deal of further research, involving many areas of the country, into the effects of malnutrition *on the individual, should be set on* foot.

Present League activities centre round the ideas that the diet of the mass of the population in almost all countries falls below "optimum" standards, that increased demand for nutritious food will result in increased production, and that the world as a whole is capable of a very much greater production of foodstuffs, and in particular of the physiologically most valuable foodstuffs. It is proposed that national and international "food policies" should be boldly constructed on the principles implied in Mr. Bruce's phrase—"marry health and agriculture". If India is considered as a self-supporting unit, the problem takes on a somewhat different complexion; many consider that there is little possibility of the country producing an improved diet for its rapidly increasing population. We need, however, much more information on this point. If, on the other hand, we regard India, not as an isolated unit, but simply as part of the world, the ideas formulated at Geneva seem to become more applicable. It is conceivable, for example, that increase of wealth and purchasing power would enable the country to benefit, by importation of the kind of foodstuffs she most needs, from a world-wide boom in agriculture. At all events, there is no reason why an attempt should not be made, when the fundamentals of the situation have been more fully investigated, to formulate a "food policy" on a national or provincial basis.

An Interferometric Method of Measuring Temperatures and Temperature Gradients Very Close to a Hot Surface.

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A STUDY of the variation of air temperature with distance above and below a hot surface is a problem of importance in Physics and Meteorology. When the surface is an infinite horizontal plane and the air temperatures are required only at distances of the order of feet or centimetres, the problem of measuring the temperature is not difficult and may be solved in a variety of ways, *e.g.*, by using ventilated radiation-proof instruments like the Assmann Psychrometer or thermo-couples or resistance thermometers. Such measurements above the bare soil surface and above and below heated plates have been discussed by Ramdas and Malurkar[1] and others. When the investigation has to be extended to within a few millimetres or a fraction of a millimetre, as for example in the dust-free Aitken's layer referred to by Ramdas and Malurkar, the measurement of temperature becomes difficult. This is easily understood because the moment we place any measuring device or element so near to the surface, the isothermal surfaces get disturbed, radiation effects become pronounced and difficult to avoid, and we cannot hope to get accurate measurements of temperature. The method of interferometry, however, provides a simple and elegant solution of the problem. About 2 years ago Mr. Paranjpe undertook an investigation of temperature variations in the air "above" and "below" hot solid surfaces, above evaporating water surfaces, as well as in the interspace between two plates as in conductivity measurements, by using the interferometric method.

Fig. 1 shows the experimental arrangement. Light from a monochromatic source S (a Zeiss sodium vapour lamp) stopped down by a diaphragm DD and rendered parallel by a lens L falls on a plane parallel glass plate P_1 and is partly reflected on to the mirror M_2 and transmitted through a second plate P_2. The beam transmitted by P_1 is reflected at the mirror M_1 and the plate P_2 and then interferes with the other beam. The two beams are seen through a telescope T which can be focussed on the interference pattern. The above arrangement of the interferometer provides necessary facilities for localising the fringes at any point in the path of either of the interfering beams without change of fringe width.

The hot surface above or below which the temperature gradient is to be measured is provided by a brass plate about 13 cms. long, 5 cms. broad and 6 mm. thick with

[1] *Indian Journal of Physics*, 1932, 3, Part I.

arrangements for electrically heating. The heated plate is inserted half-way into the aperture of the interferometer when the distortion of the fringes, above or below the surface as the case may be, due to the temperature gradient in the air near the surface, may be traced with respect to the fringes in the undisturbed portion of the field. The fringes are localised at the hot surface so that both of them can be focussed on a camera placed in the position of the telescope and photographed. The size of the mirrors M_1, M_2 and the plates P_1, P_2 of the interferometer being small, the photographs of the interference pattern were obtained in sections so that in the final pictures the horizontal portions of the fringes were obtained both above or below the hot surface as well as in the undisturbed portion of the fringe system. The temperature of the hot surface was measured by using thermal junctions of copper and constantan and a sensitive galvanometer.

