Feb. 6, 1962 J. DELCROIX ETAL 3,019,894

EXTRUSION OF METALS

Filed Nov. 12, 1958 4 Sheets-Sheet 1

Fig. 1

Fig. 1a

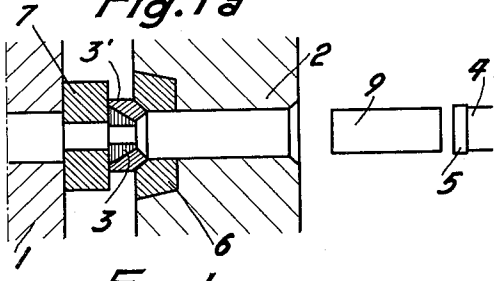


Fig. 1e

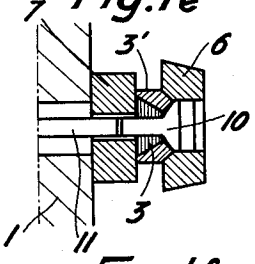


Fig. 1b

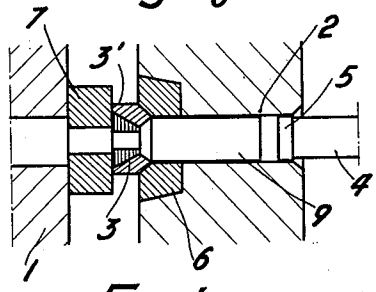


Fig. 1f

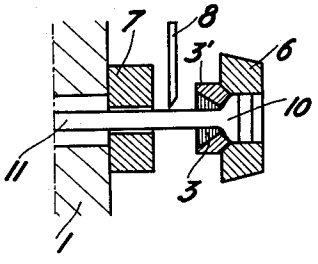


Fig. 1c

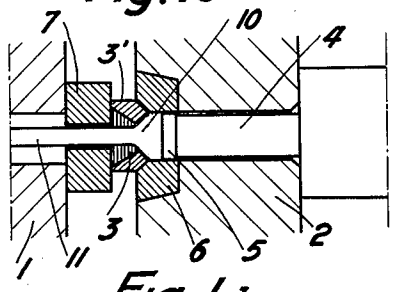


