POLARIZED LIGHT.

PRACTICAL APPLICATIONS OF THE POLARISCOPE.

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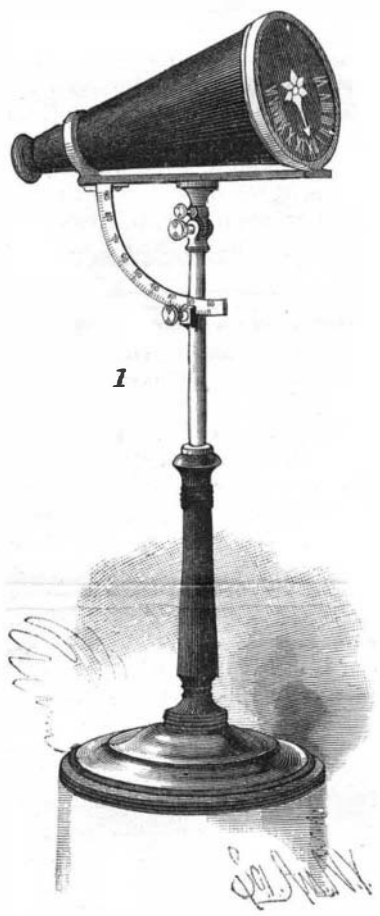
VI.

The practical applications of the polariscope are few but important. In chemistry, its most prominent use is in the determination of sugars. In medicine, it finds an application in the examination of diabetic urine. In geology and mineralogy, it is of utility in determining the origin and nature of rocks and minerals. In photometry, it forms the basis of several photometers. In photography, the polariscope, or at least a part of it—the Nicol prism—has been employed for reducing the glare of highly illuminated objects. In a similar way, the Nicol prism has been used for extending the field of vision in a fog. It forms an important part of the water telescope. It has also been used to some advantage in viewing paintings unfavorably situated in galleries. In the trades, the polariscope has proved useful in detecting strains in glass. By opticians, it has for years been recognized as a test for the genuineness of Brazilian pebble lenses for spectacles. It has also proved of great utility to the microscopist in the microscopic examination of structures.



WHEATSTONE'S POLAR CLOCK.

One of the most curious uses of polarized light is the indication of the time of day. Sir Charles Wheatstone devised a polar clock in which a Nicol prism in connection with atmospheric polarization is made to indicate the time of day. Several forms of this instrument have been made; one of them is shown in Figs. 1 and 2.* Atmospheric polarization, according to Professor Tyndall, is due to the reflection of light from the fine particles of matter floating in the air. By examining the sky on a clear day by means of a Nicol prism and a plate of selenite or other crystal, polarization will be detected without difficulty. The brightest effects are noticed at a point 90° from the sun. By directing a Nicol prism to the north pole of the heavens—a position always at right angles to the sun, or approximately so—and turning it round, the colors of the crystal plate, viewed through the prism, will change in a definite order, or, if the position of the Nicol be fixed, the movement of the sun will produce similar changes of color. The polar clock is based upon this principle.

The inventor describes this instrument as follows: "At the extremity of a vertical pillar is fixed, within a brass ring, a glass disk, so inclined that its plane is perpendicular to the polar axis of the earth. On the lower half of this disk is a graduated semicircle, divided into twelve parts (each of which is again subdivided into five or ten parts), and against the divisions the hours of the day are marked, commencing and terminating with VI. Within the fixed brass ring containing the glass dial plate, the broad end of a conical tube is so fitted that it freely moves round its own axis; this broad end is closed by another glass disk, in the center of which is a small star or other figure, formed of thin films of selenite, exhibiting, when examined with polarized light, strongly contrasted colors; and a hand is painted in such a position as to be a prolongation of one of the principal sections of the crystalline films. At the smaller end of the conical tube a Nicol prism is fixed so that either of its diagonals shall be 45° from the principal section of the selenite films. The instrument being so fixed that the axis of the conical tube shall coincide with the polar axis of the earth, and the eye of the observer being placed to the Nicol prism, it will be remarked that the selenite star will in general be richly colored; but as the tube is turned on its axis the colors will vary in intensity, and in two positions will entirely disappear. In one of these positions, a smaller circular disk in the center of the star will be a certain color (red for instance), while in the other position it will exhibit the complementary color. This effect is obtained by placing the principal section of the small central disk 22½° from that of the other films of selenite which form the star. The rule to ascertain the time by this instrument is as follows: The tube must be turned round by the hand of the observer until the colored star entirely disappears, while the disk in the center remains red; the hand will then point accurately to the hour.

