means, and seems to have been careless of fame : at least he took no trouble to communicate his invention to the world. At a trial in Westminster Hall about the patent rights granted to Dollond (Watkin *v.* Dollond),@@1 Hall was admitted to be the first inventor of the achromatic tele­scope ; but it was ruled by Lord Mansfield that “it was not the person who locked his invention in his scrutoire that ought to profit for such invention, but he who brought it forth for the benefit of mankind.”@@2 In 1747 Euler com­municated to the Berlin Academy of Sciences a memoir in which he endeavoured to prove the possibility of correct­ing both the chromatic and the spherical aberration of an object-glass. Like Gregory and Hall, he argued that, since the various humours of the human eye were so combined as to produce a perfect image, it should be possible by suitable combinations of lenses of different refracting media to construct a perfect object-glass. Adopting a hypo­thetical law of the dispersion of differently coloured rays of light, he proved analytically the possibility of constructing an achromatic object-glass composed of lenses of glass and water. But all his efforts to produce an actual object­glass of this construction were fruitless,—a failure which he attributed solely to the difficulty of procuring lenses worked precisely to the requisite curves (*Mem. Acad. Berlin,* 1753). Dollond admitted the accuracy of Euler’s analysis, but disputed his hypothesis on the grounds that it was purely a theoretical assumption, that the theory was opposed to the results of Newton’s experiments on the refrangibility of light, and that it was impossible to de­termine a physical law from analytical reasoning alone (*Phil. Trans.,* 1753, p. 289). In 1754 Euler communicated to the Berlin Academy a further memoir, in which, starting from the hypothesis that light consists of vibrations excited in an elastic fluid by luminous bodies, and that the differ­ence of colour of light is due to the greater or less fre­quency of these vibrations in a given time, he deduced his previous results. He did not doubt the accuracy of New­ton’s experiments quoted by Dollond, because he asserted that the difference between the law deduced by Newton and that which he assumed would not be rendered sensible by such an experiment.@@3 Dollond did not reply to this memoir, but soon afterwards he received an abstract of a memoir by Klingenstierna, the Swedish mathematician and astronomer, which led him to doubt the accuracy of the results deduced by Newton on the dispersion of refracted light. Klingenstierna showed from purely geometrical considerations, fully appreciated by Dollond, that the re­sults of Newton’s experiments could not be brought into harmony with other universally accepted facts of refraction.

Like a practical man, Dollond at once put his doubts to the test of experiment, confirmed the conclusions of Klingen­stierna, discovered “a difference far beyond his hopes in the refractive qualities of different kinds of glass with respect to their divergency of colours,” and was thus rapidly led to the construction of object-glasses in which first the chromatic and afterwards the spherical aberration were corrected (*Phil. Trans.,* 1758, p. 733).

We have thus followed somewhat minutely the history of the gradual process by which Dollond arrived indepen­dently at his invention of the refracting telescope, because it has been asserted that he borrowed the idea from others. Montucla, in his *Histoire des Mathématiques* (pp. 448-449), gives the following footnote, communicated to him by Lalande :—

“Ce fut Chestermonhall ” (an obvious misprint for Chester Moor Hall) “qui, vers 1750, eut l’idée des lunettes achromatiques. Il s’adressoit à Ayscough,@@4 qui faisoit travaillir Bass. Dollond ayant eu besoin de Bass pour un verre que demandoit le duc d’Yorck, Bass lui fit voir du crown-glass et du flint-glass. Hall donna une lunette à Ayscough, qui la montra à plusieurs personnes ; il en donna la construction à Bird, qui n’en tint pas compte. Dollond en profita. Dans le procès qu’il y eut entre Dollond et Watkin, au banc du roi, cela fut prouvé ; mais Dollond gagna, parce qu’il étoit le premier qui eût fait connoître les lunettes achromatiques.” It is clearly established that Hall was the first inventor of the achromatic telescope ; but Dollond did not borrow the invention from Hall without acknowledgment in the manner suggested by Lalande. His discovery was beyond question an independent one. The whole history of his researches proves how fully he was aware of the conditions necessary for the attainment of achromatism in refracting telescopes, and he may be well excused if he so long placed implicit reliance on the accuracy of experiments made by so illustrious a philosopher as Newton. His writings suffi­ciently show that but for this confidence he would have arrived sooner at a discovery for which his mind was fully prepared. It is, besides, impossible to read Dollond’s memoir (*Phil. Trans.,* 1758, p. 733) without being im­pressed with the fact that it is a truthful account, not only of the successive steps by which he independently arrived at his discovery, but also of the logical processes by which these steps were successively suggested to his mind.

