not exceed fifteen inches in diameter. A perfect idea of the construction and effect of this apparatus, may be formed, by conceiving a parabola to revolve about its parameter as an axis, so that its upper and lower limbs would become the generating lines of two surfaces possessing the property of reflecting, in lines parallel to the axis of the parabola, all the rays incident upon them, from a light placed in the point where the parameter and axis of the generating para­bola intersect each other. This point being the focus of each parabolic section of this apparatus, the light is equally dispersed in every point of the horizon, when the axes of the parabolic sections are in a plane perpendicular to a ver­tical line. But however perfectly this apparatus may at­tain this important object, it does so at the sacrifice of the most efficient part of the parabolic surface, which lies be­tween the vertex and the parameter ; and, therefore, pro­duces a proportionally feeble effect. This beautiful little instrument is shewn in Plate 11, fig. 5 ; in which *b* shews the burner *p, p* the upper reflecting surface, and *p'* *p'* the lower reflecting surface, both generated in the manner above described by the revolution of a parabola about its para­meter *x b ;* F is the focus of the generating parabola ; and *l l* are small pillars, which connect the two reflecting plates, and give strength to the apparatus.

M. Bordier Marcet has also prepared a very ingenious modification of the paraboloidal mirror, which he has describ­ed under the name of *fanal à double aspect;* and the object of which is, to obtain a convenient degree of divergence from parabolic mirrors, by the use of two flames and two re­flecting surfaces, each of which is acted upon by its own flame, and also by that of the other. This modification consists in the union of two portions of hollow paraboloidal mirrors, generated by the revolution of two parabolas about a com­mon horizontal axis, and illuminated by two lamps placed in the focus of each. The first surface is generated by the revolution on its axis of a segment of a paraboloid inter­cepted between the parameter and some double ordinate greater than it, and may, from its form, be called the rib­bon-shaped mirror. The second surface is that of a pa­rabolic conoid, which is cut off by a vertical plane pass­ing through a double ordinate, which is equal to the para­meter of the parabolic ribbon, which is placed in front of it. The elements of the curve which forms the conoidal mirror, must be so chosen as to have its focus at a conveni­ent distance in front of that of the ribbon-shaped mirror, so as to admit of placing the two lamps separate from each other, as well as to produce the necessary degree of divergence, which is to be obtained by the action of these mirrors re­spectively on the flame placed in the focus of the other. These two mirrors are thus joined together. Each mirror produces, by means of the lamp placed in its focus, an ap­proach to parallelism of the reflected rays, which M. Bor­dier Marcet has not inaptly termed the *principal effect;* whilst the action of each surface on the lamp which is placed in the focus of the other, causes what the inventor calls the *secondarg* or *lateral effect.* Their secondary action may be described thus : The lamp, which is in the focus of the ribbon, is much nearer the vertex of the conoid than its own focus ; so that its rays making, with normals to the surface of the conoid, angles greater than those which are formed by the rays proceeding from its focus, are of ne­cessity reflected in lines diverging from the axis of the mirror. Those, on the contrary, which proceed from the focus of the conoid, meet the ribbon-shaped surface, so as to make angles with its normals more acute than those which the rays from its own focus could do, and which are, there­fore, reflected in lines converging to the axis of the mirror. These reflected rays must therefore cut the axis, and diverge from it on the other side. This apparatus has been tried with success at La Hève and some other lights on the French coast. But it is impossible not to perceive the great loss of

light which results from the use of two flames in one mirror ; and it must not be forgotten, that the divergence which is obtained is not confined to tire horizontal direction in which only it is wanted ; but the light is scattered in every direc­tion round the edge of the mirror.

Spherical mirrors have been employed in lighthouses only when they can be introduced as subsidiary parts in dioptric apparatus ; and any observations regarding them will, therefore, be made in treating of the dioptric lights of Fresnel.

Floating lights are only resorted to in cases of absolute necessity, as their maintenance is extremely expensive, whilst they are less to be relied on, and, in all respects, less efficient than land lights. They are large vessels, built with great breadth of beam, and are generally moored off shoals, or serve as guides for taking channels. The lights are from lamps placed in front of small reflectors, ranged in lanterns, which are hoisted on the masts of the vessel. The number of lights varies from one to three as the only means of distinction, the feebleness of the light generally rendering it inexpedient to adopt the distinctions derived from the use of coloured media.

Catoptric lights are susceptible of nine separate distinc­tions, which are called *fixed, revolving white, revolving red and white, revolving red with two whites, revolving white with two reds, flashing, intermittent, double fixed lights, and double revolving white lights.* The first exhibits a steady and uniform appearance, which is not subject to any change ; and the reflectors used for it, (as already noticed), are of smaller dimensions than those employed in revolving lights. This is necessary in order to permit them to be ranged round the circular frame, with their axes inclined at such an angle, as shall enable them to illuminate every point of the horizon. The revolving light is produced by the revo­lution of a frame with three or four sides, having reflectors of a large size grouped on each side, with their axes paral­lel ; and as the revolution exhibits a light gradually in­creasing to *full strength,* and in the same gradual manner decreasing to total darkness, its appearance is extremely well marked. The succession of *red* and *white* lights is caused by the revolution of a frame whose different sides present red and white lights ; and these, as already men­tioned, afford three separate distinctions, namely, alternate, red, and white ; the succession of two white lights after one red, and the succession of two red lights after one white light. The *flashing* light is produced in the same manner as the *revolving* light ; but owing to a different construction of the frame, and the greater quickness of the revolution, a totally different and very striking effect is pro­duced. The brightest and darkest periods being but momentary, this light is characterised by a rapid succession of bright flashes, from which it gets its name. The *inter­mittent* light is distinguished by bursting suddenly into view and continuing steady for a short time, after which it is suddenly eclipsed for half a minute. This striking ap­pearance is produced by the perpendicular motion of circu­lar shades in front of the reflectors, by which the light is alternately hid and displayed. This distinction, as well as that called *the flashing tight,* are peculiar to the Scotch coast, having been first introduced by the present Engineer of the Northern Lights Board. The double lights, which are generally used only where there is a necessity for a *leading* line, as a guide for taking some channel or avoiding some danger, are exhibited from two towers, one of which is high­er than the other ; and when seen in one line, form a di­rection for the course of shipping. At the Calf of Man, a striking variety has been introduced into the character of leading lights, by substituting, tor two *fixed* lights, two lights which revolve in the same periods, and exhibit their flashes at the same instant ; and these lights are, of course, suscept­ible of the other variety enumerated above, that of two re-