

tube with another glass vessel exhausted of air, and covered with a cloth wetted with salt and water; the vapor from the water passing into the empty vessel was condensed, and during the course of the lecture the water, thus deprived of its heat, became frozen. With reference to the heat produced and liberated in molecular processes, Prof. Tyndall stated that 8 lbs. of oxygen and 1 lb. of hydrogen, combining to form 9 lbs. of water, produced an amount of heat which, expressed in mechanical force, would be sufficient to lift 47,000,000 pounds a foot above the earth's surface—in other words, its effect was equal to 47,000,000 foot-pounds. The first effect of the combination was to produce aqueous vapor, and in the passage of that vapor to water the amount of heat set free would be equal to the raising of 6,720,000 lbs. a foot above the earth's surface. In the passage of the 9 lbs. of water to ice, the heat liberated would be equal to 993,654 foot-pounds. In treating of the subject of liquefying gases, Prof. Tyndall produced snow from carbonic acid gas, and froze quick-silver in the process of melting the snow. In connection with this experiment, he referred to the deposition of snow upon the Alps by the rarefaction of the air blown from the plains of Lombardy; in the process of rarefaction work was done, in the doing of which heat was expended, and by the consequent reduction of temperature the moisture held in the air became condensed, and fell as snow.

#### A HOME-MADE TELESCOPIC EQUATORIAL STAND.

By T. D. SIMONTON.

THE next thing for the amateur, after becoming possessed of a telescope,\* is to secure a proper mounting for it. Of course a small instrument can be held in the hand simply, and something can be seen in that way. But any one who has seen a star dance in the field of vision, or has had his bloodless arms drop, perforce, before getting even so much as a sight of the object sought, will want something better. And we believe there are thousands of ingenious young men in our country, who are able to make or to buy a modest instrument, who come short of a most admirable pleasure and instruction, because they either do not know the capabilities of a small glass when properly mounted, or have no idea that such a mounting is within their reach, as it probably is not, in the ordinary way.

But Proctor in Great Britain and Draper in America have

This mounting will be seen in Fig. 1, below. It consists of the pieces 1, 2, 3 and 4; a base block, an upright piece, an angle or elbow, and a grooved rest for the telescope. The base block (1) is intended to be screwed to the top of a post, or to the outer post of a window sill. The upright or post (2) rests upon this base perpendicularly, and is fastened to it by a strong screw (not seen in the figure), with its head let into the under side of the base block. This allows motion, so as to facilitate in adjusting the post to the true meridian, after the base block is made fast. When nice adjustment is secured, the base block can be removed from its fastenings and the strong screw made fast so as to hold the post firmly in place, when the whole affair can be returned, or at any time placed in correct adjustment, by simply screwing it down to the place where it was first adjusted. If this be a window-sill, looking south, we will say, all that will be necessary to adjust it to a window looking west will be to loosen the strong screw and rotate the post 90 degrees to the left, when the screw can be again tightened; and the same in principle for any other direction or outlook.

But we now come to the angle or elbow (3), all-important in this arrangement. It is absolutely necessary that the motions we secure where this is connected with pieces 2 and 4 be at right angles to each other. We make sure of this by taking two turned wooden boxes, of some 2½ inches diameter, and gluing them (the bottoms of them) to the adjoining sides of a perfectly square piece of wood. We thus obtain the elbow (3) (best seen in Fig. 2); and as the boxes and lids are alike turned, the circles obtained are not only true but parallel with the bottoms of the boxes, and consequently, if the boxes are glued to a square piece of wood, their planes will be at right angles to each other. This is what we want; and by simply gluing the lids of these boxes in proper position to pieces 2 and 4, and placing the whole thing together—each lid to its box—we obtain the two motions of the hour circle and the declination circle, belonging to an equatorial mounting. These circles can be graduated as any other circles, and distances and angles on the heavens thus be measured with facility. The closer the graduation and the greater the nicety of the whole mechanism, the finer the measurements that can be made, of course. Good hard maple tooth-powder boxes, with clean smooth rims and lids, are most suitable for the purpose we here speak of; and the joints should be well rubbed with a very soft lead pencil to secure smoothness of motion when all is placed together for use.

