the first surface of one or of a pair of prisms, which should be placed with their edges vertical, and may stand close to the heliostat. The light emerges from the prisms as a divergent beam producing a horizontal spectrum, and one which, if the microscope is set up at a distance of four or five yards, will probably be about two feet long and not too bright in the violet or indigo. If too bright, remove the microscope further from the prisms, or use unsilvered glass instead of the mirror of the microscope; if not bright enough, bring it nearer. It is convenient to place the prisms on a sole-plate supported by three screws, which make it easy to slope the prisms and thus raise or lower the spectrum so as to cause it to fall on the mirror of the microscope. The condenser will then form, by the light of each wave-length, an image of the sun of convenient size and coincident with the objects in the field of view.

These arrangements are extremely simple, and furnish in the microscope a uniform field of monochromatic light of exquisite beauty and efficiency; and of any colour that may be desired by simply shifting the microscope sideways through the spectrum.

I am, Gentlemen,
Yours faithfully,
G. JOHNSTONE STONEY.

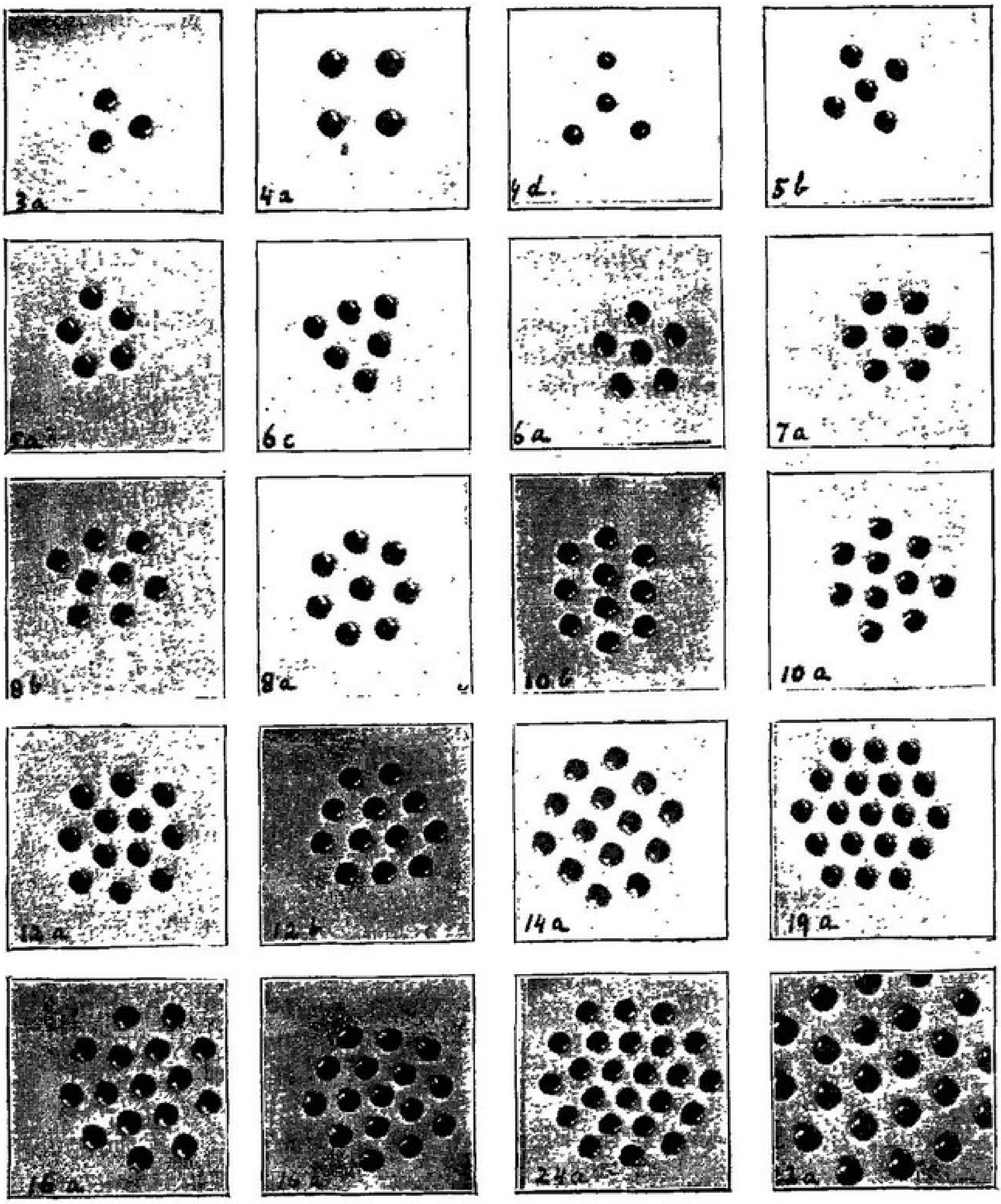
8 Upper Hornsey Rise, N.
June 6th, 1898.