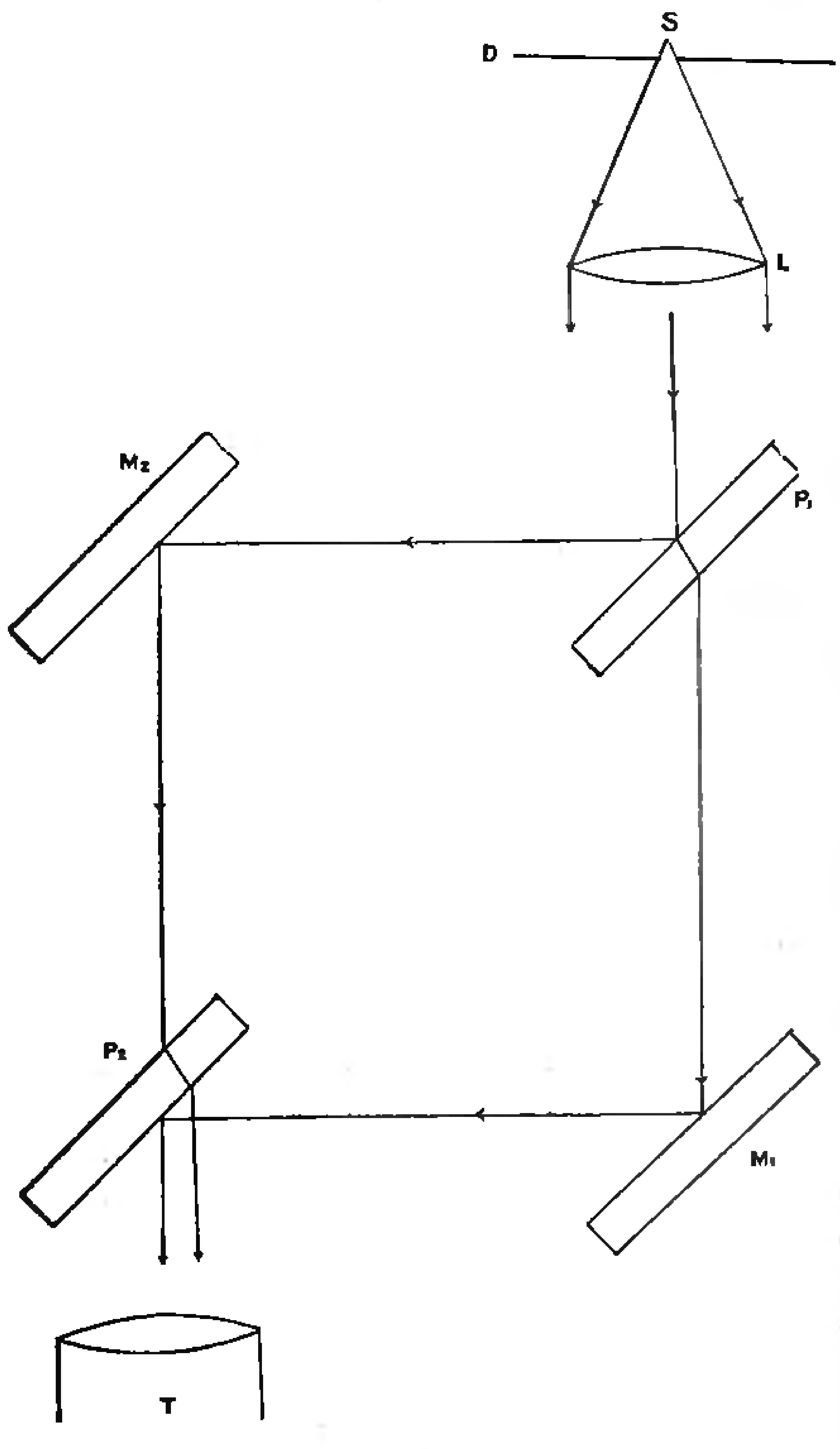

Fig. 1.

Arrangement of the interferometer.

Two interesting cases arise according as the hot plate is inserted between P_1 and M_1 or M_2 and P_2 (Fig. 1).

Case (i):—The interfering wave fronts are, say, OA and OB as in Fig. 2 (*b*) where the angle A O B is shown exaggerated. Let CD indicate the position and width of the horizontal hot surface which causes the wave front OA to be distorted into A E O as shown by the dotted lines. The distortion will be greatest near CD both above and below, and become negligible some distance away from CD. If one considers the slope of AE in Fig. 2 (*b*) it will be clear that above the surface the system of fringes will move away from the surface. At the

