THE OPHTHALMO-DIAPHANOSCOPE.

The ophthalmo-diaphanoscope is an instrument for examining the fundus, or back of the human eye. It is the invention of Dr. Carl Hertzell, of Berlin, who claims that the instrument and its accessories supersede anything that has previously been in use. Briefly, the instrument consists of an eighty candle-power electric lamp, which the patient holds in his mouth, as far back as possible. This highly illuminates the retina of the eye from the back, and the surgeon, looking at it from the front, is able to make a much more satisfactory examination than was possible by means of reflected light and eye-mirrors.

Of course, the examination takes place in a totally dark room, while the patient wears a black mask over his face, in order to concentrate the effect of the illumination, holes being cut in front of the eyes, through which the surgeon makes his observations.

These are the essential points connected with the ophthalmo-diaphanoscope and its working. There are, however, a few other details connected with the invention which are of particular interest. The illumination, which is concentrated at one end of the tube, is ten times more powerful than that which is emitted by any other lamp previously employed in surgery for transmitted light. As we have seen, the normal candle-power is eighty; and a moment's reflection will convince the reader that it would be quite out of the question to make use of an ordinary lamp of this kind in the mouth, or, indeed, in close contact with any part of the body, because of the great heat which is generated. This difficulty has been surmounted by means of a continuous stream of cold water which circulates within the lamp. In the complete equipment, the water is stored in a glass reservoir supported upon a column, down the hollow of which the fluid passes to a flexible tube which carries the stream into the lamp, through which it circulates. A similar tube carries away the waste water, which is ultimately discharged into a vessel at the base of the apparatus.

A necessary and most ingenious addition to the ophthalmo-diaphanoscope is the contact signal lamp, which is fixed to the column beneath the reservoir, that is to say, about on a level with the eyes of the surgeon when he is making an examination of the patient.

This lamp lights automatically just before all the water is discharged from the reservoir, so that no matter how much absorbed the surgeon may become in his examination, he will be at once apprised that the reservoir is almost empty by a sudden illumination of the darkened chamber. He can then at once switch off the current from the lamp, which, now that the cooling stream has ceased to flow, would become heated and cause discomfort to his patient.

It should be added that the outer cover glass of the special lamp is readily removable, so that it may be sterilized after each use. Moreover, every part of the lamp may be had in duplicate; and as these are perfectly interchangeable, a broken or faulty part may be at once replaced. The whole apparatus has been devised with the utmost care; and it is claimed that even those who are unfamiliar with electrical appliances may quickly become accustomed to its use.

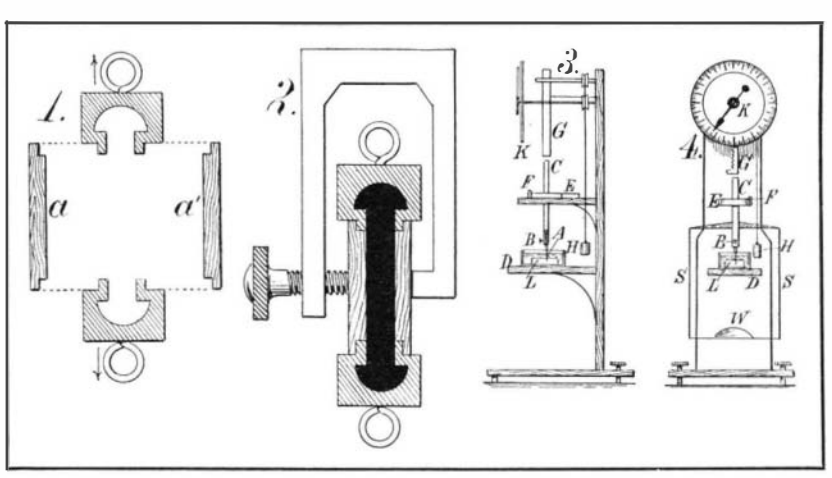
The ophthalmo-diaphanoscope was specially invented as an aid to diagnosing diseases of the eye; but it has proved of great service in examinations of the throat and nasal cavities, while it will probably prove of service to medical science in many other ways. Its chief advantage lies in the fact that an extremely powerful light may be obtained without heat radiation.

