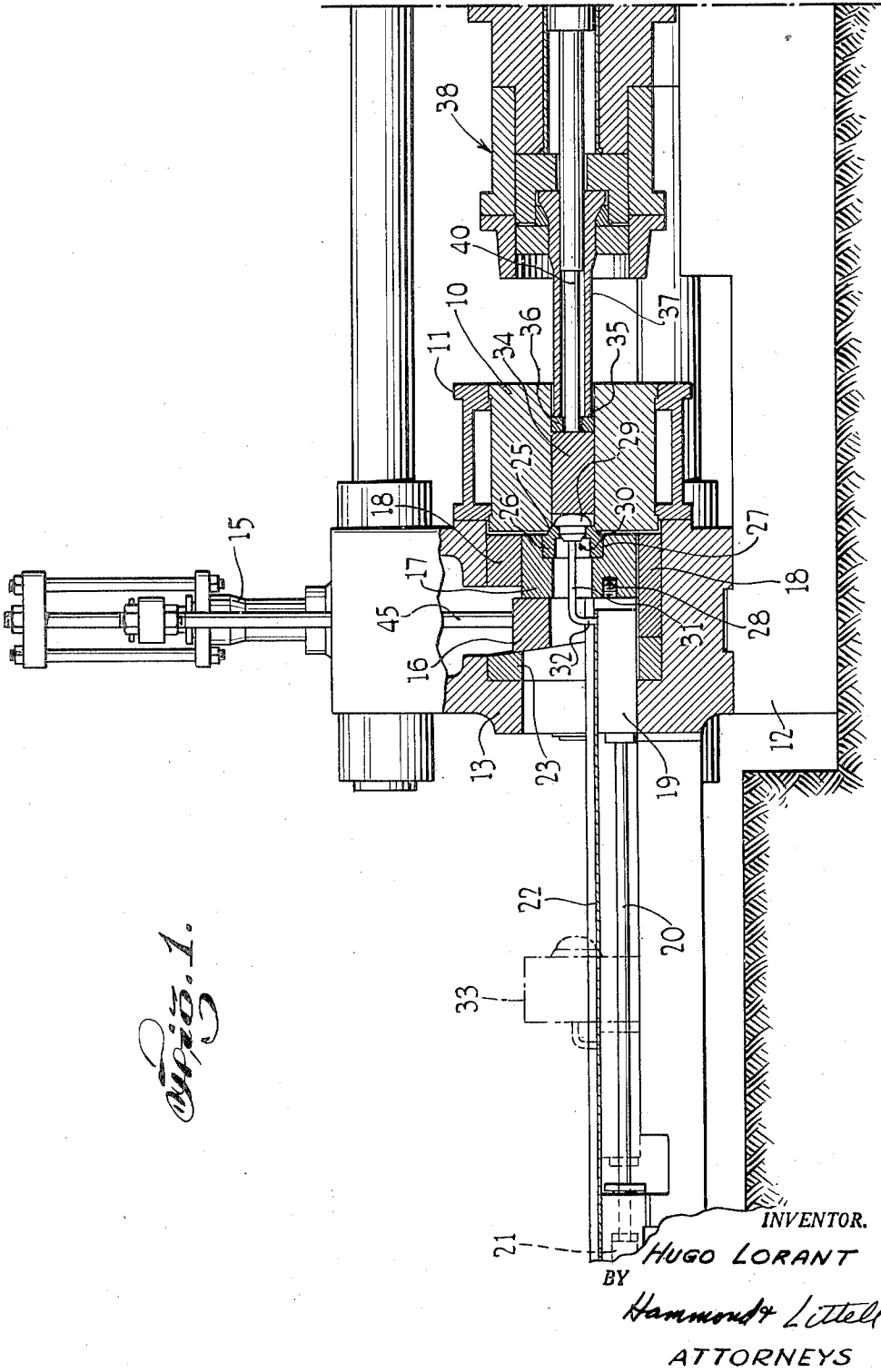


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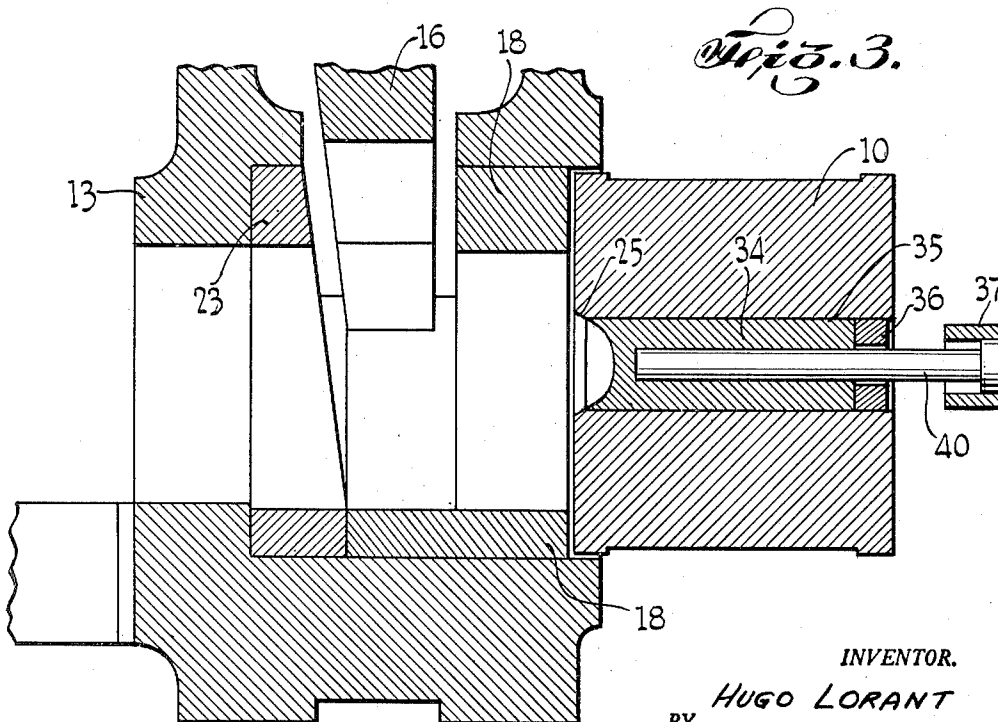
