The Dollond Family

Five Generations of Opticians

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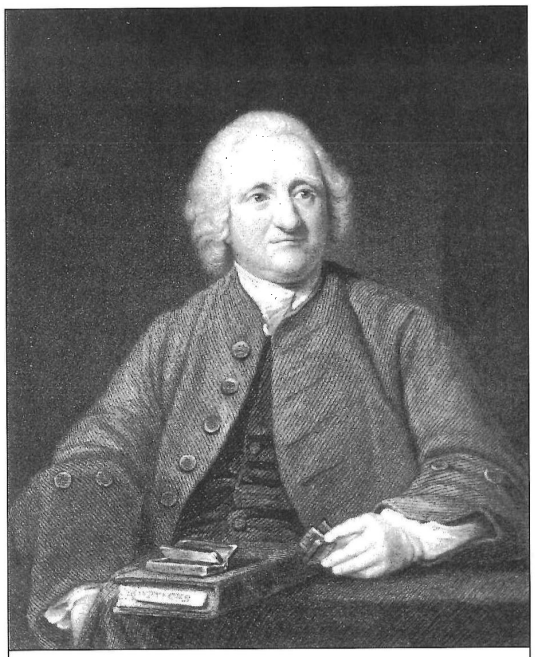

Figure 1: *John Dollond (1706-1761).*

Abstract

The history of the Dollond family and the optical business for which they are famous are traced from the time of the Huguenot migration from France in the late 17th century down to the great-great grandsons of John Dollond, who patented the achromatic telescope. Eleven members of the family were opticians, including Jesse Ramsden who married a daughter of John Dollond. A family tree has been constructed to help understand the complex connections in this family which had so much to do with the development and manufacture of telescopes.

The Huguenot emigration to England

In 1598, after 32 years of religious wars, Henry IV of France initiated a long period of peace and stability by issuing a proclamation, the Edict of Nantes, which gave full freedom of worship to the nearly 10% of the population of France that was Protestant. However, by 1685 the religious climate had changed and Henry's grandson, Louis XIV, revoked the Edict and forbade the Protestants, called Huguenots, from practicing their religion. Those who resisted were subjected to hideous tortures and other persecution. Although they were forbidden to emigrate, 400,000 managed to escape, about 50,000 of whom went to England. The Huguenots were skilled in crafts and commerce and were welcomed in their new countries where they established a number of new arts and manufactures which proved highly beneficial to their host countries. A section of London was given to the Huguenot silk weavers, among them Jean Dollond who came from Normandy. It is believed that the name Dollond may be a corruption of d'Hollande, suggesting that the Dollonds may have been of Dutch origin.

The Dollond family in London

On June 10, 1706 a son, John, was born to the Dollond family in Spitalfields in London. After his father's early death, John left school and took up the weaving trade to help support his family. However, not having quenched his thirst for learning, he continued his studies privately. These included Latin, Greek, anatomy, theology, algebra, geometry, optics, and astronomy. His portrait is shown in Fig. 1.

His eldest son Peter at first joined his father in the weaving business, but having developed an interest in optics through his father, he set up shop instead as an optician. Seeing his son's success, John, at the age of 46, joined Peter in the optical business.

John Dollond's inventions

John had an inventive mind and in the following year he produced two new devices for use with telescopes. One was a new ocular with less spherical aberration. He noted that this aberration increased as the cube of the amount of refraction, so he divided the refraction among two or more lenses. He also found that by adding another lens to the ocular he could reduce the chromatic aberration as well. The other invention was the divided object-glass micrometer, also called a heliometer. As shown in Fig. 2, the objective lens of a telescope was divided into two halves, one of which could be racked laterally along a scale giving a double image. This micrometer became an important tool for astronomy which enabled the user to measure small angles such as the angular diameter of a planet or the spacing between two stars. The spheroidal shape of the planets was measured with it, as were the elongations of Jupiter's satellites, the lunar diameter, and the variation of the sun's apparent diameter with the seasons.

