be as near to perfection as the art of the optician can attain, while the mounting has been inspected officially by Prof. Newcomb and Mr. Burnham, unofficially by Mr. Brashear, Mr. Saegmuller, and others, and has met with their entire approval.

The only actual work which has been attempted is a series of micrometric measurements of the satellites of Mars, made by myself during the past opposition whenever the work of construction would allow; but these observations, although made under the most unfavorable circumstances with an imperfectly adjusted instrument, promise success in this important field of work, while the brightness with which these ordinarily difficult objects appear in the great telescope attests the extraordinary light-gathering power of its objective. Enough has been shown, however, to demonstrate its undoubted fulfillment of the condition imposed in the trust deed of James Lick, that of being "superior to and more powerful than any telescope ever yet made."

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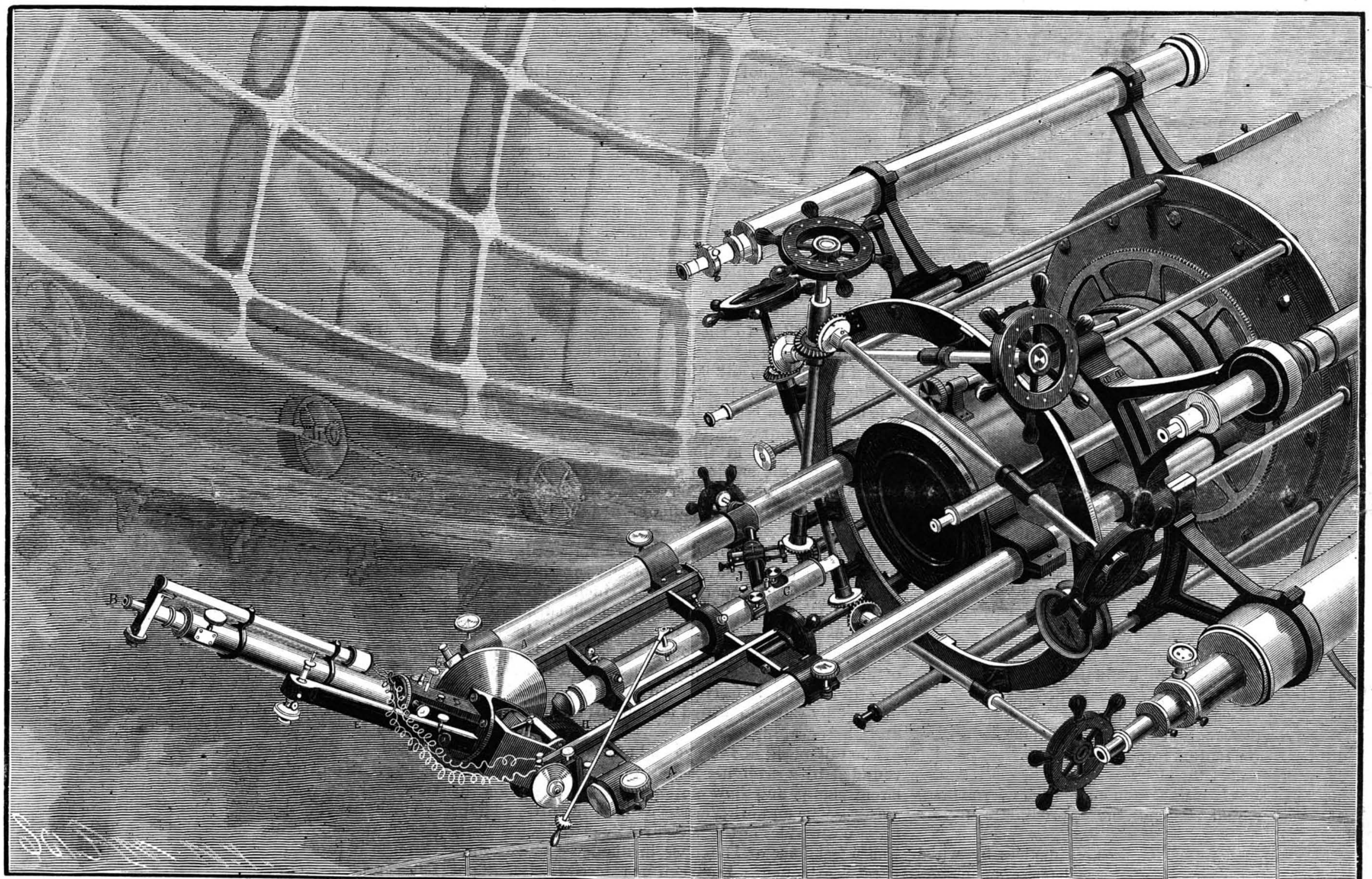
ONE of our contemporaries rightly observes that radical changes in the science of steam engineering have not been numerous in the last quarter of a century, but improvements in the details of construction and operation have been many and of high utility. How important this progress has been in its economical results is indicated by a statement recently made that railway trains in England are now driven at an average speed 14 per cent higher than twenty years ago, with but little more than half the quantity of coal.

### SPECTROSCOPE FOR THE LICK OBSERVATORY.

There has recently been constructed at, and shipped from, the astronomical instrument works of Mr. John A. Brashear, Allegheny City, Pa., a spectroscope of unusual power and completeness. It was forwarded to its ultimate destination, Lick Observatory, Mt. Hamilton, California, there to be employed in astronomical research in connection with the great telescope. The contract for the spectroscope, which was let in December, 1886, called for an instrument of the highest capabilities, and for adaptation to the pursuit of two special studies. These were: 1, the study of the physical constitution of the stars, and, 2, the important study of stellar motion in the line of sight. To conduct the latter study requires mechanical adjustment of the greatest delicacy. The spectroscope in question is of the compound order, *i. e.*, possessed of both prisms and gratings. Of prisms, the instrument includes in its equipment three varieties. Of gratings, it contains one of the largest and most dispersive ever made, showing 46,000 parallel lines, ruled by a diamond splinter upon speculum metal, and so closely placed as to number 14,438 to the linear inch. This number is regarded as the best for general work. The ruling was done by Professor Roland, of the Johns Hopkins University, Baltimore, the plates being made by Mr. Brashear. The power conferred by this grating upon the spectroscope is equivalent to that of at least fifty prisms—assuming it to be possible for that number to be used at once. The office of this vital portion of the instrument is the dispersion of light, thus enabling the observer to define the nature of its source. For the purpose of comparing the spectra of celestial objects with those of known elements (in combustion), a "comparison attachment" forms part of this spectroscope. By its use, and with the aid of the electric current, can be obtained spectra of all gases or metals, which spectra, by means of a totally reflecting prism, can be sent into the spectroscope and there displayed, superimposed on a spectrum of a star or other celestial body. By means of a device invented by Professor J. E. Keeler, of the Lick Observatory, the two spectra can be placed in such exact relations with each other, and these relations and their absolute coincidence or displacements measured so accurately, that the study of stellar spectra, it is confidently expected, will be greatly advanced. The action of this instrument upon light may here be briefly outlined. The ray, proceeding from some infinitely remote body under contemplation, through the 36 inch lens of the Lick telescope, falls upon the slit of the collimator of the spectroscope, thence spreading in a beam that falls upon the lens of the collimator, to emerge therefrom in parallel rays that fall upon the grating, or pass through prisms, as the observer desires. Through the use of a prism, a single spectrum is produced—if the prism is of glass. With the grating, a multiple spectrum is obtained—a result of the highest importance, in that the separation of the dark lines is so much greater that these lines—the indices of the nature of the remote body—can more readily be identified and their significance interpreted. An additional advantage in the use of the grating is the production of a normal spectrum. With the prism the spectra show a compression or "crowding up" at the red end. By means of the observing telescope that forms a part of the Brashear instrument, the first, second, third, or fourth spectrum can be taken up and studied. This powerful instrument will be rigidly attached to the Lick telescope by means of steel projections at the eye end of the larger instrument. Every arrangement has been made for the most delicate adjustment, and for the collimation of all optical parts. Micrometers are employed for reading with the greatest degree of accuracy, and to the 1" of arc, and by the use of delicate and accurate mechanism, the relative qualities of the two spectra—that produced artificially and that from a celestial body—can be studied most satisfactorily. This spectroscope has been tested in the solar spectrum with splendid results, the great B group coming out with remarkable clearness and sharpness.



A A. Steel support rods on end of telescope. B. Observing telescope, 22½ in. focus, 2½ in. aperture. C. Collimator. D. Reversion attachment, containing a Christie half prism and reversion prism. E. Reversion micrometer. F. Prism and refraction grating table. G. Graduated circle and vernier. H H. Counterpoises. J. Electrical comparison attachment.

SPECTROSCOPE OF THE LICK OBSERVATORY.—(From photograph by H. E. Matthews.)

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### How to Use Glue.

