Jan. 12, 1960 R. GENDERS 2,920,760

EXTRUSION PRESS

Filed Dec. 17, 1956

Fig. 1.

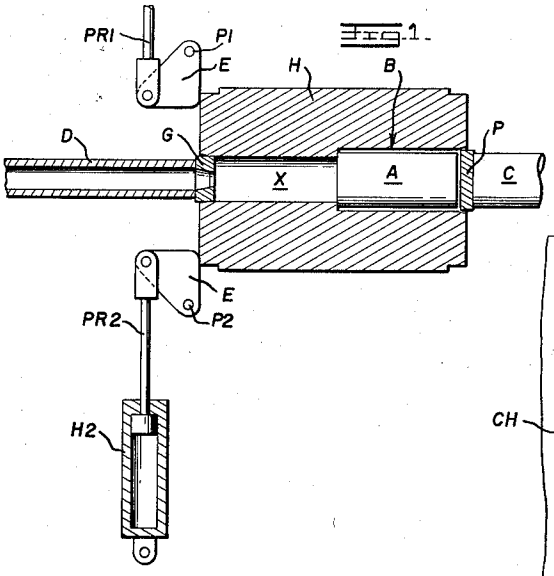


Fig. 2.

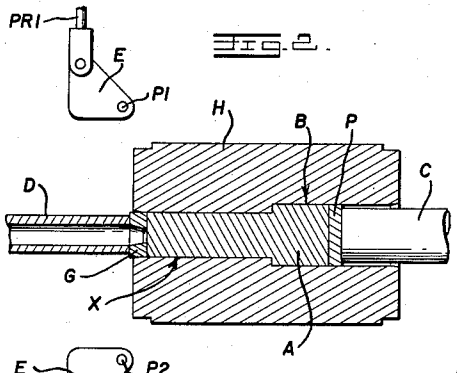


Fig. 3.

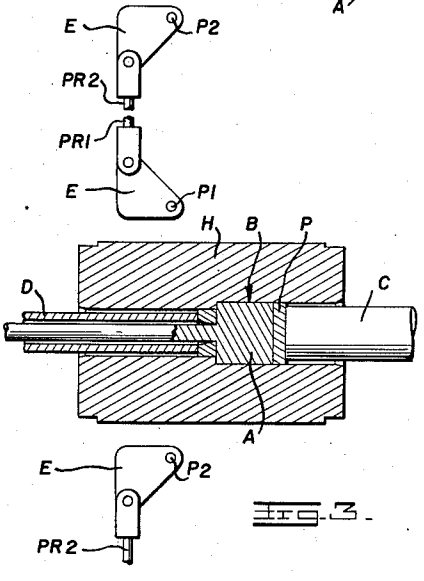


Fig. 5.

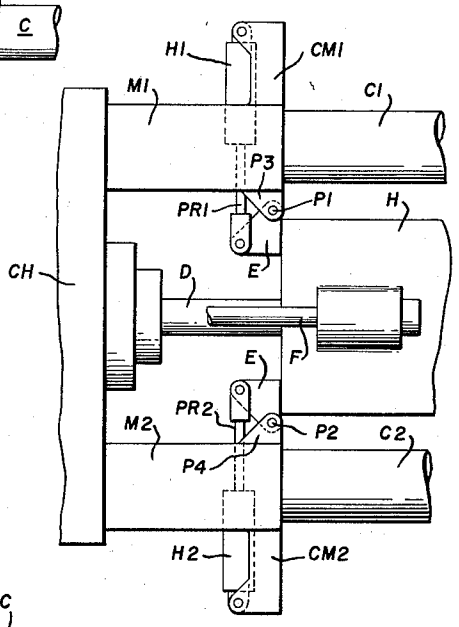
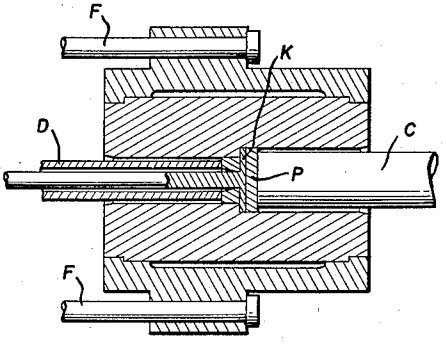


Fig. 4.



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EXTRUSION PRESS

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2 Claims. (Cl. 207—9)

This invention relates to extrusion presses in which direct and inverted modes of flow may be used separately or alternatively, in combination to give a flow resulting from mixed direct and inverted modes of flow.

