

What Man Devised That He Might See by Richard D. Drewry, Jr., MD

Apparently no visual instruments existed at the time of the ancient Egyptians, Greeks, or Romans. At least this view is supported by a letter written by a prominent Roman about 100 B.C. in which he stressed his resignation to old age and his complaint that he could no longer read for himself, having instead to rely on his slaves. The Roman tragedian Seneca, born in about 4 B.C., is alleged to have read "all the books in Rome" by peering at them through a glass globe of water to produce magnification.

Nero used an emerald held up to his eye while he watched gladiators fight. This is not proof that the Romans had any idea about lenses, since it is likely that Nero used the emerald because of its green color, which filtered the sunlight. Ptolemy mentions the general principle of magnification; but the lenses then available were unsuitable for use in precise magnification.

The oldest known lens was found in the ruins of ancient Nineveh and was made of polished rock crystal, an inch and one-half in diameter. Aristophanes in "The Clouds" refers to a glass for burning holes in parchment and also mentions the use of burning glasses for erasing writing from wax tablets. According to Pliny, physicians used them for cauterizing wounds.

Around 1000 A. D. the reading stone, what we know as a magnifying glass, was developed. It was a segment of a glass sphere that could be laid against reading material to magnify the letters. It enabled presbyopic monks to read and was probably the first reading aid. The Venetians learned how to produce glass for reading stones, and later they constructed lenses that could be held in a frame in front of the eyes instead of directly on the reading material.

The Chinese are sometimes given credit for developing spectacles about 2000 years ago--but apparently they only used them to protect their eyes from an evil force. In the year 1268, Roger Bacon, the English philosopher, wrote in his *Opus Majus*: "If anyone examine letters or other minute objects through the medium of crystal or glass or other transparent substance, if it be shaped like the lesser segment of a sphere, with the convex side toward the eye, he will see the letters far better and they will seem larger to him. For this reason such an instrument is useful to all persons and to those with weak eyes for they can see any letter, however small, if magnified enough". In 1289 in a manuscript entitled *Traite de con uite de la famille, di Popozo* wrote: "I am so debilitated by age that without the glasses known as spectacles, I would no longer be able to read or write. These have recently been invented for the benefit of poor old people whose sight has become weak". Thus it appears that the first spectacles were made between 1268 and 1289. In 1306 a monk of Pisa delivered a sermon in which he stated: "It is not yet twenty years since the art of making spectacles, one of the most useful arts on earth, was discovered. I, myself, have seen and conversed with the man who made them first". The name of the true inventor of eyeglasses remains lost in obscurity.

The first known artistic representation of eyeglasses was painted by Tommaso da Modena in 1352. He did a series of frescoes of brothers busily reading or copying manuscripts. One holds a magnifying glass but another has glasses perched on his nose. Once Tommaso had established the precedent, other painters placed spectacles on the noses of all sorts of subjects, probably as a symbol of wisdom and respect. (See Crivelli's painting of St. Peter) From the 14th century, painters also presented portraits of St. Lucy, often carrying her own eyes--they even appeared as lorgnette-like glasses on a stem.

One of the most significant developments in spectacle making in the 16th century was the introduction of concave lenses for the nearsighted. Pope Leo X, who was very shortsighted, wore concave spectacles when hunting and claimed they enabled him to see better than his companions.

The first spectacles had quartz lenses because optical glass had not been developed. The lenses were set into bone, metal or even leather mountings, often shaped like two small magnifying glasses with handles riveted together typically in an inverted V shape that could be balanced on the bridge of the nose. The use of spectacles spread from Italy to the Low Countries, Germany, Spain, and France. In England a Spectacle Makers Company was formed in 1629; its coat of arms showed three pairs of spectacles and a motto: "A blessing to the aged".

From the moment they were invented, glasses posed a problem that wasn't solved for almost 350 years: how to keep them on! For all its developmental changes over the years, the spectacle frame is one of technology's best examples of poor engineering design. It virtually teems with defects. The center of gravity and center of rotation are too far forward to keep the lenses in optimal position. Frames depend far too much upon noses, which vary in size, shape and firmness, and upon ears, which vary in symmetry, in contour of cartilaginous support, and in the amount of hair interposed between frame and ear. They require that the lens plane be perpendicular to the visual axis, yet this is geometrically possible for only one direction of gaze--all other directions will induce changes in spherical and cylindrical power.

They require that the optical center of each lens be supported directly in front of the center of each pupil, but this is manifestly impossible since the eyes are constantly moving, altering in version and vergence.

