

Mr. Raman.—The mention which Mr. Bose makes of "Nebulium" reminds me of Dr. J. W. Nicholson's recent work on the spectra of the corona and of the hypothetical gases, "Nebulium," "Coonium," etc.

Mr. Tomkins.—There is one point. I gather that Mr. Bose says that the people of the Stone Age saw Sirius on the other side of the Milky Way.

President.—Is there any record of this? Some Anthropologists consider there are finds which indicate some kind of worship in the Stone Age, but the subject is a very large one. For us in an Astronomical Society, I think it is better to depend on the telescope and photography than on what it is surmised the people of the Stone Age believed in.

President.—We should return a vote of thanks to Mr. Bose for his interesting paper.

Some lantern slides of antique forms of telescopes and their mountings were shown by Mr. H. G. Tomkins and a vote of thanks was returned to him.

The meeting was then adjourned.

The Construction of a Cheap Telescope.

BY

MR. H. G. TOMKINS, C.I.E., F.R.A.S.

PAPER V.

IN my last paper I explained the theory of the method of testing the surface of the mirror and it now remains to put the theory into practice. For this we shall want a little simple apparatus which any one can easily make for himself or at any rate get made without any difficulty. Three things will be wanted: a holder for the mirror, the artificial star, and the testing apparatus. The first is a very simple contrivance to enable the mirror to be set up on edge for testing without risk of rolling over and breaking. Two pieces of wood of sufficient width and strength are nailed together at right angles

to each other as shown in Fig. 11. The piece *B* strengthens them and also prevents the mirror from rolling off on one side ;

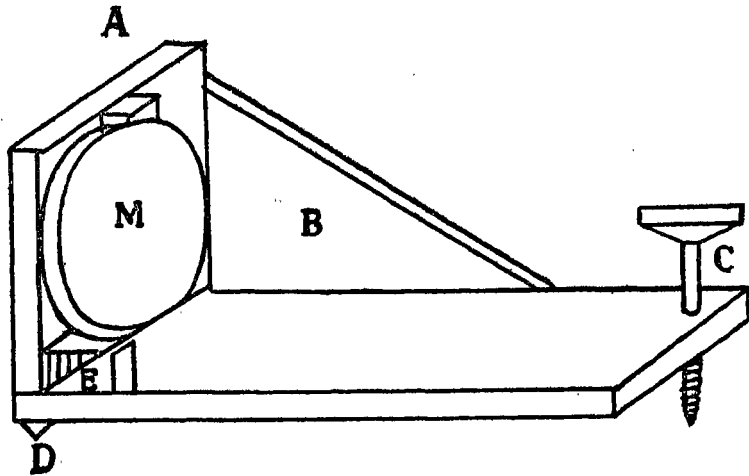


Fig. 11.

the block *E* does the same on the other. *A* is a catch to prevent the mirror from falling on its face. *D* is a leg to the machine and there is also another leg at the other corresponding corner. *C* is a screw by means of which the whole base and consequently the mirror can be tilted back or forward for purposes of adjustment. An ordinary screw (for wood) will do very well for this as well as some other matters which I shall describe later on, and to make it work smoothly it is only necessary to have the hole in the wood a fair fit and to work it in with a little oil. It is handy to have a little piece of tin soldered in the groove in the head of the screw for convenience of turning it ; and as several will be wanted, it would be best to get pieces of tin soldered into several screws so as to have them ready.

The next item is the star. For this an ordinary oil lamp of small size is best. A wick half an inch wide is ample. To the lamp fit a tin chimney instead of the glass one and just opposite to the white part of the flame drill a hole about $\frac{1}{8}$ inch in diameter. Now with a file make the hole triangular in shape with one of the angles downwards. The edges of the hole should be slanting *towards* the flame so as to have the sides of the triangle sharp and clean on the outer side of the chimney. Now fit a contrivance as shown in Fig. 12.