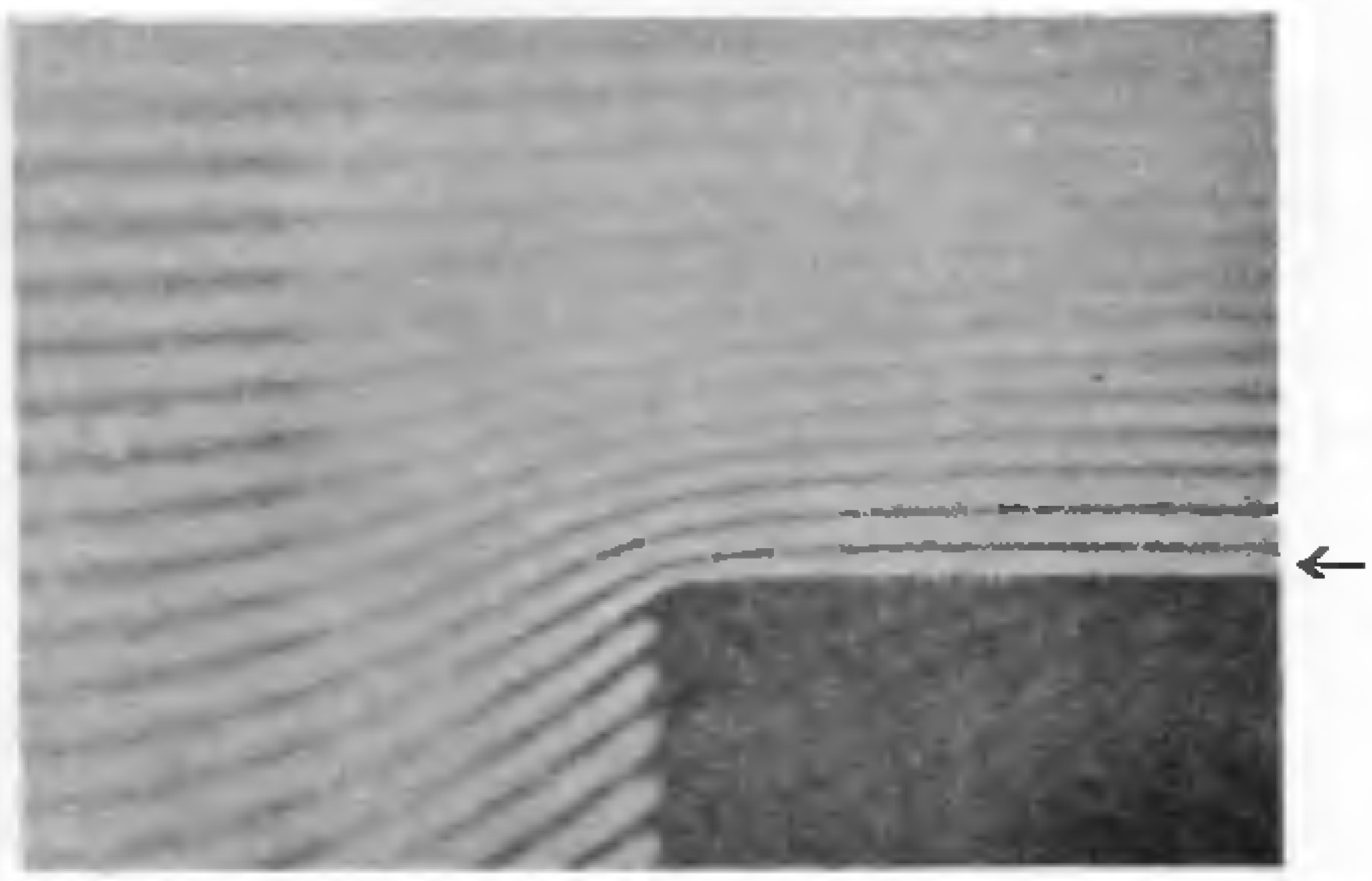

Fig. 2(*a*).