IX. *Equilibrium-Figures formed by Floating Magnets.* *By* R. W. WOOD*.

IN attempting to repeat before classes Mayer's well-known experiment with the floating magnets, many have doubtless been troubled with the lack of perfect symmetry of the figures that arises from the unequal magnetization of the needles and other minor causes. This is particularly the case when more than six or eight needles are used. As the experiment proved so suggestive to Lord Kelvin in its relation to the kinetic equilibrium of columnar vortices, and is of such use in illustrating the equilibrium of molecules mutually repellant, but drawn towards a centre by an outside force, I believe it worth while to draw attention to an improvement on the original form of the experiment, which I find gives perfectly symmetrical figures even when twenty or thirty particles are employed. The apparatus that I have used consists of a large vertical electromagnet with a shallow glass dish partly filled with mercury immediately above, and at a distance of a few centimetres from the pole. Onto the surface of the

* Communicated by the Author.

mercury small clean bicycle-balls are dropped, which immediately fly to the centre and group themselves in the forms figured by Mayer. It is essential that the mercury be filtered immediately before use, as the slightest trace of film on the surface causes lack of symmetry in the figures.



One disadvantage of the method is that it does not lend itself to projection; but by means of a mirror at 45° the figures can be made visible to a fairly large audience; and the neatness and despatch with which they form makes it far more satisfactory than the wet and somewhat fussy experiment with the corks and needles.

The photographs illustrating this note were taken directly from the floating balls by means of a mirror, and indicate very well the degree of symmetry that can be obtained.

I have adopted Mayer's notation in lettering them, the letters *a*, *b*, *c*, *d* indicating decreasing degrees of stability. The form shown in 4 *d* is so very unstable that it invariably goes over into 4 *a* before it can be photographed; accordingly, I have reproduced it in ink. Its stability is about that of a needle balanced on its point.

The nature of the field has a good deal to do with the stability of certain forms. Often to form 6 *c* requires the exercise of the greatest care, while sometimes it will form itself without any manipulation.

A stable hexagon without a central particle, which was the form that Lord Kelvin took the most interest in, in connexion with the vortex mouse-mill, I have been unable to produce, and so far as I know it has never been produced by any one. Mayer figured three arrangements for eight particles, but I have only succeeded in forming two, and I doubt if the third can exist when the particles are as free to move as are the balls on the mercury surface. A little viscosity, such as we get when the mercury is not clean, makes all sorts of forms stable.

We can convert 10 *a* into 10 *b* by pushing in one of the outside balls; and as we go on increasing the number of balls, we increase in general the number of possible arrangements.

It is interesting, when we have a figure of thirty or forty particles, to introduce a larger one; for it immediately ploughs its way to the centre, driving its smaller neighbours to the left and right, and takes up a position directly over the pole, the others then scuttling back into their places with all possible haste.

Possibly some of the phenomena of refraction can be reproduced by starting waves on a mercury surface on which a 50-ball figure floats. If this could be accomplished, it would be better than the velvet strip and pair of wheels; but it does not seem very promising.

Physical Laboratory of the University of Wisconsin.
Madison, March 3rd, 1988.