passing the low-pressure thermometer leads quickly to either a markedly increased coefficient which increase depends on the rate of flow and is therefore due to kinetic energy effects; or to such a small heat capacity passing the plug that the errors due to heat gain and which are determined largely by the difference of temperature, become larger than desirable. Warming curves of the plug with the flow stopped may be used to get the maximum value of these corrections. Data have been obtained with the low side pressure appoaching one atmosphere where the values of the coefficient were independent of rate of flow.

Great difficulty has been experienced in obtaining suitable porosity. The plugs used are made of porous porcelain and the porosity reduced to that desired by precipitating barium sulphate within the wall. Unfortunately the precipitate blows out. Repeated fillings lead to very non-uniform porosity and consequently erratic values for the coefficient.

Apparatus is at hand for covering the temperature range + 250° C. to about − 100° C., and the pressure range 1–200 atmospheres. It will be extended to other gases when the air data are completed.

University of Wisconsin,
December 10, 1921.

Ether-drift Experiments at Mount Wilson Solar Observatory.

By Dayton C. Miller.

The ether-drift interferometer with a light-path of 224 feet, which was used by Morley and Miller in the Cleveland experiments of 1904 and 1905,[1] has been remounted at the Mount Wilson Observatory in southern California, and observations were obtained in April and in December, 1921. In some of the earlier observations made on a slightly elevated location there was a small displacement of the interference fringes such as would be expected from a true ether-drift. The present series of observations had the object of determining whether this displacement would be larger at the elevation of about 5,900 feet above sea level, and whether it would be affected by the change in the direction of the earth's motion in space from April to November. It was further decided to determine whether the effect was due to magnetic disturbances, by using a steel base for the optical parts in April, and a concrete base in December.

The results show a definite displacement, periodic in each half revolution of the interferometer, of the kind to be expected, but having an amplitude of one tenth of the presumed amount. This is slightly larger than the displacement obtained in Cleveland in 1905. However, this displacement is always accompanied by a disturbance, periodic in one complete revolution of the interferometer, the cause of which is so far unexplained. Final conclusions cannot be drawn until this disturbing factor has been eliminated, by further

[1] Philosophical Magazine, May, 1905.

experimentation. The observations show that the effect is not due to magnetism, and that its magnitude is about the same in April and December.

CASE SCHOOL OF APPLIED SCIENCE,
CLEVELAND, OHIO,
December 20, 1921.

PHOTO-ELASTICITY OR OPTICAL INVESTIGATION OF STRESS DISTRIBUTION IN SOLID BODIES.

BY PAUL HEYMANS.

THE object of the mathematical theory of elasticity is the analytical determination of the elements defining the elastic state at any point of a solid body, *i.e.*, the directions and the algebraic values of the principal stresses.

The number of cases for which a complete mathematical solution exists is limited and the calculations usually worked out in practice for the computation of stability are in general an adaptation, with simplifying assumptions of sometimes doubtful accuracy, of the ideal and incomplete theoretical solution to the needs of engineering practice.

The photo-elastic methods,[1] lead to the experimental determination of the stress distribution for all two-dimensional elastic problems, provided the material in use is isotropic and obeys Hooke's law of linear proportionality between strain and stress.

Those methods are based upon the temporary birefracting properties shown by transparent bodies, namely by xylonite, when put under stress. By means of: (1) *plane polarized light*, the isoclinic lines from which the lines of principal stress, *i.e., the directions*, (2) *circular polarized light, the values of the difference*, (3) *a lateral extensometer, the values of the sum of the principal stresses are determined* at each point of the body under examination.

As in the two-dimensional elastic problems the stress distribution is independent of the elastic constants, *i.e.*, of the nature of the substance, the stress distribution within the elastic limit is the same for any isotropic substance, xylonite, steel, or others, obeying Hooke's law.

Those methods become of valuable help for the development of general mathematical solutions of elastic problems and also for the direct investigation of specific engineering problems. It is desirable that they be extended to the three-dimensional problems.

The theoretical development of photo-elasticity is in the field of physics; their application chiefly interests the engineer. The author therefore brought their description before the Am. Phys. Soc. and in an address to the Eng. Section of the A. A. A. S. he afterwards considered the application of photo-elasticity to engineering problems.

[1] The development of the photo-elastic methods is largely due to Dr. E. G. Coker, Univ. of London, with whom the author of the paper collaborated in recent research in that line.