Fig. 1g

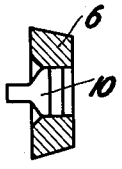


Fig. 1d

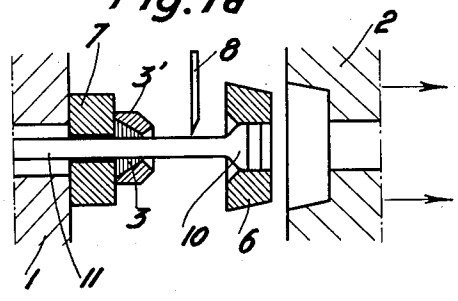


Fig. 1h

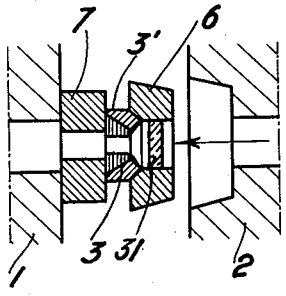


Fig. 2

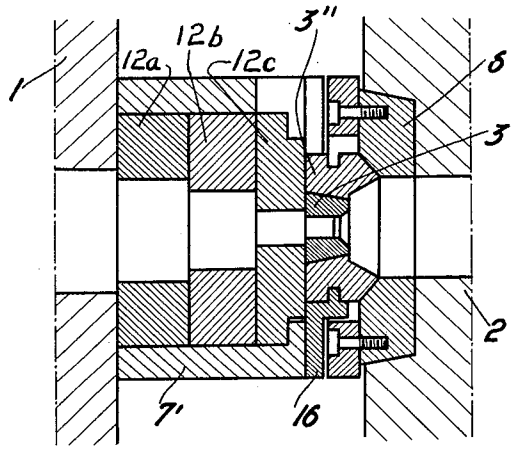


Fig. 3

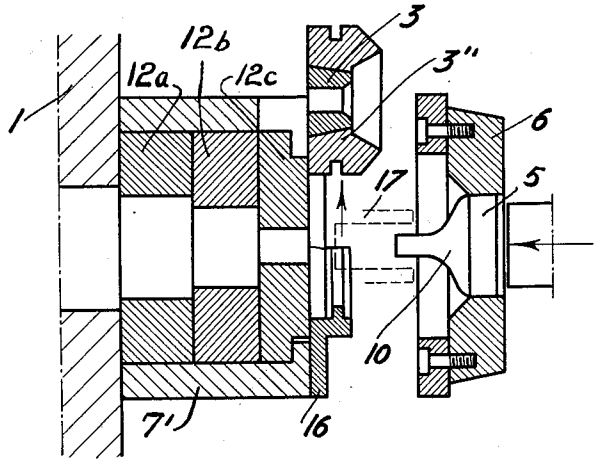


Fig. 4

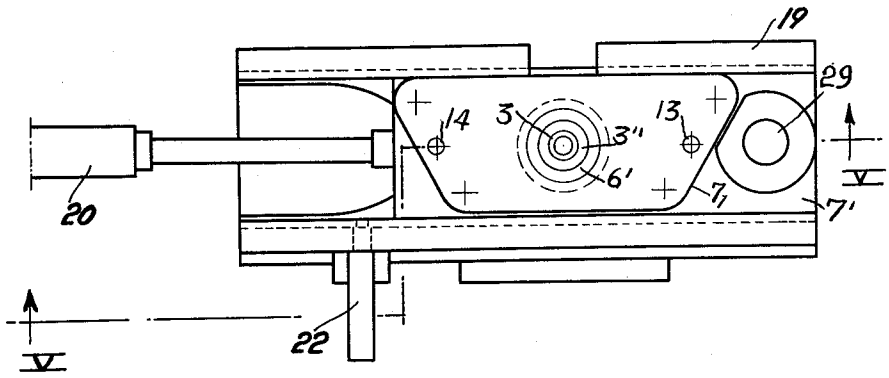
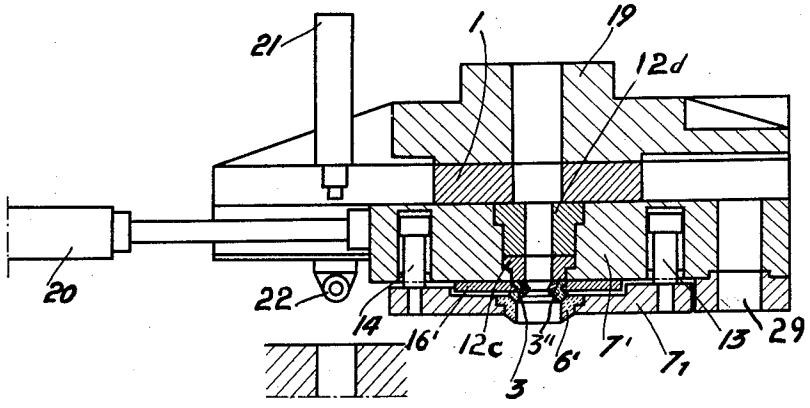