Fig. 2 will show the arrangement more in detail. Of course it is known that the hour circle on the top of the upright (2) must be in the plane of the equator, consequently the screw *j* adapted to the hole *m* of piece 3 must be parallel with the axis of the earth, or, in other words, point to the true pole of the heavens. The letter *b* (Fig. 1) shows when the head of this screw is let into the post. It must have a rotating motion in this hole, the thread fitting so tightly in piece 3 as to hold firmly. By tightening or loosening the screw, the proper amount of friction may be secured to hold the telescope firmly, yet allow motion when it is desired. The same of the screw *k*, adapted to the hole *l*, in piece 3. The head of this screw is let into the bottom of the groove *i*, Fig. 1, where the telescope is placed, of course, when all is completed. The telescope can be firmly tied or strapped in place, and any simple device be used to secure its being truly parallel with the declination circle, in case it be an instrument with joints.

The letters *a a*, Fig. 1, show the screw holes for the base. The letters *c d f h*, the boxes as used, with their lids, and the letter *g* the graduated circle for declination. [By mistake the lid, instead of the bottom, of one of the boxes used

the amateur should learn to do), distances in right ascension between bodies can be measured, and by the same process with the other circle their declination be measured. This is the beginning of true astronomical research, and at least puts one in position to appreciate the wonderful results that have been obtained by the greatest workers and greatest instruments of our day. It may do more. It may inspire some of us to a career in this direction that will be one of continued progress. There is a delight in feeling that we can make and arrange for ourselves an instrument with which we can begin to trace out the great paths of the heavenly bodies. And it is with the hope of helping some that can afford nothing more complete at present that we present them with the design of something they can afford, and that will be of great service to them—the Amateur Equatorial Telescope Mounting.

[THE ACADEMY.]

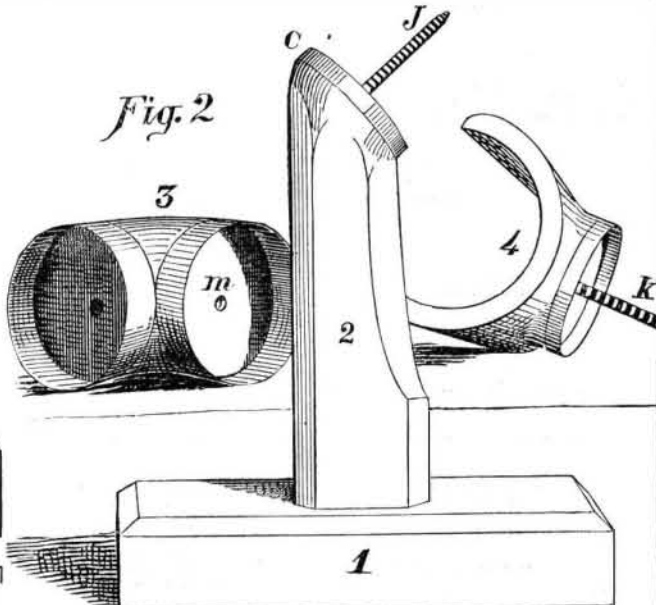
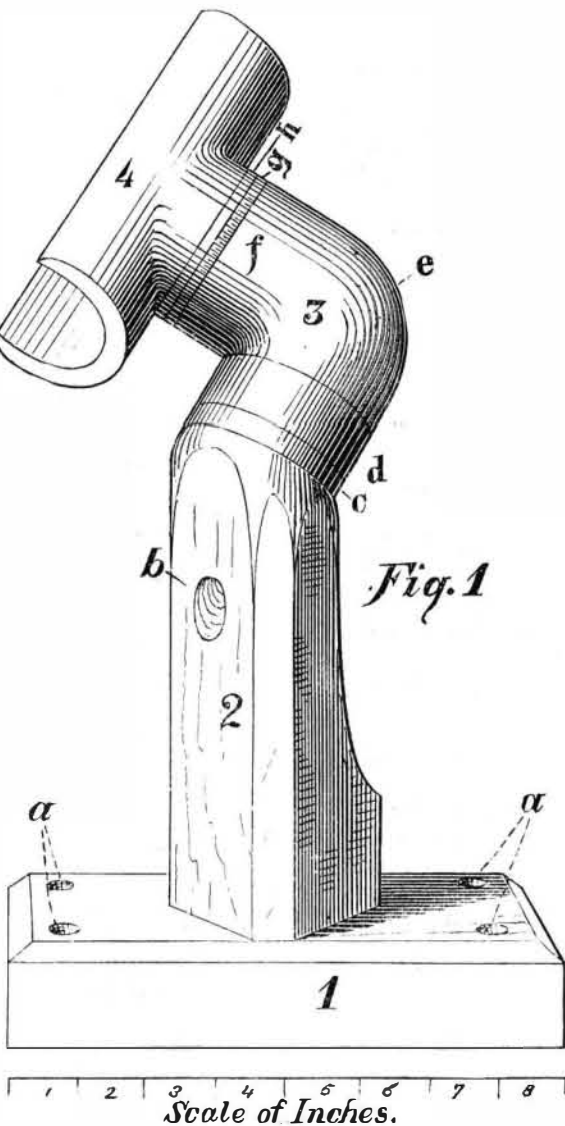
#### SCIENCE NOTES.

