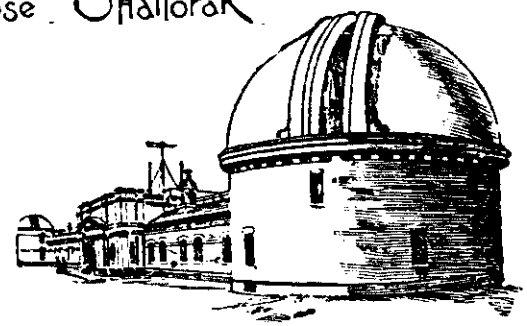
MARVELS OF MODERN ASTRONOMY

·BY· Rose O'Halloran



THE expected completion of the Yerkes telescope before the end of the present year awakens many thoughts and hopes and fears in the minds of astronomical students throughout the world, as to the possiblities vested in the elaborate equipment of the new observatory.

Like the Lick telescope, it has been manufactured with the view of surpassing all others previously made.

If it were but a matter of money, size and time, fulfilment might be assumed, but optical science has to contend with drawbacks that strengthen and grow in proportion to the size of the lens.

There is no doubt, however, but that the munificence of Mr Yerkes in the cause of science will yield great and enduring results.

On an elevation near the shores of Lake Geneva, Wisconsin, many miles removed from the disadvantages of city surroundings, a cruciform structure has been erected, mainly with a view to stability, though its gray brick walls and domed roofs have also attained no small share of architectural merit. The large dome on the west side, being ninety feet in diameter, will afford ample space for the great telescope, which is a 40 inch refractor.

All important details have received more than usual thought and study, and as the construction of a large telescope and its accessories is no longer an untrodden path there has been a wide scope, both for the avoidance of mistakes and the adoption of approved experiments.

The chief instrument, as the illustration shows, is similar in general aspect to the Lick refractor, with which American astronomers and a large portion of the Californian public are already familiar. The colossal tube, which alone weighs six tons, varies in diameter from 42 inches near the lens to 52 at the central part and 38 at the eye end, and is 62 feet in length, being two feet longer and four inches wider in diameter than the tube at Mount Hamilton.

On account of the unfortunate tendency of these heavy tubes to flexure, or a drooping of both ends from the propped up central part, which is fastened to the declination axis, special care has been given to attain rigidity in its construction, as such flexure counteracts to some extent the excellence of lens and eyepiece. By many ingenious mechanical contrivances the mounting is also given the full benefit of past experience.

As in the case of all giant refractors, it has an equatorial motion, and keeps pace by means of a driving clock with the movement of the heavenly bodies westward, thus counteracting the effect of the earth's rotation. The movable floor is nearly similar to that of Mount Hamilton, but, with the movements of the dome and telescope, is controlled by electric motors convenient to the observer.

The two smaller domes will be used for telescopes of medium size, one a 12-inch and the other a 16-inch, and between them is a room occupied by the heliostat, an instrument so constructed as to cause the sunbeam under observation to remain fixed and unaffected by the diurnal motion.

The meridian-room at the east end of the structure is destined to hold a telescope of more than ordinary efficiency for observing heavenly bodies on the meridian and making accurate measurements of their positions. The meridian circle, as it is named, is devoted exclusively to this most important duty of an observatory.

Spectroscopic, physical, and chemical laboratories, photographic apartments, a library, and many other accessories to a thoroughly equipped observatory occupy the central portion of the building.

The director, Professor George E. Hale, will devote special attention in person to solar observations, and photographs of the sun will be taken every few minutes on clear days.

The chief centre of attraction, the 40-inch lens, first designed for a proposed Southern California observatory, will be devoted to those researches that are most thwarting to the powers of average instruments; such as the discovery of new satellites, nebular and planetary details, and close double stars, which have been chiefly discovered by Professor S. W. Burnham, now a member of the staff.

The coming winter will probably forecast the achievements of the great telescope. Those who understand the possibilities of optical science are not likely to be disappointed, but the enthusiasts who are yearning for a message from Mars will no doubt find that interplanetary signal service is still in a backward condition.

A short account of the other great observatories of the world may be of some interest at this time.

Of the Lick Observatory, already a familiar subject to the reading public, it need only be said that it will prove a close rival to any astronomical institution likely to appear for many years.

As terrestrial divisions are of little moment in a science that reaches beyond the stars, the 'four corners of the earth' being all too limited for the aim in view, the description will proceed in the order of size and efficiency without regard to country, continent or period of construction. It is not generally understood that a reflecting telescope in order to be the peer of a refractor, must be about double its tubular diameter, and then weight and unwieldiness hamper its use and accuracy, though for photographic and spectroscopic work it possesses compensating facilities that leave the conceded superiority of the refractor open to some exceptions. On the ground of general preference, the large reflectors will be considered first and separately.