Fig. 5

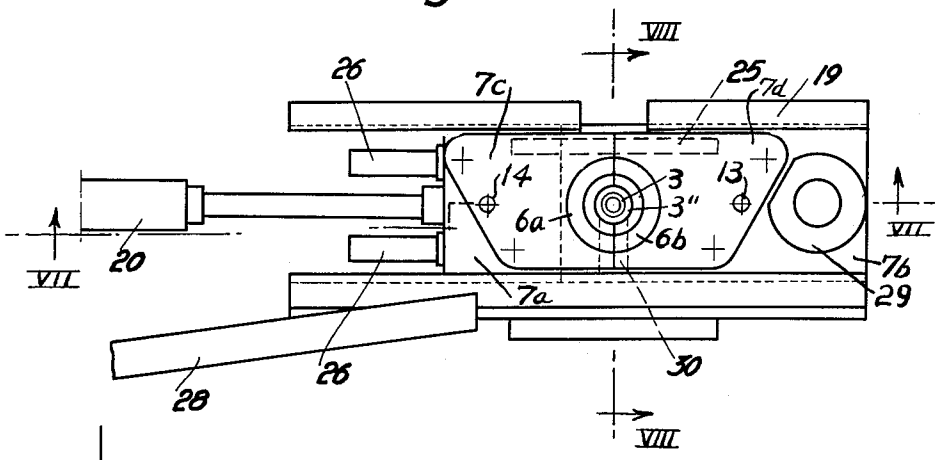


Feb. 6, 1962 J. DELCROIX ETAL 3,019,894

EXTRUSION OF METALS

Filed Nov. 12, 1958 4 Sheets-Sheet 4

Fig. 6



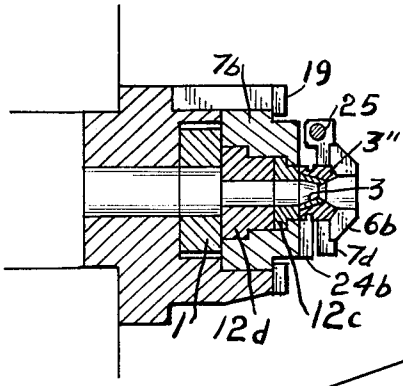


Fig. 8

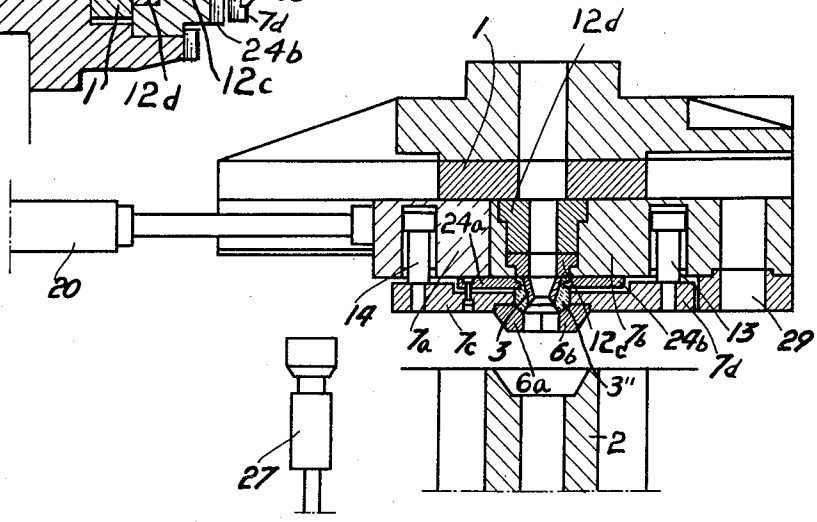


Fig. 7

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3,019,894

EXTRUSION OF METALS

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4 Claims. (Cl. 207—2)

The present invention relates to improvements in the extrusion of metals, and mainly of ferrous metals.

