Oct. 9, 1934. K. KECK 1,976,447

HYDROMECHANICALLY OPERATED TUBE EXTRUSION PRESS

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Fig. 1

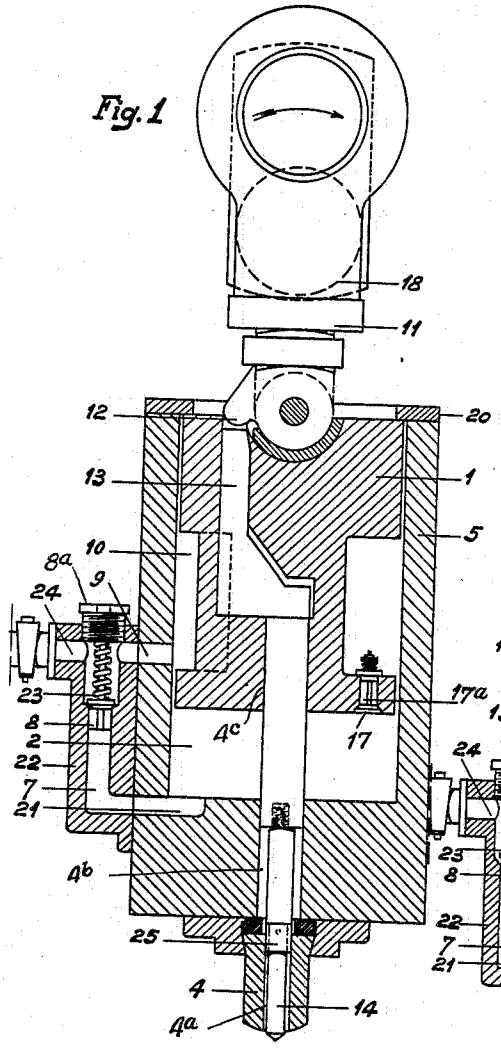
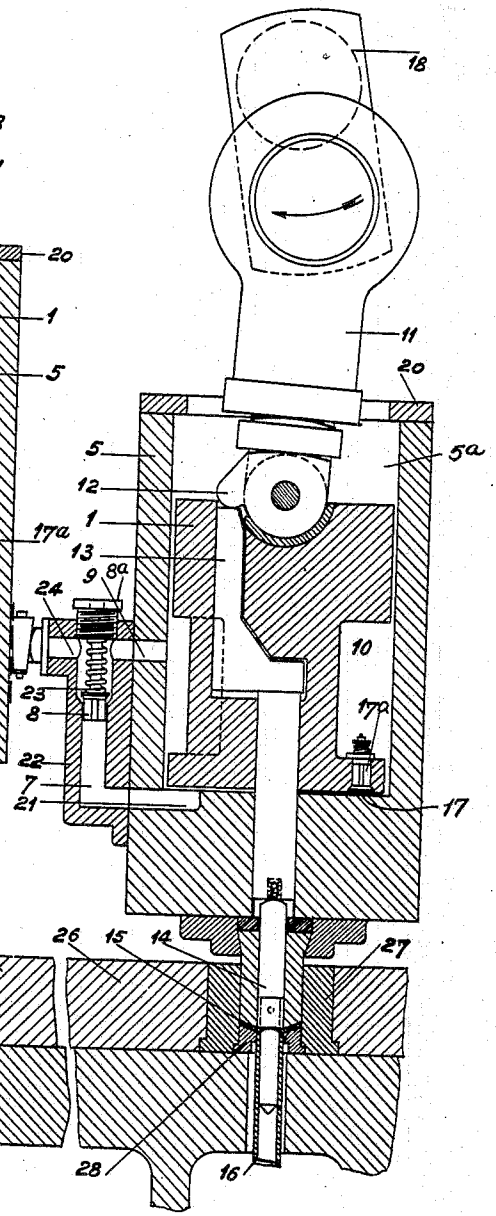


Fig. 2



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HYDROMECHANICALLY OPERATED TUBE EXTRUSION PRESS

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5 Claims. (Cl. 207—3)

The present invention relates to extrusion presses and more particularly to that type which is mechanically driven for producing hollow and solid articles, such as seamless tubes, bars and the like.