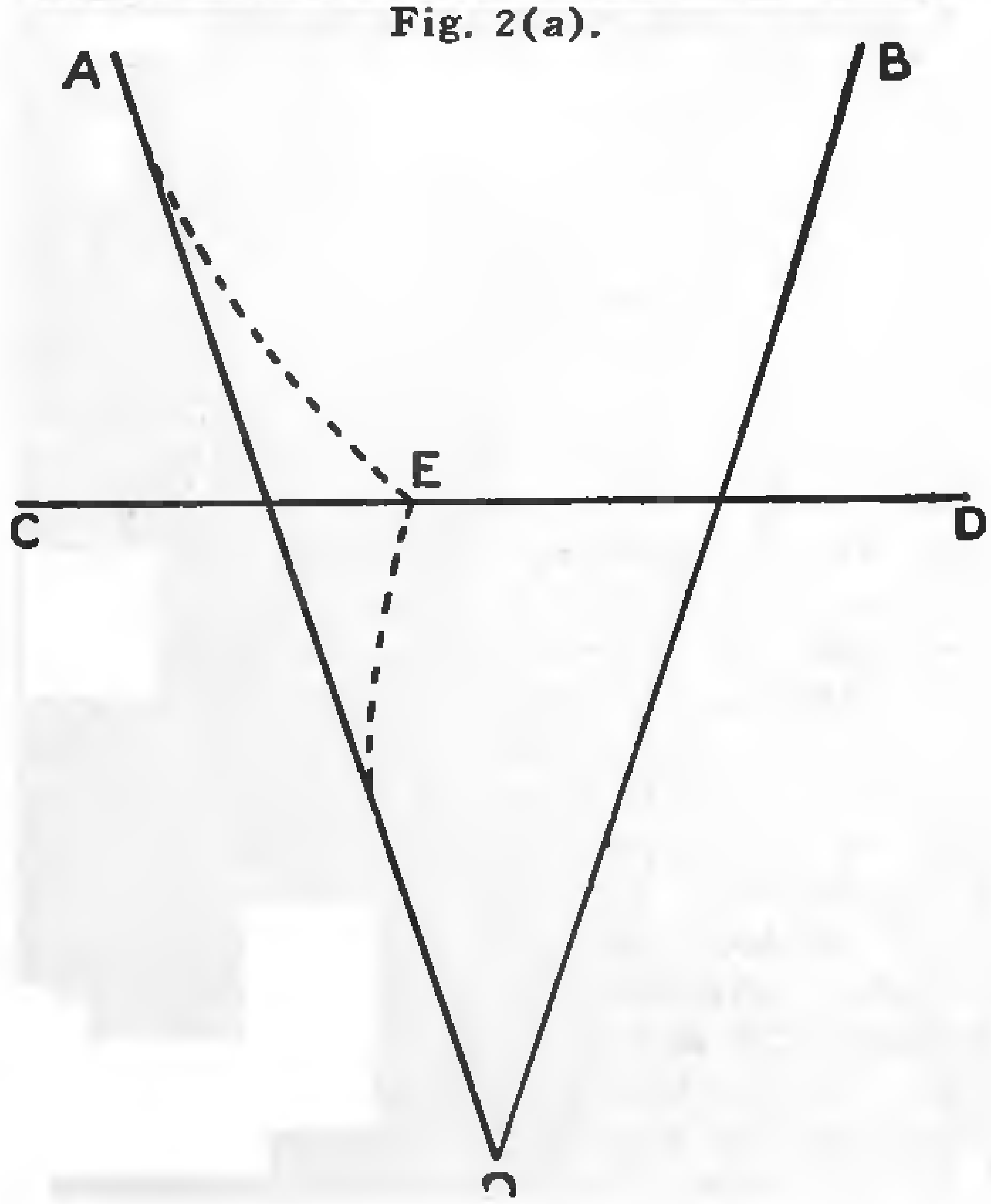

Fig. 2(*b*).

same time the fringes will become narrow, the minimum fringe width occurring nearest to the hot surface. Below the surface the distorted wave front is OE and it will be seen that the fringe system would move towards the surface and widen out at the same time, the maximum widening being nearest to the surface. Fig. 2 (*a*) shows the behaviour of the fringes above the hot surface which is only inserted half-way into the field. The position of the surface is indicated by an arrow.