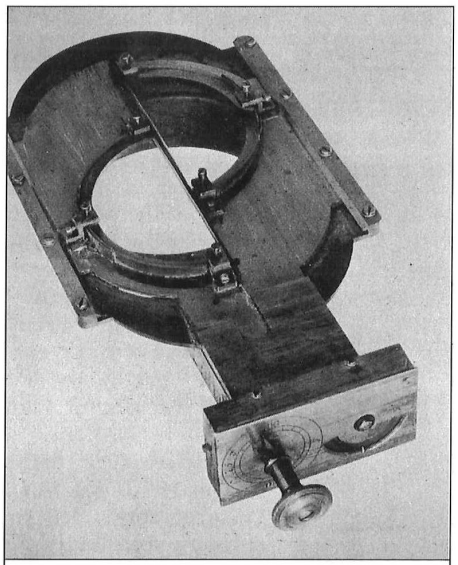

Photo 2: *Heliometer invented by John Dollond. This is a modification to a telescope used to measure small angular separations.*

These inventions were disclosed to James Short, a well-known London optician who read the papers before the Royal Society in 1753. In England at that time there was friendly intercourse between professional scientists and instrument makers that brought the latter into the circle of the scientific community. The best of the mechanics were elected to fellowship in the Royal Society. This was in contrast to the situation in France where the rigid class system put the craftsman in a distinctly lower class than the gentleman scientist. This difference in attitudes showed up in the quality of the instruments and was described by J.D. Cassini, the Director of the Paris Observatory who wrote: "I have the more noticed, especially since my journey in England, that the inferiority of our makers compared with the English comes from their profound theoretical ignorance; the Ramsdens, the Dollonds are geometers and physicists, our best makers are but workmen".

John Dollond is best known for his invention of the achromatic lens, one of the most important developments in the history of telescope making. The story of that development and its aftermath is long and complex, involving a challenge to the work of the late Sir Isaac Newton, a prior invention by a reclusive lawyer named Chester Moor Hall, and an ongoing series of patent disputes, not to mention nationalistic controversies among scientists from other countries. This is a lengthy story in itself and since it has been told in various other places, I will not go into it here except to describe John Dollond's important early prism experiments as he reported them to the Royal Society in 1758. It was these experiments that led to the development of a practical achromatic telescope.

Dollond's prism experiment

Dollond cemented together plates of glass to form a wedge-shaped vessel into which he put a 60º glass prism and filled the remaining spaces with water. This formed two prisms of water which were wider at the top and a prism of glass which was wider at its bottom. The angles of the sides were variable, thus changing the angle of the water prisms. This was the same type of device that Newton had used, but Dollond found quite a different behavior. He varied the angle between the plates of glass until the refraction of the water cancelled that of the glass prism, but unlike Newton, he observed that the transmitted light was "much infested with prismatic colors". He then tried the converse experiment in which the angle was varied to cancel the dispersion to see if any refraction remained, but with his 60º prism he could not make the angle of the vessel large enough so he replaced that prism by one with 9º angle. Then, when he cancelled the dispersion, he found that he was left with a considerable refraction.

Fortified with this new knowledge, he attempted to build a telescopic objective consisting of two glass lenses with water in between but the large curvatures needed produced too much spherical aberration. So, he went back to the prism experiments and made wedge-shaped prisms out of various kinds of glass such as Venice glass, English