Five miles west of Paris the ruined Castle of Meudon, once the scene only of royal pageantry and revels, is now devoted to a nobler use and holds in its lordly tower an instrument destined for greater achievement than any of the royal occupants of former years. More than thirty-two inches in diameter and fifty-five feet in focal length, it is inferior in size only to the Lick and the Yerkes telescopes. Somewhat unique in construction, it has been made with a view to meeting the requirements of the 'new astronomy,' which previously were a secondary consideration in the designing of a giant telescope.

This so-called new branch of the science is comparatively new to mankind, preoccupied as they have hitherto been with wars and superstitions, while the great works of nature rested unknown. After half a century of investigation it is still in its infancy, though with a promising future opening before it. It deals with the knowledge gained by means of the spectroscope of the vaporous material of which the luminous orbs of heaven are composed; and also includes the photographic discoveries withheld from telescopic vision. The 32-inch lens is mounted in a square tube of steel which is also adapted to hold a 24-inch lens specially suited for photographic work.

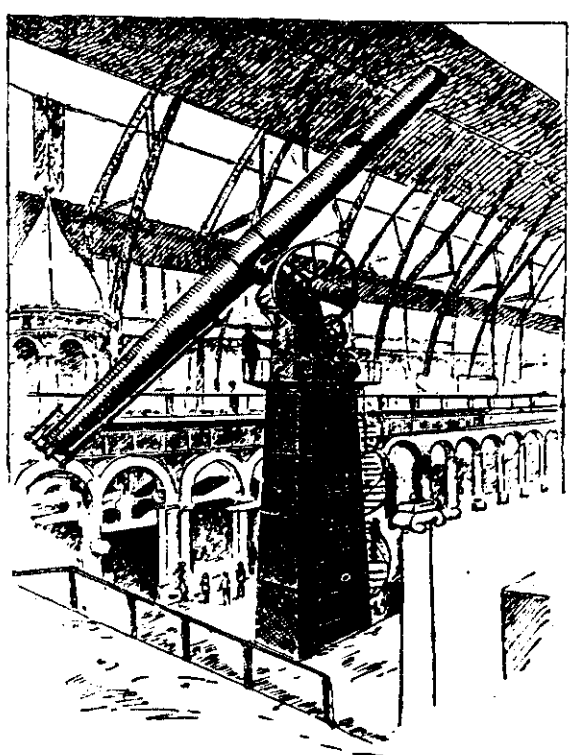
The spectroscopic equipment will soon place the observatory in the lead of astrophysical research, and the specimens of photography that have already appeared are of the highest excellence.

A reflecting telescope three feet and a third in diameter completes the important part of the equipment, which will owe much of its efficiency to the scientific zeal of M. Janssen, the director, who was the first to announce that the solar flames could be viewed without the sheltering shadow of an eclipse. This noted French savant it was who soared in a balloon beyond the reach of German rifles during the siege of Paris for the purpose of vewing a solar eclipse in the line of totality. Unfortunately a cloudy day frustrated his efforts and the instruments he had conveyed under such difficulties were unused.

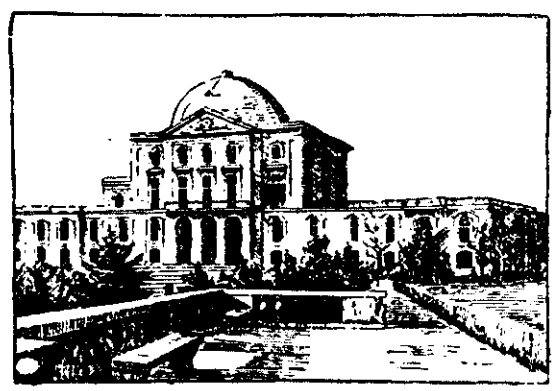
Though advanced in years he ascended to the summit of Mount Blanc in 1890, and took some valuable solar observations at that high altitude, where an observatory has since been established.

The director of the Imperial Observatory, Pultowa, Russia, ordered a lens thirty inches in diameter from Messrs Clark, of Boston, in 1879, and what at that time was the largest refracting telescope in the world was completed in 1882. It is considered to have a slight advantage over the Lick in the matter of colour correction and the obtrusive violet halo is less conspicuous in observations on that account. The mounting of the polar axis was officially commended by Professor Newcomb a few years ago, when visiting the European observatories, and also the method of illuminating the finding circles so as to be readable at the eyepiece by the observer.

This latter convenient device was then almost unknown in this country, though since put in use on a more effective scale at Mount Hamilton. The detection of close double stars, the measurement of star distances, and investigations as to the constitution of the rings of Saturn, are among the researches to which this great instrument has been devoted. The observatory also contains a 15½-inch refractor, excellent meridian circles, an astro-physical laboratory, equipments for photographic work, an extensive astronomical library containing many



THE YERKES TELESCOPE. CLEAR APERTURE OF OBJECTIVE FORTY INCHES. [From an approved engraving.]



MEUDON OBSERVATORY, NEAR PARIS. [Reproduced from an engraving]