Spanish spectacle makers of the 17th century experimented with ribbons of silk that could be attached to the frames and then looped over the ears. Spanish and Italian missionaries carried the new models to spectacle wearers in China. The Chinese attached little ceramic or metal weights to the strings instead of making loops. In 1730 a London optician named Edward Scarlett perfected the use of rigid sidepieces that rested atop the ears. This perfection rapidly spread to the continent.

In 1752 James Ayscough advertised his latest invention--spectacles with double hinged side pieces. These became extremely popular and appear more often than any other kind in paintings, prints, and caricatures of the period. Lenses were made of tinted glass as well as clear. Ayscough felt that white glass "gives an offensive, glaring light, very prejudicial to the eyes, and on that account, green and blue glasses have been advised...." In Spain in 1763 Pablo Minguet recommended turquoise, green, or yellow lenses but not amber or red.

European men and women, particularly the French, were self-conscious about wearing glasses. Parisian aristocrats used reading aids only in private. The gentry of England and France used a "perspective glass" or monocular which could be hidden from view easily. In Spain, however, spectacles were popular among all classes because people thought glasses made them look more important and dignified.

Far-sighted or aging colonial Americans imported spectacles from Europe. Spectacles were mainly for the affluent and literate colonists, who required a valuable and treasured appliance. Glasses cost as much as \$200 in the early 1700's. The Boston Evening Post of 1756 carried an advertisement: "Just imported in the Scow Two Brothers, Cpt Marsden, from London and to be sold by Hannah Breintnall at the Sign of the Spectacles, in Second-Street near Black-Horse-Alley." Francis McAllister opened his store in Philadelphia in 1783 with "a bushel basketful" of spectacles, through which presumably his customers could pick and choose.

Benjamin Franklin in the 1780's developed the bifocal. Later he wrote, "I therefore had formerly two pairs of spectacles, which I shifted occasionally, as in traveling I sometimes read, and often wanted to regard the prospects. Finding this change troublesome, and not always sufficiently ready, I had the glasses cut and a half of each kind associated in the same circle. By this means, as I wear my own spectacles constantly, I have only to move my eyes up or down, as I want to see distinctly far or

near, the proper glasses being always ready." Evidently the idea of bifocals had already been experimented with in London as early as 1760 (possibly by Franklin himself, who was there at the time) though never used extensively.

Bifocals progressed little in the first half of the 19th century. The terms bifocal and trifocal were introduced in London by John Isaac Hawkins, whose trifocals were patented in 1827. In 1884 B. M. Hanna was granted patents on two forms of bifocals which become commercially standardized as the "cemented" and "perfection" bifocals. Both had the serious faults of ugly appearance, fragility, and dirt-collection at the dividing line. At the end of the 19th century the two sections of the lens were fused instead of cemented, an idea originated by de Wecker in Paris and patented in 1908 by Borsch. At the turn of the 20th century, there was a considerable increase in the use of bifocals.

Between 1781 and 1789 silver spectacles with sliding extension temples were being made in France; a pair owned by Franklin is dated 1788. But it was not until the nineteenth century that they gained widespread popularity. John McAllister of Philadelphia began manufacturing spectacles with sliding temples containing looped ends which afforded much easier manipulation with the then-popular wigs. The loop supplemented the inadequacy of stability by affording a means for the addition of a cord or ribbon which could be tied behind the head, thus holding the spectacles more firmly in place.

In 1826, William Beecher came to Southbridge, Massachusetts from Connecticut to establish a jewelry-optical manufacturing shop. The first ophthalmic articles he produced were silver spectacles which were later followed by blue steel. In 1869 the American Optical Company was incorporated and absorbed the holding of William Beecher. In 1849, J. J. Bausch emigrated from Germany to the United States. He had already served an apprenticeship as an optician in his native land and had found work in Berne. His compensation for the labor on a complete pair of spectacles was equal to six cents. Mr. Bausch encountered difficult times in America from 1849 until 1861, at which time war broke out. When the war prevented importation of frames, demand for his hard rubber frames zoomed. Continuous expansion followed and the large Bausch and Lomb Company was formed.

The monocle, which was first called an "eye ring", was introduced in England about 1800; although it had been developed by a German during the 1700's. A young Austrian named J. F. Voigtlander (same family as the camera people) studied optics in London and took the monocle idea home with him. He started making monocles in Vienna about 1814 and the fashion spread and took particularly vigorous root in Germany and in Russia. The first monocle wearers were men in society's upper classes, which may account for the aura of arrogance the monocle seemed to confer on the wearer. After World War I, the monocle fell into disrepute, its demise hastened no doubt, by its association with the German military.