For the extrusion of non-ferrous metals, extrusion presses which are generally used have a longitudinal sliding-carrier; this sliding carrier, which supports the die and the various bolsters, moves along the axis of the press; during the extrusion proper, it serves to apply the die against the container and is locked in that position, after extrusion the locking is removed and the sliding carrier is brought back to the front of the press in order to separate the discard from the extruded bar, to check the die and to change it, if so required. During this time, it is possible to clean the container and, in the case of extrusion of tubes, to cool the mandrel. Usually, in the extrusion of non-ferrous metals, no special efforts are made to extrude rapidly or to operate at a high production rate; on the contrary, with the extrusion of ferrous metals, it is necessary for technical reasons to carry out the operations in a very short time, of the order of a few seconds; in addition, in the case of inexpensive metals, it is necessary that the cost of conversion shall be as low as possible. In order to reduce this cost, it must be possible to extrude a great number of billets per hour. Since the extrusion operation itself is very short, the extrusion cycle could be fairly short if the subsidiary operations (placing the dummy-block in position, loading the billet, sawing-off the discard, cooling the mandrel, cleaning the container) did not remain relatively long, although they are mechanized and made automatic. On the other hand, the movement of the sliding-carrier over a great length and the locking operation involve a waste of time which it is difficult to reduce. In addition, the long slides on which the sliding carrier moves necessitate costly mainteance; finally, it is difficult to provide access, for checking and re-adjustment when necessary, to the bearing surfaces of the tools which are located in the interior of the frame of the press.

In order to reduce the extrusion cycle, and, in addition, to lengthen the life of the tools and reduce the press maintenance costs, steps have been taken to replace the longitudinal sliding carrier by a transverse sliding carrier which moves perpendicularly to the axis of the press between the plate and the container. This sliding carrier, which moves over a short distance, can work rapidly. It has furthermore the advantage of having short slides and the bearing surfaces of the tools are located on the outside of the press at places which are easy to check. In these presses, the container is mounted in a moving housing. In this case at the end of the extrusion operation the ram is stopped in its travel by a spacer ring and leaves in the container a discard of metal between the front of the dummy block and the die, The sawing or cutting-off of the extruded product can be effected for example in accordance with French Patent No. 1,044,933, issued on June 24, 1953 to the present applicants; the container having been moved away, the extrusion discard or butt, which remains stuck in the container during the movement, is employed to cause a certain length of the extruded bar to pass through the die. At this moment, a saw moves down between the container and the front of the press in order to cut-off the bar. In this case, when

the cutting operation is finished, the container is brought back against the front of the press; the small piece of bar left at the front of the discard pushes the extruded bar through the die which is then freed and is carried away towards the front of the press. Finally, the ejection of the discard may be effected, either by bringing back the container towards the ram, which remains fixed and which passes through the container to eject the discard, or, if the force resulting from the movement of the container is not sufficient to eject the discard by the ram, by causing the container to be applied against a hollow stopping-device and using the displacement of the ram to eject the butt.

Under these conditions, however, and in spite of the possible rapidity of the movements of the transverse sliding carrier, cleaning of the container and also cooling of the mandrel in tube extrusion, and the other operations referred to above can only be carried out after completion of the extruded product, and ejection of the discard, whilst they could be carried out simultaneously with a longitudinal sliding carrier.

On the other hand, it has been found that the wear of containers takes place mainly in that part of the container adjacent the die and over a length equal approximately to that of the butt increased by the length of the dummy block (thrust block). This wear is due to the fact that, during the sawing operations, the discard remains in contact with the dummy block which heats-up and expands; by reason of this expansion and of the presence of the wedge of metal located between the periphery of the dummy-block and the surface of the container, there is produced, at the moment of ejection of the butt, a substantial degree of friction which causes wear in this part of the container.

The applicants have sought to overcome these disadvantages, while at the same time retaining the advantages of the known arrangements. A solution has been found in accordance with the present invention, which consists essentially in interposing between the container and the die or the die-holder mounted on the transverse sliding carrier, a ring—which will hereinafter be termed the "false container"—the thickness of which is approximately that of the thrust-block increased by that of the discard. The false container is mounted on and movable with the transverse sliding carrier so that it can be moved transversely of the press and it also can be slightly displaced along the axis of the press to move it away from or toward the sliding carrier.

The false container may be in a single piece, the press then being provided with an auxiliary laterally located jack or cylinder to provide for the ejection of the discard. The false container may also be formed by two portions assembled together along a diametral plane, the press then being provided with means for separating these two parts one from the other in order to ensure disengagement of the discard.