The two methods of extrusion known as the direct and the inverted methods possess individual characteristics providing differing advantages. Thus, in the case of the direct process in which the billet container is stationary and a moving ram forces the billet through a die, so that the billet moves relatively to the container, a high pressure is required and while the extruded product exhibits good surface qualities, the type of flow involved in the direct process may introduce defects within the product.

In the case of the inverted process, in which the container travels towards the die with the billet, so that the billet does not move relatively to the container a lower pressure is required than in the direct process and an internally sound extruded product results, although the surface quality may not be so good as in the direct process if an unmachined billet is used.

Methods of and apparatus for effecting extrusion by the direct or indirect processes, as well as a combination of these processes is described in U.S.A. patent specification No. 2,675,125.

The object of the present invention is to provide a construction of hydraulic press and a method of operating it in order to obtain greater advantages from the inverted process and from combined flow extrusion than are obtainable with known forms of press.

According to the present invention, a hydraulic extrusion press constructed to operate selectively under any of direct or inverted flow conditions or under combined or mixed direct and inverted flow conditions, is provided with a billet container having a billet receiving bore the internal cross sectional area of which is greater at the end at which a billet is inserted than at the opposite end.

In the case of one form of container having a circular bore, the diameter of the bore is constant for a substantial length thereof, the remainder of the bore being of appreciably less and constant diameter.

A press constructed to operate in accordance with the invention may be provided at one end with a solid ram and at the other end with a hollow ram, the solid ram being of greater daimeter than the hollow ram, which in operation of the press will enter that portion of the container bore which is of reduced diameter.

The invention will be described in greater detail with reference to the accompanying drawings which are of an explanatory nature, and in which Figures 1 to 4 show in cross section one form of container and cooperating hollow and solid rams constructed in accordance with the invention, these four figures showing the parts in different relative positions and Figure 4 being a section perpendicular to the sections in Figures 1 to 3. Figure 5 is a fragmentary elevation showing portions of a press structure including the mounting and operating means for the billet container restraining means.

Referring to Fig. 1 of the drawings, a billet A of metal to be extruded is placed in a part B of the bore of a container H which is of greater diameter than the remaining part X of the container. When desired, the container H is restrained from movement in the direction of extrusion by any appropriate means, represented as pivoted catches E, so that the press will operate under the direct mode of flow. The mounting and method of operating the catches E will be described in connection with Figure 5 of the drawing. The billet may be machined or may be a rough ingot or casting having an appreciable clearance in the container bore. A solid ram C carrying a follower pad P of diameter equal to the bore of the container is moved forward, extruding the billet into the smaller part X of the bore which is closed by an extrusion die G carried at the end of a stationary hollow ram D.

When the condition shown in Fig. 2 has been reached in which the smaller bore is filled with metal, each catch E holding the container is tripped and extrusion then automatically commences by inverted flow, the container moving forward with the speed of the ram C.

Fig. 3 shows the condition reached after the inverted flow operation has continued up to a point at which no portion of the billet remains in the smaller diameter part of the container bore. Instead of continuing extrusion by inverted flow after the condition shown in Fig. 2 has been reached until that shown in Fig. 3, combined or mixed flow operation may be adopted as shown in Fig. 4 in which auxiliary rams F are provided to impose controllable restraint on the movement of the container. The fluid pressure applied to the rams F determines the degree of restraint imposed on the movement of the container and thus the degree of relative movement between the billet and the container. The condition will thus approach the direct mode of flow but will in fact be a mixture or combination of the direct or inverted modes of flow.

Figure 5 shows a convenient method of operating the catches E which are pivoted at points P1, P2 on projecting portions P3, P4 of members M1, M2 extending from a fixed crosshead CH. C1, C2 are the main columns of the press. Hydraulic cylinders H1, H2 supported from carrier members CM1, CM2 have their piston rods PR1, PR2 pivotally attached, as shown, to the pivoted catches E. Fluid pressure supplied to one or the other face of the piston in each of the hydraulic cylinders in the well known manner, will effect projection or retraction of the piston rod with consequent motion of the catches E into or out of the path of the container H.

The facilities provided by the inverted or mixed types of flow may be increased by selection of the lengths and diameters of the two parts B and X of the container bore. Variations in the ratios of lengths and diameters will obviously vary the ratio between the volume of metal which can be extruded and the distance of travel of the main ram. The main purpose of such variations is to control the proportions of the billet subjected to inverted or combined flow.