For glue to be properly effective it requires to penetrate the pores of the wood; and the more a body of glue penetrates the wood, the more substantial the joint will remain. Glues that take the longest to dry are to be perferred to those that dry quickly, the slow drying being always the strongest, other things being equal. For general use, no method gives such good results as the following: Break the glue up small, put it into an iron kettle, cover the glue with water, and allow it to soak twelve hours. After soaking, boil until done. Then pour it into an air tight box, leave the cover off until cold, then cover up tight. As glue is required, cut out a portion and melt in the usual way. Expose no more of the made glue to the atmosphere for any length of time than is necessary, as the atmosphere is very destructive to made glue. Never heat made glue in a pot that is subject to the direct heat of the fire or of a lamp. All such methods of heating glue cannot be condemned in terms too severe. Do not use thick glue for joints or veneering. In all cases work it well into the wood, in a similar manner to what painters do with paint. Glue both surfaces of your work, except in cases of veneering. Never glue hot wood, as the hot wood will absorb all the water in the glue too suddenly and leave only a very little residue.

### A DWARF ARMADILLO.

In South America, in the stony regions of Mendoza and San Luis, lives a strange little armadillo, discovered in 1824 by Harlan. The colonists have given this singular animal various names. In one place it is called *Juan calado*, "John the pointed," on account of its pointed snout, and elsewhere it is the *pichiciego*, the "little blind one," for it is supposed that, like the mole, whose form and habits it possesses, it must be blind. The scientists of the region call it the *cuirassed mole* and the *Chilian mole*. Naturalists have baptized it *Chlamydophorus*, a word which means "wearer of a mantle," and to this generic name they have added the specific epithet of *truncatus*, for, in fact, the animal appears to have lost the posterior extremity of its body. There are armadillos of all sizes, from the giant *Priodontus*, of Paraguay whose length exceeds five feet, to the nine banded species, which is about eighteen inches long; but there is none smaller than the truncated chlamydophorus, the largest specimens of which do not exceed five inches in length. In our engraving this latter is shown of natural size. Among all the members of this family of armored animals there are certainly some that are better protected. Many have a completer shield, recalling those armors of overlapping plates formerly worn in the lists in fighting on foot.

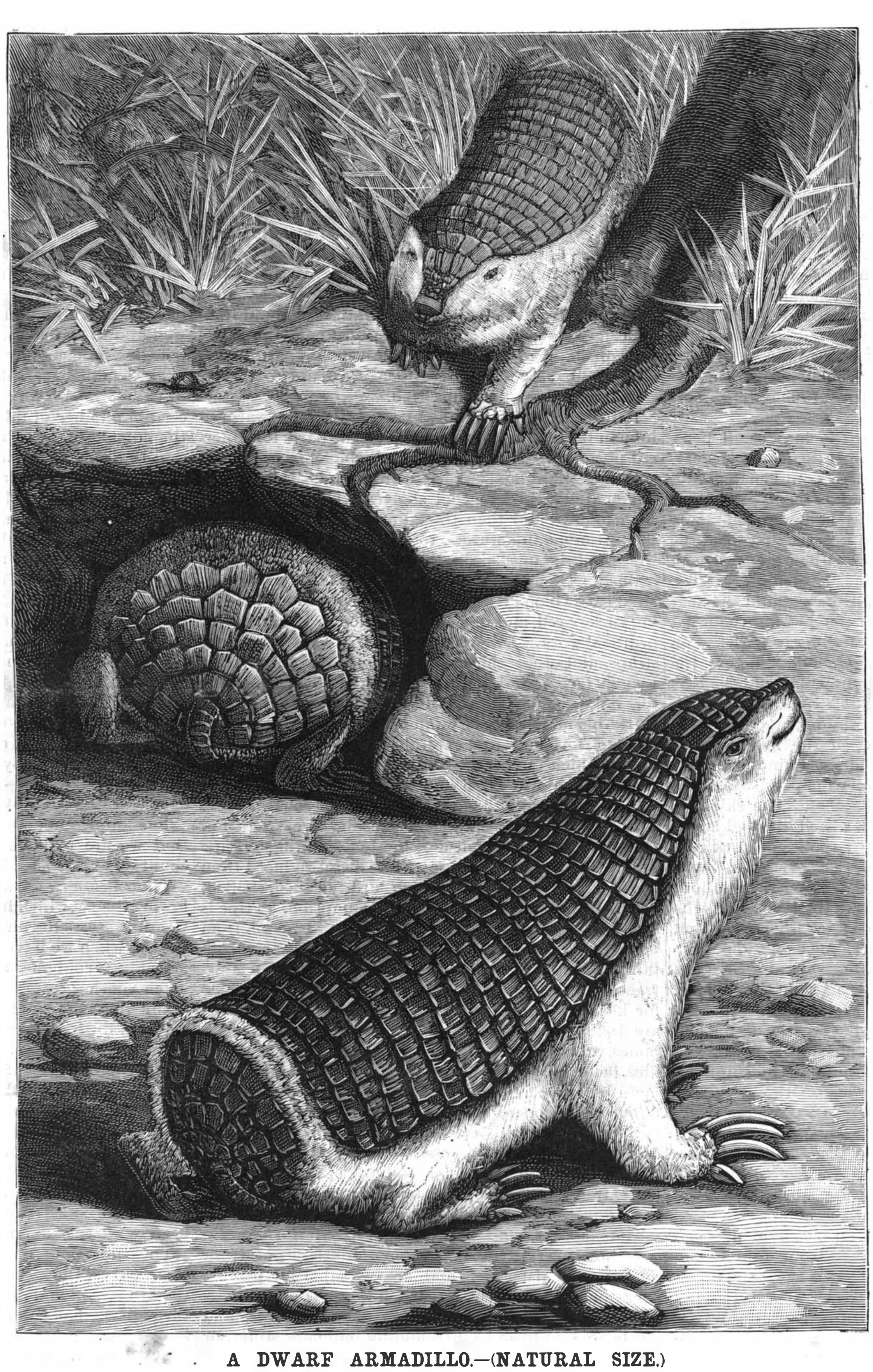
The truncated chlamydophorus is lightly armed. Its short head, which is strongly convex behind, terminates in front like a sharp cone, and is covered above by a portion of the carapax that extends over the entire back.

This armor is a solid bony plate (with polygonal divisions) in the shape of a rounded shield, having in the center of its posterior end an aperture, through which emerges a short tail with an enlarged extremity. The rest of the body, with the exception of the tail, the sole of the feet, the chin, and the snout, which are naked, is covered with long, soft, fine, yellowish fur. The short, stout legs are remarkably adapted for digging, especially the fore ones, the feet of which are armed with five large and strongly curved claws. The hind legs, which are not so strong, have likewise five toes to the foot, but the claws are not so strong, and are obtuse, straight, and flat, while those of the fore feet, in the form of a scythe blade, and sharp on the external edge, increase in size from the second toe to the external one, which latter is provided with a wide, flat claw.

The dentition is really that of an armadillo—eight to ten pairs of teeth to each jaw, with neither incisors nor canines. The molars, which are covered with enamel, have no roots and are hollow in the lower half. The one in the center of each row is the largest; the others diminish in size to each extremity. The mouth, which is very small, opens beneath the pointed snout. The latter, which is cartilaginous, recalls that of a hog in miniature. The tongue is long, fleshy, and covered with papillæ.

To consider it more closely, the carapax is of a horny consistency, of a whitish or dirty yellow color, quite thick, and consequently not very flexible; but the bending of the body is favored by the manner in which the bands are articulated. In fact, each band is united to its neighbor by a membrane that permits of a certain extension, so that this cuirass, formed of intricated segments, does not prevent the animal from rolling itself up into a ball. The dorsal carapax is formed of twenty-four transverse bands, each composed of seven or eight scales, then of fifteen to seventeen, and eighteen to twenty-four, in measure as they approach the posterior region, the body progressively widening from the shoulders to the pelvis. These scales are irregular and tubercular in the anterior region and regular and rectangular in the posterior.

The armor that covers the extremity and forms a right angle with the rest of the body is inflexible, and consists of five or six concentric rows of scales arranged in a semicircle, and each of them being square or lozenge-shaped. The upper and largest row is made up of twenty scales, and the smallest consists of but six. At this point the tail emerges, and is attached to the armor of the rump by a membrane. This armor is united with the pelvis and firmly connected with its apophyses; but the dorsal portion does not adhere so firmly to the back of the animal, the plates being attached to the body only along the spine, through a membrane. The frontal region of the carapax is firmly attached to the cranium, and, further behind, the plates are fixed by two scales to projecting eminences over the eyes. The immovable part of the cephalic carapax is formed of two transverse rows of four plates each, and of three others of five plates.



A DWARF ARMADILLO.—(NATURAL SIZE.)

The animal's eyes are very small, and are partially covered by the hairs of the face. There are no ears. The auditory canal opens in a narrow orifice surrounded by a cutaneous fold.

It is not yet known with certainty what the animal's habits are. Doubtless, like other armadillos, it lives upon insects and worms, and perhaps also upon the tender roots and bulbs that it finds in the course of its underground burrowing. It is a nocturnal animal, seeking desert and uncultivated places.