The false container may be mounted on a transverse sliding carrier which moves on a straight or curved line; in the latter case, a turret or barrel may be provided to carry for example two die-holders.

Various forms of embodiment of the improvements in extrusion of metals forming the object of the present invention are described below. For the purposes of this description reference is made to the accompanying drawings, in which:

FIGS. 1*a* to 1*h* are a series of diagrammatic views showing the principle of operation of an extrusion press fitted with a false container in accordance with the invention;

FIGS. 2 and 3 show views in diagrammatic cross-section of a press equipped in accordance with the invention;

FIG. 4 is a front elevation of a press equipped with a false container made in a single piece;

FIG. 5 is a section taken substantially on the line V—V of FIG. 4;

FIG. 6 is a front elevation of a press equipped with a false container made in two parts; and

FIG. 7 is a section taken substantially on the line VII—VII of FIG. 6.

FIGURE 8 is a vertical section taken on the line VIII—VIII of FIGURE 6.

There have been shown in FIG. 1 the stages *a*, *b*, *c*, *d*, *e*, *f*, *g*, and *h* of an extrusion operation on a press with a false container according to the invention. This press comprises a frame 1, a container 2, a die 3 in its die-holder 3', a ram 4, a dummy-block 5, a false container 6, a transverse sliding carrier 7 and a saw 8. The billet is shown at 9, and at 10 the extrusion discard or butt.

The stages of operation are as follows:

(*a*) *Loading.*—The billet 9 is brought in known manner into the axis of the press and is thrust into the container 2;

(*b*) *End of loading.*—The billet 9 is now inside the container 2 and the extrusion is about to commence;

(*c*) *End of extrusion.*—The front shoulder of the ram 4 comes up against the rear end portion of the container 2; it is no longer necessary to provide, as in the case of known devices, a stopping device having a thickness equal to the sum of the thicknesses of the discard and the dummy-block; for this reason, the length of the ram can be reduced by a length equal to the corresponding thickness;

(*d*) *Sawing-off the extruded bar.*—Immediately after the end of extrusion, the ram 4 and the container 2 are drawn-back to permit the cleaning of the container and the cooling of the mandrel in the case of extrusion of tube. The false container 6 remains in position against the die holder 3'. Immediately after, the false container 6 is moved away from the die holder in order to permit the passage of the saw 8 which moves in to cut the extruded bar 11;

(*e*) *Ejection of the extruded bar.*—In order to eject the extruded bar 11 the false container 6 is then brought towards the die 3 and by means of the small extremity of the bar which remains on the discard 10, the bar is ejected from the die;

(*f*) *Sawing of light sections.*—The die holder 3' remains against the false container 6 during its travel away from the sliding carrier 7; the bar 11 is then sawn-off behind the die 3, and it is then free immediately after sawing. The false container 6 is then brought back towards the front and then moved away from the die 3 which should remain fixed in its respective holder and holder housing;

(*g*) *Ejection of the discard.*—The transverse sliding carrier 7, having been moved out of the axis of the press, the discard 10 is ejected from the false container 6 by means of an auxiliary cylinder or (a false container can be used made in two parts assembled along a diametral plane; the ejection of the discard is then effected simply by the separation of the two halves of the false container);

(*h*) *Next operation.*—After checking or after replacement of the die when this is necessary, the false container 6 is applied against the die holder 3' and inside the false container is placed the lubricant 31 of the type appropriate to the nature of the metal extruded. The movement of the sliding carrier 7 replaces the tools (die holder and false container) in the axis of the press, the container 2 is applied against the false container 6, and the press is ready for a further operation.

Under these conditions, the usual wear of the container (which, as has already been indicated, takes place in known devices mainly on the side of the die over a length approximately equal to that of the discard increased by that of the dummy-block) is transferred to the false container which is easily replaced.

