cally fulfil the condition, that the sum of the resistances of the n arcs is equal to the resistance of *one* arc, to have the same current ; *i. e.* the former must be made smaller than the latter, on account of practical construction reasons.

We may therefore sum up as follows :—*The economical solution of the division of the electric light is theoretically quite possible, but practically difficult to obtain.* The division can never become unlimited ; but ingenious inventors may nevertheless solve the problem *practically*.

The attempt by inventors to solve the question is therefore perfectly legitimate. If their attempt cannot lead to a perfect solution, they may nevertheless do so approximately, and by it tend towards real progress in illumination, inasmuch as by their attempts the electric light may probably become more and more a successful general rival to gas, which at present the electric light certainly is not.

Before I conclude, I must briefly avert to a paper on the Electric Light by Mr. W. H. Preece, published in the Philosophical Magazine for January 1879, in which the author believes that he has demonstrated from dynamical considerations that the division of the electric light is impossible. This it certainly is under the conditions introduced by Mr. Preece, *viz.* that the resistance of each voltaic arc, or each incandescent wire, is maintained *constant*. But it is unfair to the electric light to introduce this condition, especially as it does not at all represent the question at issue.

When a number of lights are connected in series, the resistance of each must be diminished, and when a number of lights are joined parallel, the resistance of each must be increased in proportion to their number, so as to maintain the total external resistance constant. If Mr. Preece will introduce this condition into his equation, he will find that theoretically the division of the electric light is quite possible, *i. e.* that, theoretically, however the lights be arranged, the unit of light will always be produced by the same expenditure of energy. Inventors should not, therefore, be downhearted. On the other hand, investors in gas need not hasten to get rid of their shares ; for there are many questions involving practical difficulties which still remain to be solved ; but, at the same time, gas companies should be aware that they have a formidable rival in the field, and bestir themselves to maintain the lead they hold by improving their own means of illumination and extending its application.

THE TRUE THEORY OF FRESNEL'S INTERFERENCE PHENOMENA.

BY H. F. WEBER.

When the interference-fringes produced by a biprism or Fresnel mirror are examined, the effect observed in the focal plane of the eyepiece is the same as that which would result from two spherical waves emanating from the two images of the luminous source, and bounded respectively by the rectangular apertures occupying the place

of the two mirrors or the two halves of the prism. Fresnel (*Mémoires sur la diffraction*, vol. i. p. 355 *et passim*) assumes that, in the central part of the fringes, the diffraction resulting from this limitation of the waves plays but an absolutely negligible part. On that hypothesis the fringes should all have the same breadth, proportional to the distance from the focal plane to the luminous images, the minima of intensity should all be *nil*, and all the maxima equal, in homogeneous light, and in white light the central fringe should be of absolute whiteness.

According to M. Weber *, attentive observation shows that these consequences are not exactly verified: the relative breadths of the lines vary with the distance of the sources from the focal plane in which they are observed; the intensities of the maxima and minima differ very much; in white light the central line is nearly always coloured. M. Weber arrives at the explanation of all these appearances by taking into account the fact that the waves which produce the phenomenon are not indefinite. By calculations necessarily long, and into the details of which we of course cannot enter, he first reduces the problem to the determination of Fresnel integrals, which he afterwards expresses by means of a Bessel function and another, analogous, definite integral. He thus obtains a comparatively simple expression for the intensity of the light in any point of the interference-field.—*Bibliothèque Universelle, Archives des Sciences physiques et naturelles*, September 15, 1879, tome ii. pp. 360, 361.

AN ABSORPTION HYGROMETER. BY A. VAN HASSELT.

The air whose moisture is to be ascertained is introduced into a flask which is furnished with a thrice-perforated stopper. Through one of the perforations a glass tube is passed which reaches to the bottom, through the second a thermometer, and through the third a glass tube communicating, by means of an indian-rubber tube, with a manometer having oil for its liquid. Both the glass tubes can be closed by glass cocks. The indian-rubber tube is itself surrounded with a second one, filled with oil in order to prevent any diffusion of the aqueous vapour—a circumstance which Edelmann (*Wied. Ann.* v. p. 455) has not taken into consideration. It might probably be advantageous to substitute glass for the indian rubber. First, a thin-walled glass sphere containing anhydrous phosphoric acid is put into the flask, and is broken by shaking the latter. From the variations of pressure in the manometer the amount of aqueous vapour is determined. In order that the previous volume of the air may be restored, the manometer consists of two glass tubes connected by one of indian rubber. The results were perfectly satisfactory.—*Beiblätter zu den Annalen der Physik und Chemie*, 1879, No. 9, p. 697.

* *Vierteljahrsschrift der Züricher naturforschenden Gesellschaft*, 1879.