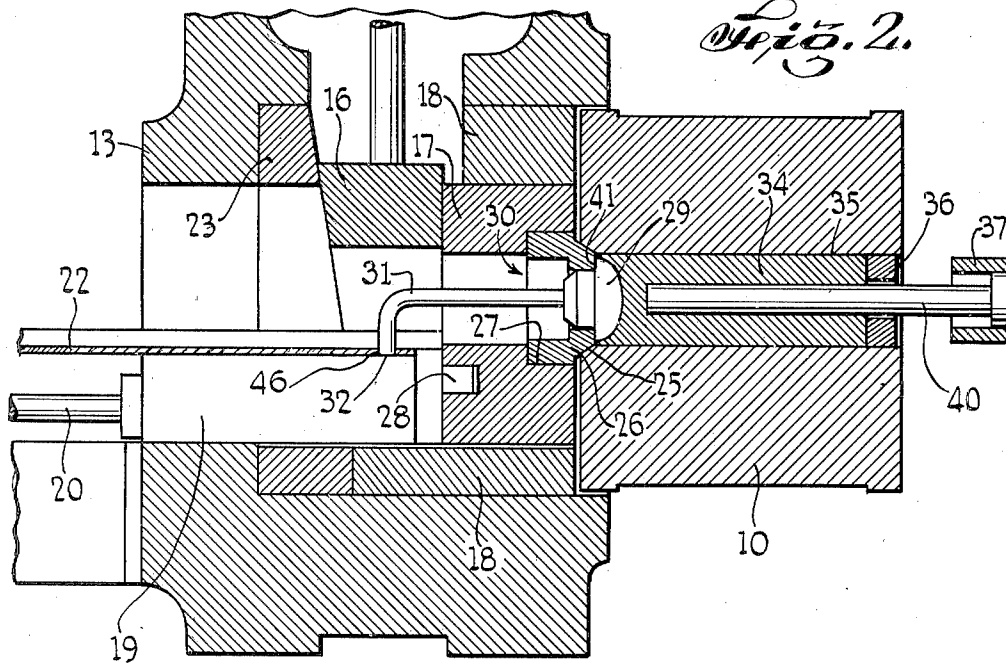
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CLOSURE PLUG

