its exteriorly pure, white, trumpet-shaped, velvety flower tinted with various clear colors of purple, golden, pink, etc. Orchids in great variety are numerous, also ferns of all sizes, up to trees twenty feet high, are abundant.

This wilderness contains much undeveloped wealth in its export varieties of trees, medicinal and fibrous plants, and in its undeveloped minerals, metals, and very fertile agricultural lands, and has much to interest scientists, especially naturalists.

July 30.

A NEW REFLECTING AND DIRECT ACTING POLARISCOPE FOR THE ARC LIGHT PROJECTOR.

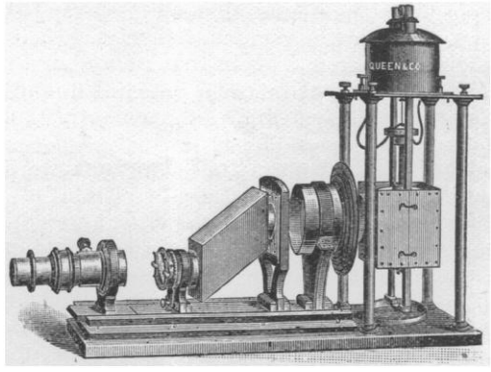
BY OSCAR KNIPE, PHILADELPHIA.

REFERRING to a paper on the subject of Projection, published lately in *Engineering* and several other periodicals, it was then indicated that most of the accessory instruments for Projection, among them the polariscope, would become more popular and find increased employment in the various courses of instruction. The arc light being so convenient, prompt in application and so perfectly satisfactory, suggests, of course, an extended application, and in consequence the expert will frequently find chances for improvement.

The favorite construction of the polariscope has been with Nichol's Prisms, two of these being employed, one for the polarizer and the other for the analyzer. To obtain brilliant effects it is necessary that the former should be at least two inches across the face; unfortunately it is now impossible to obtain such large crystals of spar, and as the demand for these instruments increases very much the reflecting polariscope again comes to the front; the old elbow arrangement furnished by some makers of instruments is a very clumsy attachment and inconvenient, as it requires the projector to be turned side-ways so that the light can reach the screen in front of the audience.

Various modifications have been proposed mainly by London makers and amateurs to obtain a direct acting reflecting polariscope by two opposite surfaces set in a box at the usual angle and deflecting the beam upward or downward, but the main objection, that of being inconvenient, still remained. The optical bench of the Paragon Projector offers, however, special advantages in that respect; the distance from the centre of the arc to the slide base being sufficient to allow a downward polarizer to be adopted, leaving abundant room for the object stage, objective and analyzing prism upon the bench. In practice this instrument is found to be simple in adjustment with the light, and the results obtained are surprising; the field projected is perfectly circular and even, alternating it light and completely dark by rotating the analyzer. The object stage here used is a novel devise; it consists of two uprights which open and close by a spring forming a clamp, a rotating ring with spring clips is secured to each clamp upright, so that three objects can be combined at one time, which is required for circular and eliptic polarization. The stage for exhibiting the phenomena of polarization in crystal, glass forms (verre trempe), and those produced by heating the object will be described at a future time.

The polariscope described above is specially adapted for plane and circular polarization of geometric and fancy designs of Selenite and Mica. The latter is easily obtainable and can be split into laminæ of various thicknesses, the thinnest that can be taken off in a square of about two inches is technically known as an eighth wave plate, the next thickness equal to two one-eighth films superposed is termed a quarter wave film and another equal to two one-quarter films superposed is the half wave film. The quarter and half wave films are the most useful in producing the most marvellous color combinations imaginable, not only in the gay primaries of the solar spectrum, but also in the more quiet grays and plain colors generally; taking a specimen composed of four or six strips of selenite about one-quarter of an inch wide by one and a quarter inches long, laid closely together, it will project its primary colors at once upon the dark field obtained by the position of the analyzer; the slightest turn to the right or to the left produces a change in the colors, but if we move the prism through one-quarter of a revolution the field is changed to a ground flooded with light and the colors have respectively changed to their complementary tint, the carmine has become a pale green, the lemon color an azure blue and so on; they are termed complementary because when superposed they produce white light. Allowing the specimen to remain, we take advantage of the rotary slip in front of our triple object stage and place there another specimen of selenite strips exactly like the first, but place it at right angles or diagonally and we now will have an illustration of the fact alluded to that complementary colors produce white light. The reason that only here and there a square or diagonal of real black or white is produced is found in the difficulty in matching exactly the films. After passing through the various changes, taking a note perhaps of the exact angle at which a certain color is produced so as to be able to repeat it afterward, we will remove the specimen from the front of the stage, and replace it by a quarter wave film; these have generally the axis marked on the edge by an arrow. We shall now obtain a decidedly different set of colors, which con be varied by rotating the analyzer; but notice now that instead of the two complementary colors we have a continual interchange of four or more colors, which can all be registered and repeated. When the quarter wave or half wave film is placed on the rotary clip at the back and rotated we obtain a different set of colors as well as



a colored background. A specimen representing three or four concentric circles, or a wheel divided into a number of sections joining at the centre or again a thin slab of selenite which is ground concave on its face, either of these will give the most beautiful and fascinating changes of color. As these various types of colors are absolute standards taken from the book of nature which can be exhibited precisely alike, it is obvious that we have here in this branch of polariscope study the most brilliant, complete and unchangeable system of color samples with their complementaries and color contrasts which far surpass any book of artificial colors. These when projected on the screen in a class become the objective point of every member, and can be pointed out, and commented upon by the instructor. As the geometric designs may be varied in composition, the mica films being very inexpensive, it requires merely a little patience and experience to produce an unlimited variety. The apparatus described in this article is made by Queen & Co. Incorporated of Philadelphia.