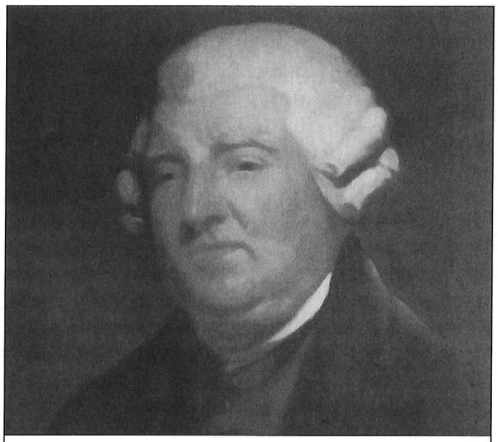

Figure 3: *Peter Dollond (1730/31-1820).*

crown glass, and white flint glass. He discovered that the crown and flint glasses had the greatest differences in dispersion so he made his telescope objective of those materials. At our 1996 Convention, Rolf Willach told us how Dollond probably went about shaping his lenses in the most economical way to give the least spherical and chromatic aberration. The result was such a great reduction in the aberrations that it made the refracting telescope competitive with the reflecting telescope. The Royal Society conferred its prestigious Copley Medal on Dollond for his achievement and elected him to fellowship.

The Dollond business

The new achromatic telescopes were obviously better than those sold by other makers and the micrometer devised by Dollond provided astronomers with a new and powerful tool. Son Peter, shown in Fig. 3, was an astute businessman and with these superior products, the firm of Dollond & Son prospered and they were soon receiving orders from all parts of the world. Their customers included Frederick the Great, Leopold Mozart, the father of the famous composer, and Nevil Maskelyne, the Astronomer Royal. In 1761 John was appointed optician to the king, but enjoyed this honor for less than a year before he died.

Although Peter Dollond did not have the theoretical knowledge of his father, he was not without inventive skills and he was able to improve on his father's achromatic doublet by adding a third lens to reduce spherical aberration and to allow the use of a greater aperture. At first that system was used only on small spyglasses, such as the one shown in Fig. 4, but later he made triplet lenses up to about 4" in diameter. With the difficulty of obtaining flint glass in that size, this represented the ultimate in telescope making at that time. William Kitchener, an amateur authority on telescopes, thought very highly of Dollond telescopes and called Peter "the Father of Practical Optics". He declared a 5-foot achromatic telescope made by Dollond to be "as perfect an Instrument as Art can produce". Dollond was even able to make a telescope with an object glass of 10 feet focal length and 5 inch diameter for the Royal Observatory at Greenwich, but that was the only one of that size that he ever constructed.