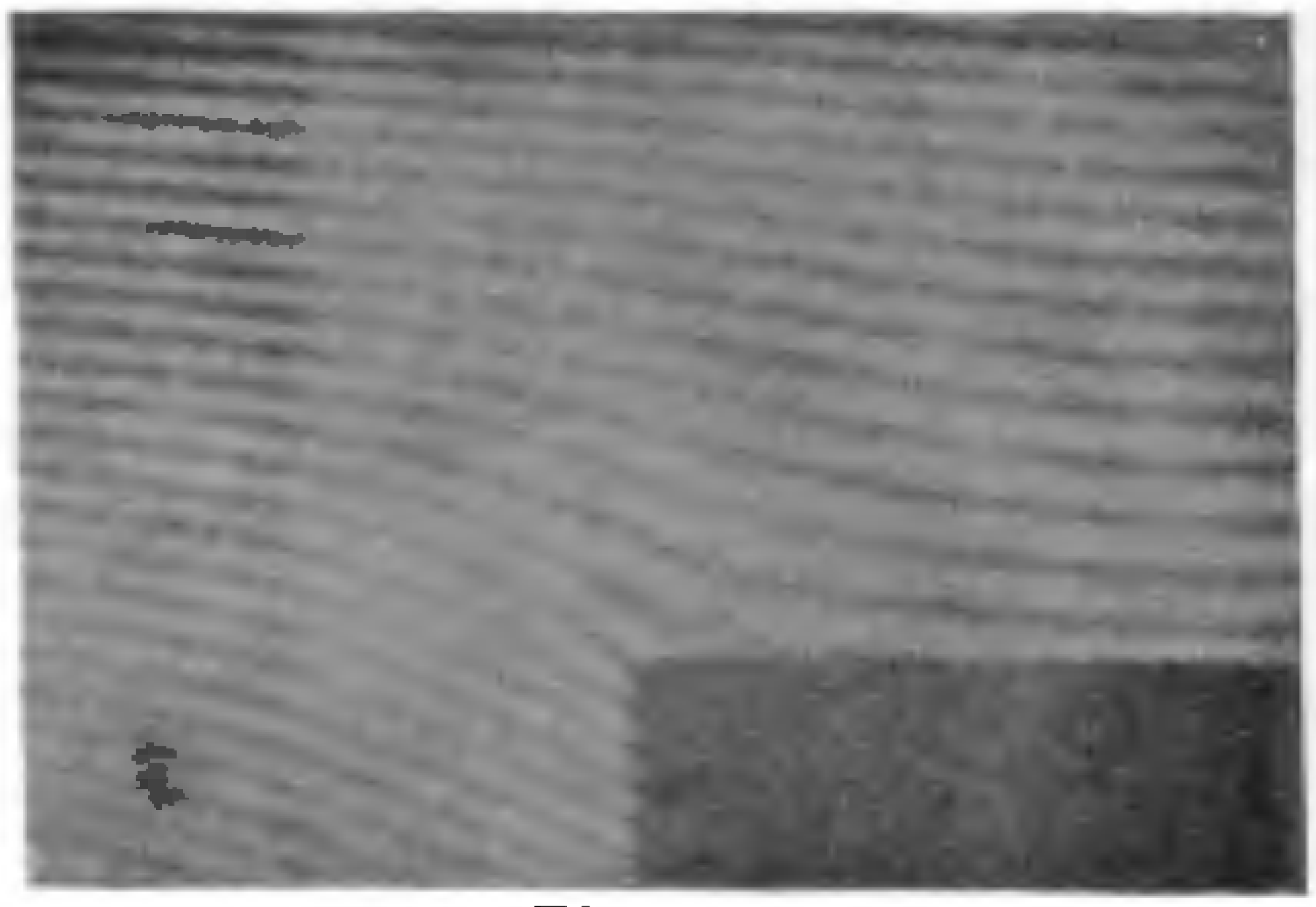

Fig. 3(*a*).