"The accuracy with which the solar time may be indicated by this means will depend on the exactness with which the plane of polarization can be determined. One degree of change in the plane corresponds with four minutes of solar time."

In Fig. 3 is shown the tourmalin tongs, the simplest polariscope known. It consists of two plates of tourmalin, cut parallel to the optic axis of the crystal, and mounted in cells arranged to turn in eyes formed at the extremities of the looped wire. When the plates are parallel, light passes through them; but when they are arranged at right angles with each other, the light is completely extinguished. If a plate of crystal, a Brazilian pebble spectacle lens for example, be placed between the tourmalins arranged in this way, the light will again pass, showing that it has been depolarized by the rock crystal.

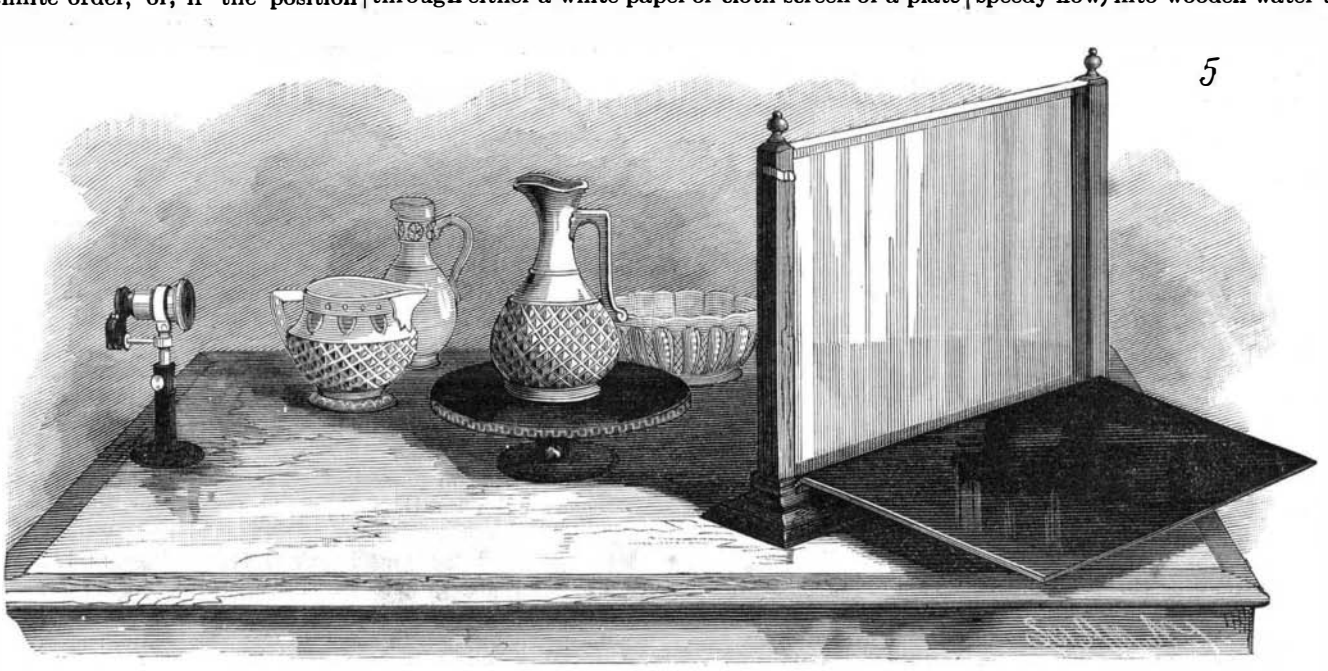
This has been accepted as an infallible test of the genuineness of lenses of this class. In the hands of an expert it is undoubtedly valuable, but glass lenses may be put under strain by heating them and allowing them to cool rather quickly. They will then, to some degree, act on the polarized beam like the true crystal.

This form of polariscope is useful in the examination of crystals generally, but on account of the natural dark color of the tourmalin, the utility of the instrument is limited.

In Fig. 5 is shown a polariscope designed for the examination of large objects, such as glassware, etc. It consists of a bundle of 16 glass plates, about 20 or 24 in. square, arranged with reference to the Nicol prism employed as an analyzer at an angle of 35° 25′. Behind the series of plates is hinged a board covered with black velvet, which may be raised up parallel with the glass plates when it is desired to polarize the beam by reflection.