It so appears—and this has been confirmed by practical

operations—that the arrangement in accordance with the invention has a number of valuable advantages which may be summarized as follows:

Reduction of the time of the extrusion cycle by making simultaneous, as in the case of a longitudinal sliding carrier, the operations which were effected in succession with the usual transverse sliding carrier;

The use as a wearing part of a readily interchangeable container;

Easy insertion of the lubricant for die lubrication;

Thus, the lubricant may be preferably introduced near to the die-holder into the false container, before the latter comes back along the axis of the press.

Elimination of the ram stopping device at the end of extrusion.

In FIGS. 2 and 3, there has been shown diagrammatically a first form of embodiment of the invention. There is shown the frame 1 of the press, the various blocks 12*a*, 12*b* and 12*c* supporting the die-holder 3'' and the die 3, the false container 6, the container 2 and the transverse sliding carrier 7'. A control device of any known type maintains the parallelism of the false container 6 with the sliding carrier 7' during the movement of the false container. For example, the false container support can be guided on the one hand by pins, and on the other hand, in a perpendicular plane, by sliding rods. In FIGS. 6 and 7 for example, the movements of the false container are guided, parallel to the axis of the press by the jacks 13 and 14, and in the direction at right angles to the press axis, by the member 25. In FIGURES 2 and 3, between sliding carrier 7' and the false container 6 is provided a die holder housing 16 comprising a notch of horse-shoe shape, open at its top, in which rests the die holder 3''; this housing 16 may be rigidly fixed to the sliding carrier 7' or to the false container 6 by means of a coupling piece. FIG. 2 shows the assembly of the tools of a press equipped in order to carry out the operations indicated in FIGS. 1*a* to 1*h*. The tools are in the same position as in FIG. 1*a*. FIG. 3 shows the said assembly after an extrusion operation; the tools are arranged for the ejection of the extrusion discard 10 and the dummy block 5; the container 2 has been withdrawn and the false container 6 has moved away from the sliding carrier 7' so as to permit the die holder 3'' to be freed from its housing 16 and the checking or replacement of the die 3. The ejection of the discard 10 remaining in the false container 6 is effected either by means of an auxiliary piston or jack, or, after having replaced the die-carrier 3'' by a hollow piece 17, by forcing the false container 6 against the said hollow piece 17.

In the form of embodiment shown in FIGS. 4 and 5, there is again seen the frame 1, the die 3, the die holder 3'', the supporting blocks 12*c* and 12*d* for the die and die holder, the false container 6', and the sliding carrier 7'; there are also shown the jacks 13 and 14 for moving the false container 6' axially; there can also be seen the slide 19 for the sliding carrier 7', the housing 16' for the die holder 3'' and the support 7_1 of the false container, the jack 20 of the sliding carrier, the discard ejector 21 and the ejector 22 for raising the die holder 3'' from its housing 16'.

The sequence of the operations effected with the aid of this device is explained below.

After the extrusion shown diagrammatically in FIG. 1*c*, the following operations are effected: The container 2 is withdrawn; the false container 6 or 6' is moved away from the sliding carrier 7 or 7' by means of the jacks 13 and 14 and carries away the extruded bar 11, the discard 10 and the dummy block 5. The tools are then located in the positions shown diagrammatically in FIG. 1*d* and the extruded bar is then sawed off between the die holder 3' or 3'' and the false container 6 or 6'. As shown in FIG. 1*e*, the false container 6 or 6' is then moved by means of the jacks 13 and 14 toward the sliding carrier 7 or 7', which enables the extruded bar to be expelled through

the die 3 by means of the discard 10. The false container 6 or 6' is then again moved away from the die holder 3' or 3'' and the sliding carrier 7 or 7' is displaced laterally by means of the jack 20. The die holder 3' or 3'' is raised from its housing 16 or 16' by means of the ejector 22. The discard 10 and the dummy block 5 are ejected through the false container 6 or 6' by means of the ejector 21. A new die holder 3' or 3'' with its die 3 is then put in position in its housing 16 or 16' and the sliding carrier is brought into the axis of the press by means of the jack 20. The false container 6 or 6' is finally applied against the die holder 3' or 3'' (FIG. 1*h*) and the container 2 is applied against the false container 6 or 6'. The tools are then in position for a fresh extrusion operation.