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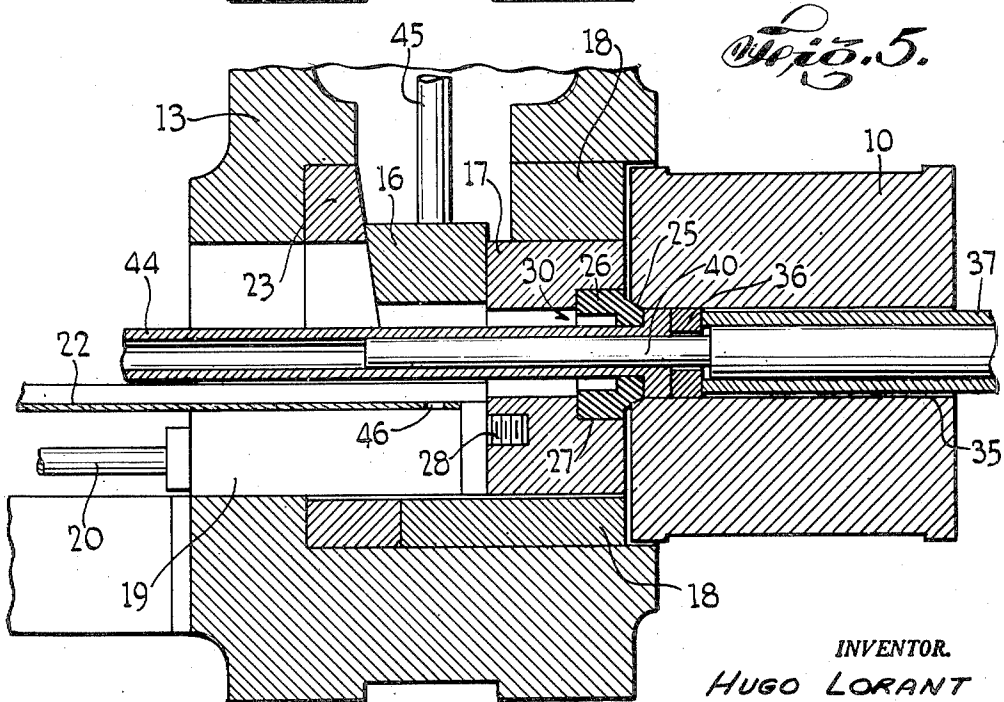
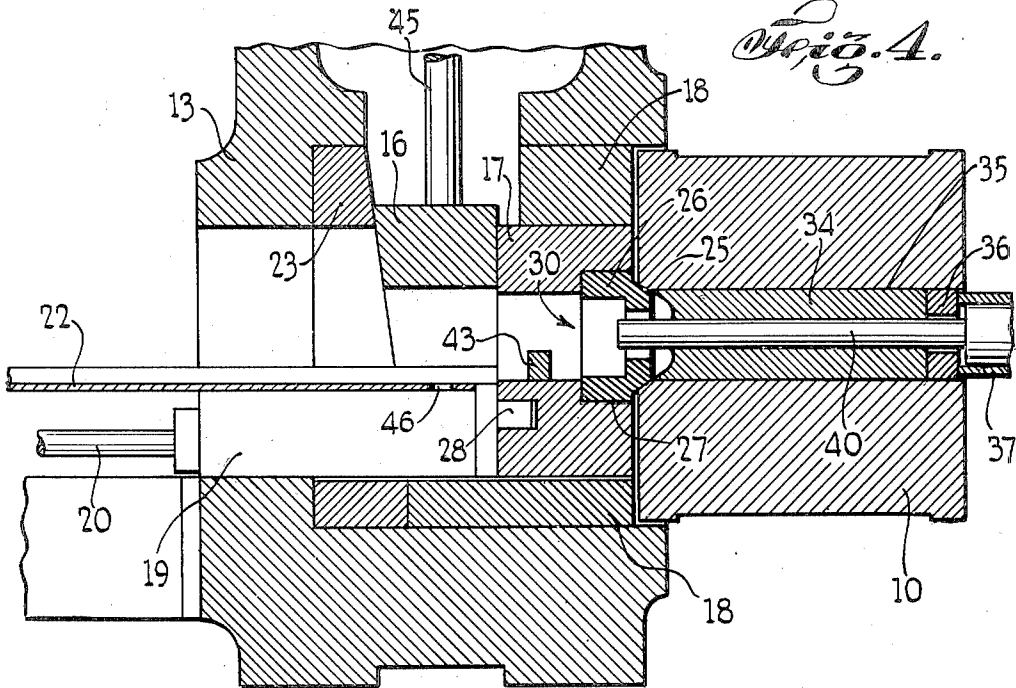
