July 30, 1929. G. R. KINKEAD 1,722,634

APPARATUS FOR MAKING HOLLOW ARTICLES BY EXTRUSION

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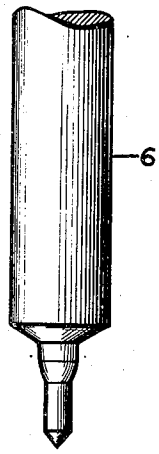
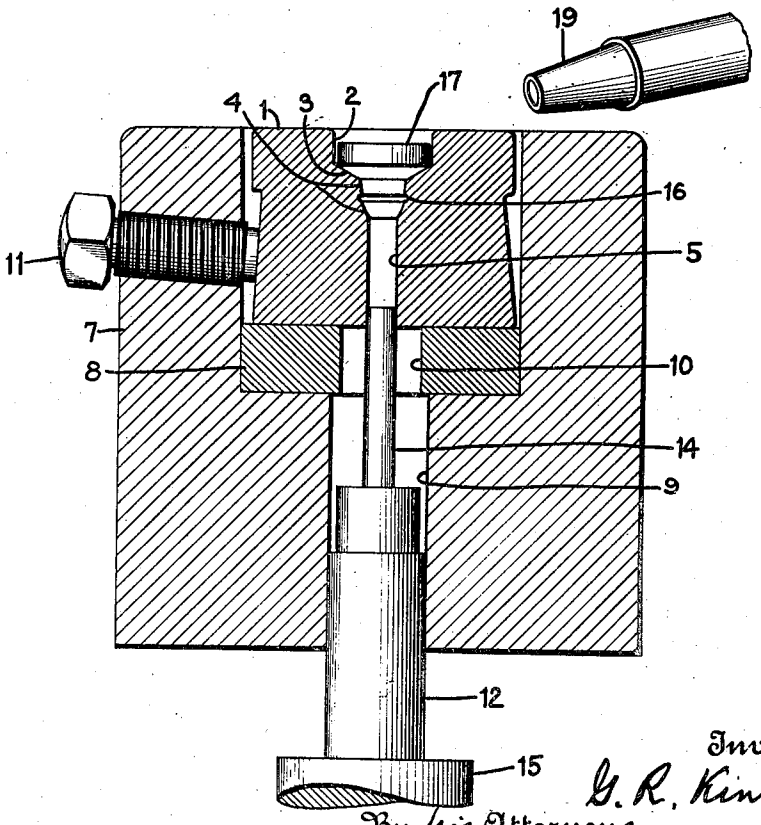


FIG.1.