THE OPHTHALMO-DIAPHANOSCOPE.

TESTING BITUMENS FOR PAVEMENTS.

In every direction, the industrial and scientific worlds are endeavoring to measure the properties of substances. An instance of this tendency was given in the article on "Testing for Hardness" in the SCIENTIFIC AMERICAN for August 29th, 1908. In the present article it is proposed to give some account of measurement efforts in a very different field of activity.

The sheet asphalt pavements so common in certain parts of the United States are composed of an admixture of some asphaltic cement and sand. It is quite important to have pretty exact information about this bituminous cement in advance of its use in paving mixtures. One reason for this is that the cements are by no means all alike. And second, the requirements for this use and that vary greatly. Thus it comes about that it is a matter of considerable importance to determine the characteristics of samples in course of manufacture or an advance of actual use. In fact, since the asphaltic cement is the controlling factor in the mixture used in sheet asphalt paving, it is very necessary to make this cement with just the properties suited to the particular case in hand. That is to say, asphaltic cement is a combination of refined asphalt and some tempering oil, as residuum petroleum. It will readily be seen, then, that the properties of the cement will vary with the relative quantities of the two ingredients, to say nothing of the characteristics of the particular asphalt and oil used. For practical purposes, then, it is found very desirable to know in advance whether the cement being made is going to be what is wanted.



Figs. 1 and 2 show mold for sample prism. Figs. 3 and 4 show side and front views of the Dow penetrometer.

There are two principal properties whose determination is sought. These are ductility and viscosity.

In order to measure the ductility, the following method, due to Mr. A. W. Dow, may be employed: A mold of four pieces is constructed, the plan view of these being shown in Fig. 1. These pieces are set up on a brass plate which forms the bottom. The side parts are held in position by a clamp, as shown in Fig. 2. The interior portion of the mold is in the form of a prism, 1 x 1 x 5 centimeters. The cement is now poured in, hot of course. When cool enough, the top is smoothed off. When the temperature has fallen to the point at which it is desired to make the test, the clamp is loosened, and the two side pieces *aa'* (Fig. 1) are removed. We now have a prism of cement held at the sides by clips—the end pieces of the mold. By inserting hooks in the eyes of the clips, it is easy to arrange matters so that these clips may be steadily drawn apart. This may be accomplished by hand. Mr. Dow mentions the rates of separation as 5 centimeters per minute for the temperature of 77 deg. F., and of 1 centimeter per minute for 20 deg. F. It is stated that "it is not safe for an asphalt having a consistency of 40 penetration at 77 deg. F. to pull less than 20 centimeters at this temperature." What is meant by "a consistency of 40 penetration" will become clear in the sequel.

In order to measure the viscosity (consistency) of a cement, recourse is had to a device for measuring the depth of penetration accomplished by a weighted needle in a given time. Prof. H. C. Bowen is said to have invented the pioneer machine about twenty years ago. Several devices have been developed since. The one which is probably most in use at the present time was devised by Mr. Dow. But this latter has now been improved upon by Messrs. Richardson and Forrest.

In the Dow machine, a broad upright rises at the rear of a base, as shown in vertical section in Fig. 3. The specimen of asphaltic cement is contained in a small tin box *L* immersed in water in a suitable receptacle. This last rests upon the shelf *D*. An aluminium rod *C* is held by a clamp *E*, controlled by a button *F*. A No. 2 cambric needle *A* is inserted in a brass rod, and this latter is held in position in the aluminium rod by the screw *B*. Attached to the aluminum rod *C* is the framework *SS*, Fig. 4, carrying a weight *W*. It will readily be seen now that by locking the clamp *E* open, by means of the button *F*, the needle, weighted by the parts *C*, *SS*, and *W*, may be brought into contact with the upper surface of the specimen, and allowed to begin penetration.