**On the Poisonous Effects Usually Attributed to Salts of Copper.**—In a communication to the Academy of Sciences (*Comptes Rendus*, April 9, 1877) Galippe points out that, although the various compounds of copper give rise to severe vomiting when administered in large doses, the same compounds may be taken for long periods of time in smaller doses, progressively increased, without the occurrence of any unpleasant symptoms. Burq and Ducom fed dogs every day during two months on food which had been cooked, and allowed to cool, in copper vessels previously exposed to the action of vinegar and salt, without producing any poisonous effects. Galippe himself, for more than a month, lived on food cooked with or without vinegar in untinned copper saucepans, whose contents were often allowed to remain for twenty-four hours in contact with the metal before they were put on the table. The various dishes thus prepared, though often coated at their edges with the greenish matter commonly termed verdigris, were partaken of, both by himself and by other members of his family, without giving rise to any dangerous or even disagreeable symptoms.

**Zinc a Normal Constituent of the Body.**—Lechartier and Bellamy have found that zinc is constantly present, in appreciable quantities, in the liver of the human subject and of many lower animals, such as the calf, ox, and dog (*Comptes Rendus*, April 9, 1877). They also demonstrated its presence in hens' eggs, in wheat, barley, maize, and haricot beans. These facts have an obvious bearing on certain medico-legal questions.

**Animal Heat.**—At a meeting of the Société de Biologie on April 14, 1877, M. Claude Bernard communicated the results of some fresh investigations on this subject (*Gazette Méd. de Paris*, April 28, 1877). The first part of his communication referred to the temperature of the blood in different parts of the circulatory apparatus. By introducing long and slender thermo-electric probes into the larger arteries and veins, he succeeded in ascertaining that while the temperature of the blood in the aorta and its more important branches is uniform, that of the venous blood varies considerably in different regions of the inferior vena cava and its principal tributaries. At the junction of the extremities and the neck with the trunk of the body, the venous blood is colder than that in the great arteries; in the right heart it is decidedly hotter. If we determine its temperature at successive points in the inferior vena cava, we find that at the junction of the iliac veins this is lower than the arterial temperature; on a level with the entrance of the renal veins, the two are about equal; on a level with the hepatic veins, the temperature of the venous exceeds that of the arterial blood by some tenths of a degree. It maintains this superiority even after it has become mixed in the right heart with the colder blood returned through the superior vena cava. Accordingly, though the venous blood of peripheral parts is colder than that in the arteries, it acquires sufficient heat during its passage through the abdominal cavity, not merely to equalize the difference; but actually to give it a permanent advantage. It must not, of course, be inferred from these results that the abdominal viscera are, in any special sense, the source of animal heat. They are simply protected by their situation from the effects of radiation and evaporation. If a limb be carefully swathed in cotton-wool, so as to guard against any loss of heat from its surface, the blood returning from it will be found hotter than that conveyed to it, even when the muscles are kept in a state of absolute repose. Heat is generated in all the tissues: in the muscles, the nerves, the nerve-centers, the glands. The rise of temperature which may always be detected in a muscle when thrown into a state of contraction is invariably preceded by a slight but distinct depression. Precisely the same phenomenon is exhibited by a gland when its secretory nerve is stimulated. For instance, if the sub-maxillary gland be excited through the chorda tympani nerve, a thermo-electric needle having previously been implanted in its substance, a momentary fall of temperature may always be noticed to precede the rise which coincides with the occurrence of secretion. In the last part of his paper, M. Bernard insists on his old doctrine of the difference between thermic and vaso-motor nerves, and promises further investigations on the subject.