According to Goering, the traces that this singular animal leaves upon the ground are characteristic. Since, in walking, it drags its feet instead of lifting them, it leaves on the ground two continuous furrows that are readily recognized. The entrance to the burrow has, too, a special conformation. On coming out, the animal throws to the right and left the earth that incommodes him, and probably sweeps it with his paws. This earth forms a hillock on each side, and between these is a passageway. No other South American mammal has such a habit.

The truncated chlamydophorus is far from being well known. It appears to be nowhere common, and, as the natives make no use of it, they do not hunt for it.

The skeleton of the animal exhibits remarkable peculiarities. The pelvis is strong, and the legs, which are robust, with flattened femurs and humerus, show by the insertion-apophyses the power of the muscles that cause them to act. This remarkable genus is separated from the armadillos by a great number of features. The chlamydophorus (says Oscar Schmidt, in a recent publication), which inhabits the regions near La Plata, differs so much from the armadillo (*Dasyphus*), properly so called, despite the appearance of relationship, that between these two genera there must have been quite a series of transition forms whose evolution required no less than several geological periods. The German scientist, who is a warm partisan of Darwin's doctrines, thinks that it is necessary to go back to the tertiary period to evolve the chlamydophorus from the armadillo.

Carl Vogt remarks that by the strong conformation of its limbs, and other peculiarities of its skeleton, the animal under consideration more closely approaches the extinct gigantic animals of the group of megatheriums and allied forms than does any other living edentate.—*La Nature.*

### Trial of the Maxim Gun.

A portion of the official report of the Austrian war office on the trial of the Maxim gun has been issued. From this it would appear that the preliminary trials of last July established the superiority of the Maxim system over all others, both as regards rapidity of fire and ease of manipulation, and thereupon the Austrian government ordered exhaustive experiments to be made, which included tests for range and accuracy at distances from 200 meters to 1,575 meters, and tests for strength and durability. The results showed that the accuracy of the Maxim gun is superior either to the two-barrel Gardiner or the five-barrel Nordenfelt. For testing durability, series of 334 rounds, fired consecutively, were almost exclusively used, and an average speed of ten rounds per second was obtained, not only with the greatest elevation and greatest depression, but also when traversing the gun laterally through the greatest angle that the mounting would allow. In all, 13,504 rounds were fired, and the report states that, on the whole, the gun behaved extremely well, the loading and firing mechanism operated faultlessly, and, if certain reserve parts are supplied, and the buffer spring made stronger, the durability of the weapon would be guaranteed under all circumstances. After 6,356 rounds had been fired, the weapon was tried for accuracy, at a target 2 meters by 3·6 meters, at 600 meters range, and an excellent diagram obtained. The 11 millimeter rifle cartridge (model of 1877) was used, and trials of the barrel with English Henry rifling did not show any advantage over that of the Werndl barrel. The report is signed by Colonel H. Huffzky.

### Removal of Old Varnish.

A Mr. Myer has just patented, in Germany, a composition for removing old varnish from objects. It is obtained by mixing 5 parts of 36 per cent silicate of potash, one of 40 per cent soda lye, and one of sal ammoniac (hydrochlorate of ammonia).

### Beef, Blood, and Bones.

Hammond, Ind., would not be much of a place without that great cattle slaughtering establishment, the Hammond Packing Company. This firm, on an average, kill a thousand head of cattle per day, six days in the week. This mighty procession of animals surges forward, accompanied by the sound of the trampling hoofs, hoarse bellowings, and tossing heads of the massive beasts doomed to die for the nutrition of mankind. The scene outside the packing house is, in one respect, instructive and suggestive. Shambling around in pens outside the packing house, the uneasy creatures are kept waiting for certain barred gates to be opened and apparent liberty regained. Beside these pens a small streak of dense-looking liquid trickles lazily to a broad stream of water in the distance. Between these cattle and the muddy stream stands one huge connecting link, and that is the great, solid-looking slaughter or packing house. The beasts march in at one end of it, and of all that mass of beef, blood, and bones, nothing is thrown away or wasted, except that little, muddy stream, which is the geometrical difference between the slaughter house and the cattle—the useless residue of a great industry.

The Union Stock Yards Company, of Chicago, occupy 360 acres of land; the Hammond Company owns 90 acres in and around its works.

Let us follow the different operations of killing and dressing under the tutelage of S. F. Fogg, superintendent. Dinner is over, lunch cans are placed aside, brawny arms are bared, and gleaming knives are hastily resharpened. Boys with long poles go to the pens, open the gates and drive the required number of steers to small inclosures, right close to the butchering shop. From this inclosure they are driven along a narrow lane, just wide enough for them to march in single file.

Presently, doors divide the cattle into small pens, and there they stand in a dumb state of visibly nervous apprehension. A strong, active young man climbs up and walks on boards by the side of the tops of these pens. He carries a long-handled hammer, commonly known as a poleax. Stepping up to the first pen, the imprisoned steer looks upward with large, terrified, rolling eyes, as if suddenly conscious of danger. Too late. The vigorous arms skillfully swing, and the next minute the hammer crashes on the head of the beast between the eyes and horns, stretching it senseless on the ground with a dull thud. On and on goes the slaughterer, never halting or hesitating, and the lane of live stock, in a remarkably short time, is a lane of stunned carcasses, ready for skinning and dressing. The butchers' assistants now open the inside doors, and, attaching a strong iron chain to a hind leg, rapid machinery drags the animals from the pens, which are speedily reoccupied by other batches. The skinning is a wonderful example of regular, well directed labor, each man having his specially appointed work and doing nothing else. First comes the "sticker," who cuts the throat and collects the blood in shallow, wide, circular pans. Then follows the "header," who skins the head, next men who attack the front foot, hind foot, belly skin, leg worker, men on sides pulling out the caul, men cutting hams, chopping briskets, cleaning out throat, man rubbing right hand side, man on left hand side, man who catches the film, backer, one who splits, emptying cattle of nucleus of fronts, man to drop hide, splitter of necks and trimmer of inside, trimmer on outside, finishing up with five washers to carefully cleanse the quivering beef with clean water, and pass it to cool places ready to be moved to the immense refrigerators, where it hangs for 48 hours before being loaded into the ice-cooled freight cars. Thence it is rushed to cities in America and to steamers, waiting to be conveyed across the Atlantic.

Let us see, now, about the parts not used as beef. The steer is hanging by a leg to a strong iron chain, and the hide strippers are busy. It is the rule in all packing houses for special men to skin special parts of the hides, and this is one reason why packer hides are so strictly alike in trim and take off, and why the tanners are usually willing to pay a cent per pound more for these hides than for those taken off in the country towns. The hide, then, is thrown into the hide cellar, a cool, pleasant place in the Hammond house, 250 feet wide by about 300 feet long, with another one in progress of building. The first thing the cellar men do is to sort the branded and unbranded green hides into separate piles, and it is remarkable how expertly and rapidly this is done by the old hands. Next comes the salting and packing away in piles. Coarse Syracuse salt is used in preference to all other kinds. It takes about three weeks in summer and four weeks in winter to thoroughly cure hides, although when tanners are in a hurry a little less time is given by mutual agreement and by using necessary precautions. Hides containing four grubs and under, if satisfactory in other respects, are classed as No. 1's. No. 2's have five grubs and over, and are sold for one cent per pound less than No. 1. This is the regular rule; also, all cut hides go as No. 2.

H. C. Tillinghast & Co., of Chicago, who have entire control of the Hammond hides, have these hides swept clean of salt, and then allow to purchasers a tare of 1¾ pounds per hide on winter kill and 1½ pounds on summer hides. Butt-branded steers are picked out of native cattle, most of which sort are found in receipts from Nebraska. Texas steers are not selected for brands, as these cattle are so universally afflicted in this respect. Texans are grubbed for No. 1 and No. 2, same as native hides. The system of grubbing is an ingenious and time-saving arrangement, mutually accepted by seller and buyer. When a tanner orders hides, about twenty are taken at random from each car load, when made up, and selected for grubs. Suppose, out of these twenty steers, five are found to have five or more grubs, this makes them No. 2's, and the twenty hides then stand at a rate of twenty-five per cent No. 2 and 75 per cent No. 1. If this percentage is considered a fair representation by the experienced men looking after the interests of packer and tanner, they agree to call the car load of hides (say 600) as 25 per cent No. 2 and 75 per cent No. 1. If either party objects, a second batch of twenty is sorted by the tanner, who may chance to find ten No. 2 hides, or 50 per cent of the lot. If the packer thinks this is hardly as it should be, a third score of hides are picked over, and, whatever the result, it is accepted as a finality. This seems to be a kind of lottery arrangement, but it does away with the need for scratching and examining all of the 600 hides for the car load, and each car load is separately thus sampled. It is estimated that these green hides shrink in weight 20 to 24 per cent after being cured. H. C. Tillinghast goes to Hammond from Chicago every day, and personally directs the whole hide business of the Hammond company, to which is also added 350 to 400 hides per day, sent from their slaughter house at Omaha, Neb.