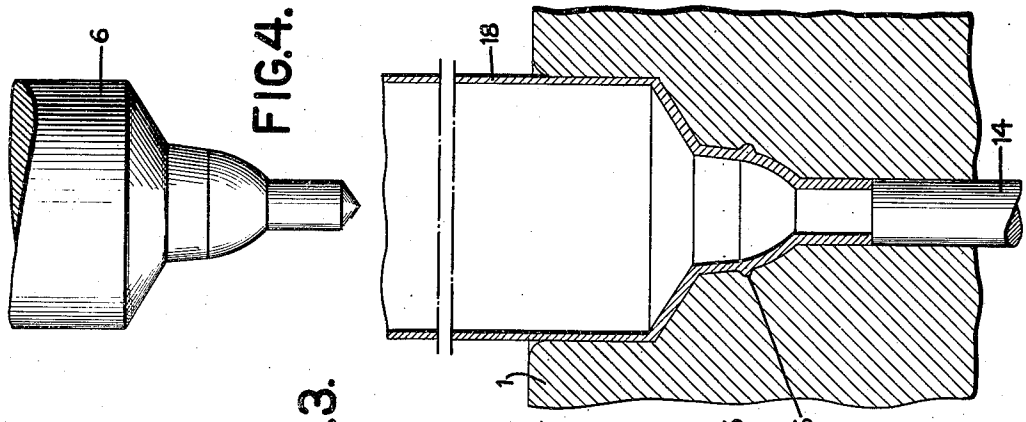


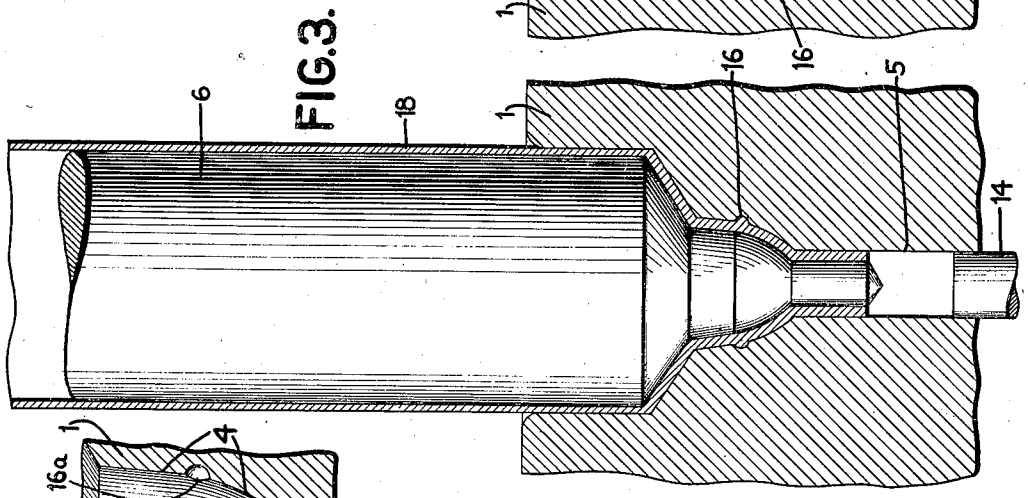
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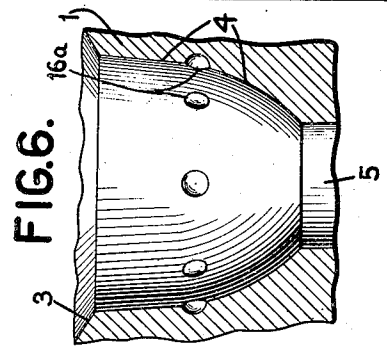
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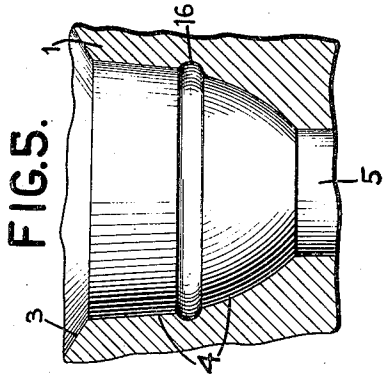
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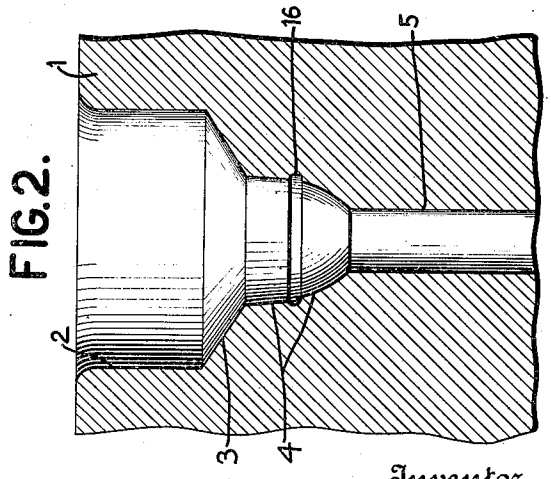
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MAKING HOLLOW ARTICLES BY EXTRUSION.

Application filed October 23, 1928. Serial No. 314,375.

This invention relates to extrusion presses for forming collapsible tubes of soft metal, as for example tin and aluminum, and relates particularly to automatic removal of the tube from the press after the forming operation.

An object of the invention is the provision of simple means for accomplishing the removal, directly cooperant with the die of the press and not involving the use of complicated or otherwise undesirable devices.

Another object of the invention is the elimination of a manual operation which has heretofore been commonly employed in forming collapsible tubes of aluminum.

The extrusion presses which are commonly used for forming collapsible tubes or similar thin-walled tubes comprise a die having a suitably shaped die cavity and a punch, the outer diameter of which is so related to the inner diameter of the die cavity as to provide between the punch and the walls of the cavity an annular space of suitable width. In the extrusion process a metal slug or blank is placed in the die and is acted upon by the punch whereby a portion of the metal is extruded outwardly in the annular space between the punch and the die in a direction opposite to the movement of the punch to form the walls of the tube, while the remaining metal conforms to the shape of the die and forms the thicker head and neck portion of the tube.

