of the enveloping hoop, above noticed, such a hoop would of course possess the property of refiracting an equally dif­fused zone of light round the horizon. The difficulty, how­ever, of forming this apparatus, appeared so great, that Fresnel determined to substitute for it a vertical polygon, composed of what have been improperly called *cylindric lenses,* but which in reality are mixtilinear and horizontal prisms, distributing the light which they receive from the focus, equally over the horizontal sector which they subtend. This polygon has a sufficient number of sides to enable it to give at the angle formed by the junction of two of them, a light not very much inferior to what is produced by one of the sides ; and upper and lower courses of curved mirrors, are so placed as to make up for the deficiency of the light at the angles. The effect sought for in a fixed light is thus obtained in a much more perfect manner, than by any com­bination of the parabolic mirrors used in the British light­houses.

An ingenious modification of the fixed apparatus is due to the inventive mind of Fresnel, who also conceived the happy idea of placing one apparatus of this kind in front of another, with the axes of the cylindric pieces crossing each other at right angles. As these cylindric pieces have the property of refracting all the rays which they receive from the focus, into a direction perpendicular to the mixtilinear section which generates them, it is obvious that if two re­fracting media of this sort be arranged as proposed by Fres- uel, their joint action will unite the rays which come from their common focus into a beam, whose sectional area is equal to the overlapped surface of the two instruments, and thus produce the effect of an annular lens. It was by avail­ing himself of this property of crossed prisms, that Fresnel invented the distinction for lights, which he calls *a fixed light varied by flashes;* in which the flashes are caused by the revolution of cylindric media, with vertical axes round the fixed-light apparatus already described.

Fresnel immediately perceived the necessity of combin­ing with the dioptric instruments which he had invented, a burner capable of producing a large volume of flame ; and the rapidity with which he matured his notions on this subject, and at once produced an instrument admirably adapted for the end he had in view, affords one of the many proofs of that happy union of practical with theoretical ta­lent, for which he was so distinguished. Fresnel himself has modestly attributed much of the merit of the invention of this lamp to M. Arago; but this gentleman, with great can­dour, gives the whole credit to his deceased friend, in a notice regarding lighthouses, which appeared in the *Annu­aire du Bureau des Longitudes* of 1831. The lamp has four concentric burners, which are defended from the action of the excessive heat, produced by their united flames, by means of a superabundant supply of oil, which is thrown up from the cistern below by a clock-work movement, and con­stantly overflows the wicks, as in the mechanical lamp of Carcel. A very tall chimney is found to be necessary, iin order to supply fresh currents of air to each wick with suffi­cient rapidity to support the combustion. The carbonisa tion of the wicks, however, is by no means so rapid as might be expected, and it is even found that after they have suffered a good deal the flame is not sensibly diminish­ed, as the great heat evolved from the mass of flame, pro­motes the rising of the oil in the cotton. The writer of this article has seen the large lamp at the Tour de Corduan burn for seven hours without being snuffed, or even having the wicks raised.

The annexed diagrams will give a more perfect idea of the nature of the concentric burner than can easily be con­veyed by words alone. The first shews a plan of a burner of four concentric wicks. The intervals which separate the wicks from each other and allow the currents of air to pass, diminish in width a little, as they recede from the centre.

The next shews a section of this burner. ιC, C', C", C"' are the rack handles for raising or depressing each wick, AB is the horizontal duct which leads the oil to the four wicks, L, L, L, are small plates of tin by which the burners are solder­ed to each other, and which are so placed as not to hinder the free passage of the air; P is a clamping screw, which keeps at the proper height the gallery R, R, which carries

the chimney. The last shews the burn­

er with its glass chimney and damper.

E is the glass chimney, F is a sheet iron

cylinder, which serves to give it a greater

length, and has a small damper D, capa­

ble of being turned by a handle for regu­

lating the supply of air ; and B is the

pipe which supplies the oil to the wicks.

The great risk in using this lamp arises

from the leather valves that force the oil

by a clock-work movement, being occa­

sionally liable to derangement ; and se­

veral of the lights on the French coast,

and more especially the Corduan, have

been extinguished by the failure of the

lamp for a few minutes, an accident which

has never, and scarcely can happen with

the fountain lamps which illuminate the

reflectors. To prevent the occurrence

of such accidents, and to render their

consequences less serious, various pre­

cautions have been resorted to. Amongst

others, an alarum is attached to the lamp,

consisting of a small cup pierced in the bottom, which re­ceives part of the overflowing oil from the wicks, and is capable, when full, of balancing a weight placed at the opposite end of a lever. The moment the machinery stops, the cup ceases to receive the supply of oil, and the re-