Returning to the skinned beast, we find a swarm of human bees taking away the different parts for different purposes. The first run of the blood from the cut throat of the animal is collected in round, shallow pens, which are trucked to cool shelves, where coagulation soon follows, and then the albumen is dried and sold to button manufacturers, to be speedily made up for the use of the unsuspecting public, who are thus blood stained, as it were, in a highly artistic fashion. Coagulated cattle blood is also used by calico printers for dyeing turkey red, and in the preparation of red liquor for printers' work. Dried blood serves to clarify wines, sirups, and other thick solutions. In Scandinavia it is made into a kind of good bread for the poor. Doctors have recommended the drinking of warm, fresh cattle blood in cases of pulmonary diseases.

From the heads are carefully taken small pieces of meat, which go to the sausage factory. The horns find ready sale to comb and knife haft makers, being softened by heat and moulded into numerous articles. The guts, after scrupulous cleansing, are packed in tierces and shipped to dealers in sausage casings. Tripe is a nutritious and cheap food, and it is produced from the animals' stomachs, which are cleaned, boiled, scraped, and placed in kegs for consumption. Tripe is sometimes pickled, according to the demand from buyers. The legs are steamed for what glue they contain, and also to soften the hoof, from which is extracted the celebrated neat's foot oil, which is valuable for keeping shoes soft and waterproof. These hoofs are finally ground up and sold to fertilizers. The shin bones, after being boiled, are in request for knife handles, being shipped to Europe. The Sheffield manufacturers in England convert these shin bones into handles for spoons and knives, backs for tooth and nail brushes. The jaw bones are sawed in two, in order to extract every possible vestige of glue from them. To go to the other end of the animal, even the extreme portion of the tail is cut off and sold to the manufacturers of curled hair.

The bladders, when dried and prepared, form useful coverings for the transportation of glazier's putty, for oilmen, druggists, etc., and are valuable for placing over the jars in which the careful housewife lays away her preserves and pickles. The kidneys, liver, and lights are sold fresh to surrounding butchers' stores, or sent in refrigerator cars to distant points. The tongues are cunningly curled, put into air tight cans, and find their way to many a village at home and abroad, where they are useful for picnics and cold collations.

Hot tanks are great levelers, and every scrap of sinews, loose bones, or small rough pieces is boiled down to threads and fragments, and the liquor, when drawn off and cooled, produces glue or other available material. Even the dirt and residue at the bottom of the tank is sold as "tankage" for fertilizing, and refuse blood is eagerly collected and turned to account in refineries.

Now we come to the utilization of the fat. Oleomargarine has outlived a good deal of the abuse to which it was subjected when first introduced to a people suffering under imitations of everything except air, fire, and water. It is now a cheap and acceptable article of food, and, if honestly made, a satisfactory addition to diet. The oleomargarine department of the Hammond packing house is conducted similarly to a dairy, though it isn't one. No cows are to be seen pressing their fragrant noses against rustic gates. No bustling farmer's wife is there with red, bared arms, directing trim, plump dairy maids. Even the surreptitious cat is missed, and there is no sound of the watch dog's honest bark, which Byron declared it was "sweet to hear." Oleomargarine is made as follows: The caul and best parts of the fat of the cattle are boiled down to a thin, transparent oil. Fresh milk is brought every morning to the packing house for mixing with this beef oil. The milk and oil are poured into the churn together, and a little pure prime lard is added to cause the mixture to flow more easily from the churn, which is driven rapidly by machinery till the yellow globules separate. This semi-liquid mass drains into a large ice cooler for a short time. Then these globules are taken and kneaded together carefully, drained, and the mass is salted by special machinery with good, clean, English dairy salt. The oleomargarine is colored by common annatto seeds, as used in all dairies, and thus prepared is put into clean white linen cloths by neat-looking girls, and, as ready for sale, is difficult to distinguish from real butter in taste or color. It retails at 15 cents per pound. 40,000 pounds per day of oleomargarine is made at Hammond, Ind. After the first boiling of the beef fat, the residue is wrapped in thin linen cloths and placed under hydraulic pressure, which forces out the remainder of the oil. Before pressure the fat passes through "hashers," which render the after process more effective. This fat, after being under the hydraulic machine, comes out quite white and firm, and is called stearine, a well known article used by candle makers and tanners.

Tallow is made by boiling the rough pieces of fat.

The ox tail meat and bones constitute the chief luxuries obtained from cattle. Each car of beef carries a certain number of tails, which are mostly bought by the hotel keepers. Prior to 1685, the London butchers sent the tails to the tanners with the hides, and even during the past 20 years the men employed in English tanneries used to find these tails in the hides and take them as useful perquisites. French refugees 200 years ago taught the world to utilize this valuable and nutritious food. Even the udder from a young dry cow, when nicely corned and boiled, is very good eating. The ox gall is used for liniments, for the mixing of paints, cleaning clothes, carpets, etc.

The Hammond company carry a steady stock of 150,000 tons of ice, in two large ice houses. They cut and store from the Calumet River. About 600 men and boys are employed, and work progresses year by year in that small, busy town, free from labor troubles or anything tending to disturb the good feeling between emplo ers and employes.—*Shoe and Leather Reporter.*

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### Will This be a Hot Summer?

The impression seems to prevail, pretty generally, that we are to have a hot summer throughout the country.

The *Indiana Pharmacist* predicates it upon the following theory, which has been advanced by others: The weather seems to run in cycles of about seven years, that is, when we have a hot summer, it is always followed by a cold one, and it takes about seven years to reach another equally hot. It will be remembered by many that the summer of 1867 was very hot, and so dry that during August the grass crumbled under the feet when trod upon. The summer of 1868 was noted for its coolness, the thermometer very seldom getting above 85°, and we did not reach the top wave of thermality again until 1874, when it was extremely hot. The following summer was cold to a remarkable degree. From then on the summers grew gradually warmer until 1881, which was excessively hot and very dry, no rain falling for over nine weeks, and there were more sunstrokes that summer than there has been in all the summers since.

The summer of 1882 was quite cold, a few flakes of snow fell on the morning of July 4, followed by hail in the afternoon, and during the rest of the month and through the month of August the temperature was so low that overcoats were necessary for comfort, particularly at night. The summers since 1882 have grown warmer and warmer, and last summer was a moderately hot one, but unless all signs fail, the coming summer will be the climax of the cycle, and a hot, dry season may be expected. So far this spring the signs have been against the theory here advanced, but possibly the coolness of the spring may be succeeded by a regular old scorching summer whose temperature will rival sheol for hotness.

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### Torpedo Fired by Lightning.

A letter from a special correspondent with the Italian forces in Abyssinia contains an account of an explosion of a torpedo by lightning. The torpedo consisted of a glass bottle charged with powder and scrap iron, fitted with a detonator to which a wire was attached. Several of these were scattered for purposes of defense in front of the battery of guns, the discharging wires being at the battery. It was found, so it is said, that lightning passing along the wire had produced the explosion.—*Electrical Review.*

## SPIRALLY WELDED TUBING.

At the recent meeting of the American Institute of Mining Engineers, Boston, Mr. James C. Bayles read a paper on the above subject, an abstract of which we give from *Engineering:*

