THE BEHAVIOUR OF METALS UNDER TENSILE LOADS OF SHORT DURATION

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Abstract

Apparatus is described for producing a tensile impact loading of about 10 msec.duration, during most of which the load remains constant. The specimen is rigidly supported at one end, and the other end is attached to a moveable yoke which is struck by a moving brass bar, 58ft long. The bar is rapidly brought to rest and the specimen is stressed in tension. The duration of the load is the time taken from an elastic stress wave to travel to the free end of the bar and back. The bar is in sections, and smaller load durations can be obtained by using shorter lengths.

Tests were made on sixteen engineering materials-steels, cast-irons, aluminium alloys, and brasses. Those without yield points showed increase's in proof stress up to 20% on account of the increased rate of strain which is necessary if a given strain is to be produced in such a short time. It is shown that the amount of the increase depends partly on the shape of the static stress-strain curve, and a possible correlation between the two is suggested.

The materials with yield-points, mild steel in particular, have shown the existence of delay period before yielding commences, the delay becoming shorter as the applied stress is increased. This effect in mild steel was further examined by means of longer load durations produced by an arrangement of buckled struts, and the experimental results are compared with recent theories of yielding based on the locking of dislocations by 'atmospheres' of interstitially dissolved carbon.