TORSIONAL EXTENSOMETER

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The device described below was developed at the Bendix Corp., Kansas City Div. by Chester Thompson and Lloyd Lazarus to measure torsional strain (Modulus of Rigidity) of numerous materials. The device was designed to be compatible with the servo chart drive system of an Instron Universal Test Machine. This device permits accurate measurement of the angle of rotation of a torsional specimen being tested anywhere in the temperature range of -320° to 200°F in various atmospheres including liquids. The angle meter (Fig. 1) consists of a constant rise cam (c), a support ring (e) and a strain gaged cantilever beam (b). The cam and support rings are split so they can be fastened around a specimen of material being tested. The test is performed by rotating one end of the specimen while the other is held stationary. As the end rotates, the cam also rotates and deflects the strain gaged cantilever beam. Output of the device can be recorded in terms of degrees or radians depending on calibration. The cam is designed to increase the deflection of the beam for 180° rotation and then decrease at the same rate for another 180° as rotation continues.

A unique feature of the angle meter is that it measures angular rotation over a known or fixed gage length. A circular shaft of uniform cross section loaded at the end by a torque rotates about the longitudinal axis. The only deformation in the specimen is the rotation of the cross sections with respect to each other. This means that no longitudinal stress of any account is developed during rotation for small shear strains. Errors could occur in torsion devices where the angle of rotation is measured at the ends with the torque being applied through splines, bonded ends or specimen with various cross sections.

The transducer may be used on material considered brittle to ductile. Sensitivities of one minute can be realized. Strain gages for this application are Micro-Measurement type EA-13-200M-120 option SE. These gages are suitable for dynamic or static strains from 3 to 5% over the range from -320° to 400°F. The adhesive used was BLH EPY-600 and the installation was coated with an extremely thin layer of RTV 3140. The beam is 0.030 inch thick, 0.250 inch wide 6061-T6 aluminum.

Calibration of the transducer incorporated an optical encoder with a precision dummy specimen. Accuracy of the system is better than $\pm$ 0.10 degrees.

(See next page for Figure 1)