

3.2. THE EXPERIMENTAL APPROACH

3.2.1 The Equipment

A drawbench (Fig. <2>) may be used to measure the force required in wire drawing. The workpiece, the rod passing through the die, has its front end, the narrow end, held by grips. The grips are pulled by a hydraulic system - a cylinder with piston - or by other means. The force applied is transmitted through a load cell (Fig. <3>). In a load cell strain gauges are applied to the tensile rod to produce a Wheatstone bridge in which the voltage differential, properly calibrated, provides a measure of the drawing force. For details see Reference [1].

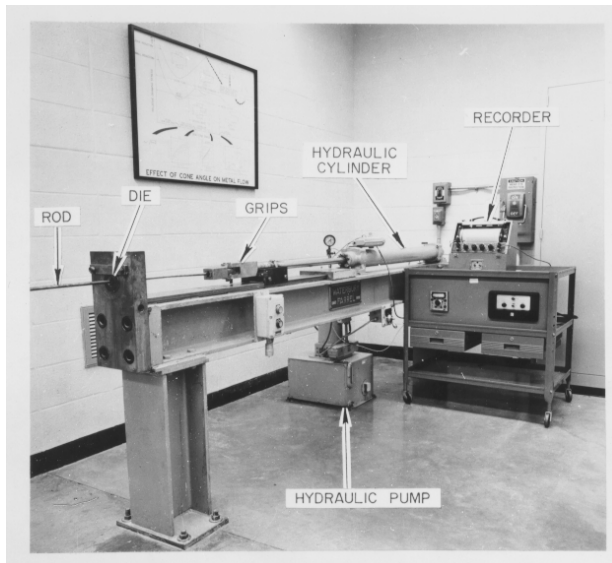


Fig.2 Wire drawing.

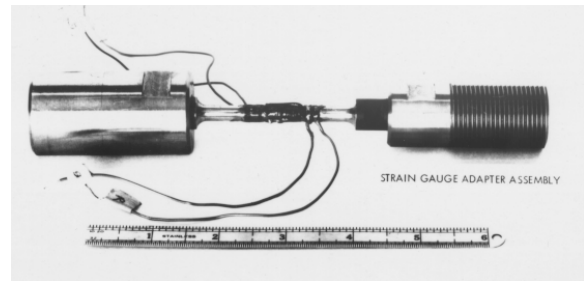


Fig.3 Load cell.

2.2 Recording of the Readings

The measure of drawing force is produced continuously on a recorder, or on an oscillograph as a function of grip displacement, i.e., length of wire drawn. Updated instrumentation may digitize

the force vs. displacement readings and record them on tape, disk, or other memory unit on a microcomputer. Figure <4> represents a record of a single run of a wire through a die. With the application of motion to the hydraulic piston, the load on the wire rises; the steep slope of the curve, due to the elastic stretching of the system with increasing force, and other factors, such as the settling of the ridges of the grips biting into the workpiece, occurs before any wire is drawn through the die. The peak of the curve is due to two factors. One comprises the inertia forces; the sudden application of force accelerates the wire from standstill to full speed in a short time. Another cause of the peak is that at standstill and slow speeds, friction is higher than friction at fully developed speeds. As the inertia force subsides and friction reduces, the drawing force drops to its steady-state constant value for the constant speed drawing. This measure of steady-state drawing force should ordinarily be taken as the force reading. When the drawing force is divided by the cross-section area of the wire emerging from the die, the result is the drawing stress for the specific combination of reduction, cone angle, and friction.

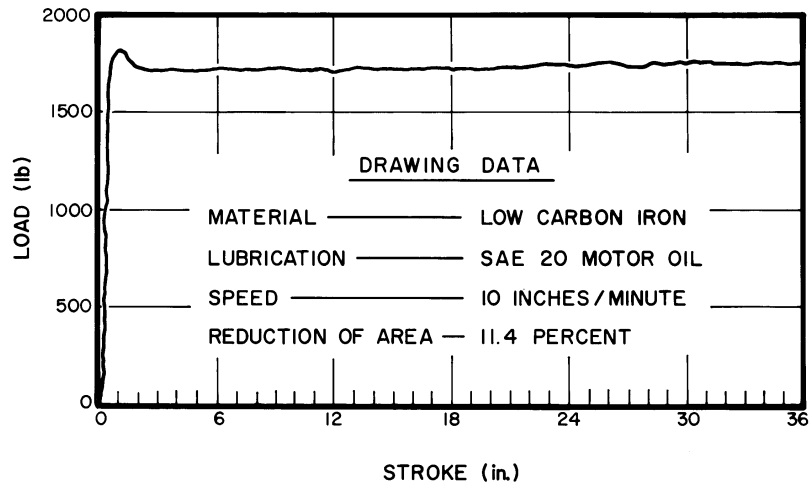


Fig. 4 Peak phenomenon in wire drawing.

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