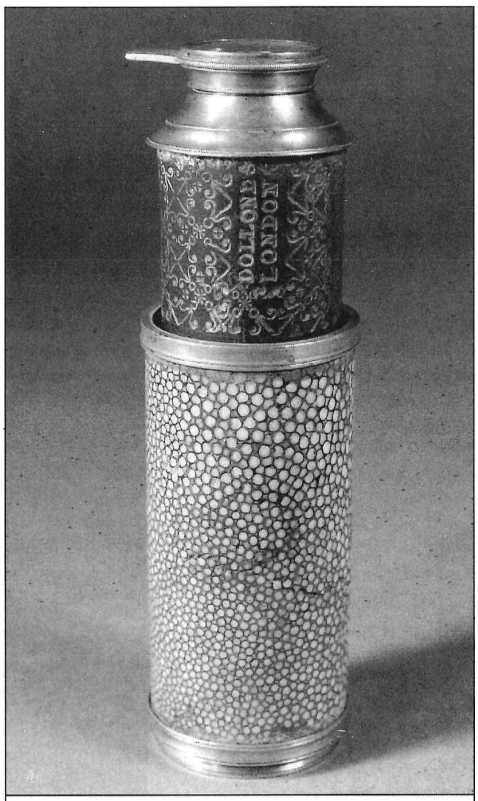

Photo 4: *A spyglass with a triplet objective lens by Dollond.*

In 1767 Dollond moved his shop to larger premises at 59 St. Paul's Churchyard, and at that time he took his younger brother John into the business. Together they produced high quality optical apparatus including spectacles, magnifiers, telescopes, surveying instruments, theodolites, microscopes, and sextants. In 1769 Captain James Cook, who was preparing an expedition to Tahiti to observe the transit of Venus, had Dollond convert his achromatic telescope into a heliometer. The Napoleonic Wars created a demand for compact hand telescopes and about 1780 Dollond introduced the "Army Telescope" which had a brass-bound mahogany body with telescoping brass draws. These had apertures ranging from 1 to 2 3/4 inches. Dollond supplied instruments to many observatories on the continent; an equatorial circle to Cassel, a 30-inch Gregorian telescope to Greifswald and other instruments to Vilna in Poland, to Stockholm and Upsala in Sweden, and to Geneva, Switzerland as well as a transit telescope to Milan, Italy. The astronomer who went with Captain George Vancouver on his 1791 voyage in search of the Northwest Passage had instruments with him by Dollond and Ramsden.

In addition to his business duties, Peter became the director of the French Hospital in East London, and was Master of the Worshipful Company of Spectacle Makers. He was appointed Optician to His Majesty and to His Royal Highness the Duke of York. His reputation spread across the ocean and he was also elected a member of the American Philosophical Society.

Jesse Ramsden (1734-1800)

In 1755 Jesse Ramsden, shown in Fig. 5, the son of a Yorkshire innkeeper, became an apprentice to a mathematical instrument maker in London named Mark Burton. He soon became highly skilled in engraving and was much in demand by other instrument makers. In 1763 he set up his own business and rapidly became an expert in his trade. Two years later he married Peter Dollond's youngest sister Sarah, and as part of the marriage agreement he was given a share of her father's patent for making achromatic lenses. Although he had his own shop, he maintained a business relationship with the Dollonds.

Ramsden was an unusually clever person who devised many instruments and made improvements in others. In his portrait, his arm rests on his most important invention, namely his dividing engine which revolutionized the making of instruments having angles or distances marked on a scale. While the best divider at the time achieved an accuracy of 3 seconds of arc, Ramsden's did better than a half second. He was elected a fellow of the Royal Society and was awarded its Copley Medal in 1792 for the invention of this dividing engine. In 1779 he began making what is now called the Ramsden eyepiece; a type still used today. Some have called Ramsden the greatest practitioner of all time. He was certainly one of the leading instrument makers of his day and the products of his workshop are highly prized by collectors today.

Ramsden is shown in the picture with the large theodolite-like instrument that he finished in 1789 for

Giuseppe Piazzi's new observatory at Palermo, Italy. With it Piazzi catalogued 8000 stars. To commemorate an instrument Ramsden had made for the Emperor of Russia, the artist of the portrait added the fur coat that Ramsden wears. This, however, did not please Ramsden who said that he had never worn such a thing in his life!

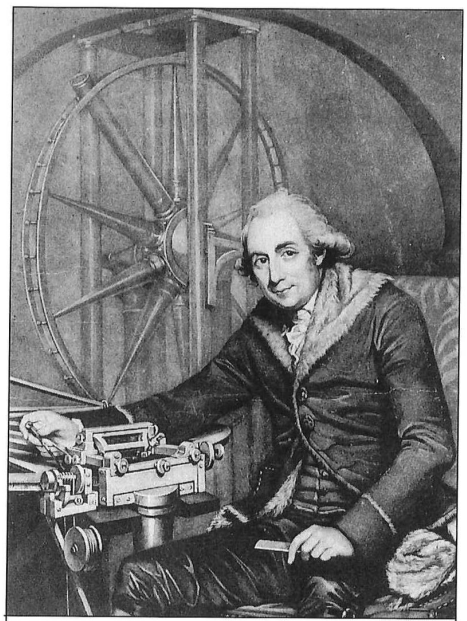

Figure 5: *Jesse Ramsden (1734-1800).*

Besides telescopes, he sold balances, barometers, drawing instruments, lightning demonstrators, microscopes, quadrants, sectors, theodolites, and thermometers. His shop sold over 1400 sextants during his career. Ramsden employed as many as fifty workmen in his shop but still had trouble keeping up with the demand for his instruments.

