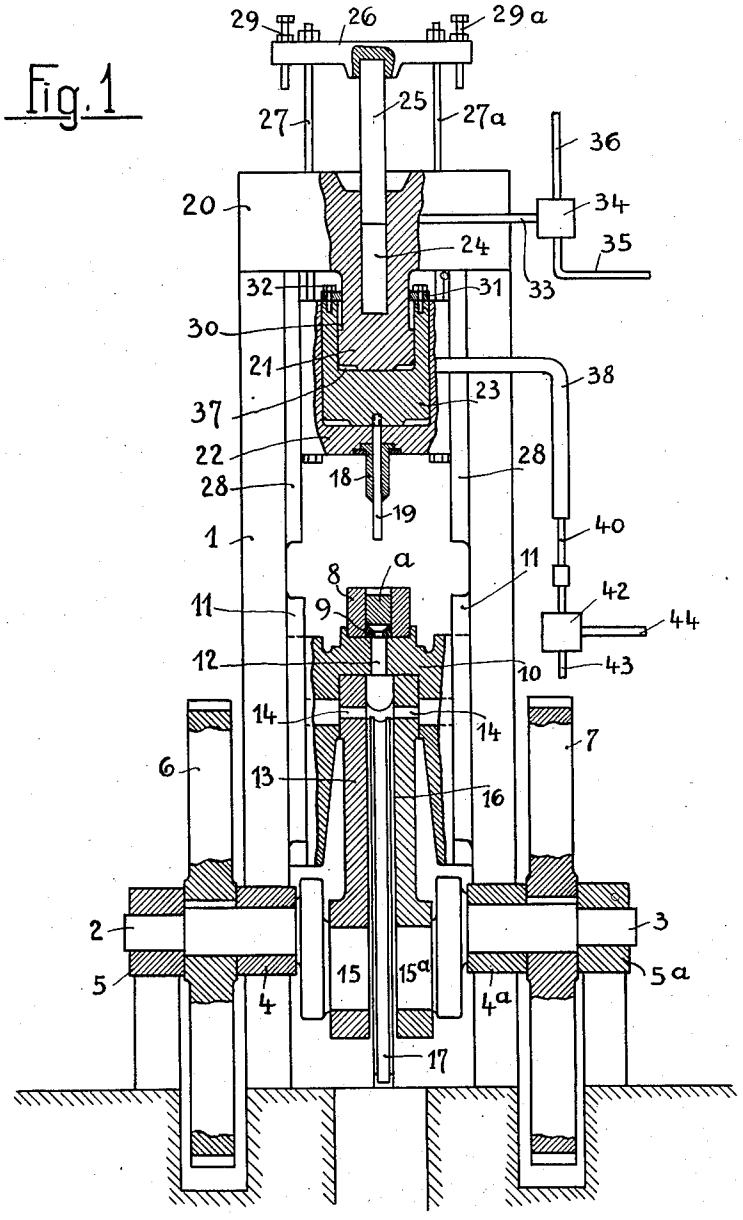
June 25, 1935. A. WEFING 2,006,080

EXTRUSION PRESS

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Fig. 1



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Fig. 2

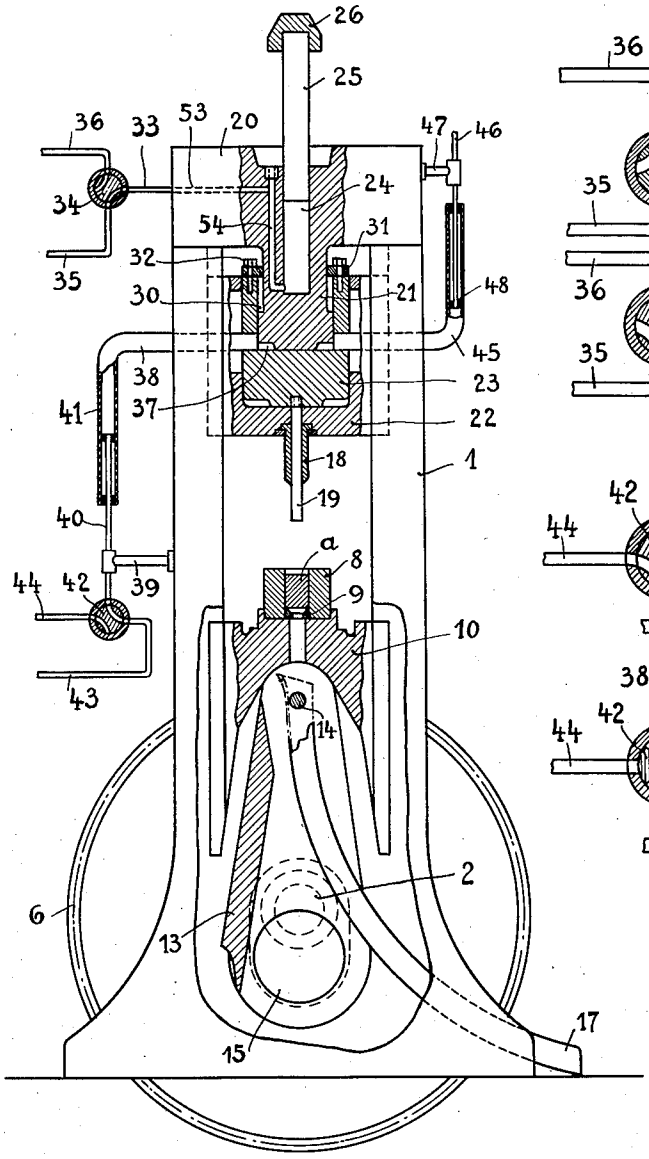


Fig. 3

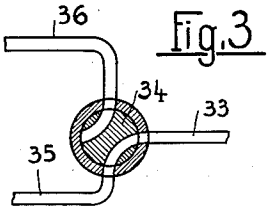