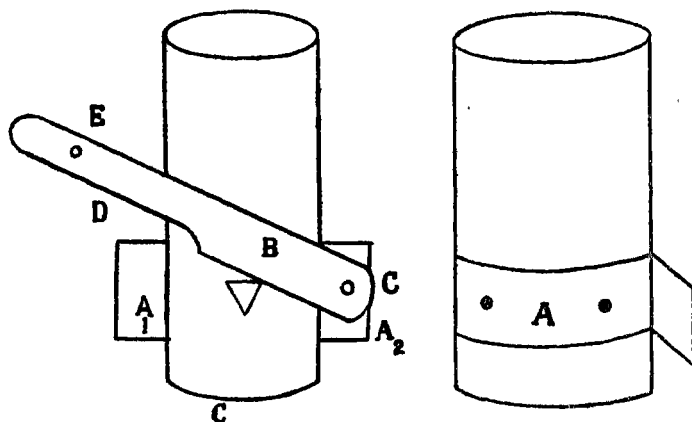


Fig. 12.

A is a piece of tin rivetted round the chimney as shown in the two sketches, and to it at *A*₂ is fixed the movable piece *B* by means of the rivet *C*, so that *B* can be moved up and down in front of the triangular hole in the chimney. *D* is a small piece of tin fixed to the back of *B* by the rivet *E* so that the *A* passes between *B* and *D*, thus keeping the piece *B* pressed against the tin chimney. Now when *B* is moved downwards it is evident that its lower edge, which should be filed nice and sharp and clean, will gradually diminish the size of the triangle, and this reduces the size of the star to any extent. If carefully made with nice clean edges to the triangle and the strip *B* the star can be reduced to a most minute point of light at will. Do not forget that the edges of the triangular hole should be bevelled inwards and the lower edge of *B* outwards so that the sharp edges are in contact; otherwise you will have a ragged star. We must now attend to the testing apparatus which, as will probably have been gathered from my last paper, is simply a knife edge arranged on a support in such a way that it can be conveniently moved to and from the mirror, and from side to side across the cone of the rays of light from the mirror.

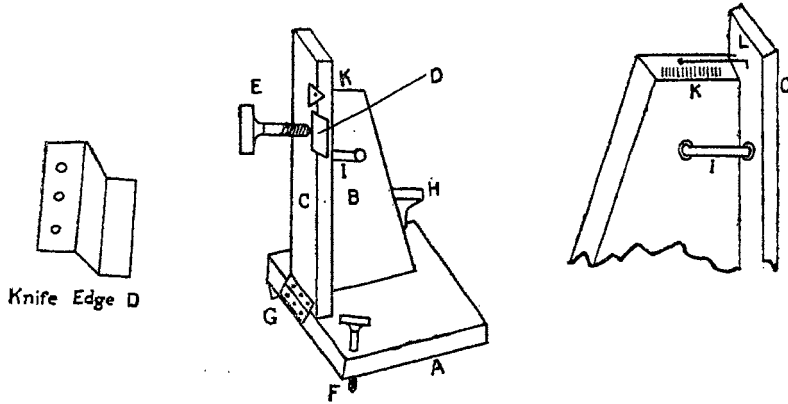


Fig. 13.

Fig. 13 will show the arrangement. *A* is the base, which should be a good piece of wood about an inch thick. On this *B* is nailed perpendicular. *C* is a movable piece hinged at the bottom so that by means of the screw *E* it can be moved from and towards *B*. *I* is an india-rubber band to keep *C* up to *B*. When the screw *E* is turned to bring *C* away from *B*, this band stretches and this always keeps the point of *E* pressing on the edge of *B*. The knife edge is *D* and the edge must be made quite smooth and regular. It is best to rub it up even on a hone or a smooth slate, etc. *G* is a fixed leg to the base and *F* and *H* are screws to tilt it the one sideways and the other back and forward. *K* is a small scale of 100 lines to the inch with zero in the middle which is fixed on the top edge of *B*; and *L* is a pointer fixed to *C*. Thus when the screw *E* is turned thus moving *C* the distance can be read off on the scale by means of the pointer *L*. *K* and *L* are on the far side of *B* in the large figure and I have therefore given a separate sketch of them. I have also given a separate sketch of the knife edge.

