$$P_1 = M.\ F_1$$

$$P_1 = \frac{W}{2}$$

$$M = \frac{W}{G}$$

$$\text{Then } F_1 = \frac{G}{2} \quad (1)$$

$$E = \frac{P_1\ C_1}{T_1}$$

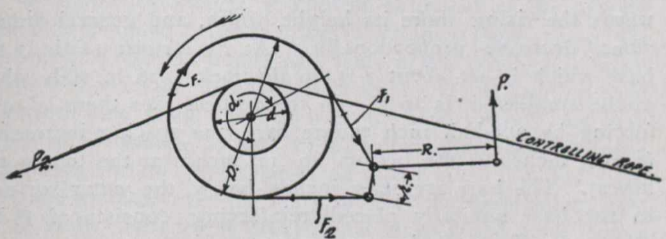

Fig. 2.

$$C_1 = \frac{1}{2} F_1\ T_1^2$$

$$\text{And } C_1 = \frac{G\ T_1^2}{4}$$

$$T_1^2 = \frac{4\ C_1}{G} \quad (2)$$

By inserting this result in the equation we get:

$$E_1^2 = \frac{P_1^2 - G - C_1}{4} \text{ For first cycle.}$$

$$E_2^2 = \frac{P_2^2 - G - C_2}{4} \text{ For second cycle.}$$

And ultimately we have:

$$P_1^2\ G = P_2^2\ C_2$$

$$\left\{ \begin{array}{l} P_1 = P_2 \sqrt{\dfrac{C_2}{C_1}} \quad (3) \\ P_2 = P_1 \sqrt{\dfrac{C_1}{C_2}} \quad (4) \end{array} \right.$$

= constant strain in controlling rope or retardation force in second cycle.

To determine the size of the brake band on the controlling drum is an easy matter when the strain on the rope is known. Corresponding to the letters in the figure.

F = Friction between band and surface.
P_2 = Tension in rope.
D = Diameter of brake rim.
d = Diameter of controlling drum.
u = Coefficient of friction.
e = Base of nat log.
F_1 = Tension in dead end of brake band.
F_2 = Tension in live end of brake band.
r = Radius of brake cam.
R = Radius of brake lever.
X = Angle embraced by brake band.

We have:

$$F = F_1 - F_2$$

$$F_2 = \frac{F}{e^{ud} - 1} \qquad \frac{F_1}{F_2} = e^{ud}$$

$$\text{and } F_1 = \frac{F.\ e^{ud}}{e^{ud} - 1}$$

On ordinary brake bands $\dfrac{1}{e^{ud} - 1} = 0.83$

$$\text{and } \frac{e^{ud}}{e^{ud} - 1} = 1.83$$

$$\text{Thus } F_2 = \frac{F}{1.83}$$

$$F = \frac{P_2\ d}{D}$$

$$\text{And } F_2 = \frac{P_2\ d\ 0.83}{D} \quad (5)$$

$$F_1 = \frac{P_2\ d\ 1.83}{D} \quad (6)$$

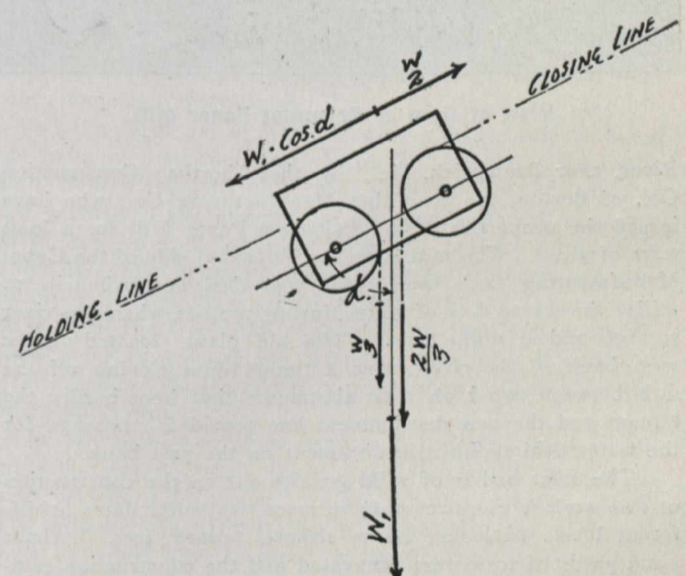

Fig. 3.

This latter tension determines the size of the band. For the length of lever:

$$R = \frac{F_2\ r}{P} \quad (7)$$

In this search no attention has been paid to the weight of the trolley and no allowance has been made for stiffness of cables.

However, when the boom is inclined P_1 in the first cycle is changed to $\frac{W}{2} - W_1 \cos. d$ when going up. For going