short-sight tends to increase during the early, especially the school, years of life, and that hygienic treatment, good light, good type, and avoidance of stooping are important for its prevention.

*Convex Lenses.—*In hypermetropia the retina is in front of the principal focus of the eye. Hence in its condition of repose such an eye cannot distinctly see parallel rays from a distance and, still less, divergent rays from a near object. The defect may be overcome more or less completely by the use of the accommodation. In the slighter forms no inconvenience may result; but in higher degrees prolonged work is apt to give rise to aching and watering of the eyes, headache, inability to read or sew for any length of time, and even to double vision and internal strabismus. Such cases should be treated with convex lenses, which should be theoretically of such a strength as to fully correct the hypermetropia. Practically it is found that a certain amount of hypermetropia remains latent, owing to spasm of the accommodation, which relaxes only gradually. At first glasses may be given of such a strength as to relieve the troublesome symptoms; and the strength may be gradually increased till the total hypermetropia is corrected. Young adults with slighter forms of hypermetropia need glasses only for near work; elderly people should have one pair of weak glasses for distant and another stronger pair for near vision. These may be conveniently combined, as in Franklin glasses, where the upper half of the spectacle frame contains a weak lens, and the lower half, through which the eye looks when reading, a stronger one.

*Anisometropia.—*It is difficult to lay down rules for the treatment of cases where the refraction of the two eyes is unequal. If only one eye is used, its anomaly should be alone corrected; where both are used and nearly of equal strength, correction of each often gives satisfactory results.

*Presbyopia.—*When distant vision remains unaltered, but, owing to gradual failure of the accommodative apparatus of the eye clear vision within 8 in. becomes impossible, convex lenses should be used for reading of such a strength as to enable the eye to see clearly about 8 in. distance. Presbyopia is arbitrarily said to commence at the age of forty, because it is then that the need of spectacles for reading is generally felt; but it appears later in myopia and earlier in hypermetropia. It advances with years, requiring from time to time spectacles of increasing strength.

*Cylindrical Lenses.—*In astigmatism, owing to differences in the refractive power of the various meridians of the eye, great defect of sight, frequently accompanied by severe headache, occurs. This condition may be cured completely, or greatly improved, by the use of lenses whose surfaces are segments of cylinders. They may be used either alone or in combination with spherical lenses. The correction of astigmatism is in many cases a matter of considerable difficulty, but the results to vision almost always reward the trouble.

Convex spectacles were invented (see Light) towards the end of the 13th century, perhaps by Roger Bacon. Concave glasses were introduced soon afterwards. Sir G. B. Airy, the astronomer, about 1827, corrected his own astigmatism by means of a cylindrical lens. Periscopic glasses were introduced by Dr W. H. Wollaston.

**SPECTROHELIOGRAPH,** an instrument for photographing the sun with monochromatic light. In its simplest form it consists of a direct-vision spectroscope, having an adjustable slit (called “ camera slit ”), instead of an eyepiece, in the focal plane of the observing telescope. This slit is set in such a posi- tion as to transmit a single line of the spectrum, *e.g.* the K line of calcium. Suppose a fixed image of the sun to be formed on the collimator slit of this spectroscope, and a photographic plate, with its plane parallel to the plane of the solar image, to be mounted almost in contact with the camera slit. The spectro- scope is then moved parallel to itself, admitting to the collimator slit light from all parts of the sun’s disk. Thus a monochromatic image of the sun, formed of a great number of successive images of the spectral line employed, will be built up on the plate. As the only light permitted to reach the plate is that of the calcium line, the resulting image will represent the distribution of calcium vapour in the sun’s atmosphere. The calcium clouds or *flocculi* thus recorded are invisible to the eye, and are not shown on direct solar photographs taken in the ordinary way.

