of Bridges and Roads in France, is, by some, considered the first who hinted at the advantages of parabolic reflec­tors ; and he is said, in a memoir dated the 26th June 1783, to have proposed their combination with Argand lamps, ranged on a revolving frame, for the Corduan lighthouse. Whatever foundation there may be for the claim of M. Teulère, certain it is, that this plan was actually carried in­to effect at Corduan under the directions of the Chevalier Borda, and to him is generally awarded the merit of hav­ing conceived the idea of applying parabolic mirrors to lighthouses. These were prodigious steps in the improve­ment of lighthouses, as not only the power of the lights was thus greatly increased, but the introduction of a revolving frame proved a valuable source of distinction amongst lights, and has since been the means of greatly extending their utility. The exact date of the change on the light of the Corduan is not known ; but as it was made by Lenoir, the same young artist to whom Borda about the year 1780, in­trusted the construction of his reflecting circle, it has been conjectured by some, that the improvement was made about the same time. If this conjecture be correct, the claim of M. Teulère must of course fall to the ground. The reflec­tors were formed of sheet-copper, plated with silver, and had a double ordinate of 31 French inches. It was not long before these improvements were adopted in England, by the Trinity House of London, who sent a deputation to France to inquire into their nature. In Scotland, one of the first acts of the Northern Lights Board in 1786, was to sub­stitute reflectors in the room of coal-lights, then in use at the Isle of May in the Firth of Forth, and the Cumbrae Isle in the Firth of Clyde, which had, till that period, been the only beacons on the Scotch coast. The reflectors employ­ed were formed of facets of mirror glass, placed in hollow parabolical moulds of plaster, according to the designs of the late Mr. Thomas Smith, the engineer of the board, who, as appears from the article *Reflector* in the Supplement to the third edition of the Encyclopaedia Britannica, was not aware of what had been done in France, and had, himself, conceived the idea of this combination. The system of Borda was also adopted in Ireland, and in time, variously modified, it became general wherever lighthouses were known.

The property of the parabola, by which all lines incident on its surface from the focus make with normals to the curve at the points of incidence, angles equal to the inclin­ation of these same normals respectively to lines drawn par­allel to the axis of the curve, is that which fits it for the purposes of a lighthouse. A hollow mirror, formed by the revolution of a portion of a parabola about its axis, has, in consequence of this property, the power of projecting the re­peated images of a luminous point placed in its locus, in direc­tions parallel to the axis of the generating curvc,so that when the mirror is placed with its axis parallel to the horizon, a cylindric beam of light is thereby sent forward in a horizon­tal direction. When such mirrors are placed side by side, with their axes parallel on the faces of a quadrangular frame which revolves about a vertical axis, a distant observer receives the successive impressions which result from the passage of each face of the frame, over a line drawn be­tween the observer’s eye and the centre of the revolving frame. This arrangement constitutes what is called a re­volving light. A fixed light is produced by placing side by side, round a fixed circular frame, a number of reflec­tors, with their axes inclined to each other, so as to be radii containing equal arcs of the frame on which they are placed. It is obvious that a perfect parabolic figure, and a luminous *point* mathematically true, would render the illumination of the whole horizon by means of a fixed light *impossible;* and it is only from the aberration caused by the size of the flame which is substituted for the point, that we are enabled to reader even revolving lights practically useful. But for this ab­

erration, even the slowest revolution in a revolving light, which would he consistent with a continued observable series, such as the practical seamen could follow, would render the flashes of a revolving light greatly too transient for any useful pur­pose ; whilst fixed lights being visible in the azimuths only in which the mirrors are placed, would, over the greater part of the distant horizon, be altogether invisible. The size of the flame, therefore, which is placed in the focus of a parabolic mirror, when taken in connexion with the form of the mirror itself, leads to those important modifications in the paths of the rays, and the form of the resultant beam of light, which have rendered the catoptric system of lights so great a benefit to the benighted seaman.

It is obvious, from a consideration of the nature of the action which takes place in this combination of the parabo­loidal mirrors with Argand lamps, that the revolving light is not only more perfect in its nature than the fixed light, but that it possesses the advantage of being susceptible of an increase of its power, by increasing the number of reflectors, which have their axes parallel to each other, so as to con­centrate the effect of several mirrors in one direction. The perfect parallelism of the axes of separate mirrors, it is true, is unattainable, but approaches may be made sufficiently near for practical results ; and in order to prolong the dura­tion of the flash, the reflectors are sometimes placed on a frame, having each of its sides slightly convex, by which arrangement, the outer reflectors of each face of the frame have their axes less inclined inwards from the radii of the revolving frame which pass through their foci.

The best proportions for the paraboloidal mirrors, depend upon the object to which they are to be applied ; as mirrors which are intended to produce great divergence in the form of the resultant beam should have one form ; whilst those which are designed to cause a near approach to parallelism of the rays, will have another form. These objects may also be attained by variations of the size of the flame applied in the same mirror, but it is much more advantageous to produce the effect, by a change in the form of the mir­ror, as any increase of the flame beyond the size which is found to be most advantageous in other respects, cannot be regarded otherwise than as a wasteful expenditure of light. The details into which a fiιll investigation of this matter would lead us, are quite beyond the scope of this article, and it therefore seems sufficient to give the formulæ which express the relations which exist between the size of the flame, the reflecting surface, and the corresponding diver­gence of the reflected ray. If Δ represent the inclination of any reflected ray to the axis of a paraboloidal mir­ror, *e* the distance of the focus from the point of reflec­tion, and *d* the distance from the edge of the flame to the fo­cus in the plane of reflection, we shall have sin Δ=d/e,

and when the flame in the given plane of reflection is cir­cular, or has its opposite sides equi-distant from the focus of the mirror, we shall, by putting ∆' for the effective diver­gence of the mirror in the given plane, have ∆'=2 Δ. When, therefore, great divergence, as in the case of the fixed lights, is required, the prolate form of the curve is to be preferred ; and the oblate is conversely more suited to revolving lights.

The power of the reflectors ordinarily employed in light­houses, is generally equal to about 360 times the effect of the unassisted flame which is placed in the focus. This value, however, is strictly applicable only at the distances at which the observations have been made, as the propor­tional value of the reflected beam must necessarily vary with the distance of the observer, agreeably to some law depen­dent upon the unequal distribution of the light in the lumin­ous cone which proceeds from it. The ordinary burners used in lighthouses are one inch in diameter, and the focal