The lorgnette, two lenses in a frame the user held with a lateral handle, was another 18th century development (by Englishman George Adams). The lorgnette probably developed from the scissors-glass, which was a double eyeglass on a handle. Since the two branches of the handle came together under the nose and looked as if they were about to cut it off, they were known as binocles-ciseaux or scissors glasses. The English changed the size and form of the scissors-glasses and produced the lorgnette. The frame and handle were frequently artistically embellished, since they were used mostly by women and more often as a piece of jewelry than as a visual aid. The lorgnette maintained its popularity with ladies of fashion, who would not wear spectacles. The lorgnette was still popular at the end of the 19th century.

Pince-nez are believed to have appeared in the 1840's, but in the latter part of the century there was a great upsurge in the popularity of the pince-nez for both men and women. There was an enormous variety of styles available. Gentlemen wore any style which suited them--heavy or delicate, round, or oval, straight, or drooping--usually on a ribbon, cord, or chain about the neck or attached to the lapel. Ladies more often than not wore the oval rimless style on a fine gold chain which could be

reeled automatically into a button-size eyeglass holder pinned to the dress. Whatever the disadvantages of the pince-nez, it was convenient.

In the 19th century the responsibility of choosing the correct lens lay, as it always had, with the customer. Even when the optician was asked to choose, it was often on a rather casual basis. Spectacles were still available from traveling salesmen. J. C. Bloom, writing in 1940, described the method of fitting glasses in the Western part of the United States in 1889, when he first went into practice: "When a person came in to get a pair of glasses, you would look him over, ask his age, and then reach into one of the boxes that had the mounted goods and you would reach from box to box until the patient said he could see. He would ask what the price was, and it was anywhere from \$150 to \$5." A short paragraph in the "Optical Journal" of 1901 warned that itinerant peddlers were as troublesome as ever: "If you value your eyesight, you will place no confidence in the statements of tramps who go from house to house selling spectacles. They will tell you your eyes are diseased and nothing but their electric or magnetised glasses will save you from blindness. Such talk is an insult to your intelligence." Insulting or not, the peddlers evidently succeeded in selling their wares, as they had for centuries.

At the beginning of the 20th century, Dr. Norburne Jenkins wrote in the "Optical Journal": "Wearing spectacles or eyeglasses out of doors is always a necessity.... Glasses are very disfiguring to women and girls. Most tolerate them because they are told that wearing them all the time is the only way to keep from having serious eye trouble. If glasses are all right, they will seldom or never have to be worn in public." Despite this statement, a variety of glasses and optical aids were available and were worn in public. Spectacles with large round lenses and tortoise shell frames became the fashion around 1914. The time had now come when "the average human disfigurement, often an injury, seldom a person, instead of being ashamed that his eyes are on the blink, actually seems to be proud of it." The enormous round spectacles and the pince-nez continued to be worn in the twenties. In the thirties there was increased emphasis on style in glasses with a variety of spectacles available. Meta Rosenthal wrote in 1938 that the pince-nez was still being worn by dowagers, headwaiters, old men, and a few others. The monocle was worn by only a minority in the United States. Sunglasses, however, became very popular in the late 30's.

Contact Lenses

As early as 1845 Sir John Herschel suggested the idea of contact lenses, though he evidently did nothing about it. The practical application of a lens to the eyeball did not occur until late in the century, when F. E. Muller, a German maker of glass eyes, blew a protective lens to place over the eyeball of a man whose lid had been destroyed by cancer. The patient wore the lens until his death, twenty years later, without losing his vision. The term contact lens originated with Dr. A. Eugen Fick, a Swiss physician, who in 1887 published the results of independent experiments with contact lenses. In 1889, August Muller, a German medical student, described his own experimentation with contact lenses. Although his attempts to use ground lenses were not successful, he did help lay the groundwork for further experimentation. In 1892 other doctors and optical firms in Europe cooperated in developing practical contact lenses; before long several firms began specializing in manufacturing them. By the early 40's a variety of contact lenses was available: blown glass, ground glass, molded glass, plastic and glass, and all plastic. All were still comparatively large and could not normally be tolerated for long periods of time. Improvements in manufacturing, material, and fitting of contact lenses lead to increased numbers of Americans wearing them. By 1964 over 6 million people in the United States were wearing contact lenses, 65% of them female.