Fig. 5

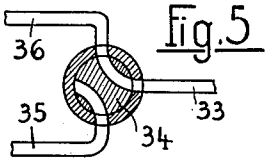


Fig. 4

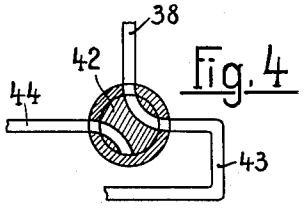
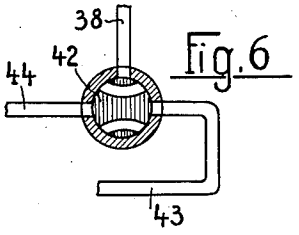


Fig. 6



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Fig. 9

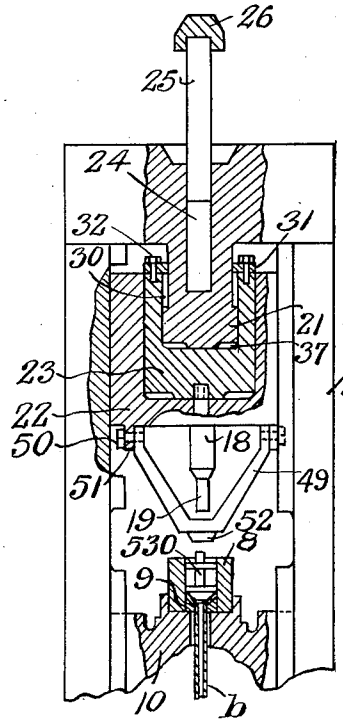
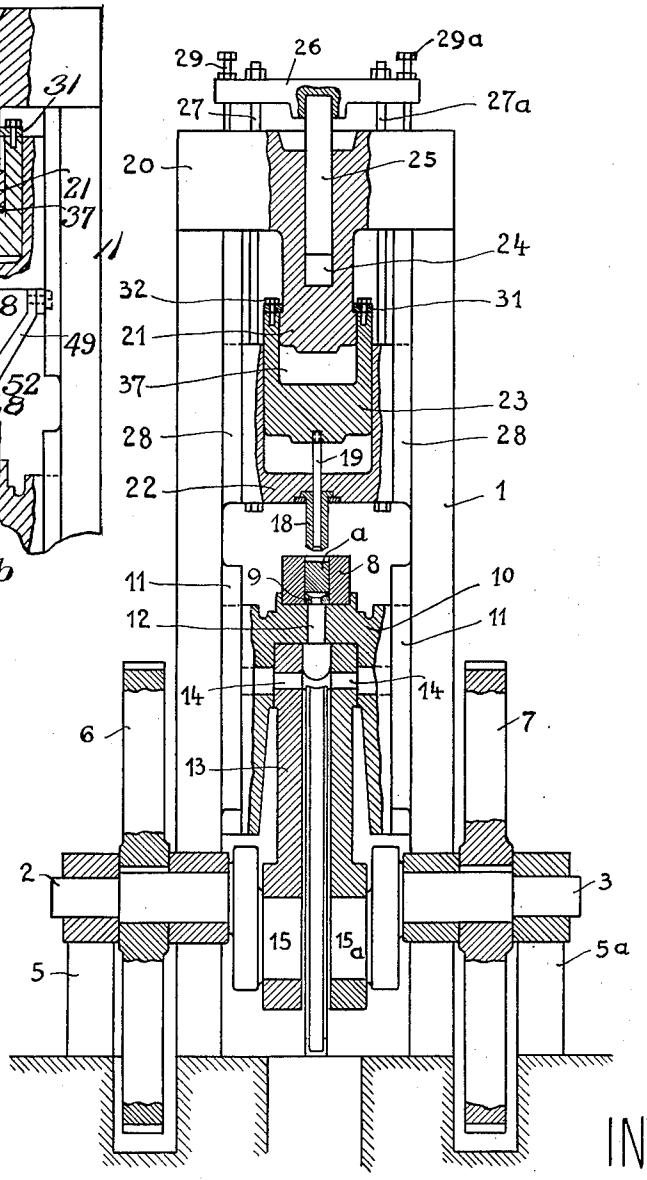


