

COMMON TELESCOPES AND WHAT THEY WILL SHOW.

BY G. E. LUMSDEN.

THE opening years of the Seventeenth Century found the world without a telescope, or, at least, an optical instrument adapted for astronomical work. It is true that Arabian and some other eastern astronomers, for the purpose, possibly, of enabling them to single out and to concentrate their gaze upon celestial objects, used a long cylinder without glasses of any kind and open at both ends. For magnifying purposes, however, this tube was of no value. Still it must have been of some service, else the first telescopes, as constructed by the spectacle makers, who had stumbled upon the principle involved, were exceedingly sorry affairs, for soon after their introduction, the illustrious Kepler, in his work on Optics, recommended the employment of plain apertures, without lenses, because they were, in his opinion, superior to the telescope, being free from the color-fringes around images, due to refraction.

But the philosophers were not long in appreciating, at something like its true value, the accidental discovery that lenses could be so arranged as to appear, by magnifying them, to bring distant objects nearer to the eye. They saw the possibilities, as it were, that underlay this novel principle, if rightly applied in the field of astronomy, and they labored to improve the new "Optick tube," which soon ceased to be regarded as a toy. Galilei worked as hard in developing the telescope as if he had been its inventor, and, long before his death, he succeeded not only in making a convert of Kepler, but in constructing glasses with which he made discoveries that have rendered his name immortal. Yet his best telescope did not magnify much above thirty times, or, in other words, not so

well as some of the spy-glasses, one inch and one-quarter in aperture, that can be purchased now-a-days in the shops of the opticians. With one of these small telescopes, one can see the moons of Jupiter, some of the larger spots on the sun, the phases of Venus, the stellar composition of the Milky Way, the "seas," the valleys, the mountains, and, when in bold relief upon the terminator, even some of the craters and cones of the moon. These practically comprise the list of objects seen in a more or less satisfactory manner by Galilei; but the spy-glass, if it be a very good one and armed with an astronomical eye-piece of some power, will show something more, for it will not only split a number of pretty double-stars, but will reveal a considerable portion of the Great Nebula in Orion, and enough of the Saturnian system to enable one to appreciate its beauty and to understand its mechanism, though it must be admitted that these results would be mainly due to the fact that observers now know what to look for—a great advantage in astronomical work, and one not always possessed by Galilei.

For nearly one hundred and fifty years, telescopes labored under one serious difficulty. The images formed in them were more or less confused, and were rendered indistinct by certain rainbow tints due to the unequal bending or refracting of the rays of light as they passed downwards through the object-glass, or great lens, which was made in a single piece. To overcome this obstacle to clear vision, and also to secure magnification, the focal lengths of the instruments were greatly extended. Telescopes 38, 50, 78, 130, 160, 210, 400, and even 600 feet long were con-