thus appear that in fixed lights, the French apparatus pro­duces nearly *four times* more light, by the combustion of the same quantity of oil, than can be obtained by the catop­tric mode.

But the great superiority of the dioptric method chiefly rests upon its fulfilling *perfectly* the condition required in a fixed light, by distributing a more intense light *equally* in every point of the horizon. In the event of the whole ho­rizon not requiring to be illuminated, the dioptric light would lose a part of its superiority in economy, and when half the horizon only is lighted, it would be more expensive than the reflected light ; but the greater power and more equal distribution of the light, may be considered of so great importance, as far to outweigh any difference of expense. In the latter case, too, an additional power might be given to the light, by placing at the landward side of the lightroom, a spherical mirror with its centre in the focus of the dioptric apparatus. The luminous cone of which such a reflector forms the base, instead of passing off uselessly to the land, would thus be thrown back through the focal point, and finally refracted, so as to contribute to the effect of the light seaward.

The expense of establishing a fixed light composed of twenty-six reflectors, may be estimated at L.950, and the annual maintenance at L.425, 10s.; and the expense of fit­ting up a fixed light on the dioptric principle is L.1058; and the annual maintenance may be taken at L.267, 6s. 4d. It thus appears that the annual expenditure of the diop­tric fixed light is L.158, 3s. 8d. less than that of a fixed light composed of twenty-six reflectors; and the light given out is *four times* more powerful, and it is at the same time more equally diffused over the horizon.

The comparative views already given of the catoptric and dioptric modes of illuminating lighthouses, demonstrate that the latter produces more powerful lights by the combustion of the same quantity of oil ; while it is obvious that the catoptric system insures a more certain exhibition of the light, from the fountain lamps being less liable to derange­ment than the mechanical lamps used in dioptric lights. The balance, therefore, of real advantages or disadvantages, and consequently the propriety of finally adopting one or other, in­volves a mixed question, not susceptible of very absolute solution, and leaving room for different decisions, accord­ing to the value which may be set upon obtaining a cheap­er and better light, on the one hand, as contrasted with less certainty in its exhibition, on the other. A few general considerations, which may serve briefly to recapitulate the arguments for and against the two systems, may not be out of place. And, first, regarding the fitness of dioptric instru­ments for revolving lights, it may be observed, that, from the details above given, it appears,

*1st* That by placing eight reflectors on each face of a revolving frame, a light may be obtained as brilliant as that derived from the great annular lens ; and that in the case of a frame of three sides, the excess of expense by the re­flecting mode, would be L.137, l8s.; and in the case of a frame of four sides, the excess would amount to L.333.

*2d.* The diverging property of the lens being less than that of the reflector, it becomes difficult to produce, by lenses, the appearance which characterises catoptric revolving lights, which are already so well known to British mariners; and any change which might affect their appearance, would involve many grave practical objections.

3d. The uncertainty of the management of the lamp renders it more difficult to maintain the revolving dioptric lights without fear of extinction, an accident which has se­veral times occurred at Corduan and other French light­houses.

4th. The extinction of one lamp in a revolving catoptric light is not only less probable, but leads to much less serious consequences than the extinction of the single lamp

in a dioptric light ; because, in the first case, the evil is limited to diminishing the power of *one face* by an *eighth* part ; whilst, in the second, the *whole horizon is totally de­prived of light.* The extinction of a lamp, therefore, in a dioptric light, leads to evils which may be considered *infi­nitely great* in comparison with the consequences which attend the same accident in a catoptric light.

In comparing the fixed dioptric, and the fixed catoptricapparatus, the results may be ranged under the following heads:

1st. It is impossible, by means of any practical combina­tion of parabolic reflectors, to distribute round the horizon a zone of light of exactly *equal intensity ;* while this may be easily effected, by dioptric means, in the manner already described. In other words, the qualities required in fixed lights cannot be so *perfectly* obtained by reflectors as by

refractors.

*2d.* The light produced by burning one gallon of oil in Argand lamps, with reflectors, has only about *one-fourth* of the intensity of that produced by burning the same quantity in the dioptric apparatus ; and the annual expenditure is L.158,3s.8d. less for the dioptric than for the catoptric light.

3*d* The characteristic appearance of the fixed reflecting light would not be changed by the adoption of the dioptric method, although its increased intensity would render it visible at a greater distance.

4th. From the equal distribution of the rays, the dioptric light would be observed at equal distances in every point of the horizon ; an effect which cannot be fully attained by any practicable combination of parabolic reflectors.

*5th.* The inconveniences arising from the uncertainty which attends the use of the mechanical lamp, are not so much felt in a fixed as in a revolving light, because the less complex nature of the apparatus admits of easier access to it, in case of accident. In those situations, too, where the horizon is not illuminated all round, the mechanical lamp may perhaps be supplanted by a large fountain lamp of four concentric wicks, the use of which would, in a great measure, remove the objection of uncertainty in the exhibi­tion of the light.

*6th.* But the extinction of a lamp in a catoptric light, leaves only one-26th part of the horizon without the bene­fit of the light, and the chance of accident arising to vessels from it may, therefore, be considered as incalculably less than the danger resulting from the extinction of the single lamp of tne dioptric light, which deprives the whole horizon of light.

*7th.* There may also, in certain situations, be some danger arising from the irregularity in the distances at which the same fixed catoptric light may be seen in the different points of the horizon. This defect, of course, does not ex­ist in the dioptric light.

There can be little doubt, that the more fully the system of Fresnel is understood, the more certainly will it take the place of all other systems of illumination for lighthouses, at ieast, in those countries where this important branch of ad­ministration is conducted with the care and solicitude which it deserves. To the Dutch belongs the honour of having first embraced the system of Fresnel in their lights. The Commissioners of the Northern Lights followed in the train of improvement, and in 1834, sent Mr. Alan Stevenson on a mission to Paris, with full power to take such steps for acquiring a perfect knowledge of the dioptric system, and forming an opinion on its merits, as he should find necessary. The singular liberality with which he was re­ceived by M. Léonor Fresnel, brother of the late illustrious inventor of the system, and his successor as the Secretary of the Lighthouse Commission of France, afforded Mr. A.Stevenson the means of making such a report on his return, as induced the Commissioners to authorise him to remove the reflecting apparatus of the revolving light at Inchkeith, and substitute dioptric instruments in its place. This change was complet-