HOW A TELESCOPE WAS MADE AT THE JESUIT COLLEGE, MONTREAL.

Through the courtesy of the Rev. Father Foullety, we are enabled to give our readers an account of an undertaking, through which the Jesuit College at Montreal, Canada, has secured a telescope which satisfies all the demands made upon it. The telescope was built from the designs of the Rev. Father Garais, by the members of the Jesuit College. The spherical mirror of this telescope is in point of size the third in North America, being excelled only by those of the Yerkes and Lick observatories. No little admiration is due to the man who has not only designed the whole and constructed the principal parts of so intricate an instrument, but who has moreover with his own hand erected the machinery required for its production.

We are informed that a lathe was put up upon which the crude block of Mantois glass for the mirror was ground. The process used for cutting the mirror shows some novel and interesting features, and is best explained by reference to our diagrams.

A cast-iron wheel, four inches in diameter, *C* (Fig. 1) was rapidly rotated by means of a driving belt, *d*, from the pulley, *W*. The wheel, *C*, was so fixed that it could be raised or lowered at will by means of a fine adjustment. Under it was placed the block of glass. This block, *M*, was firmly fixed upon the table, *N*, which could be rotated about a vertical axis by the handles, *h h*. The table, *N*, carrying the glass, could also be moved in a straight line parallel with the direction of the belt, *d*. From a reservoir, *R*, sand and water were fed upon the grinding wheel, *C*. The process adopted was as follows: The rapidly rotating wheel, *C*, was lightly applied to the glass block. While sand and water were continually fed from the tank, *R*, a slow rotary motion was given to the block by turning the handles, *h h*, the wheel, *C*, being gradually lowered as the glass wore away. In this way an annular channel was ground. The block was then moved in a straight line parallel to the belt, and outward from the pulley, so that the wheel, *C*, came nearer to the center of the mirror; thereupon another rather deeper groove was ground close to and concentric with the first. In this way the block was worked until its condition was that shown in Figs. 2 and 3 in plan and section respectively. By a similar process the ridges, *r*, left by the first operation were next reduced. After this the remaining roughness was ground away with cast iron laps ruled with a network of interlacing furrows forming squares. It is gratifying to us to hear from Father Foullety, that in this matter an article which appeared in the Scientific American Supplement (No. 582) helped to furnish the requisite information. For the polishing process the mirror was fixed upon a cask, as shown in Fig. 6, and the operator, circling slowly

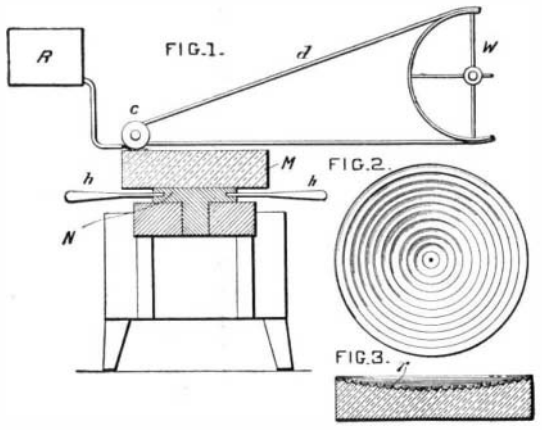

Diagram Illustrating the Method of Grinding the Lens.

and regularly around this, giving at the same time a rotating motion to the lap, worked the latter with great care over the surface of the glass, finally approximating it to a parabolic shape by polishing a little more toward the edges.

The final polish was effected with the finest emery, the lap being covered with a layer of wax half an inch thick. This delicate operation required about 50 hours' work. The whole of the grinding and polishing took some 320 hours.

The process used for silvering the mirror was that described in Troost's "Chemistry," French edition, 1884, p. 675. Four solutions are prepared.

1. 40 grammes of silver nitrate, dissolved in 1 liter of distilled water.

2. 60 grammes of ammonium nitrate, dissolved in 1 liter of distilled water.

3. 100 grammes of pure caustic potash, dissolved in 1 liter of distilled water.

4. 25 grammes of cane sugar dissolved in 250 grammes of water, inverted by boiling for ten minutes with 3 grammes of tartaric acid, then neutralized, added to 50 grammes of alcohol, and made up to 500 c. c.

The glass was thoroughly cleaned with nitric acid, then with caustic potash. Alcohol was unnecessary. It was washed in pure water and suspended with the surface to be silvered downward in the bath obtained by mixing the above solutions in equal volumes. The operation was carried on in a room kept at 80 deg. F. (27 deg. C.). The mirror was kept immersed for about ten minutes. Fig. 4 shows this operation in progress.

It next became necessary to construct the tube and the mechanism for efficiently mounting the mirror. A wooden mold was fixed by radial supports upon an iron cylinder fifteen feet long. Upon this sheets of paper were rolled, and by gluing 250 pounds of paper sheet upon sheet, an excellent tube of great rigidity and strength was obtained, which for lightness probably surpasses anything which could have been made with other material. In Fig. 5 the tube is seen in the process of its development.

The working gear was prepared at the foundries of Garth & Co. and of Belanger, both of Montreal, under the supervision and after the directions of Father Garais, who also designed all the parts and furnished the wooden models.