There are two remaining things for which mechanism must be arranged. There must be some means of measuring the time and the amount of penetration. The former of these is quite a simple matter. A pendulum beating half-seconds is arranged at some convenient point of attachment. The second requirement is accomplished as follows: In Figs. 3 and 4, *G* is a rack meshing with a pinion back of the dial *K*, and controlling the indicator. At the rear end of the spindle carrying the pinion is a drum. A rather thick thread is wound about this drum, and weighted at its lower end by the weight *H*. This last is of such amount as just to counterbalance the weight of the rack on the pinion. Consequently, if the lower end of the rack is brought into contact with the aluminium rod *C*, it will not contribute any influence to the penetration of the needle. At the beginning of the test, the lower part of the rack is brought into contact with *C*, and again at the conclusion. The difference in position of the rack will, therefore, give the amount which the needle has

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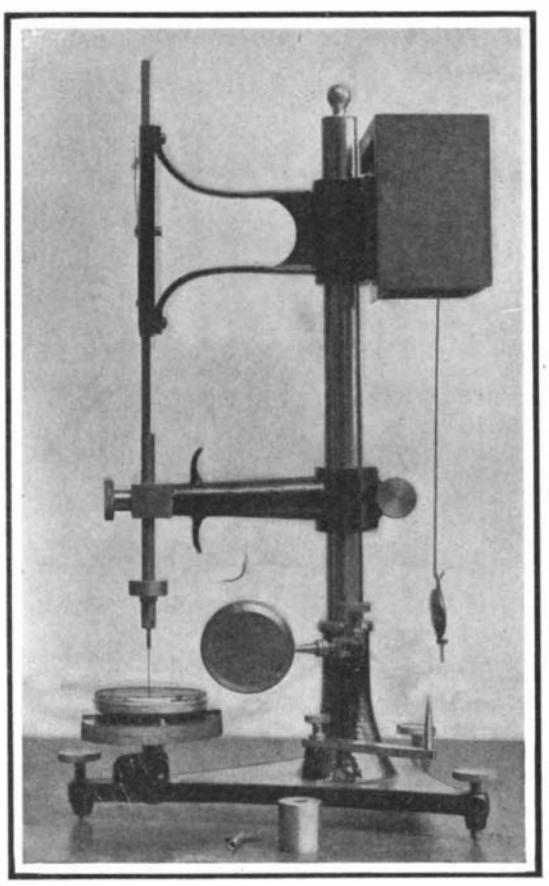
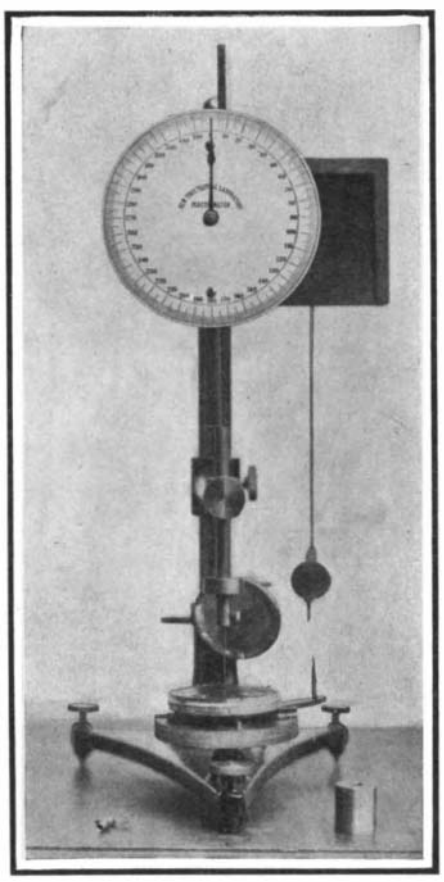


Side view of the improved penetrometer.



Pendulum and indicator dial.

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