Fig. 7



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Fig. 8

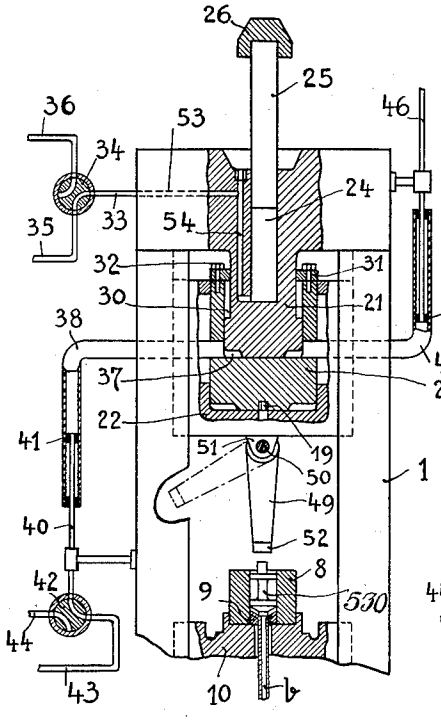
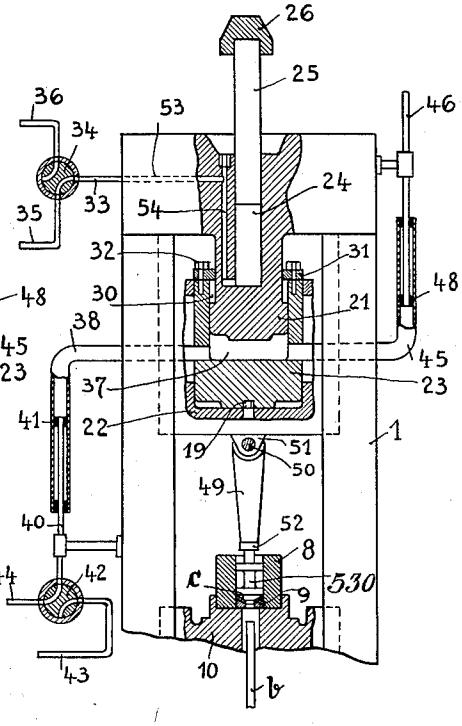


Fig. 10



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UNITED STATES PATENT OFFICE

2,006,080

EXTRUSION PRESS

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Application March 7, 1934, Serial No. 714,421
In Germany December 12, 1931

10 Claims. (Cl. 207—3)

This invention relates to extrusion presses for extruding tubes, rods and the like, e. g., from metals, such as ferrous metals and alloys, especially to presses in which a billet- and die-carrier is moved toward and from a male extruding tool, and; with regard to more detailed aspects of the invention, it applies particularly to vertical presses in which the male tool is likewise moved relative to the die.

Two types of vertical press construction of this general class have been available up to the time of this invention, viz., presses having a crank arranged in the head of the press frame for moving a male die to effect extrusion, and bottom-slide drawing presses in which cranks are arranged outside of the bottom part of the press frame to reciprocate, by means of connecting rods, a cross head movably disposed in the head part of the press frame.

