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METHOD FOR PARTING-OFF A LENGTH FROM METAL BAR STOCK

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The invention relates to a method of parting-off a length from metal bar stock, particularly when of steel, and among its objects is to do this in a speedy, efficient and economical manner.

According to the invention the method includes providing a sharp notch to weaken the bar in the position in which it is to be parted, and applying alternating stresses to induce rapid fatigue failure of the bar at the weakened section.

The application of the alternating stresses may be such that there is a positive reversal of the stress in the bar, or, according to a further feature, the bar is subjected to a desired degree of pre-stress, on which the alternating stresses are superimposed. Thus, for example, the pre-stressing may be such that when added to the positive half-waves of the alternating stress applied, the total stress in the bar will be somewhat less than the elastic limit so as to accelerate the onset of fatigue fracture.

Preferably, and according to a further feature, the sharp notch is made to extend right round the periphery of the bar.

It has been found that difficulties can arise in producing a planar fracture by this method, particularly when attempting to form a blank of fairly precise shape from steel stock for use in a cold extrusion machine, owing to part of the fracture being due to ductile necking and causing an undesirably wide variation in the shape of the length parted off.

To mitigate that disadvantage, it is arranged, according to a further feature, for the alternating stresses to be applied while at least the zone to be fractured of the bar stock is maintained at a temperature in the region of, but preferably below, the brittle/ductile transition temperature of the metal. In this way the opportunity for ductile necking to occur is at least materially reduced, and should it occur at all it will be over a smaller proportion of the area of the fracture. The portion of the fracture due to fatigue, and that due to brittle failure are substantially flat and coplanar, and it is obviously of advantage, when a planar fracture is required, to reduce ductile necking, which not only produces prominences and craters in the fracture but also microscopic grain flow distortion, to a minimum or to eliminate it altogether.

During the performance of the method the fatigue fracture will commence from the bottom of the notch in the bar stock, and if this notch extends around the periphery of a cylindrical bar the fracture can commence either all round, or at one or more angularly spaced points. As the fatigue fracture develops in either case the work-heating of the bar will develop mainly in the residual core.

According to a further feature, therefore, the temperature applied to the stock is progressively depressed with the development of the fracture so that all unfractured metal in the plane of the intended fracture shall be maintained in the region of, but preferably below, the brittle/ductile transition temperature up to the time the fracture is completed.

In the application of the method the bar stock will be gripped at each side of the weakened section, and the

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alternating stresses to be applied through the gripping means. For example, the gripping means at one side of the weakened section could be held fast while the alternating stresses, and any basic pre-stress employed, are applied to the gripping means at the other side of the section, or the stresses could be applied to the gripping means at both sides of the weakened section.

The alternating stresses can be tensile, compressive, torsional, shear or bending stresses according to circumstances, or any desirable combination of these, and they can be applied mechanically, electrically, hydraulically or pneumatically by any suitable apparatus.

The frequency of alternation of the stresses, and their magnitude, for optimum parting-off will depend on the metal of the bar stock and also on its cross-sectional area and shape at the bottom of the notch.

Any basic pre-stress used may be of the same character as the alternating stress employed (e.g., they may both be tensile, compressive, tensile/compressive, or torsional) or they may be appropriately different (e.g., the basic stress could be tensile and the alternating stress could be torsional).

Obviously the gripping means will be such as to withstand the alternating stresses without themselves suffering rapid fatigue failure.

The notch can be formed in any suitable manner, for example, by a mechanical working method or by a cutting operation. Thus, when the former method is used it is possible to part-off the length without the production of any swarf at all, while if the notch is cut the amount of swarf produced can be very small.

It will be seen that when the notch extends right round the periphery of the bar stock, and is of V-formation, the parted length will have its parted end chamfered which particularly when the stock is of circular cross-section, is a desirable feature in some cases.

In one example, a mild steel bar of 0.682 in. diameter, intended to be parted into cylindrical blanks to be fed to a cold extrusion machine, was provided with a circumferential V-notch 0.043 in. deep. The bar was gripped at one side of the notch by a stationary jaw, and at the other side by a jaw capable of minute reciprocation in the direction of the axis of the bar. A basic, tensile stress of 3.4 tons per square inch was applied to the bar through the jaws, and an alternating stress of 13 tons per square inch was superimposed at a frequency of 40 cycles per second while the temperature of the bar in the zone of the notch was maintained at minus 60° C. The stress variation was, therefore, between the limits of minus 9.6 tons per square inch and 16.4 tons per square inch, and the bar was fractured after 41,900 stress reversals (i.e., in 17½ minutes). Deformation of the bar at the point of fracture was found to be negligible, and the ends of the blank thus parted-off from the bar stock were not only peripherally chamfered, due to the V-notch, but were sufficiently planar at right-angles to its axis as to render the blank suitable for use in the cold extrusion machine.

By increasing the frequency of the stress reversals, fracture can be brought about in a much shorter time.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. The method of parting-off a length from a mild steel bar of 0.682 in. diameter which includes providing the bar in the position in which it is to be parted with a circumferential V-notch 0.043 in. deep, depressing the temperature of the bar in the region of the notch to minus 60° C., applying a steady tensile pre-stress of 3.4 tons per square inch, and applying an alternating stress of 13 tons per square inch at a frequency of 40 cycles per second.

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2. The method of parting-off a length from metal bar stock which includes providing a sharp notch to weaken the bar in the position in which it is to be parted, cooling the region to be parted to the brittle/ductile temperature of the metal of the bar stock, and applying high-frequency alternating stresses to the bar to induce rapid fatigue failure at the weakened section.

3. The method according to claim 2 in which a steady pre-stress is applied to the metal bar stock before applying the alternating stresses to it.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,309,354	Dallmeyer et al. -----	July 8, 1919
1,366,063	Culhane -----	Jan. 18, 1921
1,661,846	Oakes et al. -----	Mar. 6, 1928
2,057,928	Stahl -----	Oct. 20, 1936
2,521,352	Dockerty et al. -----	Sept. 5, 1950
3,036,405	Dwinell et al. -----	May 29, 1962