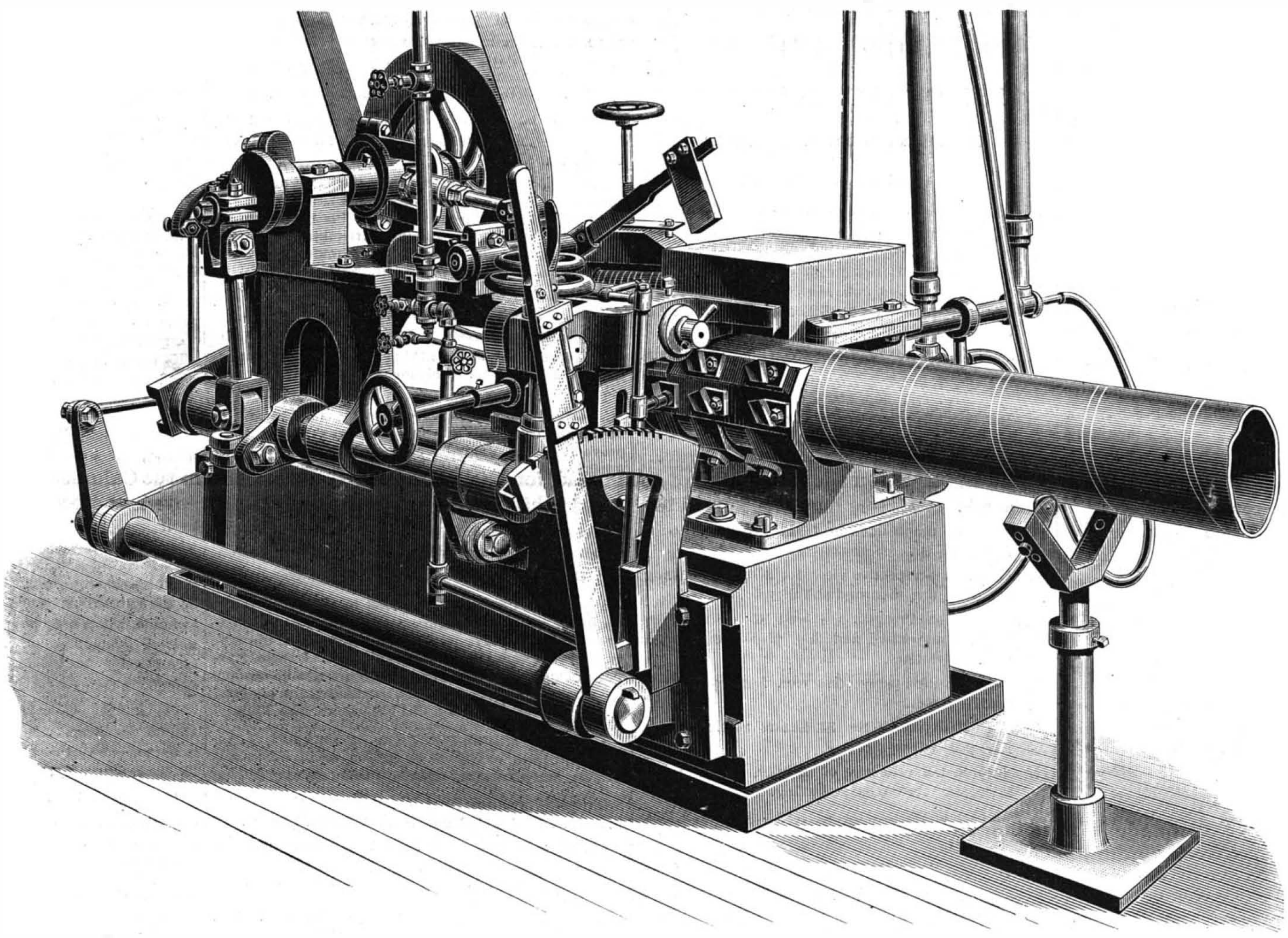
According to the first process described, namely, that adopted by the Spiral Weld Tube Company, of Orange, New Jersey, the tubing is made from strips of steel or iron skelp, which are wound spirally and heated along the overlapping edges, the welding being accomplished by hammering. The tube made is of uniform diameter, and its length is optional, being only limited by convenience of handling and transporting. The sizes range from 4 in. to 30 in., and it was stated this could be increased to any required size. Of the thickness of metal, the lightest used was No. 29 iron, and the heaviest No. 14 steel.

The metal is slit in widths varying with the desired diameter of the pipe—thus for 6 in. pipe 6 in., 8 in., 10 in., or 12 in. skelp is used. Of course, the widest possible skelp makes the pipe more rapidly. Using 8 in. skelp, 8·175 in. is added at each revolution in a 6 in. pipe, and with 12 in. skelp 14·59 in. In practice, it has been found more convenient to use 6 in., 12 in., 18 in., and 24 in. for the width of the skelp, and in the case of long pipes the ends are united by lap welding.

A ribbon 49 ft. long, for instance, is used in making a 30 ft. pipe 6 in. in diameter. In welding, the sheets are so placed as to have a ½ in. lap. They are clamped in this position, and the heat is applied above and below from movable furnaces along the seams; then a vertical hammer acting against an anvil with a reciprocating motion makes the weld, the whole process occupying about a minute to each cross section. Pressure rolls smooth out any inequality in the hot metal, and the latter is trimmed by rotary shears. In case of a defective weld or failure of the shears to act in the proper line, the weld is cut by a shear suspended by a counterbalance when not in use, and a new weld is made.

The pipe machine proper—of which we give a perspective view on the present page—occupies about 3 ft. by 6 ft. of floor space. One end of the ribbon of skelp is placed upon a guide table, which is set at an angle varying with the width of the skelp and the diameter of pipe into which it is to be made. The metal is carried into the machine between feed rolls geared together and actuated by a ratchet, giving them an intermittent rotation, and a rate of feed variable between ⅛ in. and ⅝ in. at each impulse, at the pleasure of the operator. The ratchet then carries the metal to the forming jaws, which bend it to the desired curvature.

The guide table for the skelp is adjustable to any desired angle, and this is one essential feature of the machine; another consists in the rolls which pass the skelp forward, a process so arranged that it moves when the hammer is raised and stops at its fall. There is also an adjustable former to shape the metal to its proper diameter, and finally the movable furnaces, and the hammer and anvil. No mandrel is used in this process, but the pipe is held in place by a pipe mould, and rotates inside of it as the stock is fed in. The anvil is quite heavy and steel faced, but the hammer is light and strikes about 160 blows to the minute. The lever and notched sector seen at the side of the engraving regulate the feed. The heating furnace heats both edges of the skelp at once, and is kept a few inches in advance of the point where the welding is being made. The heating is effected by one or two blowpipes of water gas and air, two being found to work better than one, as they heat the metal more rapidly, and admit of a faster rate of feeding. The speed varies with the thickness of the metal fed, and the relation of the width of the skelp to the diameter of the pipe. The present average is about 1 ft. per minute, although more rapid progress is expected. One strong feature of this process is that it requires but little skilled labor. After the pipe is finished it is treated with asphalt, and after testing is ready for sale. Another method of making spirally arranged pipe was described as being employed by the Providence Steam Engine Company. Two ribbons are used which lie over a mandrel, the ribbons overlapping for half their width, so that the pipe consists of two thicknesses. These are not welded, but soldered together by means of a bath into which the mandrel dips as it revolves, thus putting a thin coating of solder on the strips, which are at once soldered together by the pressure of the winding.



MACHINE FOR MAKING SPIRALLY WELDED TUBES.

## New Petroleum Engine.

Interesting reports have been presented on Messrs. Priestman's engine by Sir William Thomson, F.R.SS. L. & E., LL.D., M. Inst. C. E., Sir Samuel Canning, M.Inst.C.E., Boverton Redwood, Esq., F.I.C., F.C.S., and by Messrs. H. Alabaster, Gatehouse & Co.

Sir William Thomson says: I have inspected Priestman's petroleum engines (made under Priestman's, Humes', and Eteve's patents), at their works, Holderness Foundry, Hull, where I found six engines all working with common petroleum, of gravity about 800. In one shop I saw a 4 horse power petroleum engine doing ordinary duty in a perfectly satisfactory manner, I am informed, in place of a semi-portable engine and boiler, which has now been entirely dispensed with for some months past.

Another shop, containing lathes, etc., is being driven constantly by a smaller engine. This is similar to another engine supplied by the makers to Messrs. Richardson Brothers, of Newcastle, which I had previously inspected in Newcastle, and found working very satisfactorily. A small double cylinder engine has been mounted upon a truck, which is worked on a temporary line of rails, in order to show the adaptation of a petroleum engine for locomotive purposes, on tramways, and in my opinion there is a great future for this engine in that important direction. I was shown a launch in progress, designed for being driven by petroleum, the engines for which were also in hand.

The exemption from boiler and "getting up steam," and from need for fresh water supply for the boiler, and the smallness of the weight of the fuel in proportion to duty done in Messrs. Priestman's petroleum engines, and the convenience for stowing the oil in tanks in the bottom of the boat, give what seem to me important advantages to these engines in comparison with steam engines for launches and small steamers in many places, and for varied applications. I made careful tests on a 6 horse power engine. After seeing it started and stopped several times, and kept running on the brake for an hour at 7¼ horse power, and for two hours at 6 horse power, without measuring the oil, I gave it exactly an hour's run with the brake loaded slightly more than for 6 horse power, and with arrangements to measure the oil accurately.

The result was that the engine ran with very admirable regularity at from 158 to 160 revolutions, doing 6·43 horse power on the brake. The quantity of oil used was very exactly 11 pints, being at the rate of 1·71 pints per hour per brake horse power,* or 1·69 lb. per hour per brake horse power, which seems to be remarkably good economy, considering the great difficulties which had to be overcome in using the combustion of oil directly as a motor. It must be noted that these results refer to the horse power of work actually done externally by the engine, and not merely to "indicated horse power," which in the steam engine, and still more in the gas engine, falls short of true horse power by a large difference.

Messrs. Priestman's engine, unlike one upon another system to which my attention has been called, does not use only the lighter portion of the oil, leaving a large residuum which cannot be utilized, but has the great advantage of consuming the whole of the oil put into the cistern, which I verified by careful examination of the working of the engines which I tested. Messrs. Priestman's engines are simple in construction, and there are few working parts liable to get out of order. By a new and effective mode of regulating the supply of vapor to the cylinder, combustion so perfect is obtained that deposit of carbon in the cylinder and passages is most satisfactorily obviated, as I have myself verified by careful examination. As the engine is governed by reducing the charge admitted into the cylinder, instead of cutting off the supply, the explosion takes place with great regularity, thus securing steady running with or without load, and with varied loads, which, judging from my own experience of the irregular running of gas engines running at anything less than full load, is a very important advantage. Some of Messrs. Priestman's engines are fitted with a combined circulating water tank and pump, obviating the necessity of having a separate tank with overhead piping, which in many cases is objectionable. The piston requires no oiling, as the vapor admitted into the cylinder lubricates it sufficiently. As this engine has all the advantages of a gas engine, without being dependent on gas works and a gas supply, it is available for many important applications from which the gas engine is precluded.