Such constructions are open to major disadvantages. Thus, it has been necessary to apply the main driving force to the male extrusion tool in order to permit downward extrusion of the article. In consequence the arranging of the crank shaft in the head of the press frame has the drawback that the press frame must be built very heavily, and foundations of considerable height must be provided for the gearing, whilst in bottom-slide drawing presses the heavy strains of flexure exerted on the movable cross head disposed at the upper end of the frame and the pressure forces acting laterally on the press columns necessitate a very weighty shaping of these press parts.

It is among the objects of this invention to provide an extrusion press in which the crank is mounted in the bottom part of the press and actuates, as a main driving means, the member carrying the billet and die, whereby to obviate or minimize the foregoing and other disadvantages of prior presses, for example by reducing the stressing on parts of the press and thereby permitting lighter and less expensive construction, and to facilitate access to the press and ready placement of such auxiliary automatic devices as may be desired.

A special object is to provide a vertical extrusion press of the type referred to in which the billet- and die-carrier and the crank are connected by a connecting rod construction permissive of free downward movement of the extruded article, thus overcoming the former inability to position the main crank drive in the bottom of the press.

A further object is to provide a press which embodies the foregoing advantages and in which the male extruding tool is likewise reciprocated, relative to the female tool, or die, by auxiliary driving means controlled independently of or by the main crank drive.

Still another object is to provide means for shearing off the pressing residue in the die from the extruded article, which shall be simple and easily applied, and which does not require any material alteration in press construction or interfere with the operation of the press.

Other objects will appear to those skilled in the art from the following description.

According to this invention the main driving force for the extrusion of the billet is effected by a crank arranged in the bottom part of the press and connected to the billet and die carrier by a connecting rod construction to drive the said carrier during the extrusion operation proper.

Arranging the crank within the bottom part of the press frame for reciprocating the die normally entails certain constructive difficulties because with the normal shaping of the crank shaft the crank and the connecting rod would prevent free downward exit of the extruded article. In accordance with this invention these difficulties are overcome by using either a double crank of the three-bearing type and a pair of connecting rods spaced to provide an extrusion passageway aligned with the die opening, or a special crank construction may be used in which the pins of two coaxially mounted cranks arranged in the bottom part of the press frame are rotatively connected to a hollow member that connects the two cranks with a billet- and die-carrier and which is provided with an extrusion bore, the connecting member being open at one side to permit the article to be extruded through the die, the bore of the hollow member, and the connecting member.

With the new press construction the total cycle of operations or only part of them, for instance only the extrusion, or the piercing and extruding operation, may be performed by the main crank drive. In the latter case the invention provides means for advancing the male extruding tool, before or after setting into motion the main crank drive, towards the billet and the matrix die. For this purpose, according to the invention, the male tool, i. e., a punch or a punch and a mandrel, is carried by a special reciprocating member, or is advanced towards the matrix die during the working stroke and returned into the initial positions during the back stroke by auxiliary driv-

ing means actuated independently of or through the main crank drive. In the preferred embodiment this comprises hydraulic actuation, and a compact and efficient telescoping association of the punch and mandrel carriers when the male tool includes both, as will be described more fully hereinafter.

In a further aspect of the invention the press includes means associated with the male tool and actuated by the auxiliary driving means for advancing a tool to shear off the pressing residue from the extruded article after the extrusion and after the press parts have been returned into their initial positions. In accordance with the invention this comprises a member pivotally associated with the male die mechanism so that it can be swung away during the extrusion operations and so that it may be brought into its working position in alignment with a chisel inserted into the billet and die container, whereby a short stroke of the tool carrier suffices to shear off the pressing residue.

The accompanying drawings represent by way of illustration, but not of limitation, the preferred embodiment of the invention. In the drawings Fig. 1 is a longitudinal vertical section showing the press parts and the tools in their initial positions; Fig. 2 a side elevation of the press, partly in section, showing the press parts and tools in the positions shown in Fig. 1; Figs. 3, 4, 5 and 6 are schematic cross sections through the controlling valves for the auxiliary driving means in the different working positions of the press; Fig. 7 is a view similar to Fig. 1 showing the press parts and tools before the piercing operation; Fig. 8 is a side elevation, partly in section, of the head part of the press showing the shearing-off member in its two positions, together with the shearing-off chisel inserted into the container; Fig. 9 a front view, similar to Fig. 8, of the head parts of the press; and Fig. 10 is a side elevation similar to Fig. 8 but showing the position of the press parts at the end of the shearing-off operation.