It now only remains to cut out the cardboard or paper shields for the zone testing of the mirror, and the testing can begin. These are very simple and I give sketches of the first and last shield and one of the middle ones.

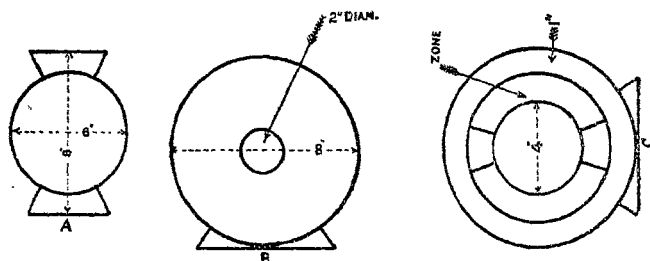


Fig. 14.

A when placed before the mirror will have a zone 1 inch wide on either side uncovered: *B* will have the centre 2 inches uncovered. *C* will have the zone so marked uncovered. For the 8" mirror there will be two shields of this pattern, the inside diameters being 4" (as in *C*) and 2".

Now for the testing. This is done in the dark. Choose a place with a firm floor (stone or cement is best) and free from draughts and air currents, and on a table of convenient height place the mirror in its support. In front of this and at a distance away equal to twice the focal length of the mirror (*i.e.*, 13 feet 4 inches in the present case) place a table for the testing apparatus and the artificial star. It will now cost you some little patience to get your star and apparatus in the right place for the first time. You will soon get expert at this however. Open the star fully and holding the lamp near your face, stand in front of the mirror and about 4 or 5 feet away, and moving the lamp and your head slowly about, try to catch the reflection of the lamp in your right eye. You will probably see it flash by as a blaze of light. You must now learn to get this in your eye and hold it steadily, having done which move slowly backwards, still keeping the reflection in your eye. You will find it a little difficult at first. Be careful not to trip over the table behind you or you will sit down with the artificial star in your lap. Now as you move backward you will easily see if the reflected star is going to be too high or too low for your testing apparatus or on one side or the other. Move the mirror accordingly so as to get the reflection as near as you can judge in the direction of the knife edge. Now take your star (lamp) and standing behind the table and putting your eye somewhere in the region of the knife edge with the star a few inches to the right, move carefully about once more and try and again catch the reflection. You will soon do it. If about right, put your

lamp on something such as a box on the table in its correct place, that is about 4 inches to the right of the knife edge. The testing apparatus is of course so placed that the knife edge is on the right and next to the star, as in Fig. 14. The star is not shown as it is the other side of the chimney.

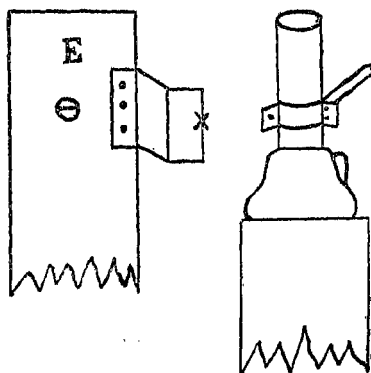


Fig. 15.

Now once more try for the reflection and eventually bring it to the place marked with X on the knife edge in Fig. 15. Having done this you may practice passing the edge across the cone of rays. If the shadow comes on the mirror from the left, your knife edge and star are too near the mirror; if from the right they are too far away. You must therefore move them until you get an equal darkening from both sides, and here we will leave the testing till my next paper.

Notes on Venus.

BY

REV. J. MITCHELL, M.A., F.R.A.S.

IN continuation of my brief note on Venus, published in the January JOURNAL, I herewith send two sketches of the planet. Notice how much sharper the cusp on one side is than on the other. In the sketches I have probably slightly exaggerated this difference in order that attention might be drawn to it; but there is no doubt whatever of its existence. During the past week from the 15th to the 22nd March the definition of the planet in the 5" has been much better than usual. For