In the mid-18th century the French made a national survey of their country and in 1783 they suggested that the observatories at Paris and Greenwich be linked by triangulation across the channel to resolve a disagreement over their relative meridians. The following year the surveyor William Roy undertook this project. Since he wanted the highest accuracy possible, he chose Ramsden to provide the instruments for the survey including a large theodolite. Roy and his crew had to wait three years for this instrument to be completed and he complained bitterly in his reports about the long delay. But when it was finally delivered, it was a magnificent instrument. It contained two telescopes, 30" long with 2 1/2" aperture. Angles could be read with an error of only 2 arc seconds and when it was used to triangulate in both directions between two baselines 380 miles apart, the two measurements differed by only 5 inches, an astounding achievement at that time.

Cassini, after his 1787 visit to the London instrument makers, wrote about Ramsden: "The fruitful genius of this maker, the perfection of his work, and his consummate experience in his trade, led me to recognise that, for a long time it will be difficult, I do not say to surpass, but simply to equal him ... our makers produce very inferior instruments for you and spend twice as much as one of Ramsden's masterpieces would cost".

He was highly respected and was known as "Honest Jesse". If a completed instrument didn't come up to his standards, he would say, "Bobs, man! this won't do; we must have at it again", and it was rejected, regardless of the cost. He lived frugally, ate and slept little but he constantly studied. One of his obituaries describes his habits as follows:

"Most of his evenings were spent drawing plans by the kitchen fire, a cat on one side, a mug of porter and a plate of bread and butter on the other, while some apprentices sat round, and he whistled or sang. After explaining a design to a workman, he would say, 'Now, see, man, let us try to find fault with it', and intelligent suggestions generally led to amendments".

His chief failing was his total disregard for time. His frustrated customers sometimes had to wait for many months or in one case, as long as 23 years for delivery. At one time the king ordered an instrument from him and specified the time it was to be delivered. When Ramsden came with the instrument, the king noted wryly that he had come at the right day and the right hour, but exactly one year late!

Figure 6: *George Huggins Dollond (1774-1852).*

Peter Dollond answered the derogatory remarks made by some foreign scientists about his father in a 1789 paper read to the Royal Society. In it he defended his father's claim to be the inventor of the achromatic telescope but no mention was made of Chester Moor Hall, the lawyer who had made an achromatic telescope nearly a quarter of a century before Dollond. In fact, by this time Hall's name had been all but forgotten. The facts, however, were well known to Ramsden who felt that Hall should his receive proper recognition. But as a brother-in-law and business associate of Peter, Ramsden was in an uncomfortable position. His solution was to publish an anonymous letter in Gentleman's Magazine in 1790 giving Hall the credit for the invention. He signed it "Veritas", the Latin word for truth. At about the same time he deposited in the archives of the Royal Society a signed, handwritten testament in which he stated a similar set of facts. However, in this document he was careful to also give credit to his father-in-law who "does not appear to be indebted to Mr. Hall for the discovery, any further than that he accidentally learned from Mr. Bass [the optician who ground Hall's lenses] the proper materials for making Achromatic object Glasses". This document was only recently rediscovered and its text published by Stuart Talbot. Ramsden died on November 5, 1800 at the age of 65. His only son, John, was a captain for the East India Mercantile Marine.

The third generation of opticians

George Huggins, shown in Fig. 6, the son of Peter's youngest sister Susan, was born in 1774 in London. His father was a hatter who died while George was young. When George's father died, his uncle Peter took charge of his education. After his formal schooling he was apprenticed to Charles Fairbone, a mathematical instrument maker and in 1788 he became an apprentice to his uncle. For a long time he was incapacitated with a severe illness but he recovered and soon developed such ability that he was put in charge of the mathematical instrument department of the Dollond business.