One of the principal objects of my invention is the provision of a press structure having inner and outer rams or plungers cooperating in a manner that great pressure is exerted both prior to and during the piercing operation.

Another object of my invention is to provide a structure wherein the pressure can be regulated to suit any particular case.

A further object of the invention is to provide a press structure having means for severing the waste portion or end of the extruded member.

Other objects and advantages will be apparent from the following description, annexed drawing and appended claims.

The invention accordingly comprises the elements and combination of elements, features of construction and arrangement of parts which will be exemplified in the structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, wherein like numerals designate like parts throughout,—

Figure 1 is a vertical sectional view of my invention and which shows the positions which the various parts occupy when the actuating crank is in its top dead center position.

Figure 2 is a similar view which shows the positions which the various parts occupy when the actuating or working crank has nearly reached its lower dead center position.

As shown in the several views, an outer plunger or ram member 5 is provided with a recess or bore 5*a* adapted to receive an inner plunger, ram or piston member 1. A crank shaft 18 equipped with a connecting rod 11 is connected to the inner plunger 1 and serves to operate the same in a manner as hereinafter set forth. The lower end of the connecting rod 11 which is pivotally connected to the inner plunger 1 is formed with a cam element 12.

A retaining ring 20 serves to secure the outer plunger 5 to the inner plunger 1 when the device is in the inoperative or raised position as shown in Figure 1. It will be readily understood that when the parts are in this position (shown in Fig. 1) a chamber 2 is formed between the lower face of the plunger 1 and the lower inner wall of the plunger 5, for receiving a suitable liquid, such as oil or the like.

A circumferentially arranged pocket 10 is formed in the plunger 1 and communicates with the chamber 2 by means of a connecting duct 17*a* in a check valve 17 which permits liquid to pass from the pocket 10 into the chamber 2 but prevents any liquid from passing from the chamber into the pocket.

The lower wall of the ram 5 is provided with a suitable passage 21 which connects with a corresponding passage 7 formed within a housing 22 connected to the side of the outer ram. A valve 8, capable of being regulated to operate at a predetermined pressure exerted by the liquid, permits the liquid to pass from the passages 21 and 7 into the bore 24 of the housing and the passage 9 in the outer plunger 1 and thence flows into the pocket 10. The form of valve shown is provided with a spring member 23 for keeping the valve seated and the tension of this spring is regulated by means of an adjusting screw or nut 8*a*.

Secured to the outside lower face of the plunger 5 is a press or male die member 4 having a central bore 4*a* which communicates with bores 4*b* and 4*c* located within the outer and inner plunger members 5 and 1 respectively. Positioned within these bores and carried by the inner plunger is a piercing element or mandrel 14 having an offset portion 13, the upper end of which is engaged by the cam element 12, and which is capable of vertical movement relative to the inner plunger for operation in connection with a cutting or severing operation hereinafter described.

The lower end of the mandrel 14 is reduced and is provided with a cutting ring 25 for severing or cutting off waste material from the end of the tube or bar which is formed.

A female die or bushing 27 is secured to a table or base 26 under and in alignment with the male die 4. A drawing ring 28 is secured within the lower part of the female die 27, thus enabling a metal work block 6 to be placed therein to be acted on by the die member 4 and mandrel 14. The block 6 is of a temperature suitable for hot piercing and pressing and is to be formed into a tube 16 (see Fig. 2).

