March 14, 1944. W. J. CORMODE 2,344,285

UPSETTING OF METAL TUBES, RODS, OR THE LIKE

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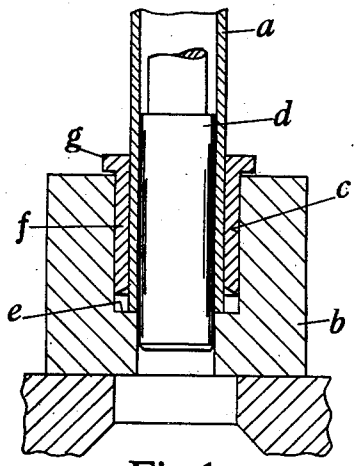


Fig.1

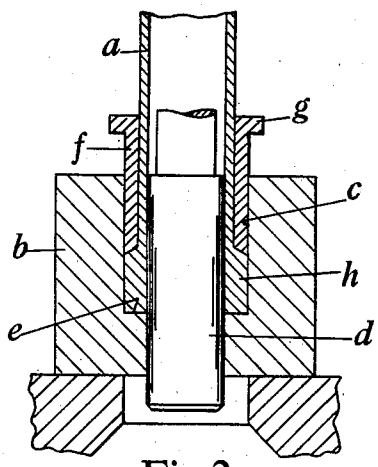


Fig.2

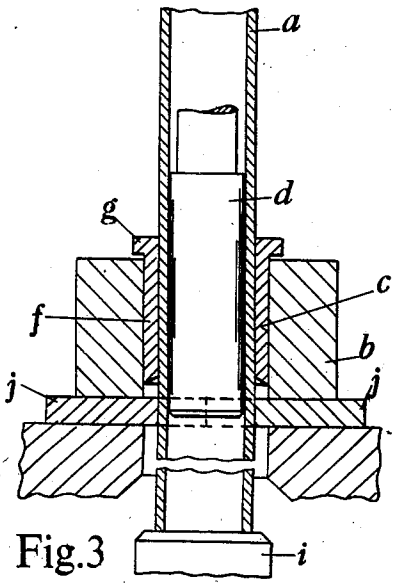


Fig.3

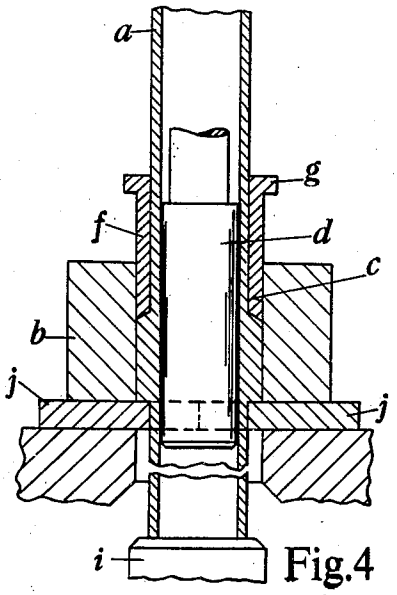


Fig.4

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UPSETTING OF METAL TUBES, RODS, OR THE LIKE

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In Great Britain June 23, 1942

1 Claim. (Cl. 78—63)

This invention relates to the upsetting of metal tubes, rods, bars, extruded sections or the like. To elucidate the problem with which the invention is concerned, the simple instance of forming an external collar or flange on one end of a tube will be described. One mode of procedure in this instance is to place the end of the tube in a die and apply endwise pressure to the tube. Prior to or during the operation the tube end is suitably heated, and the interior of the tube is supported by a plug or mandrel. The die consists of a block of metal in which is formed a cylindrical cavity of the same diameter as the required flange, and of at least the same depth as the thickness of the flange. If the axial thickness of the flange to be produced is substantially greater than the wall thickness of the tube, and at the same time, the diameter of the flange to be produced exceeds the outside diameter of the original tube by an amount substantially more than 50% of the thickness of the tube, the flange will result mainly from buckling of the metal and will consist of a series of folds. For many purposes, however, and especially when machining operations have subsequently to be performed on the flange this mode of formation is unsatisfactory. What is required is that the metal displaced from the main portion of the tube by endwise pressure shall flow along regular lines without the formation of folds or wrinkles. So far as I am aware, this requirement has not hitherto been satisfactorily met, especially in the working of metal tubes, bars or the like made from aluminium or aluminium alloys or magnesium alloys which are capable of being worked at moderate temperature obtained from heat imparted through the die.