The drawings represent the invention as embodied in a vertical press for extruding tubes, and it embodies a male extruding tool mounted in the upper part of the press and a billet- and die-carrier mounted therebelow for reciprocation relative thereto. In this embodiment the male tool likewise is reciprocated for reasons which will be understood by those skilled in the art, such as to enable the use of a short crank stroke, with consequent various benefits. The male tool includes an extruding punch and a mandrel, but it will be understood that the invention is not restricted thereto, these male tool elements being susceptible of use according to the particular article to be extruded.

Having reference now to the drawings, the press comprises a frame 1 in the bottom part of which a pair of crank shafts 2 and 3 is mounted coaxially with their inner ends journalled in bearings 4 and 4a in the frame, and with their outer ends in suitable bearings 5 and 5a. These cranks are driven by spur gears 6 and 7.

In accordance with the invention the die and billet container are mounted on a carrier member, actuated by the crank, the construction being such as to permit the article to be extruded freely. To this end the die and billet container is mounted coaxially with the bore of a hollow carrier member whose bore opens into an extrusion passageway provided by the pitman construction. The passageway referred to may be provided by using a pitman composed of two connecting rods with a three-bearing double crank shaft, the space between the rods providing the necessary extrusion passage.

In the embodiment shown, however, this is accomplished by mounting the billet- and die-container 8, in which is disposed the female extrusion die 9, on a carrier member 10 slidably mounted in ways 11 and provided with a bore 12 with which the container 8 and its die 9 are aligned axially. The upper portion of carrier 10 is solid, except for bore 12, while the lower part, as shown in Fig. 1, is hollow for receiving the upper end of a hollow pitman, or connecting rod 13 which is connected to the carrier by wrist pins 14. Connecting rod 13 is rotatably connected at its lower end to the axially aligned crank pins 15 and 15a of cranks 5 and 5a, respectively.

Bore 11 within the billet- and die-carrier 10 permits the extruded article to exude through the carrier into the hollow connecting member 13 in the bore 16 of which an outset channel 17 is mounted rotatively. Connecting member 10 may also be made of two separate parts arranged at a sufficient distance from each other to render possible the free exit of the extruded article.

Mounted ahead of the reciprocable female extrusion tool, i. e., in the head part of frame 1, is a male extrusion tool, and in the preferred embodiment of the invention this tool is disposed for reciprocation relative to the female tool, or die, 9, and it is actuated by an auxiliary driving means for effecting the various operations.

An important feature of the invention resides in a particular mode of constructing, or associating, the male tool elements for efficiency and simplicity of operation and construction. To this end the male extruding tool is connected to a hollow carrier reciprocable in the frame, and the bore of the carrier cooperates with a piston which likewise is bored to form a cylinder for a second piston connected to a movable cross head from which the tool carrier is suspended. These cylinders are supplied with fluid under pressure, through suitable valve means, for moving the tool upwardly or downwardly in the frame in the cycle of press operations.

In the embodiment shown the press is for making tubing, and accordingly the male tool includes both a hollow punch 18 and a mandrel 19 movable through the punch. In the construction illustrated the head part of the press frame includes a fixed cross head 20 from which a piston 21 projects downwardly in the frame axially of the tool axis. Punch 18 is carried by a hollow punch carrier 22 the bore of which receives a hollow mandrel-carrier 23 whose bore in turn receives piston 21. Thus the punch carrier and the mandrel carrier act respectively as a hydraulic cylinder and piston, and the mandrel carrier is likewise a cylinder for piston 21. Piston 21 is provided with a bore 24 for receiving a piston 25 suspended from a movable cross head 26 from which the punch carrier 22 is suspended by rods 27 and 27a passing through fixed cross head 20. Punch carrier 22 moves in the frame on vertical ways 28.

The movements of the cross head 26 and of the punch-carrier 22 are limited on the one side by abutment screws 29 and 29a mounted in cross head 26 for cooperation with cross head 20, and on the other side by the bottom of the mandrel-carrier 21. Relative movement of piston 21 and mandrel carrier 23 is limited by providing the lower end of the piston with a shoulder 30 which

coacts with a ring 31 connected, as by bolts 32, to the upper end of the mandrel carrier.

As shown in the drawings, mandrel 19 extends downwardly through the bore of punch 18 for movement relative to the punch in the various stages of the extruding cycle, as explained hereinafter.

