approach the edge, a thin plate, under the same conditions, has a position of stable equilibrium near the edge of the drop. This seems to depend on the constancy of the angle of contact between the glass and the mercury.

Let $A\ B$ (Fig. 1) be the section of a flat drop of mercury cut by a vertical plane, and let $C\ B$ (Fig. 1)

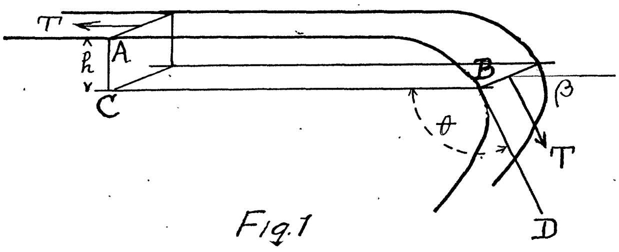

Fig. 1

be a horizontal surface at such a depth that the angle $C\ B\ D$ (θ) is the angle of contact of mercury with glass. Consider the equilibrium of the portion of the drop contained between the planes $A\ B$, $B\ C$ and a plane parallel to $A\ B\ C$ but unit distance from it. If T be the surface tension, and D the density of mercury, and β the angle to the horizontal of the mercury surface at B,[1] we have for the equilibrium of this portion of the drop since θ is greater than 90° (horizontal components)

$$\frac{h^2}{2}Dg - T + T\cos\beta = 0 = \frac{h^2}{2}Dg - T - T\cos\theta.$$

The forces due to atmospheric pressure cancel out.

If a thin piece of glass (say 1 mm thick) be placed on the mercury surface and loaded until it displaces the fluid within the planes specified above, it will rest in equilibrium; for, by Poynting's lemma[2] the horizontal forces on the glass will be the same as if the fluid were not depressed but ran at its level right up to the vertical surface of the glass.

Now, let the load be increased so that the glass sink a further distance h'. The glass at first takes the position shown in Fig. 2, where the resultant hori-

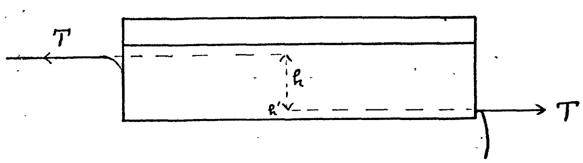

Fig. 2

zontal force is to the right, and is due only to the difference in the hydrostatic pressures $(h+h')\ Dg$ and $h'\ Dg$. As soon as these forces have moved the glass

[1] Note that while $\theta + \beta = 180°$ here, β but not θ changes in the last case considered below.

[2] See Poynting and Thomson, "A Text-Book of Physics. (*Properties of Matter*)," Chap. xiv, p. 153.

so that it projects from the mercury, we have the state of affairs shown in Fig. 3, where, since θ and T are

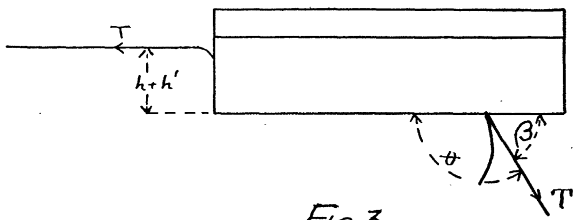

Fig. 3

the same constants as in our equation above, the increased hydrostatic pressure drives the glass off the flat surface of the drop. But, if the load be lessened, so that the lower surface of the glass rises above the level of $B\ C$ in Fig. 1, to depth $\bar{h}$, the fact that T and $T\cos\beta$ have not altered and the term due to the hydrostatic pressure is less, there remains a resultant force that drives the glass to the left. As the line of glass-mercury contact comes to the corner where the glass surface bends sharply upwards, the angle $\bar{\beta}$ (to the horizontal) rapidly diminishes (θ remaining the same) and we get a position of equilibrium where

$$\frac{\bar{h}^2}{2}Dg - T + T\cos\bar{\beta} = 0.$$

If the glass be pushed either way from this position the resulting change in $\bar{\beta}$ gives a resultant force that drags it back to the position of stability.

The behavior of the thin glass plates in Manley's manometer[3] seems to depend on this phenomenon.

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[3] *Proc. Phys. Soc.*, London, Vol. xl, p. 178, June, 1928.