in the Laboratory of Purdue University were taken by Mr. Adam Herzog, B. M. E., a summary of which is as follows:

First, measurements were taken from a 15 x 24 Corliss engine; this machine has unusually massive parts, the frame being a heavy girder, and the whole being mounted in an excellent manner upon a deep foundation. Observations were made while the engine was developing only 35 horse-power with an initial steam pressure of 80 pounds. The head end of the cylinder was found to move in a horizontal direction with every revolution of the engine, a distance of 0.009 of an inch; the frame over the guides moved in a vertical direction 0.014 of an inch, and the pillow block castings in a horizontal direction 0.030 inches.

Secondly, measurements from a 14 x 16 engine, having a modification of the box-bed, mounted upon a substantial foundation, capped by a single stone of massive size. The details of the engine are heavy and well designed. Its center line, however, is considerably above the line of resistance offered by the bed. Observations were taken during a time when the engine was running under an initial pressure of only 40 pounds and while developing only 14 horse-power, which is less than half its rated power. The head end of the cylinder was found to move horizontally 0.018″, and the top of the cylinder at the flange on the crank end to move vertically 0.022″.

These vibrations, while taking place with every stroke of the engines, would not ordinarily have been detected with the eye, and were not accompanied by any shock or other manifestation which would indicate their presence. The measurements will serve to show to what extent the heavy fixed parts of well-designed machines may move under the influence of the forces which they are designed to resist, and they emphasize the necessity for a distribution of the metal which will give strength in direct line with the stresses to be transmitted.

Viscosity of a Polarized Dielectric. By A. Wilmer Duff.

[Abstract.]

Very few observations of mechanical actions produced in liquid dielectrics by electro-static stress have been made. Faraday found that fibres of silk in the liquid set themselves along the lines of force. Quincke thought he had detected an alteration of volume, but his results have been doubted. König tried to find a variation of viscosity by finding the rate of flow through a capillary tube placed between charged plates, but failed. A limit was set to the accuracy of his method by the difficulty of maintaining the tube at a constant temperature.

The author has sought a variation of viscosity by observing the rate of descent of small drops of mercury through castor oil, which served as the dielectric in a plate condenser. The condenser consisted of a tall, glass tank, the middle part of which served as a condenser, tin-foil being glued to the middle half of the outsides of the glass plates. To eliminate temperature effects the ratio of the time of descent through the condenser part of the tank to the time of descent through the non-condenser part, the condenser being uncharged, was compared with the ratio similarly obtained when the condenser was charged. In this way any change of temperature affecting the whole tank may be eliminated. To further eliminate any variation affecting different parts of the tank unequally, a long series of readings was taken with the condenser alternately charged and uncharged; and each ratio obtained with the condenser charged was compared with the mean of the adjacent ratios obtained with the condenser uncharged. The experiment was performed in a cellar of fairly constant temperature, temperative effects being thus almost perfectly eliminated; long series of readings made as described showed invariable increases of viscosity on the application of electro-static stress. The variation of viscosity seemed to be dependent rather on a non-uniform or varying electro-static field than on a steady field. Castor oil and glycerine showed an increase of viscosity.

As the above method could only be applied to very viscous liquids, the author also constructed an analogous apparatus on the capillary tube principle suitable for mobile liquids. It consisted of a capillary tube placed vertically between condenser plates, and connected above to a large tube with four constrictions in it dividing it off into three compartments. The times of emptying of the compartments by flow through the capillary tube were observed, the condenser being first uncharged during the emptying of the middle chamber and then charged. If the ratio of the time of emptying of the middle chamber to the sum of the times of emptying of the other two be taken, the condenser being uncharged, and compared with the ratio similarly obtained, the condenser being charged, a method free from temperature effects is again obtained for detecting a viscosity variation. In this way it was found that under a varying electro-static field, carbon di-sulphide showed an increase of viscosity and paraffine oil a decrease.

The above methods are being applied to other liquids, and a determination of the law of variation of the effect discovered under varying strengths of electro-static field will be made later.