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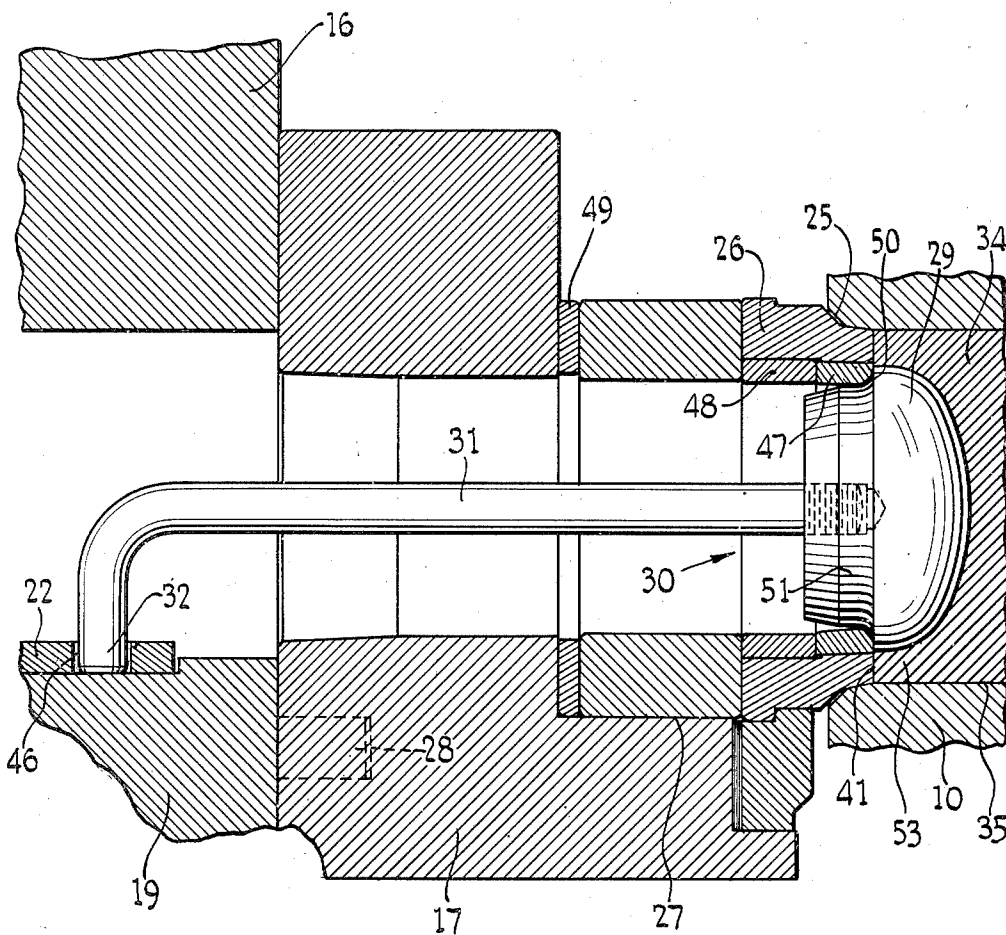
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*Fig. 6.*