The object of my present invention is to enable a satisfactory flow condition to be obtained in the metal (and particularly such metals as those above-mentioned) in a simple and convenient manner.

The invention comprises an upsetting means comprising the combination of a die, and a work support which is slidable relatively to the work-piece either freely under pressure exerted by the growing upset portion of the work-piece or at a controlled rate by mechanical means.

In the accompanying sheet of explanatory drawings:

Figures 1 and 2 are diagrammatic sectional side views illustrating in different stages one mode of carrying the invention into effect.

Figures 3 and 4 are respectively similar views to Figures 1 and 2 illustrating another mode of carrying out the invention.

The essential feature of my invention will readily be understood from consideration of the example shown in Figures 1 and 2. Let it be supposed that it is required to form on one end of a metal tube *a* made from an aluminium, magnesium, or other like alloy, a flange whose axial thickness is several times greater than the wall thickness of the tube, and whose diameter exceeds the outside diameter of the metal tube by an amount substantially more than 50% of the thickness of the tube.

In carrying the invention into effect as shown in Figures 1 and 2, I employ a die *b* having a cylindrical cavity *c* adapted to accommodate the end portion of the tube *a* on which the flange is required, the cavity being of any convenient depth and having a diameter equal to that of the flange to be produced. The die *b* is heated to an appropriate temperature by electrical or other means (not shown). Extending coaxially through the die cavity *c* is a plug or mandrel *d* adapted to fit and support the interior of the tube *a*. If desired the plug or mandrel *d* may be secured to the base of the die *b*, but preferably it is free to move axially during the formation of the required flange on the tube *a*. The inner end of the die cavity around the plug or mandrel *d* is closed by a shoulder *e* in the die *b*. Into the annular space between the exterior surface of the tube *a* and the peripheral wall of the die cavity *c* is inserted a tube-supporting sleeve *f*. This sleeve fits the tube *a* closely (though it is free to slide along the tube) but it may fit the die *b* loosely. To begin with the inner end of sleeve *f* is arranged to occupy a position so that its distance from the closed inner end of the die cavity *c* is preferably about equal to the wall thickness of the tube *a*. The sleeve *f* is preferably provided with a flange as *g* or other stop at its outer end to prevent it moving further into the die cavity *c*. Pressure is then applied to the outer end of the tube *a*. The first effect of this pressure is to cause the inner end of the tube *a* to spread laterally into the space bounded by the die *b* and the inner end of the sleeve *f*, and to fill this space. So long as the depth of this space is not substantially greater than the tube-wall thickness, the metal will flow into it without buckling or folding. Thereafter under the endwise pressure on the tube *a* the metal continues to spread laterally and to cause the sleeve *f* to recede by pressure on the inner

end of the sleeve while the flange *h* (Figure 2) formed by the spread metal is growing in axial thickness. The operation is continued until the desired thickness of the flange *h* is obtained. When a section is made of a flange thus formed the metal is found to be free from buckling or folding, and the flow-lines of the metal are in the main substantially parallel with the tube axis.

It will be apparent that the invention is capable of producing upsets such as flanges or collars on a tube, rod, extruded section, or other work-piece of long or short length and in a variety of positions. Thus such upsets may be formed at the ends or at one or more positions along the work-piece. In the latter case the die *b* is adapted to allow the tube *a* or other work-piece to extend through it as shown in Figures 3 and 4, the end of the work-piece, opposite to that to which the pressure is applied being supported by a fixed stop *i*, and the inner end of the cavity *c* between the work-piece and the inner periphery of the die being closed by plates as *j*. Also internal flanges, collars or other upsets may be formed at the ends or at positions along the length of tubes or other hollow work-pieces by appropriate modification of the die. In this case the outer surface of the work-piece is supported by the die, and the inner surface (adjacent to the upset) by a slidable plug or mandrel. Moreover, whilst it is satisfactory to employ a freely slidable support whose movement is caused by the increasing upset, it may in some cases be desirable to control the movement of the support in which case it may be actuated at an appropriate rate by any convenient mechanical means.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

Means for upsetting a metal tube, rod, bar, extruded section or like work-piece, comprising the combination of a die adapted to accommodate the portion of the work-piece on which the upset is required, and a work support by which the surface of the work-piece adjacent to the upset is continuously supported during an endwise pressing operation on the work-piece, and which is slidable relatively to the work-piece while the upset is being formed.

WILLIAM JOHN CORMODE.