Cylinder space 24 is connected by a conduit 33 to a three-way valve 34 having a branch 35 leading to a source of high pressure fluid, such as water, and a branch 36 forming a pipe for waste fluid. A pressure-water pipe 38 connected to mandrel-carrier 23 opens into the cylinder 37 formed by the mandrel carrier. This pipe extends through a longitudinal slot in punch-carrier 22, and it terminates in a vertical portion parallel to the tool axis and connected to the press frame, as by a bracket 39, Fig. 2, into which a conduit 40 projects, the upper end of conduit 40 being shaped as a piston 41 adapted to make a fluid-tight sliding fit with conduit 38. The other end of the tube 40 is connected to a 3-way valve 42 having a branch 43 connected to a low-pressure-water supply, and a branch 44 connected to the high-pressure water supply. The high and low pressure water sources are not shown, these details being familiar to those acquainted with hydraulics.

From the interior of mandrel-carrier 23 a second pipe 45 connected to the mandrel-carrier extends horizontally through a longitudinal slot in the punch-carrier 22, this pipe then extending vertically upward, parallel to the axis of the tools. Projecting into the bore of the vertical portion of pipe 45 is a pipe 46 supported by the press frame, as by a bracket 47. The lower end of pipe 46 is shaped as a piston 48 making a fluid tight fit with the bore of pipe 45. The other end of pipe 46 is connected with a safety valve, not shown in the drawings.

A further feature of value resides in the provision of means for actuating a chisel to cut off the pressing residue left in the die at the end of the extruding operation. This comprises a punch member pivotally carried by the male tool so that it may be swung out of the axis of movement of the tools during extrusion, but may be brought into that axis at the end of the extrusion cycle so that upon further movement of one of the tools it will force a chisel through the residue in the die to release the extruded article.

In the embodiment shown in the drawings the cut-off device takes the form of a V-shaped member 49, Figs. 8 to 10, the ends of the legs of which are pivotally connected by means of the bolts 50 to lugs 51 provided on the bottom of punch-carrier 22. The vertex of cut-off member 49 is disposed downwardly and carries a short punch 52.

The press operates as follows:

In the initial position (Figs. 1 and 2) the three-way valve 34 is in the position shown in Fig. 3, and three-way cock 42 is in that shown in Fig. 4. Water under pressure thus is supplied to cylinder space 24 through pipe 35, three-way valve 34, pipe 33 and bores 53 and 54 (Fig. 2) in cross head 20, whereby piston 25, the movable cross head 26 and punch-carrier 22 suspended on the latter are elevated into their initial positions, as illustrated in Figs. 1 and 2. Simultaneously any water contained in cylinder space 37 is displaced through pipes 38 and 40, three-way valve 42, and pipe 43 into the low-pressure reservoir connected to pipe 43.

Then the billet *a* is inserted into container 8 and three-way valve 34 is turned into the position of Fig. 5, cutting pipe 33 off from the high-pressure-water pipe 35 and connecting it with the waste-water pipe 36. Partly by gravity, partly by the action of the low-pressure-water supplied to cylinder space 37, piston 25, movable cross head 26, mandrel-carrier 23, and punch-carrier 22 move downwardly until the abutment screws 29 and 29*a* engage the stationary cross head 20, and the annular abutment 31 of mandrel-carrier 23 engages the annular abutment 30 formed on the lower part of piston 21. Thereby cylinder space 37 is completely filled with low-pressure fluid. Then three-way cock 42 is turned into the position illustrated in Fig. 6, whereby pipe 38 is shut off from low-pressure water pipe 43 as well as from high-pressure-water pipe 44. This brings the tools into the position shown in Fig. 7.

The crank drive is now set into motion causing billet *a* to be pierced and extruded as the tube *b* remains stationary. The extrusion finished, three-way cock 34 is turned again into the position of Fig. 3, and three-way cock 42 into the position shown in Fig. 4, which causes the mandrel carrier 23 and the punch-carrier 22 to be returned to their initial positions, whereby the tools resume the initial position of Figs. 1 and 2.

The dies returned to their initial positions, a shearing-off chisel 530 is inserted into the bore of container 8, and cut-off member 49 is swung into its working position, shown in full lines in Figs. 8 and 9. Then the three-way valve 42 is turned into the position shown in Fig. 10, whereby high pressure water is supplied through pipe 44, three-way valve 42, and pipes 40 and 38 to cylinder space 37, causing mandrel-carrier 23 and punch-carrier 22, to which the cut-off member is connected, to press against the shearing-off chisel 530, so as to shear off the pressing residue *c* (Fig. 10) from the tube *b*. The cross sectional area of piston 21 is made substantially larger than that of piston 25, as shown, so that any counter-pressure existing in the cylinder space 24 is easily overcome and it will be unnecessary to change the position of three-way valve 34.