When aluminum is used in such presses the formed aluminum tube clings or sticks to the punch and is removed from the die with the punch. The adhesion of the aluminum tube to the punch is of such tenacity as to demand a firmly acting force to effect its removal. For this purpose stripping devices have been designed which clamp or otherwise grasp the tube after the tube and punch are removed from the die and hold the tube stationary as the punch further moves to the outer extremity of its operating stroke. Another method of stripping the tube employs a hollow punch through which a blast of compressed air acts to forcibly remove the tube. Such a device is disadvantageous since the presence of an air passage in the punch decreases its strength and its operating life and efficiency. In fact the stripping devices hitherto designed to remove the tube from the punch have been generally unsatisfactory and the common practice has therefore been to remove the tube from the punch by hand.

In its preferred form the present invention provides means whereby the tube is retained in the die until the punch has been withdrawn, whereupon the tube is forcibly ejected from the die and then immediately removed from the press by a blast of air. The invention not only makes the machine automatic but also obviates the use of complicated stripping devices.

Referring to the drawings,

Fig. 1 is a sectional elevation of one form of extrusion mechanism embodying my invention.

Fig. 2 is a detail sectional view of the die, in the same plane as Fig. 1.

Fig. 3 is a view similar to Fig. 2 showing the relation of the punch, die, tube, and knockout pin at the completion of the forming operation and before the ejection of the tube.

Fig. 4 is a view similar to Fig. 3 showing the relative positions of the same parts after the punch is withdrawn from the die.

Fig. 5 is a detail section, on a larger scale, of a portion of the die shown in Fig. 2.

Fig. 6 is a section similar to Fig. 5, illustrating a modification.

The die 1 is provided with a die cavity containing a cylindrical recess 2 which has a sloping shoulder or flatly conical bottom 3 which opens into a tapering recess 4 leading to the axially disposed bore 5. The die is held in suitable co-axial relation to the punch 6 by die-holding means comprising a die-block 7 and a pressure plate 8, the block being provided with a plurality of set screws, say three or more, one of which is shown at 11, to bear upon the sloping exterior walls of the die.

A "knockout" 12, provided with a knockout pin 14, is reciprocated in the concentric cylindrical bores of the die and the die-holding means, by the block 15 which is, in turn, actuated in harmony with the vertically operated punch by any suitable press mechanism, not shown.

In accordance with the invention, there is provided in the surface of the neck-forming recess 4 a neck-engaging recess which may preferably take the form of a circumferential groove, such as that shown, for example, at 16 and best shown in Figs. 2 and 5, but which may have any suitable form.

In practice, a cylindrically shaped flat

metallic slug or blank 17 is placed in the die recess 2 as indicated in Fig. 1, after which the punch descends and, acting upon the blank, forms the thin walls of the collapsible tube by extruding a part of the metal upwardly through the annular space provided between the surfaces of the lower portion of the die cavity and the complementarily shaped head of the punch, thus forming the head and neck portions of the collapsible tube 18, substantially as shown in Fig. 3. The thickness of the head and neck portions of the tube is determined by the position of arrest of the descending punch, while the thickness of the side wall of the tube is determined by the width of the annular space between the body of the punch and the inner surface of the die recess.

As the neck is formed a portion of the metal is forced into the neck-engaging groove or recess 16, thereby forming on the neck of the tube a small shoulder which extends into the body of the die, as shown in Fig. 3, and serves to hold the tube positively in the die during the upward movement of the punch, thus "stripping" the formed tube therefrom. After the extrusion is complete the punch starts its upward stroke away from the die, the block 15 rises and brings the knockout pin 14 against the lower extremity or neck of the formed collapsible tube, as shown in Fig. 4. With further upward movement of the pin the tube is lifted bodily out of the die cavity, and as this occurs the metal of the rib in the recess 16 flows outwardly and conforms with the tube-neck surface previously formed in that portion of the tapering die cavity which lies below said recess. The length of the knockout pin is such as to carry the body of the tube clear of the die. When that position is reached the comparatively light tube, already freed from the punch, is removed from the press by any suitable means, as for example a blast of air issuing from a nozzle 19 which blows the tube into a suitable receiving container, not shown.