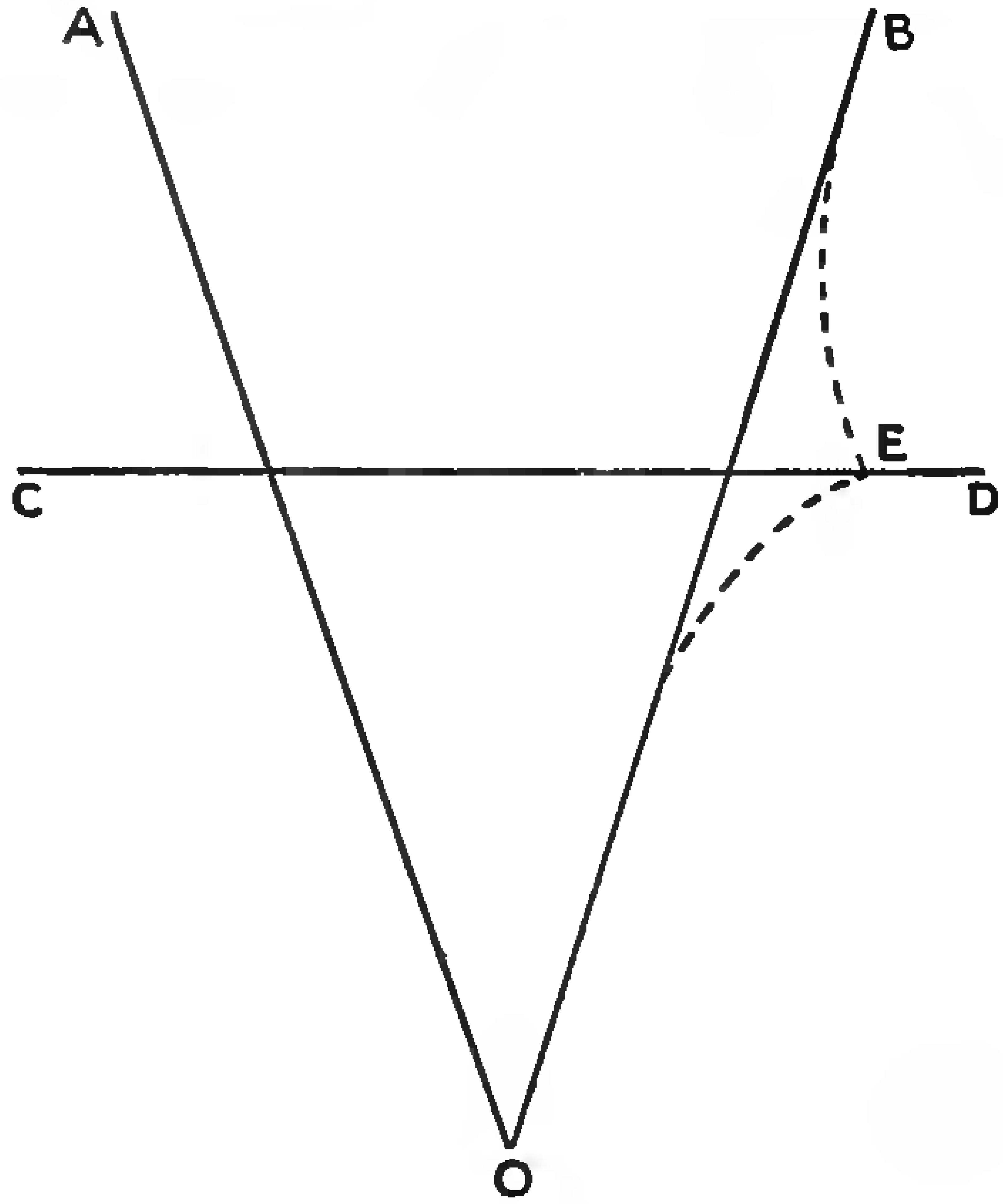

Fig. 3(*b*).

Case (ii) :—Here the wave front affected by the hot surface is OB which gets distorted into O E B as in Fig. 3 (*b*). In this case the movements of the fringe system would be exactly opposite to those observed in case (i), *i.e.*, the fringes above the surface would widen out and move towards the surface and those below would contract and move away from it. Fig. 3 (*a*) shows the behaviour of the fringes above the surface and it will be noticed that the displacement and changes in width are exactly opposite to those in Fig. 2 (*a*). In both Figs. 2 (*a*) and 3 (*a*) the temperature of the surface was 100° C. above room temperature. The left half of the figures shows the undisturbed portion of the fringe system.

Case (i) is to be preferred for the investigation of conditions above the surface as it provides a closer system of fringes for calculating air temperatures, and case (ii) is to be preferred for studying the conditions below the hot surface. In actual working the adjustment for either (i) or (ii) can be made without changing the position of the hot plate, by merely interchanging the positions of the two wave fronts.

The methods of calculating the variation of temperature with height above and below the hot surface and of allowing for the end effects, will be described in a forthcoming paper, where the temperature gradients in the space between two surfaces will also be discussed.

The table below gives an example of the variation of air temperature below the hot surface.

Distance below the surface in mm.	Temperature in °C.	Distance below the surface in mm.	Temperature in °C.
0 (surface)	87·5	0·300	71·2
0·025	82·0	0·400	68·8
0·050	79·6	0·500	66·6
0·075	78·4	0·600	64·4
0·100	77·4	0·700	62·0
0·150	75·6	0·800	60·0
0·200	74·0	0·900	58·0
0·250	72·5	1·000	56·5

Room Temperature = 22°·5 C.

It will be noticed that the temperature gradient is large very near the surface and decreases rapidly as one moves away from it. It is interesting to note that interferometry provides a useful method of making temperature measurements so very close to hot surfaces.

In conclusion we wish to express our best thanks to Professor S. D. Bhave, Sir Parasuram Bhao College, Poona, for the loan of a Michelson interferometer and to Dr. C. W. B. Normand, Director-General of Observatories, for facilities given at the laboratories of the Meteorological Office for conducting these investigations.