## Succi, the Fasting Man.

The Accademia Medico-Fisica of Florence has just given a diploma to Signor Succi, on the occasion of his having completed his thirty days' fast. The document runs as follows:

"We, the undersigned, do certify that Signor Giovanni Succi, of Cesenatico, in the Romagna, African traveler and explorer, has completed at Florence a fast of thirty days—from the midnight of the 1st to the midnight of the 31st of March of this year—subjecting himself to all the regulations imposed by the Committee of Surveillance created *ad hoc*, and to all the scientific observations of the commission nominated by this Academy, the results of which will be made *publici juris* at as early a date as possible. We further declare that by his courageous experiment, and by his scrupulous fulfillment of every moral pledge undertaken by him toward us, Signor Succi has deserved well of science." Then follow the signatures of Professor Angiolo Filippi, President of the Committee of Surveillance, and of Dr. Vincenzo Crapolo, his secretary, of Professor Luigi Luciani, President of the Academy, and the secretary of its proceedings, Dr. Aurelio Bianchi.—*Lancet.*

* This equals about 0·85 of a pint per indicated horse power per hour.—P.B.

### ENGINEERING INVENTION.

Heating railway cars forms the subject of a patent which has been issued to Mr. Carter S. Townley, of Gainesville, Texas. A pipe opening to the air in front of the locomotive passes through the steam space of the boiler, and is thence connected by proper couplings with heating drum in the car floors, similar connections being also made with chambers containing calcined line or other chemicals, to dry and heat the air, the current of which is aided by an injector entering the pipe as it passes through the boiler.

### AGRICULTURAL INVENTION.

A hillside cultivator has been patented by Mr. Edgar C. Wiley, of Independence, Va. Combined with a central beam are side beams having a pivotal and sliding connection therewith, with other novel features, whereby the plow shanks can be adjusted to throw one share in front and the other to the rear, and *vice versa*, that the front plow may be kept on the lower side, the second plow filling the furrow of the first.

### MISCELLANEOUS INVENTIONS.

A churn has been patented by Cyrus M. and Etta E. Dickey, of New Garden, Ohio. This invention covers a simple and inexpensive rocking churn, which may be operated easily and will bring the butter quickly, while it is not liable to get out of order, and may be conveniently and thoroughly cleansed.

A fire escape has been patented by Mr. William Block, of St. Petersburg, Russia. It is light and strong, and adapted to be quickly and securely attached to any form of support, being made preferably of steel wire, the invention covering various novel features of construction and the combination of parts.

A covering for pipes, boilers, etc., has been patented by Mr. William M. Suhr, of Brooklyn, N. Y. It consists of a filling of asbestos fiber, mineral wool, or similar non-combustible material, inclosed in an asbestos paper covering, lined with a wire netting, being designed to prevent loss of heat and to render buildings fire-proof.

A utensil head for canes, etc., has been patented by Messrs. Moritz Stiebritz and Adolph Miller, of Schuetzen Park, N. Y. It consists of a box for matches, with an outside lid and inner cover, and a match igniter outside the inner cover, the latter being also adapted to hold a mirror or photograph on its inner face.

A collection box has been patented by Mr. Ferdinand A. Kittell, of Hollidaysburg, Pa. It has an upper tilting bottom, a lower bottom, and a rotary supporting handle adapted to upset the tilting bottom, the arrangement being such that each deposit made in the box may be separately inspected by the collector.

A device for loading vehicles has been patented by Mr. William B. Dolsen, of Moberly, Mo. This invention covers a novel combination and arrangement of parts in a hoisting apparatus arranged in combination with the vehicle, whereby the team may be utilized in lifting and placing the load in farm or mercantile wagons.

A grain cleaning cylinder has been patented by Mr. William P. Clifford, of Ottumwa, Iowa. It consists of an upper and lower section, the former being of shorter radius, and forming longitudinal inlet and discharge openings, in combination with a beater, and other novel features, whereby the grain can be subjected to any required amount of cleaning.

A can filling machine has been patented by Mr. Conrad Seimel, of Brooklyn, N. Y. It is especially adapted for filling cans to contain Paris green and similar powders, filling the cans rapidly and shaking down the contents in such manner that the dust will be prevented from escaping, while the cans will be made of uniform weight.

A bell cord attachment specially adapted for use in street cars has been patented by Mr. George W. Naylor, of Jersey City, N. J. The invention consists principally in pivoting a lever to the window frame and securing one end of the lever to the bell cord in a novel way, whereby the bell cord may be readily and easily manipulated from the seat.

A coin controlled height measuring machine has been patented by Mr. Charles R. Williams, of Newark, N. Y. It is made with a vertically sliding pointer to be moved up or down by a person desiring to determine his height, with a plate held in front of the pointer and operated on by the introduction of a coin of a given size and weight.

An ink mill has been patented by Mr. T. Ruddiman Johnston, of Edinburgh, Scotland. This invention covers a novel construction whereby the several parts of the mill are rendered easily accessible for cleaning purposes, and the amount of attendance necessary is reduced, while a better grinding of the ink is secured.

A temperature regulator for incubators has been patented by Mr. John W. Hile, of Valley Falls, Kansas. The invention consists in the arrangement of metal plates coupled together around the inner sides of the incubator walls or drawers, whereby the damper or vent will be operated by the slightest variations of temperature within the chamber.

A ditcher and grader has been patented by Mr. James M. Holland, of Mount Pleasant, Iowa. This invention covers a novel form of implement in which the ditching blade or shovel is reversible, and so connected to the wagon or vehicle to which it is engaged that it will be free to conform to the contour of the ground over which it is drawn.

A mast hoop has been patented by Mr. Charles S. Mott, of Patchogue, N. Y. It consists of two semicircular wooden sections and two outer metallic band sections, the two sections hinged together and provided at their ends with a slotted socket and a catch, for the ready connection or separation of the hoop sections without injuring the strength or efficiency of the hoop.

A groove cutting tool has been patented by Mr. William H. Parry, of New York City. It is for gaining stair stringers and similar purposes, and consists of a holding shank, a cylindrical head, and groove cutters having side cutting edges and inclined bottom cutting edges projecting from the outer end of the head, the head and cutters being formed on a single piece of steel.

A mechanical movement has been patented by Mr. Marmaduke B. Kellogg, of San Francisco, Cal. The invention covers a device or machine for converting reciprocating into rotary motion, and is designed for the piston rods and cross heads of engines and motors, being designed with a short piston stroke to multiply the stroke without decreasing the power transmitted.

A steam shoveling device has been patented by Mr. Andrew Meyers, of Port Arthur, Ontario, Canada. A hinged shovel or scoop is mounted on a pivoted inclined way, in connection with a hoisting apparatus, a slide being connected to the lower end of the inclined way and operated from the hoisting apparatus, the machine being specially designed for economically handling coal.

A window blind fastener has been patented by Mr. William Simmonds, of Yonkers, N. Y. Each blind has the ordinary spring fastener, in connection with a staple driven into the window sill, and there is used therewith a cheap and convenient fastening device placed loosely upon each staple, whereby the blinds may be locked in closed position or held partially open.



## Business and Personal.

*The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*



### NEW BOOKS AND PUBLICATIONS.

THE PAINTER'S ENCYCLOPÆDIA. By Franklin P. Gardner. New York: M. T. Richardson. Pp. 427. Price $2.

While the title of this book is, perhaps, rather too ambitious, it may be said of it that it contains a goodly amount and great variety of information touching a wide range of subjects in the field to which it is devoted. All topics are treated in the plainest possible style, quite within the comprehension of any workman or amateur, and they embrace plain and artistic painting, with details of practice in coach, carriage, railway car, house, sign, and ornamental painting, including graining, marbling, staining, varnishing, polishing, gilding, bronzing, etc., with hints touching nearly all kinds of work in which a brush, pencil, or palette is used.

THE MAGIC LANTERN. London and New York: Ward, Lock & Co. Pp. 150. Price $1.

A "practiced hand" has, in this manual, not only described the construction and management of the magic lantern, but tells how to produce many beautiful and startling effects, ordinarily beyond the reach of amateurs. Among some of these are the snow effect, moonlight effect, storm effect, rainbow effect, fountain effect, cascade effect, etc.



## Notes & Queries

HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.
**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.
**Books** referred to promptly supplied on receipt of price.
**Minerals** sent for examination should be distinctly marked or labeled.