The device according to the present disclosure operates as follows:

The crank being at its topmost position (see Fig. 1), the outer ram or plunger 5 is suspended from the inner ram or plunger 1 and secured thereto by means of the retaining ring 20, thus permitting the chamber 2, located between the inner and outer plunger to be filled with oil or any other suitable liquid medium. As the connecting rod on the crank shaft descends, the outer

ram is forced to follow the downward motion of the inner ram or plunger by reason of its weight, without any relative displacement of the members 1, 5 or any actuation of the valves 8 and 17 taking place. This relative position of the parts is maintained until the male die 4 descends onto and rests on the piece or block 6 to be worked upon. From this moment on, the liquid medium which is prevented from escaping by means of either the outlet or inlet valves, serves as a medium for the transmission of the motive forces from the inner ram to the outer ram or plunger, in such a manner that the male die 4 presses the work piece 6, which is at a high temperature, tightly into the bushing 27. This pressing or forcing effect terminates as soon as the resistance offered by the work piece 6 or the drawing ring 28 has raised the internal pressure of the liquid to such an extent, that this pressure is sufficient to raise the valve 8 against the pressure exerted by the said spring 23, which spring pressure has previously been adjusted to suit the working conditions, thus allowing the liquid medium to be forced into the space 10 by way of the channels or passages 24 and 9. From this moment on the outer ram or plunger ceases its downward motion, but the inner ram or plunger is still being pressed further downward assisted by the liquid which is gradually, more and more, forced into the space 10.

The piercing mandrel or punch 14 is therefore forcibly penetrating through and piercing the work piece 6, while the male die 4 presses with a constant pressure on the work piece 6 which is determined by adjustment of the pressure of the spring 23 from above. This process or operation lasts until the piercing mandrel or punch 14 has completely penetrated through the draw member or ring 28, and until the inner ram or plunger 1 rests with its lower surface on the bottom of the plunger or ram 5 and then forcibly engages it and forces it to move with it. This causes the hot material being worked upon to be spurted out through the draw ring 28 and around the mandrel 14 in the form of a tube or pipe 16. In so doing, the cutting ring 25, the outside diameter of which corresponds to the outside diameter of the tube or pipe 16 and the internal diameter of which corresponds to the bore of the draw ring 28, finally comes to rest on the waste 15 of the pierced and pressed tube or rod 16. Before the crank reaches its lower dead center position, the cam element 12 engages or strikes the mandrel extension or projection 13, and the said cutting ring then descends and cuts the pressed tube or pipe 16 off from the waste ends 15.

As the inner ram or plunger rises again, i. e., recedes upwardly, a lower pressure or partial vacuum is created in the space or pocket 2 in respect to the pressure obtaining in the space 10 directly above the inner ram or plunger, and this lowered pressure is the cause of the liquid medium, which previously was forced into the space 10, now being forced to flow back through the valve 17 into the space 2 created below the inner ram or plunger. As the stroke of the cranks approaches its termination, the inner ram or plunger engages the outer ram or plunger by reason of the former striking against the abutment ring 20 thus forcing the outer ram or plunger 5 to rise so that consequently all the working parts assume their original position when the crank is in its highest position.

The preliminary pressing action of the member 4 which takes place prior to the actual piercing and formation of the work piece or block 6, serves to tightly fill the female die or bushing 27 with the hot block 6 in such manner as to completely fill it and thereby prevent bending or flexing of the mandrel, thus, insuring a uniform thickness of the walls of the tubes 16 which are subsequently formed.

Attention is directed to the fact that by the means employed in my invention, namely, the oil or liquid filled chamber, a cushioning effect is obtained during the preliminary pressing action which permits the block 6 to readily adjust itself within the female die before the piercing operation.