The calcium flocculi, on account of the brilliant reversals of the H and K lines to which they give rise, and the protection to the plate afforded by the diffuse dark bands in which these bright lines occur, are easily photographed with a spectrohelio- graph of low dispersion. In the case of narrower lines, however, higher dispersion is required to prevent the light of the continuous spectrum on either side of the dark line from blotting out the monochromatic image. A spectroheliograph which gives excellent results with the lines of calcium, hydrogen and iron is shown in the figure. This instrument, used since 1905 in conjunction with the Snow (horizontal) telescope of the Mount Wilson Solar Observatory, was constructed in the observatory instrument shop in Pasadena.

It consists of a heavy cast-iron platform (a) mounted on four steel balls (b) which run in V guides of hardened steel. Most of the weight of the instrument is floated on mercury contained in three troughs (c*,* c, c*)* which form part of the cast-iron base. The platform carries the two slits, the collimator and camera objectives and the prism-train. An image of the sun, about 6∙7 in. in diameter, is formed by the Snow telescope on the collimator slit (d). This slit is long enough (8½ in.) to extend entirely across the solar image and across such prominences of ordinary height as may happen to lie at the extremities of a vertical diameter. After passing through the slit the diverging rays fall upon the 8 in. collimator objective (e), which is constructed in the manner of a portrait lens in order to give a sharp field of sufficient diameter to include the entire solar image. In the Snow telescope the ratio of aperture to focal length is 1:30. Hence light from any point on the slit will fill a circle about *2* in. in diameter on the collimator objective, as its focal length is 6o in. Since the diameter of the solar image is 6∙7 in. there is a slight, but inappreciable loss of light from points in the image at the extremities of a vertical diameter.

The rays, rendered parallel by the collimator objective, meet a plane mirror *(f)* of silvered glass, which reflects them to the prisms g, g')∙ These are of dense flint-glass (Schott o∙1o2), and each has a refracting angle of 63° 29'. Their width and height are sufficient to transmit (at the position of minimum deviation) the entire beam received from the collimator. After being deviated 180° from the original direction, the dispersed rays fall on the camera objective (h), which is exactly similar to the collimator objective. This forms an image of the solar spectrum in its focal plane on the camera slit (i). Beyond the camera slit, and almost in contact with it, the photographic plate-carrier (J) is mounted on a fixed support. In order to bring a spectral line upon the camera slit, the slit is widely opened and the plane mirror (f) rotated until the line is seen. A cross-hair, in the focal plane of an eyepiece, is then moved horizontally until it coincides with the line in question. The slit is narrowed down to the desired width, and moved as a whole by a micrometer screw, until it coincides with the cross-hair. The eyepiece is removed and the photographic plate (k) placed in position. An electric motor, belted to a screw (l or *l')* connected with the spectroheliograph, is then started.@@1 The screw moves the spectro- heliograph at a perfectly uniform rate across the fixed solar image. Thus a monochromatic image of the sun is built up on the fixed photographic plate.

The spectroheliograph, originally designed for photographing the solar prominences, disclosed in its first application at the Kenwood Observatory (Chicago, 1892) a new and unexplored region of the sun’s atmosphere. Photographs of the solar disk, taken with the H or K line, show extensive luminous clouds (flocculi) of calcium vapour, vastly greater in area than the sun-spots. By setting the camera slit so as to admit to the photographic plate the light of the denser calcium vapour, which lies at low levels, or that of the rarer vapour at high levels, the phenomena of various superposed regions of the atmosphere can be recorded. The lower and denser vapour appears as bright clouds, but the cooler vapour, at higher levels, absorbs the light from below and thus gives rise to dark clouds.

The first photographs of the sun in hydrogen fight were made with the spectroheliograph in 1903. These reveal dark hydrogen flocculi, which appear to lie at a level above that of the bright calcium flocculi. They also show less extensive bright flocculi, usually in the immediate neighbourhood of sunspots, and frequently eruptive in character. These rise

@@@1 Two screws, of different pitch, are provided, to give different speeds.