(1) McK.—Core sand is not made by mixing. For valves use a grade of moulding sand slightly coarser than is used for outside or flasks. Mix it with a little sour beer or very thin mucilage—no more than will make the cores dry hard enough to handle. You can blow out the cores by dipping the castings in water before they are cold. Mixtures for valves should be copper 16 ounces, tin 1 ounce, zinc ½ ounce, lead ½ ounce.

(2) M. E. M. asks how to measure a miner's inch of water. A. A miner's inch of water is the quantity of water that will flow through a hole 1 inch square in a 2 inch plank, the top of the hole to be 6 inches below the surface of the water in the race or flume. This is what is meant by head. If the top of the hole is but 4 inches below the surface, you get less than a miner's inch. The amount of flow for a miner's inch is $11\frac{224}{1000}$ gallons (United States) per minute.

(3) L. J. S. asks: 1. Will a shade tree be injured by having electric light wires in contact with its branches? A. Insulated wires will do no harm. Naked arc light wires may burn leaves and small branches in contact, but they have no other effect on the growth. 2. When the sun and moon are in conjunction, will a body weigh less on the side of the earth nearest them than on the opposite side? A. Yes, theoretically, but the amount is too small for ordinary measurement.

(4) F. H. C.—Horse clippers are usually on the shears principle, and should be sharpened in the same way that shears are sharpened, by grinding the bevel edge only.

(5) W. B. asks how egg yolks are dried, and for what used. Also, where a market could be found. A. The yolks are separated from the white part and then dried in any convenient receptacle at a gentle heat. The article is made quite largely in Chicago, but is more expensive than the foreign article. It is used in the fine leather manufacture and other industries, and by bakers, who employ it to advantage when the price of eggs is high or they are scarce.

(6) J. P. M. asks: Can I cast a brass or copper nut on a square thread screw three-quarters of an inch in diameter, to replace a nut of Babbitt metal which does not stand well? A. You can, if not more than 1¼ inches in length of thread, without the metal seriously binding. Wash the screw with fine clay and heat it as hot as convenient before putting in the mould. Gently hammer the nut if possible to help unscrew it.

(7) L. B. A. asks: 1. Is there any way to waterproof a cloth apron? For waterproofing fabrics see the articles on that subject in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 58 and 317. 2. Is there anything that I can put into milk that is changed (a little sour) to sweeten it? A. Add a small quantity of finely powdered salt. 3. Is there anything that I can use in my curd or milk to give my cheese a nice flavor? A. Cheese may be flavored with herbs, or decoctions of herbs, such a thyme, sage, and the like.

(8) C. B. H. asks how to cut a Turkey oil stone in two. A. You can saw it with sand and water fed to a piece of sheet iron made into a saw without teeth, or quicker with a copper blade and emery and water.

(9) J. P. W. asks: What can I mix with talc to cause it to adhere after grinding the talc for fire brick? A. Use clay, as pure as can be had. Burn as other bricks.

(10) G. C. asks: 1. What pressure would it take to sink a hollow ball that contained 231 in. in water? A. It will take as much pressure as the ball displaces in weight of water (8·35 pounds for 231 cubic inches). 2. In a vessel $23\frac{1}{10}$ in. deep, which is filled with water, what would the pressure be on one inch of surface at the bottom? A. The pressure due to $23\frac{1}{10}$ in. in depth is 0·833 pounds per square inch. 3. What pressure would it take to compress one cubic foot of air into ⅔, into ¾, into ½, or into ¼ cubic foot? A. Compressing air to ¾=10 lb., ⅔=12½ lb., ½=15 lb., ¼

=30 lb. pressure. 4. Can water be compressed? A. Water is only slightly compressible under high pressure.

(11) F. E. DeC. asks: 1. What can be used to repolish a piano? A. Dissolve 4 oz. orange shell in one quart of 95 per cent alcohol; to this add one quart of linseed oil and one pint turpentine; when mixed add 4 oz. of sulphuric ether and 4 oz. of aqua ammonia; mix thoroughly and well before using. Apply with a cloth or sponge, and rub the surface to which it is applied until the polish appears. Such jobs require no little skill, as well as a good deal of hard work. Most amateurs will stop work where a good polisher really only commences. 2. Is there anything that will bring back the color of marble, which has been stained with vinegar? A. If the marble is white, coat it with gum arabic and expose it to the sun. When it peels off, wash with water, or make a paste with fuller's earth and hot water, cover the spots therewith, let it dry on, and next day scour it off with soft soap. The luster can be restored by rubbing with a dry cloth.

(12) E. C. R. asks: The best way to mix plumbago so as to produce a bright and lasting polish on stoves and not cause disagreeable odor. A. The common liquid stove polish consists of black lead 1 lb., water 4 oz., turpentine 4 oz., and sugar 1 oz. Mix thoroughly. It is not very lasting, nor has it a very agreeable odor, but it is about as good as anything yet found for the purpose.

(13) J. H. R. desires a recipe for a blood purifier, one that will cure acne and eruptions breaking out on the face. A. Take 2 parts of sulphur and 1 part of cream tartar and mix it with sufficient molasses to allow it to flow, *i. e.*, it must not be made too stiff. Take one tablespoonful daily.

(14) G. G. B. asks how to make a good mucilage, without using gum arabic. A. Take gum dextrine 2 parts; water 5 parts; acetic acid 1 part; dissolve by aid of heat and 1 part of alcohol.

(15) W. F. B. asks the formula for making a cement that the brass sign makers use for filling the letters on brass signs. A. Mix asphaltum, brown japan, and lamp black into a putty like mass, and then fill in the spaces, and finally clean the edges with turpentine.

(16) J. B. J. desires a formula for making glue used on edges of writing paper tablets to hold sheets together. A. Use either (1) white glue, refined glycerine, acetic acid, and coloring material; (2) common glue with 5 per cent glycerine; or (3) ¼ oz. crude gutta percha dissolved in carbon disulphide to the consistence of mucilage. The materials used in making this glue or cement are of a low grade commercially, so that some experiment is necessary to make a good article.

(17) G. H. J. asks if there is any substance that will remove printer's ink from paper, without disfiguring the paper. A. Place a thick pad of white blotting paper beneath the sheet of paper which is soiled. Then apply sulphuric ether with cotton wool, gently rubbing. Finally apply white blotting paper to absorb the color. Continue the application of fresh ether and repeat until all stains disappear. Do this away from a light.

(18) J. A. P. writes: In printing with ordinary gold size and bronze powder, upon soft leather, the print after several weeks becomes discolored and broken up, apparently by reason of the size sinking into the leather. Can you give a formula for a size which can be used on a printing press, and will dry on the surface of the leather without penetrating it? Or can you suggest a transparent flexible varnish that I can put on the leather before printing, something that is absolutely proof against the gold size, and will remain so. A. An "olive size" is made which may answer your purpose. When our printers have work of this kind to do they use ordinary gold size, but always give it two impressions. That is print the job in size and let it lie overnight and dry. In the morning run it through the press again. The leather will absorb the first printing, but the second will remain on the surface. A little of the white of egg mixed with the size, in the second printing, will make it dry very rapidly.

(19) J. C.—The plant is the English plantain or rib grass (*Plantago lanceolata*). It is a common and widely distributed weed. It has no value except as a pasture for cattle, and not much value for that.

(20) F. V. B.—Your fluid extracts are spoiled, and there is no remedy in the case. The cause of the change you mention is not known. Write to the manufacturer, who, for the sake of his reputation, would doubtless substitute fresh extracts for the spoiled ones.

(21) H. S.—The plant is the common mallow (*Malva sylvestris*). The leaves and flowers are chiefly used in fomentations, cataplasms and emollient enemata. Its properties are demulcent.

(22) H. R. E. asks concerning the process for the manufacture of yellow ocher into paint, also for preparing kaolin or china clay for the trade, such as whitening, calcimining, adulterant, etc., for which it is largely used. A. Ocher is dried by heat, ground into powder and made into paint by mixing with oil. The process is similar for the other materials mentioned.

(23) J. D. asks: What are the ingredients composed of for making metallic paints, such as are used by card writers, to write on an enameled surface? How to grade, to make them hard or soft? A. They are made in varying proportions of tin, lead, bismuth, and antimony, those that are the hardest are of lead melted with some antimony and a little quicksilver.

(24) W. P. K. asks: What should be mixed with ordinary printer's ink to make it suitable for printing etchings? A. Etcher's ink is similar to printer's, but more carefully ground. It consists essentially of linseed oil, varnish and lampblack. You can buy it much more cheaply and probably of better quality than you can make it yourself.

(25) M. G. H. asks: How mirrors or looking glasses are made, and what the materials are, and how prepared? A. A large, perfectly flat stone table is provided, upon which is evenly spread a sheet of tin-foil, without a crack or flaw. This is covered uniformly to the depth of ⅛ inch with clean mercury. The plate of glass, perfectly cleansed from all grease and impurity, is floated on to the mercury carefully, so as to exclude all air bubbles. It is then pressed down by loading it with weights, in order to squeeze out all mercury which remains fluid. After about 24 hours it is raised gently on its edges, and in a few weeks it is ready to frame.