Considering the example of a bore ratio of 2:3 in diameter and 1:1 in length, it is clear that the smaller part X of the bore will be filled with the pre-extrusion of just less than half the billet volume (Fig. 2). At the point when inverted extrusion begins by allowing the container to move freely under the pressure of the ram C, the mode of flow can proceed until the part X of the bore is traversed by the die, in which case further extrusion can only proceed by the direct process assuming the pressure available over the larger diameter is adequate. It is in many cases desirable therefore to apply restraint to the movement of the container as for example by the hydraulic rams F shown in Fig. 4, so controlling the speed of

the container to produce the combined flow type of extrusion and to empty the container except for a disc of discard K which is left between the two rams at the end of the complete stroke.

The pressure required to effect an extrusion with a press constructed in accordance with the invention does not need to be greater than that required to effect a similar extrusion using a container of conventional form, that is to say, a container having a bore the diameter of which is uniform from end to end. The pre-extrusion stroke requires only a low pressure determined by the temperature of the billet and the diametrical ratio of the two parts of the container bore. It will be clear that, according to the nature of the metal being extruded the relative proportions of a particular extrusion operation to be carried out under the inverted or combined modes of flow, the pressure available and the size of the section of the extruded product, the proportions of the two parts of the bore may be varied within wide limits.

Although in the particular example described, the die will only extrude a solid section, obviously, the extrusion of tubes may be carried out by the same press and process using a mandrel incorporated in the ram D as in known practice. Again, although the change in diameter of the bore is shown in the drawings to be quite sharp, the contour of the shoulder formed may be modified to a curve or taper.

Extrusion presses constructed and operated as described present a number of advantages including the conservation of heat by the use of a larger diameter billet than is possible with a known press of the same power and stroke. This advantage applies particularly to the extrusion of steel Again, the surface skin of the section of the billet undergoing extrusion is eliminated, thus permitting the use of the inverted mode of flow without danger of surface defects in the extruded section. Further, the preextrusion stroke in upsetting the initial billet effects a measure of pre-working of the metal to assist break up of the original cast structure of a billet. Another advantage presented is that any appreciable clearance between the billet and the container at the commencement of extrusion is eliminated during the pre-extrusion stroke with consequent symmertical flow which is particularly valuable in tube extrusion and uniformity of temperature is also obtained due to the more intimate contact between the billet and the container and the improved heat distribution throughout the body of the billet which results.

The various advantages referred to will be apparent in the case of metals which are normally difficult to extrude by reason of their rapid loss of plasticity with fall in temperature. Such metals include steels and nickel alloys.

The process described may also be applied with simple modifications to many extrusion presses of the simple orthodox type of design and of course the lubricants used in the process may be of the commonly known types. The actual form of die employed will be determined by the nature of the extruded product required.

I claim:

1. A hydraulic extrusion press constructed to operate selectively under direct, indirect and mixed direct and indirect flow conditions and provided with a billet container having a receiving bore the diameter of which is constant over a substanial length thereof, the remainder of the bore which is coaxial with said substantial length being of appreciably less and constant diameter, the press having a solid ram for entry into the insertion end of the bore, a die and a hollow ram for entry into the end of the bore of less diameter, a releasable holder for selectively holding the container stationary or allowing movement thereof whilst a billet is being forced by the solid ram through the bore, said holder upon being released allowing the container to move with and under the pressure of the solid ram in the extrusion direction whereby the die and the hollow ram enter the part of the bore of reduced cross-section area.

2. A hydraulic extrusion press constructed to operate selectively under direct, indirect and mixed direct and indirect flow conditions and provided with a billet container having a receiving bore the diameter of which is constant over a substantial length thereof, the remainder of the bore which is coaxial with said substantial length being of appreciably less and constant diameter, the press having a solid ram for entry into the insertion end of the bore, a die and a hollow ram for entry into the end of the bore of less diameter, a pivoted catch for selectively holding the container stationary or allowing movement thereof whilst a billet is being forced by the solid ram through the bore, said pivoted catch upon being released allowing the container to move with and under the pressure of the solid ram in the extrusion direction whereby the die and the hollow ram enter the part of the bore of reduced cross-sectional area.

References Cited in the file of this patent

UNITED STATES PATENTS

5,253	Cornell	Aug. 21, 1847
493,945	Robertson	Mar. 21, 1893
1,664,976	Hanff	Apr. 3, 1928
2,675,125	Genders	Apr. 13, 1954

FOREIGN PATENTS

844,287	Germany	July 17, 1952