The triple object-glass, consisting of a combination of two convex lenses of crown glass with a concave flint lens between them, was introduced in 1765 by Peter, son of John Dollond, and many excellent telescopes of this kind were made by him.

The limits of this article do not permit a further detailed historical statement of the various steps by which the powers of the telescope were developed. Indeed, in its practical form the principle of the instrument has re­mained unchanged from the time of the Dollonds to the present day ; and the history of its development may be summed up as consisting not in new optical discoveries but in utilizing new appliances for figuring and polishing, im­proved material for specula and lenses, more refined means of testing, and more perfect and convenient methods of mounting. About the year 1774 William Herschel, then a teacher of music in Bath, began to occupy his leisure hours with the construction of specula, and finally devoted himself entirely to their construction and use. In 1778 he had selected the *chef d’œuvre* of some 400 specula which he made for the celebrated instrument of 7-feet focal length with which his early brilliant astronomical dis­coveries were made. In 1783 he completed his reflector of 18 7/10-inches aperture and 20-feet focus, and in 1789 his great reflector of 4-feet aperture and 40-feet focal length. The fame of these instruments was rapidly spread by the brilliant discoveries which their maker’s genius and perse-

@@@1 At a meeting of the Royal Astronomical Society held on 9th May 1886 a legal document, signed by Chester Moor Hall, was presented by Mr R. B. Prosser of the Patent Office to the society. On the same occasion Mr Ranyard made the following interesting statement respecting Hall :—

“ Some years ago very little was known about Moor Hall. It was known that, about seven years after the patent for making achromatic object-glasses was granted to Dollond, his claim to the invention was disputed by other instru­ment-makers, amongst them by a Mr Champness, an instrument-maker of Cornhill, who began to infringe the patent, alleging that John Dollond was not the real inventor, and that such telescopes had been made twenty-five years before the granting of his patent by Mr Moor Hall. John Dollond, to whom the Copley medal of the Royal Society had been given for his inven­tion, was then dead, and his son brought an action for infringing the patent against Champness. There is no report of the case, but the facts are referred to in the reports of subsequent cases. It appears that workmen who had been employed by Mr Moor Hall were examined, and proved that they had made achromatic object-glasses as early as 1733. Dollond’s patent was not set aside, though the evidence with regard to the prior manufacture was accepted by Lord Mansfield, who tried the case, as having been satisfactorily proved. . . . Mr Hall was a bencher of the Inner Temple, and was alive at the time of the action. He was a man of some property, and is spoken of on his tombstone as an excellent lawyer and mathematician. He was not a fellow of the Royal Society, but must certainly have known of the gift of the Copley medal to Dollond. It is very curious the conflicting evidence we have to reconcile, but I think the balance of evidence is in favour of there having been a prior in­vention of achromatic object-glasses before the date of Dollond’s patent” *(Astron. Register,* May 1886 ; see also the *Observatory* for same date).

*@@@*2 *Gentleman's Magazine,* 1790, part ii. p. 890.

@@@3 For a good account of this controversy, see Dr. H. Servus *Ge­schichte des Fernrohrs,* p. 77 *sg.,* Berlin, 1886.

@@@4 Ayscough was an optician in Ludgate Hill, London.