In producing brass and steel tubes the shearing off of the thin pressing residue *c* may be effected by gravity, that is, by the weight of the punch-carrier and the punch thus rendering superfluous the use of high pressure water.

The pressing residue sheared off, three-way valve 42 is turned again into the position shown in Fig. 4 whereby the cylinder space 37 is connected with the low-pressure-water reservoir, resulting in the pressure of the high pressure water in the cylinder space 24 overcoming that of the low pressure water in the cylinder space 37 so as to return mandrel-carrier 23 and punch-carrier 22 into their initial positions, as shown in Figs. 1 and 2. Cut-off member 49 is of substantial length, and only a short stroke is needed, therefore, for this operation.

The cut-off member 49 is swung into the broken line position shown in Fig. 8, and the chisel 530 and the pressing residue are taken out of the container.

The controlling of the three-way cocks 34 and 42 may be made by hand or otherwise independently of the main drive, or by mechanical controlling means which are driven and controlled by the main drive.

While in the described embodiment of my invention the reciprocating of the matrix die is

executed by a crank drive, it will be appreciated that for this purpose also hydraulic means may be used. Such modification is, of course, within the scope and spirit of my invention.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In an extrusion press, a vertical frame, an upper male extruding tool, a lower carrier member supporting a billet- and die-container and provided with a longitudinal bore for extrusion of a billet therethrough, said tool and carrier member being mounted in the frame for reciprocation relative to each other, a pair of crank shafts mounted in the frame below the carrier member with their crank pins coaxially aligned, a hollow connecting rod connected to said carrier member and cranks, the bore of the connecting rod being aligned with that of the carrier member and the connecting rod being provided with a slot through one side, thereby providing a passageway for the extruded article, driving means for said cranks, and auxiliary driving means for said male tool.

2. In an extrusion press, a vertical frame, a tool holder mounted in the upper part of the frame, a male extruding tool mounted in and projecting downwardly from said holder, a carrier member supporting a billet- and die-container and provided with a longitudinal bore for extrusion of a billet therethrough mounted in the frame below said tool, said holder and carrier being reciprocable relative to one another, a crank in the frame below said carrier, and hollow connecting rod means connected to said carrier member and crank providing a passageway for the extruded article, driving means for said crank, auxiliary driving means for said holder, and cut-off means associated with said holder for operating a chisel to cut off extrusion residue in the die after the extruding operation.

3. An extrusion press according to claim 2, said cut-off means comprising a yoke pivotally suspended from said holder so as to be swung into or out of operative position.

4. In a press for extruding tubular articles, a vertical frame, a male die mechanism including a punch holder reciprocably mounted in the frame, a hollow punch connected to and suspended from said holder, a mandrel holder associated with said punch holder for reciprocation relative thereto, a mandrel connected to and suspended from said mandrel holder extending downwardly through said punch, and means associated with said holders to limit their relative movement; a carrier member reciprocably mounted in the frame below said holders supporting a billet- and die-container and provided with a longitudinal bore aligned axially with said container, punch and mandrel; primary driving means for reciprocating said carrier comprising a pair of cranks mounted in the frame below said carrier with their pins coaxially disposed, and a hollow connecting rod member having a slot opening along one side connecting said cranks and carrier member, said slot providing a passageway for the extruded article; and auxiliary driving means associated with said male mechanism for effecting movement of the punch and mandrel relative to said carrier member.

5. In a press for extruding tubular articles, a vertical frame, a male die mechanism including a punch holder reciprocably mounted in the frame, a hollow punch connected to and suspended from said holder, a mandrel holder associated with said punch holder for reciprocation relative thereto, a mandrel connected to and suspended from said mandrel holder extending downwardly through said punch, and means associated with said holders to limit their relative movement; a carrier member reciprocably mounted in the frame below said holders supporting a billet- and die-container and provided with a longitudinal bore aligned axially with said container, punch and mandrel, primary driving means for reciprocating said carrier comprising a pair of cranks rotatably mounted in the frame below said carrier with their pins aligned coaxially, and a hollow connecting rod member connecting said cranks and carrier, the bore of said connecting member being aligned with that of the carrier to provide a passageway for the extruded article, and means actuating said cranks; and auxiliary hydraulic driving means associated with said male mechanism for effecting movement of punch and mandrel relative to said carrier member.

