

the evil was irremediable, and that a compound lens could no more refract without producing color, than a single lens could. Euler and Klingenstierna doubted the exactness of Newton's proposition; and, in 1755, Dollond disproved it by experiment. This discovery pointed out a method of making object-glasses which should give no color;—which should be *achromatic*. For this purpose Dollond fabricated various kinds of glass (flint and crown glass); and Clairaut and D'Alembert calculated formulæ. Dollond and his son⁶ succeeded in constructing telescopes of three feet long (with a triple object-glass) which produced an effect as great as those of forty-five feet on the ancient principles. At first it was conceived that these discoveries opened the way to a vast extension of the astronomer's power of vision; but it was found that the most material improvement was the compendious size of the new instruments; for, in increasing the dimensions, the optician was stopped by the impossibility of obtaining lenses of flint-glass of very large dimensions. And this branch of art remained long stationary; but, after a time, its epoch of advance again arrived. In the present century, Fraunhofer, at Munich, with the help of Guinand and the pecuniary support of Utzschneider, succeeded in forming lenses of flint-glass of a magnitude till then unheard of. Achromatic object-glasses, of a foot in diameter, and twenty feet focal length, are now no longer impossible; although in such attempts the artist cannot reckon on certain success.

[2d Ed.] [Joseph Fraunhofer was born March 6, 1787, at Straubing in Bavaria, the son of a poor glazier. He was in his earlier years employed in his father's trade, so that he was not able to attend school, and remained ignorant of writing and arithmetic till his fourteenth year. At a later period he was assisted by Utzschneider, and tried rapidly to recover his lost ground. In the year 1806 he entered the establishment of Utzschneider as an optician. In this establishment (transferred from Benedictbeuern to Munich in 1819) he soon came to be the greatest Optician of Germany. His excellent telescopes and microscopes are known throughout Europe. His greatest telescope, that in the Observatory at Dorpat, has an object-glass of 9 inches diameter, and a focal length of $13\frac{1}{2}$ feet. His written productions are to be found in the *Memoirs* of the Bavarian Academy, in Gilbert's *Annalen der Physik*, and in Schumacher's *Astronomische Nachrichten*. He died the 7th of June, 1826.]

⁶ Baily, iii. 118.