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## UNITED STATES PATENT OFFICE

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## CLOSURE PLUG

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3 Claims. (Cl. 207—2)

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This invention relates to presses particularly adaptable for extrusion of metal into shapes, such as tubes or bars, and especially is concerned with the closing means for the extrusion die thereof when the billet is operated upon in the press before the extrusion operation.

One of the objects of the invention is to provide a simple means for converting existent presses so that billets may be placed in a container, compacted or operated upon, and then extruded. It is necessary to close the end of the apertured extrusion die while the compacting or other operation is being performed upon a billet in the container. The closure member may be made less than the diameter of the billet container so that when the billet is operated upon before actual extrusion, the end of the billet will come into contact with the portions of the die face around the closure member. Upon movement of the die with the closure in place relatively away from the billet container for the purpose of removing the closure element, which is followed by return of the die to extruding position at the end of the billet container, there will be no movement of the billet relative to the container.

Another object of the invention is to extrude large tubes from solid billets on existing presses in an economical manner. Previously there has been a large percentage of piercing scrap emerging from the large opening in the die. As an example, in prior processes when piercing a billet of 11" diameter a length of 20" using a mandrel of 7" diameter and a die opening of 8" for producing a tube 7" inside diameter and 8" outside diameter, the scrap would have a diameter of about 8" and a length of about 10", representing about 26% of the billet weight. By the method of the present invention, by closing the die aperture during piercing, the piercing scrap of 8" diameter can be kept to a length of about 1" so that the scrap represents only about 3% of the billet weight. This is a saving of 23% which is very significant considering the weight of the starting billets.

Another object of the invention is to provide a simple detachable die closure member having a rod which may be extended through the die for attachment to a portion of the die holder. These and other objects of the invention will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

Fig. 1 is a fragmentary vertical elevation partially in section of a press embodying the in-

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vention, the hydraulic cylinder arrangement being omitted for purposes of simplicity.

Fig. 2 is an enlarged cross-sectional view of the die with the closure element therefor in place and the piercing plunger extended into the billet.

Fig. 3 is similar to Fig. 2 with the exception that the die and closure have been withdrawn to the left so that the closure button can be removed.

Fig. 4 is similar to Figs. 2 and 3 with the exception that the die has been replaced and the piercing plunger or mandrel has been operated to push out the slug from the bottom of the pierced billet.

Fig. 5 is similar to Fig. 4 with the exception that the extruding plunger substantially has completed extrusion of the billet.

Fig. 6 is an enlarged view of the die and button closure element, a slightly different die holder or support being shown.

The press partially shown in Fig. 1 may be a standard press of the hydraulic or similar variety. In this press, a billet container 10 is supported in a frame 11 which may be held directly on the main bed 12 of the press or carried by sub-frame or platen 13, sub-frame 13 being mounted on main bed 12. Sub-frame 13 may have an hydraulic cylinder arrangement 15 for raising and lowering wedge 16 through rod 45. Die holder or support 17 is reciprocally removable from guide 18 by operator 19, which is connected by rod 20 with hydraulic piston 21 in a conventional manner. Bar or trough 22 is connected to operator 19 in any conventional manner, bar 22 serving as a guide and passing over the top of hydraulic cylinder 21 and sliding thereon as operator 19 is reciprocated. Mating plate 23 is carried by sub-frame 13. The bar or trough 22 may take any desired shape.

When die support 17 is in position, wedge 16 will act in conjunction with plate 23 to firmly wedge the die support 17 and die against the conical or similar face 25 at the end of the billet container 10, apertured extrusion die 26 being mounted in die support 17 in recess 27.

Die support operator 19 may be connected through the stud, bolt, or equivalent means 28 to the die support. Die aperture button closure member 29 is locatable within the aperture 30 of the extrusion die 26. Said button, as will be described in detail hereafter, has a rod 31 or other suitably shaped member extending through aperture 30 and prolongation thereof. Rod 31 is removably connected at end 32 to trough 22. In order to make this connection on existent ma-

chines, it is merely necessary to bore a hole in bar 22 at 46 (Fig. 4) to receive the end 32 of rod 31. The die and closure member are shown in withdrawn position in dashed lines at 33 of Fig. 1 in which position the closure member may be removed from the apertured extrusion die by disconnecting or lifting rod end 32 from aperture 46 and removing the closure from the die.

