the silvered surface would face the rising sun; and, if moved in an opposite direction, or towards the East, the silvered surface would face the setting sun. By combining these two motions consentaneously, the mirror can always be so inclined as to reflect the rays of the sun from rising to setting into the axis of the condenser. The two motions in question are effected by means of screws and pinion-wheels, &c.

The part just described might be a concave mirror admitting of the same motions; this would act as a reflector and condenser at the same time. The condenser is fixed in the brass plate which is attached to the window shutter; and around the condenser the metallic ring moves to which the hinge of the mirror is attached. The object of this part of the apparatus is, by refraction, to cause the large bundle of parallel rays, that impinge upon its surface, to be condensed from a cylindrical into a conical form, so that, at a given distance this converging and condensed light will arrive at its apex or focus.

Now at this focus *all the light* that has passed through the lens will be concentrated, and at a variable distance before it arrives at this focus it will cover a variable space, varying from a point or zero upwards to an amount equal to the surface of the lens.

The amount of consideration will be the ratio between the squares of the distances from the focal point; thus suppose the focal distance be twelve inches, and that we intercept the cone of light at three inches from the focus; then by dividing the square of twelve by the square of three we obtain the ratio, which is sixteen, and this indicates that the light at this distance is sixteen times more intense than it was when it first emerged from the lens.

The object of the refracting lens, therefore, is to illumine the object with condensed light. If the lens be achromatic, the light will be white; if not achromatic, it may have spectral colours, of which some are useless in photography, whilst others are exactly those which are needed. Now the scientific optician can arrange his non-achromatic condenser in such a manner as to cover the object with the violet side of the spectrum by which means he draws an advantage from what otherwise would be a disadvantage.

The next appendage to the solar microscope is the *object holder*, which has a sliding motion to or from the condenser in the neighbourhood of the focus by which means the object can be placed in a condensed part of the cone of light which is just sufficient to cover it and no more; a contrivance by which light is economized.

The remaining part of the instrument is the microscope proper, which contains the corrected objectives for magnifying the object.

Now the above description is exactly the same as that of the condensing part of the solar camera. With such an arrangement of mirrors and refractors, the camera and screen may remain fixed during the whole time of the operation.

Another arrangement for concentrating the light is accomplished by means of reflectors fixed in the form of a frustum of a pyramid. But in the application of this contrivance, the camera and screens must all move together on a universal joint like a heliostat, by which means the silver surfaces of the reflectors can always be preserved in front of the sun so as to catch his rays.

The mode of using the solar microscope and the solar camera is in no wise different, excepting that in the former a transparent object is substituted in the holder for the transparent collodion positive in the latter. Each is placed in the cone of condensed light, in order to be brilliantly illumined, and in *such a position in reference to the objective or photographic lens, that the rays of the picture coincide after emerging from the front lens with the rays of the cone of light.* It is by this means alone that the best enlarged picture can be obtained.

How to find the Point where the Lens is to be placed.

It appears then that the lens may not be placed in any position for maximum effect; the true position depends upon the power of the condenser. To obtain the best results there ought to be a relative connection between the power of the condenser, the power of the objective, and the position of the object to be magnified. This connection not existing in any of our solar cameras, we must avail ourselves of what is next best, and fix our lens where we can obtain the maximum effect with given materials. Take out the condenser, therefore, and ascertain the distance of its burning point. Measure this distance in inches and parts of an inch. Next take the front lens (which in this application is the back lens) of the camera tube and measure the distance of its burning point. Subtract one from the other, and the difference will give the distance nearly at which the black lens of the camera tube is to be placed from the condenser. For instance, supposing the focal distance of the condenser be sixteen inches, and of the back lens four inches, fix the latter lens at twelve inches from the condenser. In this way the cone of light from the condenser and the cone from the illumined object will nearly coincide, and will thus produce little or no interference.

Having once found this distance, adjust the tube accordingly and always use the same tube. The size of the diaphragm is not optional. It must be sufficiently large to admit the axis, at least of the peripheral pencils, otherwise those parts cannot appear in the picture; there must, therefore, exist an accurate connection between the size of the object, the correction of the lens, and the opening of the diaphragm; it is possible the combination will work respectably without any stops.

How to take an Enlarged Negative of a Microscopic Object.

Fix the solar microscope in the window-shutter of a darkened room. On a platform, constructed for the purpose, place a camera with an elongated bellows attached. The camera can slide between ledges nearer to or farther from the microscope. The axis of the microscope and of the camera coincide. The objectives that are most likely to give satisfaction to beginners are, the one-inch, the half-inch, and the quarter-inch. Insert the object in the holder. Bring the sun's rays, by means of the two screws on the brass plate, into the axis of the microscope. Let an assistant adjust the object into focus by bringing it nearer to the objective or withdrawing it from it, until the image is seen on the ground glass; this sometimes, and especially with a high power, is a very difficult task. When the image is once on the ground glass, let your assistant desist from all further interference excepting that of regulating the mirror, so that the sun shines continually through the object. By means of a microscope adjust the ground glass into accurate focus by sliding the camera. This adjustment is extremely refined; it requires the utmost care—the utmost precision.

When once attained, fix the camera, and see that no light can penetrate the camera excepting through the object glass. Withdraw the ground glass and insert the prepared plate for the negative, and draw out the slide for a short time. You have to find out the time of exposure by experience, so that the first attempt may be a failure. The development and fixing you already know how to manage.

By proceeding in this way the microscopist can prepare negatives of his choice specimens whereby he can obtain prints to aid him in the investigation of nature, much more accurately delineated than can possibly be accomplished by the aid of the camera lucida.

The solar camera is managed in the same way as the solar microscope, by adjustment on the shutter of a darkened room. But in this case no camera box is used. A moveable screen is used instead, on which the prepared paper is stretched on a plane at right angles with the axis of the condenser and the lens. A transparent positive is placed in the holder, in an inverted position, in order that the image on the screen may be direct. The rough adjustment to focus is obtained by moving the screen and the fine adjustment by means of the screw attached to the plateholder. The prepared paper, stretched on a board as if for a water-colour painting, is fixed exactly in the place of the focussing board, and then the cap of the tube is removed. The circle of light is kept in position by the two screws of the camera that move the mirror. The paper may have been prepared either with a chloride, as in the common contact printing process, or with an iodide or bromide, or both, as in the printing process by continuation or development, both of which will be described hereafter. To print by the former process and by means of the solar camera, is a very tedious operation, and will sometimes last several hours before a satisfactory picture can be obtained; by the latter, the process is very short, but the results are not so fine.

I need scarcely remark, what must already have suggested itself to the reader, that the shutter on which the instrument