In 1804 Peter's partner, the younger John Dollond, died and the following year Peter made his apprentice and nephew a partner in the business. At that time Huggins, by royal patent, changed his name to Dollond. Telescopes from their shop continued to enjoy a good reputation and the Duke of Wellington is said to have spoken of "the advantage which the excellence of Dollond's glasses gave him over the French generals, who were supplied with very inferior instruments".

Peter Dollond's daughter Louisa married John Kelly who, in addition to being the rector at Copford in Essex, was also a linguist who authored the Triglott Celtic dictionary and translated the Bible into the Manx Gaelic language. Kelly also wrote a short book on the life of John Dollond, his wife's grandfather.

Since the family connections begin to get complicated here, it may be well to refer to the Dollond family tree in Fig. 7. While this was a very inventive family, they seemed to be curiously unable to invent new names for their male children. There were two John Dollonds (or three if one counts the patriarch Jean), three named George Huggins, two of whom changed their names to Dollond, two named John Huggins, and two named William Huggins. Altogether there were eleven opticians in the family spread out over five generations.

Peter Dollond retired to his country home at Richmond Hill on the outskirts of London in 1817 and died three years later at the age of 89. At that time the business passed to George. He was a man of strong character and personality

Figure 8: *George Huggins Dollond (?-1866).*

and possessed exceptional skill and ability. Observatories at Cambridge, Madras, and Travancore were equipped by him. For measuring close double stars he devised a telescopic micrometer based on the double refraction of a spherical crystal which was used as an eyepiece. He read papers before the Royal Society on improvements in a variety of scientific instruments and in 1831 he was commissioned by the Society to construct a telescope on a new optical idea proposed by Peter Barlow. This was the use of a fluid concave lens placed some distance down the tube from the crown glass objective in the so-called "dialytical" arrangement. A smaller telescope, built on that principle by Barlow, had seemed promising, but the larger instrument was marred by secondary chromatic and spherical aberrations and the dialytical idea was discarded. A 5-inch achromatic telescope was made by Dollond for Elias Loomis and Denison Olmsted at Yale University, and until 1836 it was the largest such instrument in the United States.

George took an active part in the founding of the Astronomical Society in 1820 and was one of the original