One method of operating the device is to place a billet 34 into the bore 35 of billet container 10 after said billet has been brought to a suitable temperature. Ring 36 is then placed against the end of the billet and hollow plunger 37 advanced by suitable hydraulic means (not shown) acting on head 38 (Fig. 1). Previous to this operation, die support 17 with the die and closure in place has been moved axially into billet container closing position at the end of the bore 35 as shown in Fig. 1. The billet may then be compacted by hydraulic pressure being applied to plunger 37. At the completion of this operation, piercing plunger 40 can be advanced into the billet as shown in Fig. 2, compacting plunger 37 having been drawn away from ring 36 so as to allow the metal of billet 34 to move to the right in the bore 35 as the piercing proceeds. The metal at the left hand end of the billet is in this operation completely forced around the button 29 of the closure element, said button preferably being of less transverse diameter than the bore 35 and extending beyond the face 41 of the extrusion die 26. The metal may or may not completely or partially flow around the button in the preceding compacting or forging operation depending upon force applied, temperature, etc.

The die support operator 19 is then moved to the left after wedge 16 has been raised by hydraulically operated mechanism 15 (Fig. 3), billet 34 remaining in place in bore 35 of billet container 10 and not being moved lengthwise to the bore 35. The closure button 29 is then detached from trough 22 and removed from the apertured die by passing rod 31 through the die aperture. The die support and die are then moved to the right into contact with the end 25 of bore 35 as shown in Fig. 4. Piercing plunger 40 thereafter is given further movement to the left as shown in Fig. 4 to remove the slug 43 at the end of the partially pierced billet of Fig. 2, the billet not being completely pierced when the die and closure are in position so as to avoid possible injury to the closure and die. With the die and die support still in position, the hollow plunger 37 (Fig. 5) is moved to the left so as to extrude the billet to the tube shape seen at 44 in a well-known manner.

Solid shapes also may be extruded by omitting the piercing operation. In this event, it might be desirable to provide a cup-shaped form to fit against the end of the billet so as to insure flow of metal completely around the button-shaped closure member and against the face of the die during the forging operation.

In Fig. 6 is seen an enlarged view of the die arrangement showing more of the details of one specific construction of the die which may be varied to suit the particular conditions. The same reference characters are used to represent the same parts when appropriate. Die support 17 is slightly different than that shown in previous figures in that there is a cut away portion at the top of recess 27 thereof. Dieholder 26 may have an inserted die 47 with support 48 and a spacer ring 49. Button 29 has a surface 50 fitting against the face 41 of the die and a portion 51 extending within the aperture 30 of the die. Rod 31

may be threadedly or similarly fastened at 52 to the die closure. When the rod is put into engaging position, the closure element will be properly held in the die aperture and against the face of the die.

It is preferable that the billet 34 be operated upon in such a manner as to cause flow at the edges 53 into contact with the face 41 of the die. Then when the die is retracted for closure removal and replaced there will be no movement of the billet within the bore 35 caused by the die. It has been found desirable not to move the billet in the bore container during this operation and only to have substantial relative movement between the face of the bore and the surface of the billet during the actual extrusion or similar operation. The shape of the button 29 may be made as shown or similar thereto so as to facilitate flow of metal to the form shown.

It will be understood that various changes and modifications may be made from those specifically illustrated without departing from the spirit of the invention or scope of the appended claims.

I claim:

1. In a metal extrusion press, an apertured die with a face, a billet container with a bore there-through, means to reciprocate said die and billet container relative to each other, said die being movable to the end of said bore, a button closure supportable on the face of said die adjacent the die aperture, said button being of less diameter than said bore and extending into said bore of the billet container from the face of the die when said die is at the end of said bore, and means maintaining said button closure in place on said die when said die and billet container are reciprocated relative to each other.

2. In a metal extrusion press having an extrusion chamber, an apertured die having a mouth, die moving means, a button closure member having a portion in said extrusion chamber of greater diameter than the aperture of the die, said portion being supportable by the mouth of said die from longitudinal movement when working force is applied thereto, and a rod adapted to extend from said button through said die aperture and adapted to be removably connected to said die moving means to hold said button in closing position in said die.

3. In a metal extrusion press having an extrusion chamber, an apertured die having a mouth and face, die moving means, a button closure member having a portion in said extrusion chamber of greater diameter than the aperture of the die, said portion being supportable by the mouth of said die and adjacent portions of the face from longitudinal movement when working force is applied thereto, and means removably securing said die, closure member and die moving means in assembled relationship so that said die and closure member can be moved to a position where the closure member can be removed from the die opening.

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