By making the groove 16 deep and its upper edge rather sharp the upward movement of the tube by the force of the knockout pin can be made to shear off the locking rib, but such method makes it necessary to remove the rib from the groove before the next operation and I therefore prefer to have the groove no deeper than necessary to hold the rib securely as the plunger or punch is raised, and to have the upper edge of the groove obtuse enough to eliminate all possibility of shearing, so that in the ejection of the tube the rib will be smoothed out or caused to disappear in the metal of the neck below. The ejection of the tube then leaves the groove empty and ready for the next operation.

The means for causing the neck-portion of the tube to interlock with the female die is preferably a groove, as indicated in Fig. 5, but it may take other forms, as for example, a series of spaced recesses, as 16^a, in Fig. 6.

Although the present invention has been described in a form particularly applicable to the extrusion of aluminum collapsible tubes and other thin walled articles of similar nature, it is to be understood that the invention may be used in the extrusion of such articles from other soft materials. It is also understood that the invention is not limited to the specific apparatus and procedure herein described but may be carried out in other ways without departure from its spirit as defined by the appended claims.

I claim—

1. In an apparatus for forming collapsible tubes and the like by extrusion, in combination, a female die shaped to form the neck portion of the tube and having means to cause the metal of such neck portion to interlock with the die, whereby to hold the tube positively therein, a reciprocatory plunger cooperating with the die to form the tube, and reciprocatory means for pushing the tube out of the die against the resistance of the interlocking metal of the neck-portion, said means for causing the interlock being adapted to eliminate the interlock as the tube is pushed out of the die.

2. In an apparatus for forming collapsible tubes and the like by extrusion, in combination, a reciprocatory plunger formed to shape the inner surface of the tube, a female die cooperating with the plunger and formed to shape the outer surface of the tube including the neck portion thereof, the neck-forming portion of the die being recessed to form an interlocking rib on the neck-portion of the tube whereby to hold the formed tube in the die as the plunger is withdrawn, and reciprocatory means for pushing the tube out of the die, the recess in the neck-forming portion of the die being adapted to smooth out the interlocking rib as the tube is pushed out of the die.

3. In an apparatus for forming collapsible tubes and the like by extrusion, in combination, a reciprocatory plunger formed to shape the inner surface of the tube, a female die cooperating with the plunger and formed to shape the outer surface of the tube and having a circumferential recess to form an interlocking rib around a portion of the tube within the die to hold the tube in the die during withdrawal of the plunger, and reciprocatory means for pushing the tube out of the die, said die-recess being adapted to eliminate the interlocking rib by causing the metal thereof to flow into coalescence with an adjacent portion of the tube as the tube is pushed out of the die.

4. In an apparatus for forming collapsible tubes and the like by extrusion, in com-

bination, an upwardly open female die formed to shape the outside of the tube and having a neck-shaping portion provided with means adapted to interlock with the neck-portion of the tube, and a reciprocatory knockout pin arranged to enter the die from and by engagement with the neck-portion of the tube push the tube upwardly out of the die against the resistance of said interlocking portion.

5. A die-and-plunger method of forming collapsible tubes and the like by extrusion, comprising shaping the tube in the die and forming on a portion of the tube within the die a circumferential rib interlocking with the die to positively hold the tube in the die as the plunger is retracted, and thereafter ejecting the tube axially from the die and simultaneously eliminating the rib by the ejecting movement of the tube itself.

6. A die-and-plunger method of forming collapsible tubes and the like by extrusion, comprising shaping the tube in the die and simultaneously causing a portion of the metal of the tube in the die to interlock with the die so as to hold the tube positively in the die and thereby strip the tube from the plunger, and thereafter ejecting the tube from the die by axial movement against the resistance offered by said interlocking metal.

7. A die-and-plunger method of forming collapsible tubes and the like by extrusion, comprising shaping the neck of the tube in the die and simultaneously causing the neck to interlock with the die to hold the tube in the die and thereby strip the tube from the plunger as the die and plunger are separated, and thereafter ejecting the tube from the die by axial movement of the tube and by such axial movement simultaneously smoothing out the interlocking portion of the neck.

8. A die-and-plunger method of forming collapsible tubes and the like by extrusion, comprising shaping the neck of the tube in the die and forming on the neck a circumferential rib interlocking with the die to hold the tube and thereby strip the same from the plunger, and after separation of the die and plunger ejecting the tube from the die by axial movement and by the same movement simultaneously smoothing out the interlocking rib.

In testimony whereof I hereto affix my signature.

GEOFFREY R. KINKEAD.