The alternative form shown in FIGS. 6 and 7 corresponds to the case in which the false container is in two parts 6*a* and 6*b*, joined together along a diametral plane. In this case, there can be seen the frame 1 of the press, the slide 19, the supporting blocks 12*c* and 12*d*, the die-holder 3'', the die 3, and the transverse sliding carrier in two parts 7*a* and 7*b*; Belleville washers or other elastic members may be arranged so as to limit the lateral play of the false container 6*a*, 6*b* which is carried by its supports 7*c* and 7*d* which are guided by a rod 25 sliding in slots in the supports 7*c* and 7*d*. Two jacks 26 are provided to effect the movement of separation of the two parts of the sliding carrier, which can be displaced conjointly by an operating piston or jack 20. The placing of the die-holder in position is carried out by any appropriate means such as a jack, cylinder or piston 27, arranged above the trough 28 which receives the die-holder after an extrusion operation. Finally, an orifice 29 is provided for the ejection of stuck billets and the orifice 30 enables any excess lubricant (preferably vitreous) to be evacuated, when so required, between the guides 24*a* and 24*b* of the die-holder.

The sequence of the operations effected by means of this device is explained below.

After the extrusion illustrated diagrammatically by FIG. 1*c*, the following operations are carried out. The container 2 is moved away from the tools; the false container 6*a*, 6*b* and the die holder 3' or 3'' are moved axially away from the sliding carrier 7*a*, 7*b* by means of the jacks 13 and 14 and carry away the extruded bar 11 and its discard 10 during their movement. The extruded bar is sawed off behind the die carrier 3' or 3'' (FIG. 1*f*). The sliding carrier 7*a*, 7*b* is then displaced laterally by means of the jack 20 and thereafter all of the separable parts are moved away from each other by the jacks 26. The discard 10 and the die holder 3' or 3'' with its die 3 fall into the trough 28. A new die holder with its die is then brought into position by the jack 27. Finally, the separated members are again brought together by means of the jacks 26 and also 13 and 14, and the whole assembly is brought back into the extrusion position by the jack 20. The tools are thus in position for a new extrusion operation.

It will readily be understood that a press so equipped makes possible a rapid service, compatible with the low production cost desired, especially for the working of inexpensive metals. The improvements which form the object of the present invention may furthermore be applied to all presses for extruding metals.

What we claim is:

1. An extrusion press for the extrusion of metals, said press comprising a container, a transverse sliding carrier, a die mounted on said sliding carrier, an extrusion ram, a dummy block interposed between said ram and the billet to be extruded, and a false container interposed between said container and said die, said false container constituting an auxiliary and separable portion of said container with a false container passage adapted to line up with and form a continuation of the container passage, said die seating at the end of said false container passage with the die orifice opening thereinto, said false container being located in a housing with a conical supporting surface provided in the container, this housing being formed in such manner that when said false container is in position it is supported by the main container so as to be able to withstand the pressures arising during the extrusion operation and in order that said false container may be readily withdrawn after each operation.

2. An extrusion press as claimed in claim 1, in which the thickness of said false container in a direction parallel to its axis is adequate for receiving the expected extrusion discard followed by the dummy block with the ram engaging face of the latter within the passage through said false container.

3. An extrusion press as claimed in claim 1, in which said false container is capable of displacement and is formed of one single piece, and further comprising an auxiliary piston means for ejecting the extrusion discard of the extruded bar from said false container.

4. An extrusion press as claimed in claim 1, in which said false container is made in two parts assembled together along a diametral plane, and further comprising means for separating said two parts in order to eject the extrusion discard from said false container.

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