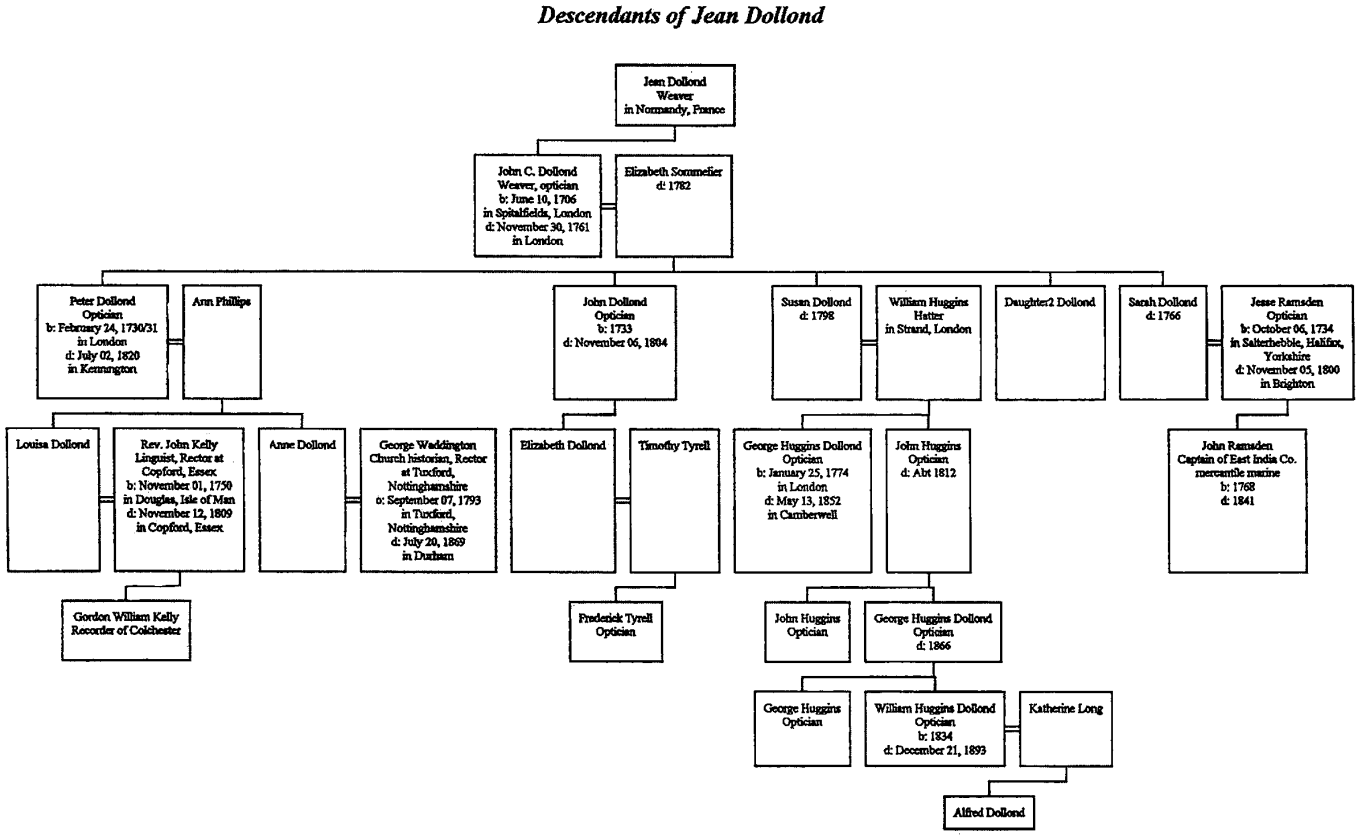

Figure 7. Dollond family tree showing descendants of Jean Dollond, father of John Dollond.

fellows of the Royal Geographical Society. Dollond collaborated with Michael Faraday and Sir John Herschel in the attempt to manufacture better flint glass. Dollond, following in the footsteps of his uncle and grandfather, was appointed Optician to Her Majesty Queen Victoria.

When George Dollond died in 1852 the business passed to his nephew George Huggins who also changed his name to Dollond. He is shown in Fig. 8. He was scientifically inclined and under his direction the business catered especially to astronomers. He was also the one who introduced the very popular "Day or Night" telescopes for mariners, and at the Great Exhibition of 1851 he exhibited a unique self-registering weather recorder. He was a fellow of the Royal Society, Master of the Spectacle Makers Company, and optician to Queen Victoria. In that capacity he outfitted the royal yacht with nautical and astronomical instruments.

The business passes out of the family

When George died in 1866, his son William inherited the business. However, he suffered from poor health and five years later the business passed out of the family to J.R. Chant, a long-time employee. The firm was sold in 1903 to two brothers Norman and Harold Parsons. Although the business had left the family, it retained the famous name of Dollond.

In 1889 an optician named James Aitchison opened the first sight-testing establishment and was the first to employ scientific methods to test eyes and fit eyeglasses. The two firms merged in 1927 to become Dollond & Aitchison. They now have numerous optical shops in England and also have outlets in Spain, Italy, and other countries. However, they no longer make telescopes; their chief product now being eyeglasses. Unfortunately, according to Mr. Stuart Eadon-Allen, former Research Director at the company, all of the company records were destroyed during the bombing of London in World War II, so it is difficult to piece together a complete history of this famous optical company started 250 years ago by an immigrant silk weaver and his son. But it is clear that the contributions of the Dollond family have been of immense importance to the fields of optics, astronomy, and instrument making.

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