6. In a press for extruding tubular articles, a vertical frame, a fixed cross head disposed at the top of said frame, male die mechanism including a piston member suspended from said fixed cross head, a movable cross head, a hollow punch holder suspended from said movable cross head for vertical reciprocation in the frame, a punch connected to and suspended from said punch holder, a hollow mandrel carrier movable as a piston within said punch carrier and itself telescoping as a hydraulic cylinder over said piston, whereby said piston, mandrel holder and punch holder are movable relative to each other, means associated with said holders for limiting their relative movement, and a mandrel connected to said mandrel holder and extending downwardly through said punch; a carrier member reciprocably mounted in the frame below said holders supporting a billet- and die-container and provided with a longitudinal bore aligned axially with said container, punch and mandrel, primary actuating means for reciprocating said carrier member toward and from said male die mechanism including a crank rotatably mounted within the frame below the carrier member and connecting rod means connecting said crank and carrier member and providing a passageway for movement of the extruded article therethrough, and means driving said crank; and auxiliary hydraulic means associated with said male die mechanism for effecting movement of the punch and mandrel relative to said carrier member.

7. In a press for extruding tubular articles, a vertical frame, a fixed cross head disposed at the top of said frame, male die mechanism including a fixed piston member suspended from said fixed cross head, a movable cross head, a second piston suspended from said movable cross head and movable in a cylinder bore provided in said fixed piston, a hollow punch holder suspended from said movable cross head for vertical reciprocation in the frame, a punch connected to and suspended from said punch holder, a hollow mandrel carrier movable as a piston within said punch carrier and itself telescoping as a hydraulic cylinder over said fixed piston, whereby said mandrel and punch

holders are movable relative to each other and to said fixed and movable pistons, means associated with said holders for limiting their relative movement, and a mandrel connected to said mandrel holder and extending downwardly through said punch; a carrier member reciprocably mounted in the frame below said holders supporting a billet- and die-container and provided with a longitudinal bore aligned axially with said container, punch and mandrel, primary actuating means for reciprocating said carrier member toward and from said male die mechanism including a crank rotatably mounted within the frame below the carrier member and connecting rod means connecting said crank and carrier member and providing with a passageway for movement of the extruded article therethrough; and auxiliary hydraulic means associated with said male die mechanism for effecting movements of the punch and mandrel relative to said carrier member.

8. In a press for extruding tubular articles, a vertical frame, a fixed cross head disposed at the top of said frame, male die mechanism including a fixed piston member suspended from said fixed cross head, a movable cross head, a piston member suspended from the movable cross head for movement in a hydraulic cylinder bore in said fixed piston, a hollow punch holder suspended from said movable cross head for vertical reciprocation in the frame, a punch connected to and suspended from said punch holder, a hollow mandrel carrier movable as a piston within said punch carrier and itself telescoping as a hydraulic cylinder over said fixed piston, whereby said mandrel and punch holders are movable relative to each other and to said fixed and movable pistons, means associated with said holders for limiting their relative movement, and a mandrel connected to said mandrel holder and extending downwardly through said punch; a carrier member reciprocably mounted in the frame below said holders and supporting a billet- and die-container and provided with a longitudinal bore aligned axially with said container, punch and mandrel, primary actuating means for reciprocating said carrier member toward and from said male die mechanism including a pair of cranks rotatably mounted within the frame below the carrier member with their pins aligned coaxially, and a hollow connecting rod member connecting said crank and carrier member with its bore aligned with that of the carrier member to provide a passageway for the extruded article, and means driving said cranks; and auxiliary hydraulic means associated with said male die mechanism for effecting movement of the punch and mandrel relative to said carrier member.

9. In an extrusion press according to claim 7, shearing residue cut-off means comprising a yoke pivotally suspended from said punch holder to be swung into alignment with the die for urging a cut-off chisel through the extrusion residue in the die at the end of the extrusion operation.

10. In an extrusion press according to claim 8, shearing residue cut-off means comprising a yoke pivotally suspended from said punch holder to be swung into alignment with the die for urging a cut-off chisel through the extrusion residue in the die at the end of the extrusion operation.

ADOLF WEFING.