**Physiological Action of Glycerin.**—A very elaborate research on this subject is published by M. Catillon in the *Archives de Physiologie* (Janvier-Février, 1877). He finds that glycerin, when administered in considerable doses, has a very decided power of lessening the decomposition both of the fatty and of the azotized constituents of the body. Animals increase in weight under its influence, and the daily amount of urea excreted is lessened. The diminished excretion of urea must be due to diminished production, not to obstructed elimination; for no excess of urea is found to accumulate in the blood. In moderate doses, glycerin acts as a mild laxative, and improves both the appetite and the digestive powers. Whatever the dose administered, none can ever be detected, either in the intestinal excreta or in the perspiration. All that enters the stomach is absorbed; but only a certain quantity is capable of being decomposed in the system. When this limit is overstepped, glycerin makes its appearance in the urine; in the human subject, it begins to be eliminated by the kidneys when the dose taken rises above twenty grammes. Elimination begins in less than an hour after it is taken, and is completed in from four to five hours. The urine never contains any trace either of albumen or of sugar. When a very large quantity of glycerin is swallowed in one dose (15 grammes per kilo. of body-weight), death usually takes place, the post-mortem lesions being similar to those after acute poisoning by alcohol. The same quantity of glycerin, however, may be administered in divided doses without ill effect; this is to be accounted for, in all likelihood, by the rapidity with which any excess of the compound is eliminated through the kidneys.



A HOME-MADE EQUATORIAL TELESCOPIC STAND.

recently had occasion to refer to the value of observations to be made by good glasses of but an inch or two aperture. And, indeed, almost all general work connected with the motions and the positions of the heavenly bodies, such as the places of the sun and moon in right ascension and declination, their distance from each other or from any star, the observation of eclipses and of occultations, can be done with an instrument of little power, if very close measurements are not required. And no such valuable adjunct to maps of the heavens, such as are to be found in many homes, is to be conceived as a telescope that may not cost more than \$10 or \$12, if need be. But to be of greatest value it must be adequately mounted, that is, if possible, equatorially mounted.

And this brings us to the object of this article, which is to describe and illustrate with figures an inexpensive yet efficient little equatorial mounting we have devised, and which we think, were its merits to be known, many would like to possess. It can be made by any cabinet-maker, and at a cost of but two or three dollars. Indeed, almost any person of ordinary skill at working in wood should be able to make one for himself, and thus secure, at nominal cost, what could not be obtained of the instrument-maker for less than several times the cost of a modest telescope, such as we have referred to.

\* See article on Construction of Telescopes in Supplement No. 1 of SCIENTIFIC AMERICAN.

to make the specimen from which our illustrations are taken was glued to the square block *e*. This should not have been, as thereby the right angle position of the two circles was jeopardized. We have spoken of the square block to which the boxes are glued. The block must be square to get the connections true, in a simple manner, but of course, after this has been effected, the whole thing can be rounded, as in the figures, for the sake of appearances.

The simplicity of the whole affair and its slight cost arises from the fact that it is easy to get a block of wood square, and that turned boxes (costing a dime each) are necessarily square in position when built upon this. Besides, the rims of the boxes have an excellent catch in their lids, and so run true when rotated, and make good smooth circles.

We cannot here go into the niceties of adjustment belonging to the equatorial telescope. These will have to be sought in books. It may be sufficient to say here that when the slope of the top of the post is made as many degrees and minutes from the horizontal as the place of the observer is degrees and minutes from the north pole, and when this slope faces directly north, neither to the right nor the left, then the declination circle being adjusted to the latitude of any star, that star can be followed from horizon to horizon and kept constantly in field by the mere rotation of the hour circle. By carefully graduating this circle, dividing it into three hundred and sixty equal parts (something