the intensity of the light was reduced until the threshold of the eye was reached for the minimum visible light intensity: the shape of the holes could be recognized and recorded photographically to a certain extent.

These experiments show that structure in the object can be resolved with an aperture of the optical instrument smaller than that postulated by the formula. Therefore it was desirable to test whether two points could be separated if their distance is too small to be separated otherwise than by this new principle.

Fig. 5. Shows the two holes imaged through a small aperture which does not enable them to be separated.

Fig. 6. Shows the effect of reduced intensity: discrimination of two points (the holes are not resolved) is achieved.

The effect has been reproduced on microscopic objects as well and the experiments are being published elsewhere.

Arising from the experiments described above, it is suggested that a factor I for the intensity of the light should be included in the formula of resolution. The value of I cannot be given as a constant as it necessarily varies with the light source employed. In my experiments it had the rough value of 0·1, judging by the respective times of exposure necessary to record the effect.

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The Modern Centrifugal Pump as a Plankton Collector

THE elimination of the many sources of error encountered in some form or another when collecting plankton for quantitative work with silk nets is a problem that has been attacked many times. During the last fifty years, a number of workers, many of them with some measure of success, have from time to time used a pump and filter as a means of collecting a small, but quantitatively accurate sample, of plankton.

Encouraged by the obvious possibilities and advantages of this method, we have recently conducted experiments with a modern centrifugal pump. The experiments were made from the Research Ship *Explorer*, Fishery Board for Scotland, and the results have proved to be of great value and interest. We are preparing a paper on the subject in which the whole aspect of the problem of sampling is discussed, and the historical position of the plankton pump reviewed.

The experiments were conducted with a water meter included on the delivery side of the pump, and show how a comparatively large volume of water (two and a half cubic metres) was filtered in ten minutes with a two-inch pump. A three-inch machine would deal with almost double the volume (five cubic metres) in the same time, and it is a pump of this calibre that we suggest for general use.

Filtering can be done either by suspending the net in a tank of water to take up the force of heavy delivery, or direct on to the ship's deck. This latter method was used in our work and the results show that the plankton so collected is little, if at all, damaged in passing the impeller at 2,000 revolutions per minute. Even complicated chains of diatoms and delicate forms such as *Aglantha* remained whole, while some of the zooplankton forms were seen swimming actively in the filtered sample. The suction action is more than ample to take all forms of life, so that the collections are in no sense selective, and the results obtained indicate clearly the greater quantity of small forms, both of phyto- and zooplankton, as compared with the larger forms.

The suction hose, which is made in jointed lengths of 25 feet (8 metres), can be readily attached to a steel warp weighted with lead, and though in the experiments only two such lengths were used, they presented no difficulty in handling. As the pump was designed to overcome the frictional resistance in ten or more such sections, there would presumably be no more difficulty with 100 metres of pipe than with 12–15 metres. The joints are made with a quickly meshed screw thread, and are water-tight; and it was found that sections of much greater length than those used could be employed without difficulty.

This modern method of plankton pumping overcomes many obstacles familiar to the quantitative worker, and should be of widespread interest.

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Symmetry of Symbols

THE application of the theory of symmetry to decorative designs is well known to students of crystallography and to mathematicians interested in the theory of groups. Text-books on design do not discuss these simple rules for the construction and classification of patterns, most likely because the subject up to the present has been treated only in the technical language of mathematics.

In preparing some articles which have as their purpose to explain the subject in a simpler form, I came across the following example which may be of more general interest. If we classify the letters of the alphabet according to their symmetry characteristics, we find the following five groups (in mathematical language they are the sub-groups of the symmetry group of the rectangle):

(I)	F G J K L P Q R
(II)	A M T U V W Y
(III)	B C D E
(IV)	N S Z
(V)	H I O X

I. Those letters which have no real symmetry properties.