Our last illustration, which gives a full view of the completed telescope, shows also the mechanism by which the motion in right ascension is effected. Motion in declination is produced simply by hand, by tilting the tube about its axle.

We close with a table which will give an idea of the general dimensions of the instrument:

Diameter of mirror	20 inches.
Weight of mirror	150 pounds.
Radius of curvature	21 feet 9 inches.
Focal length	10 feet 10½ inches.
Aperture	4 deg. 18 min.
Length of paper tube	12 feet.
Weight of tube	350 pounds.
Total weight of instrument	1,200 pounds.

Cherrick Westbrook, Sr., the inventor of the telegraph receiver, and general superintendent of the telegraph system of the Baltimore & Ohio Railroad during the civil war, died on December 6 at his late residence in Harrisburg, Pa. He was 86 years of age.

Fig. 4.—Silvering the Mirror.

Fig. 6.—Polishing the Mirror.

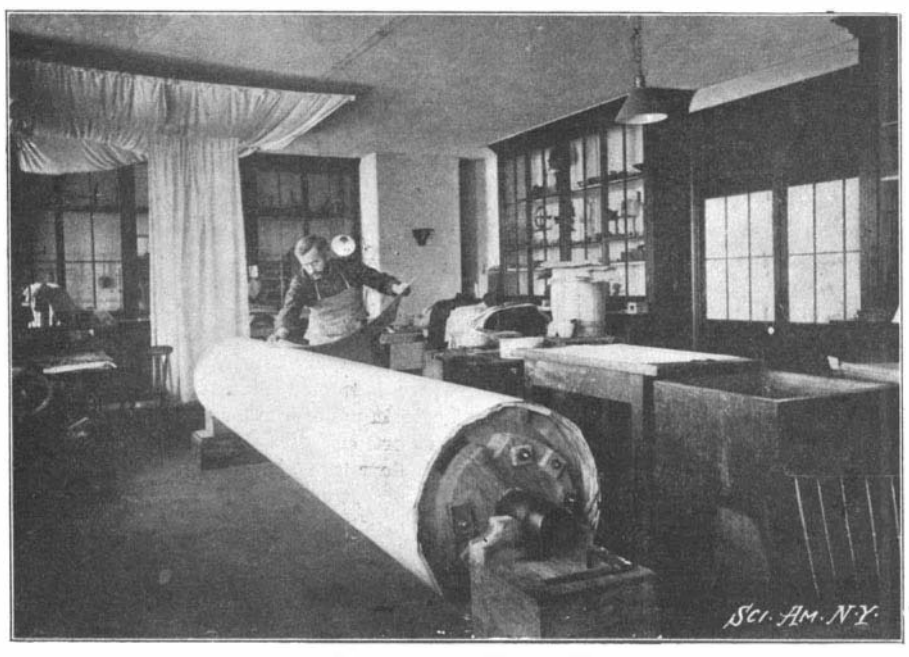

Fig. 5.—Making the Tube of Telescope.

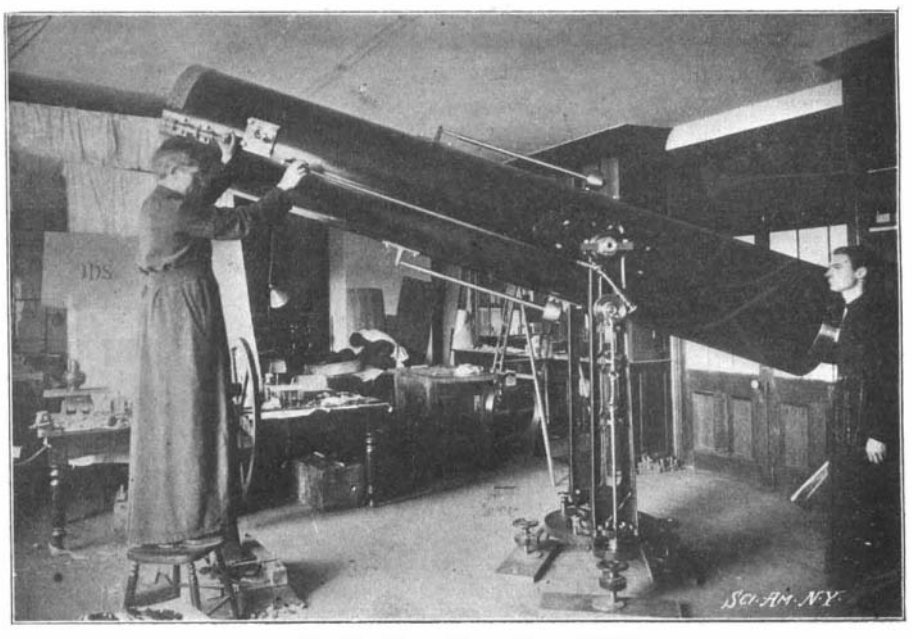

Fig. 7.—The Telescope Completed.

HOW THE LARGE TELESCOPE AT THE JESUIT COLLEGE, MONTREAL, WAS MADE.