Having thus described my invention, I claim:—

1. An extrusion press for making tubing and having opposed cooperating dies, a ram carrying one of said dies and movable toward the other die, said ram providing an axially disposed piston chamber, a piston in said chamber, means for limiting outward movement of the piston and to hold it and the ram assembled, operating means for said piston, fluid in said chamber and interposed between said piston and the die-carrying end of said ram, said piston having a fluid storage pocket providing a duct communicating with said chamber, a valve in said duct and opening toward said chamber whereby to seal said pocket against said fluid when the piston moves to compress the fluid, and to open when the piston moves in the opposite direction, said ram providing a fluid bypass communicating with said pocket and with said chamber, a valve in said bypass and opening toward the pocket end thereof, and yielding means acting upon said bypass valve for holding the same seated against predetermined pressures of said fluid in said chamber.

2. An extrusion press for making tubing and having opposed cooperating dies, a ram carrying one of said dies and movable toward the other die, said ram providing an axially disposed piston chamber, a piston in said chamber, means for limiting outward movement of the piston and to hold it and the ram assembled, operating means for said piston, fluid in said chamber and interposed between said piston and the die-carrying end of said ram, said piston having a fluid storage pocket providing a duct communicating with said chamber, a valve in said duct and opening toward said chamber whereby to seal said pocket against said fluid when the piston moves to compress the fluid, and to open when the piston moves in the opposite direction, said ram providing a fluid bypass communicating with said pocket and with said chamber, a valve in said bypass and opening toward the pocket end thereof, yielding means acting upon said bypass valve for holding the same seated against predetermined pressures of said fluid in said chamber, a mandrel carried by said piston and working through said ram-carried die in alignment with said other die to operatively engage the latter when the piston moves relatively of the ram and toward said dies, cooperating shoulders carried by mandrel and piston for holding the same assembled, said shoulders being spaced to admit of limited axial shifting of the mandrel relatively of the piston, the other end of said mandrel being exposed at the end of said piston remote from said dies, a waste stock severing cutter formed on said mandrel and cooperatively disposed in relation to said second die when the extrusion has been completed, and said piston-operating means having a part movable to en-

gage said exposed mandrel end to actuate it relatively of the piston whereby to cooperate with the second die to sever the waste stock from the end of the completed work.

3. In an extrusion press having a fixed female die, a ram-carried male die cooperating with the female die, a mandrel and carrier therefor, the mandrel having a waste stock cutter adapted to cooperate with said female die to sever the waste stock upon conclusion of the extrusion operation, there being operating means for the ram-carried male die and mandrel carrier; the combination of interengageable shoulders carried by said mandrel and carrier and spaced to admit of relative axial shifting movement, the rear end of said mandrel being exposed at the rear end of said carrier, and said carrier operating means providing a part movable to engage said exposed mandrel end upon completion of the extrusion operation whereby to actuate said mandrel to sever from the completed work the waste stock in said female die.

4. In an extrusion press including a female die within which waste stock is left connected to the work upon completion of the extruding operation, a mandrel, a carrier therefor, a waste stock cutter on said mandrel cooperable with said die, an operating crank, a connecting rod connecting said crank and carrier for actuating the same, axially spaced interengageable shoulders on said carrier and mandrel for holding the same operatively assembled, the spacing of said shoulders admitting of limited relatve axial shifting movement of the mandrel with respect to the carrier, and means carried by said connecting rod and operatively engaging said mandrel following completion of the extruding process for shifting said mandrel relatively of its carrier for severing the waste stock from the finished work.

5. In an extrusion press including a female die within which waste stock is left connected to the work upon completion of the extruding operation, a mandrel, a carrier therefor, a waste stock cutter on said mandrel cooperable with said die, an operating crank, a connecting rod connecting said crank and carrier for actuating the same, axially spaced interengageable shoulders on said carrier and mandrel for holding the same operatively assembled, the spacing of said shoulders admitting of limited relative axial shifting movement of the mandrel with respect to the carrier, said mandrel having a portion exposed adjacent said connecting rod, and a cam on said connecting rod and positioned to operatively engage said exposed mandrel end for actuating the mandrel relatively of the carrier upon completion of the extruding process to cause said cutter to operate.

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