of the whole apparatus will be more fully underst∞d by re­ferring to the Plates.

Plate II. fig. I, is a section of **a** revolving dioptric appa­ratus of the first order ; F is the focal point in which the flame is placed ; L,L great annular lenses, forming by their union an octagonal prism, with the lamp in its axis, and pro­jecting in horizontal beams the light which they receive from the focus ; L' L,' upper lenses, forming by their union a frustum of an octagonal pyramid of 50° of inclination, and having their foci coinciding in the point F. They par­allelise the rays of light which pass over the lenses. M, M, plane mirrors, placed above the pyramidal lenses, and so in­clined, as to project the beams reflected from them in planes parallel to the horizon; X,X shew the rollers and wheel work which give motion to the lenses ; and W is the weight which moves the clock-work of the mechanical lamp H. Plate II. fig. 2, is the plan of the apparatus shewn in fig. 1.

Plate II. fig. 3, shews a section of a fixed dioptric light of the first order. F is the focal point in which the flame is placed ; R, R cylindric refractors, forming by their union a prism of thirty-two sides, or a true cylinder, with the lump in its axis, and producing a zone of light of equal intensity in every point of the horizon ; Μ, M curved mirrors, ranged in tiers above and below the cylindric refractors, and hav­ing their foci coinciding in the point F ; the effect of the mirrors increases the power of the light, by collecting and transmitting the rays which would otherwise pass above and below them, without increasing the effect of the light ; W is the weight which moves the mechanical lamp H. Plate II fig. 4, is a plan of the fixed apparatus of the first order.

Mr. Alan Stevenson having been directed by the Com­missioners of the Northern Lighthouses to convert the fixed catoptric light of the Isle of May, into a dioptric light of the first order, proposed, that an attempt should be made to form a true cylindric, instead of a polygonal belt for the refract­ing part of the apparatus ; and this task was successfully completed by Messrs. Cookson of Newcastle- The defect of the polygon lies in the excess of the radius of the circumscrib­ing circle over that of the inscribed circle, which occasions an unequal distribution of light between its angles and the centre of each of its sides ; and this fault can only be fully remedied by constructing a cylindric belt, whose generat­ing line is the middle mixtilinear section of an *annular* lens, revolving about its principal focus as a vertical axis. This is, in fact, the only form which can possibly produce an equal diffusion of the incident light over every part of the horizon.

In a report to the Commissioners of the Northern Lights, there is the following description of the refractors con­structed for the Isle of May Light. “ I at first imagin­ed,” says Mr. Alan Stevenson, “ that the whole hoop of re­fractors might be built between two metallic rings, connecting them to each other solely by the means employed in ce­menting the pieces of the annular lenses ; but a little consid­eration convinced me that this construction would make it necessary to build the zone at the lighthouse itself, and would thus greatly increase the risk of fracture. I was therefore reluctantly induced to divide the whole cylinder into ten arcs, each of which being set in a metallic frame, might be capable of being moved separately. The chance of any er­ror in the figure of the instrument has thus a probability of being confined within narrower limits; whilst the rectifica­tion of any defective part becomes at the same time more easy. Oneother variation from the mode of construction at first contemplated, has been forced upon me by the re­peated failures which occurred in attempting to form the

middle zone in one piece ; and it was at length found ne­cessary to divide this belt by a line passing through the ho­rizontal plane of the focus. This division of the central zone, however, is attended with no appreciable loss of light, as the entire coincidence of the junction of the two pieces with the horizontal plane of the focus, confines the inter­ception of the light to the fine joint at which they are ce­mented. With the exception of these trifling changes, the idea at first entertained of the construction of this instru­ment has been realized. An improvement of some import­ance might also be made upon the arrangement of this ap­paratus, by giving to the metallic frames which contain the prisms, a rhomboidal,@@1 instead of a rectangular form. The junction of the frames being thus inclined from the perpen­dicular, will not in any azimuth intercept the light through­out the whole height of the refracting belt, but the interception will be confined to a small rhomboidal space, whose area will be inversely proportional to the sine of the angle of inclina­tion ; and if the helical joints be formed between the oppo­site angles of the present rectangular frames, the amount of intercepted light will be absolutely cqual in every azimuth.”

The change of the light at the Isle of May, from the ca­toptric to the dioptric system, was generally acknowledged to be an improvement. A committee of the Royal Society of Edinburgh made some observations on the two lights which were exhibited in contrast on the night of the 26th of October 1836, from the town of Dunbar, which is distant about thirteen miles from the lighthouse. Their report, which was drawn up by Professor Forbes. concludes in these words :

“ The following conclusions seem to be warranted :

“ 1. That at a distance of thirteen miles, the mean effect of the new light is very much superior to the mean effect of the old light, (perhaps in the ratio of two to one.)

“ 2. That at *all* distances, the new light has a prodigious superiority to the old, from the equality of its effects in all azimuths.

“ 3. That the new light fulfils rigorously the conditions required for the distribution of light to the greatest advan­tage.

“ 4. That at distances much exceeding thirteen miles, the new light must still be a very effective one, though to what extent the committee have not observed. The light is understood to be still a good one, when seen from Edin­burgh at a distance of about thirty miles.”

The dioptric lights used in France, are divided into four orders, in relation to their power and range ; but in regard to their characteristic appearances, this division does not apply, as, in each of the orders, lights of identically the same character may be found, differing only in the distance at which they can be seen, and in the expense of their main­tenance. The four orders may be briefly described as fol­lows:—

lit. Lights of the first order having an interior radius or focal distance of 36∙22 inches, (92cm∙) and lighted by a lamp of four concentric wicks, consuming 570@@i gallons of oil per annum.

*2d.* Lights of the second order having an interior radius of 27∙55 inches, (70cm∙) lighted by a lamp of three concen­tric wicks, consuming 384 gallons of oil per annum.

*3d.* Lights of the third order, lighted by a lamp of two concentric wicks, consuming 183 gallons of oil per annum. The instruments used in these lights arc of two kinds, one having a focal distance of 19·68 inches, (50cm∙) and the other of 9·84 inches (25cm∙)

*4th.* Lights of the fourth order, or harbour lights, having

@@@1 “The form could not be exactly rhomboidal, but would be a portion of a flat helix intercepted between two planes cutting the enveloped cylinder at right angles to its axis.”

@@@2 The experience of two at the Isle of May and Inchkeith, shews that the annual expenditure of spermaceti oil, in lights of the first order due, not exceed 570 gallons.