(26) S. L. M. asks: 1. Directions for soldering brass articles, by means of ordinary solder—for soldering brass to iron. A. For soldering process and tools, see a valuable treatise in SCIENTIFIC AMERICAN SUPPLEMENT, No. 20. 2. Also for making mastic varnish from gum mastic. A. Dissolve the gum mastic in turpentine enough to make it of the proper consistency.

(27) H. A. M. writes: A distinguished clergyman says: "Astronomers have swept their telescopes through the sky, and have found out that there have been thirteen worlds, in the last two centuries, that have disappeared. At first they looked just like other worlds. Then they got deeply red—they were on fire. Then they got ashen, showing they were burned down. Then they disappeared, showing that even the ashes were scattered. And if the geologist be right in his prophecy, then our world is to go in the same way." Does not science teach us that the earth was once a molten mass, and that it has, for countless ages been losing its heat, and is at the present time still in the cooling process? A. We believe that the clergyman referred to does not profess to be a scientist, but is ever ready to catch at a theory that may be made an element of destruction to sinners. Your question gives the idea most commonly entertained, but even at this time a collision of the earth with some wandering star from beyond our system would produce an outburst of heat and light similar to the star outbursts that have been observed.

(28) W. H. S. asks: 1. Does choke boring a shot gun improve penetration? A. No; it prevents too much scattering by drawing the charge together at the instant of leaving the gun. 2. Is the mouth of the Mississippi River farther from the center of the earth than the source? A. Yes. 3. Would the Mississippi run toward the north or south if the earth stopped revolving on its axis? A. It would run north. 4. How can I mark steel tools? A. Coat thinly with beeswax, in which make the desired marking down to the tool, and then use nitric acid 1 part and water 4 parts, to bite out the exposed surface of the steel while the wax protects the surrounding portion from the action of the acid.

(29) J. A. S. asks: 1. What is the best substance to keep gun barrels from rusting? A. You can keep gun barrels from rusting only by care in keeping dry and oiling with linseed oil. 2. Can gravel walks be practically treated so that they will not grow weeds? A. Asphalt, cold tar, and cement are good materials to mix with sand to make a layer that will not only keep the weeds out, but make a smooth and hard walk. Gravel walks generally have some soil intermixed, which, with the fining of the gravel by use, affords a foothold for the growth of weeds. 3. What is a good cure for colds? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 75, How to Cure a Bad Cold and Sore Throat. Also a valuable paper on Catching Cold, SCIENTIFIC AMERICAN SUPPLEMENT, No. 297. Also Quick Cure for a Cold in the Head, SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 25 and 228.

(30) J. C. R. desires a formula for making red or strawberry coloring from carmine (or without aniline) for coloring bottled soda pop. A. Boil some Brazil wood in water and then add a small quantity of it. You can make it very dark originally and then dilute until you get the proper shade.

(31) G. J. H. writes: A discussion relative to conductors of electricity has resulted in a wager to the effect that, a stream of water propelled from a brass nozzle and coming in contact with an electric light wire, in an exposed part through which the electric current is running, results in the death of the person handling the nozzle, by the transmission of the shock through the stream of water, provided the current is severe enough. Will you kindly decide in the next issue of your valuable paper the above? A. The conductivity of water is so poor it is doubtful if a dangerous shock could be received under the conditions named.

(32) O. F. M. writes: We want to build a tank of 3 inch pine plank to hold a wash of oil vitriol about one-fifth vitriol, four-fifths water, for wool wash. We usually put these tanks together with three-quarter inch iron bolts, down through the wood, but find the acid will soon penetrate the wood and destroy the iron bolts. Is there any metal strong enough to hold the tank together that the vitriol will not affect, that is practical to use, and where can it be obtained? A. Copper is very slowly attacked by sulphuric acid. You might inclose the iron bolts in pieces of lead pipe. The lead would resist the acid indefinitely.

(33) J. M. asks: Would a copper lined cylinder used in a common well pump do the water any harm for drinking? A. Probably not if it was kept full of water. If alternately dry and wet, it might impair the water.

(34) A. B. J. asks how to remove bookbinder's varnish from leather, after it has been on three or four years. A. Try alcohol. It will dissolve the varnish. 2. How to treat egg glair to prevent it smelling. A. Use oil of cloves or some strong antiseptic with it.

(35) G. A. H. asks: 1. Will you kindly give a cheap and effective process for bleaching coral? A. First wash well in very dilute hydrochloric acid in the proportion of one part of acid to thirty of water, then rinse well in water, then immerse in a dilute solution of chloride of lime. 2. Is there a cheap and quick method of nickel plating wire and tin? A. See "Recipe for Nickelizing without Electricity," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 191.

(36) F. M. J. asks: By what process are horns, such as are used for knife handles, combs, etc., bleached and rendered transparent? A. Care is generally taken to select good white horns, but they can be bleached by exposing to the fumes of burning sulphur, largely diluted with air.

(37) J. F. L. desires a simple process for making koumiss. A. Dissolve 4 ounces white sugar, in 1 gallon of skimmed milk and place in bottles of the capacity of 1 gallon, add 2 ounces of baker's yeast, or a cake of compressed yeast, to each bottle; cork and tie securely, then set in a warm place until fermentation is well under way, and lay the bottles on their sides in a cool cellar. In three days fermentation will have progressed sufficiently to permit the koumiss to be in good condition.

(38) G. W. W. asks how they mix rouge to make it into what is called hard rouge, also what the different articles are and how mixed? A. Take of oxalic acid 1 part, iron peroxide 15 parts, powdered rotten stone 20 parts, palm oil 60 parts, petrolatum 4 parts. Pulverize the oxalic acid, and add the iron and rotten stone, mixing thoroughly, and sift to remove all grit, then add gradually the palm oil and petrolatum, incorporating thoroughly.

(39) F. B. P. asks if there is any remedy that will remove warts. A. Take a small piece of potash, and let it stand in the open air until it slakes, then thicken it to a paste with pulverized gum arabic which prevents it from spreading where it is not wanted. Apply to the wart until it disappears. Some cases, however, are very obstinate, the warts seeming to come constantly for a period, and then suddenly disappearing.

(40) H. N. H.—For making printers' rollers, see answer to query No. 33, in SCIENTIFIC AMERICAN for March 24, 1888.

(41) J. H. asks: What was Queen Victoria's maiden name? A. Guelph.

(42) J. H. C. writes: I wish to run two incandescent Edison lamps. Will you kindly tell me the simplest and cheapest means by which I may attain that end? A. A dynamo driven by steam or other power is the most economical method of obtaining a lighting current.



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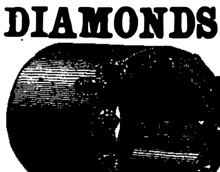

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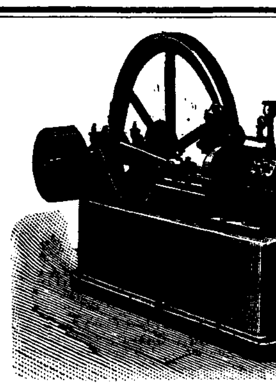

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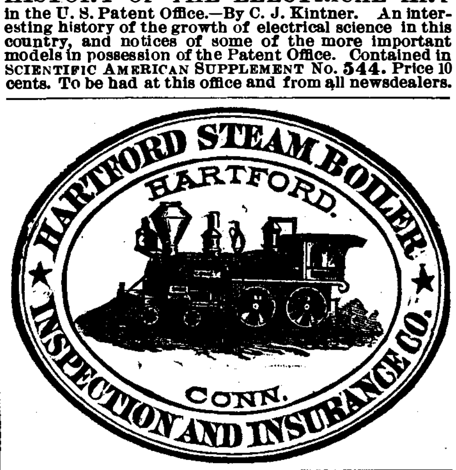



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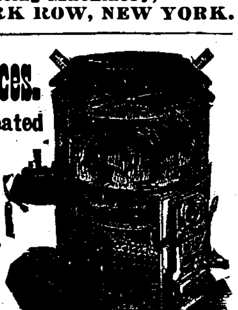

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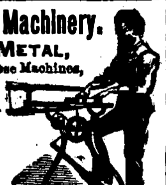

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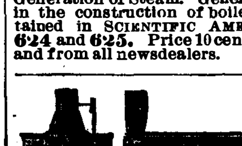

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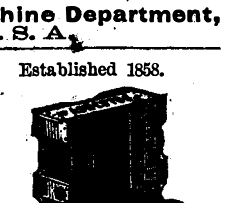

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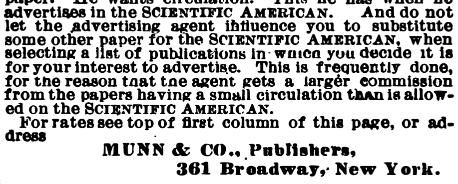



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