The analyzer, a Nicol prism, is mounted in a revoluble tube, supported by the small adjustable standard. Articles to be examined are placed on the small table between the polarizer and analyzer.

The light for the polariscope should be taken through either a white paper or cloth screen or a plate of ground glass. Any strain in the article examined will exhibit itself by its depolarizing effect on the polarized beam.



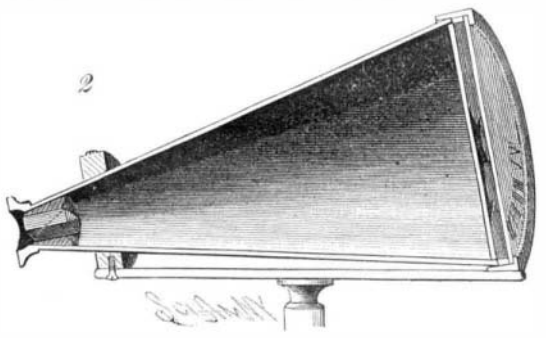
POLARISCOPE FOR LARGE OBJECTS.

* Other forms are described in Spottiswoode's "Polarization of Light."

THE forests of Ohio occupy about seventeen per cent of the entire area of the State.

The Coal Stealing Industry.

"Anthracite coal will not melt, evaporate, or blow away while in transit over a railroad," said an officer of one of the great coal-carrying companies at Scranton, the other day. "But there never was a train loaded with coal yet that reached its destination with the weight of coal it started with by a good many tons. Every station along a coal-carrying road has its complement of coal thieves. Many of them were formerly engaged in the business of selling coal to others, the stocking of their yards being the result of coal pilfered from the company. This peculiar style of dealing in coal, it has been learned, was carried on systematically in some places for years.

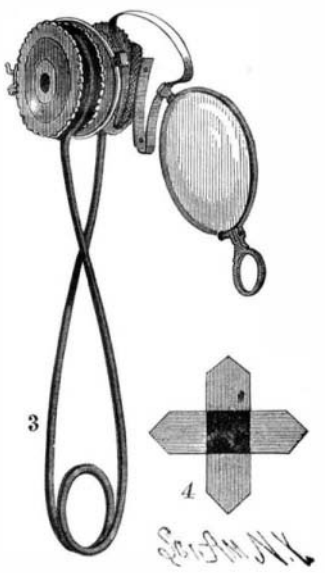


LONGITUDINAL SECTION OF POLAR CLOCK.

"But in spite of the vigilance of our detectives, the extent of the operations of thieves along the coal-carrying railroads is still something enormous. The thieves are so shrewd and so systematic in all their operations that they can relieve a train of many tons of its cargo in the course of a few minutes.

"At one station alone on the Erie road, not less than thirty tons of coal are taken from the cars every day, or rather every night, as the operations are carried on only on night trains.

"Trainmen have their customers along the line, and as the trains pass by certain places agreed upon, a few lumps are tossed off daily, and many a ton of coal is thus disposed of from every train."



TOURMALIN TONGS.

Disposal of Hotel Sewage.

An esteemed correspondent who has recently passed some time at the Manhattan Beach Hotel, at Manhattan Beach, L. I., writes that the system of sewage disposal in operation there is very successful. He does not think any system could work any more satisfactorily than does this one, designed by Mr. J. J. Powers, a Brooklyn plumber. He says:

"The sewage (excreta and house water exclusively) flows by pipes (of such moderate size as to insure a speedy flow) into wooden water-tight tanks, where, by the use of such cheap material as charcoal and copperas, the whole mass, ninety per cent of which is water, is economically and thoroughly disinfected and deodorized, the solids being precipitated, while the liquids flow in a clear and harmless stream to the sea. The process works automatically and easily; there is no smell, even close to the settling tanks, and few of the hundreds of thousands who visit those wonderful caravansaries have any comprehension of how largely the welfare and business of the whole island depends upon this common sense invention of one clear-headed, fair-minded sanitarian. The solid portions of the sewage are disinfected and drained, and are removed as frequently as is necessary; the product (called native guano), a dark-colored poudrette, is used upon the lawns, and with magical effect, and when sold brings $20 a ton."—*Sanitary News.*