Nov. 24, 1942. P. C. POCOCK 2,302,953

METHOD OF METAL STRETCHING, USING BLANK-HOLDER TYPES OF PRESSES

Filed July 23, 1940 2 Sheets-Sheet 1

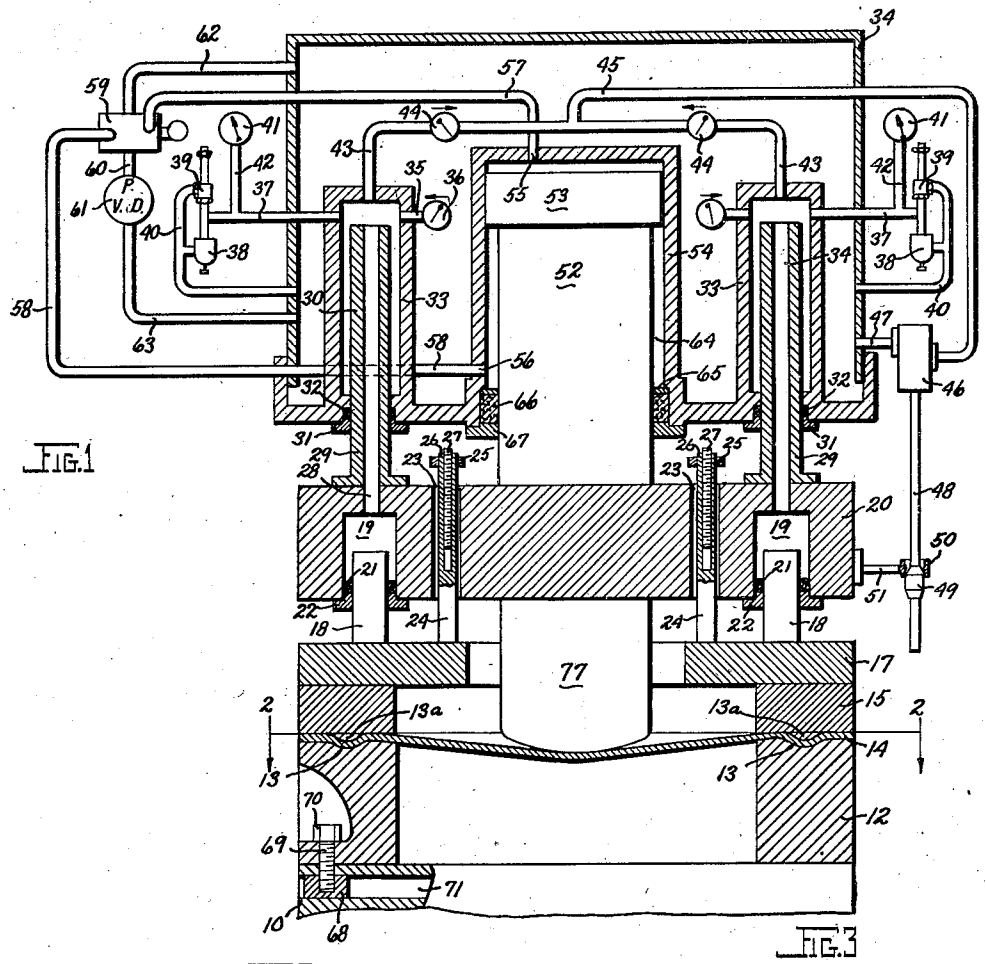


FIG. 1

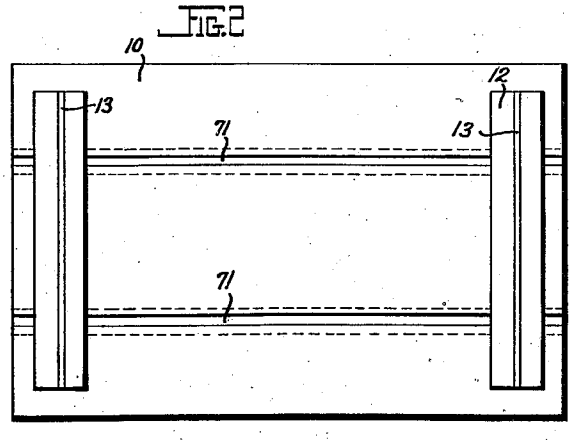


FIG. 2

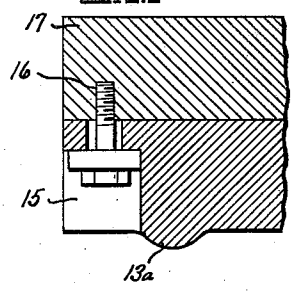


FIG. 3

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FIG. 5

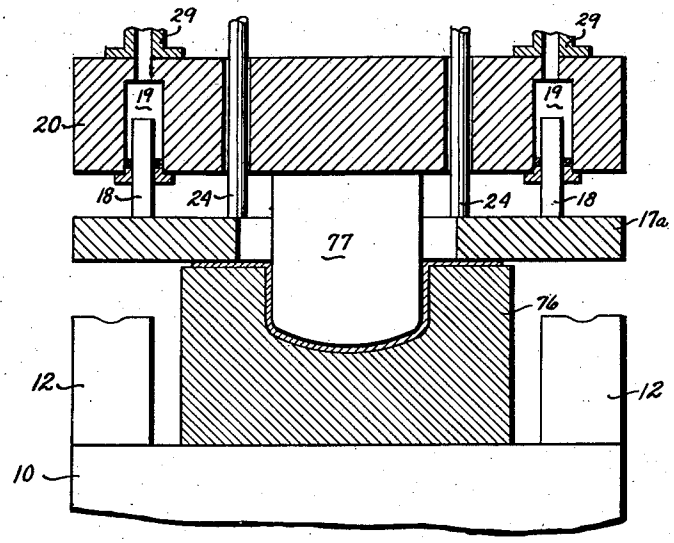


FIG. 6

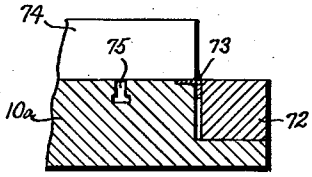


FIG. 7

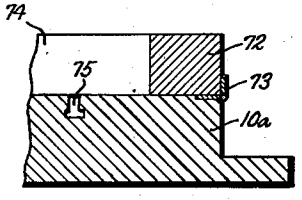
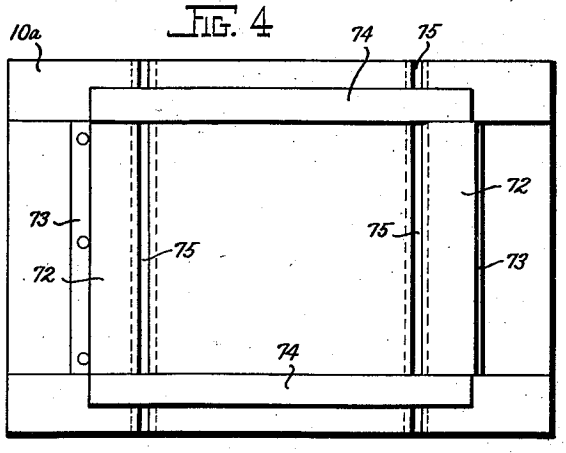


FIG. 4



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METHOD OF METAL STRETCHING, USING BLANK-HOLDER TYPES OF PRESSES

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Application July 23, 1940, Serial No. 346,944

4 Claims. (Cl. 153—48)

This invention relates to metal stretching and to presses therefor.

Various methods have been used for metal stretching in connection with manufacturing sheets as well as fabricated parts. However, heretofore specially designed machines were necessary for carrying out the said methods.

Therefore, it is an object of this invention to provide a new method of metal stretching which does not require matching dies and may be carried out on standard blankholder presses.

Another object of the invention consists in providing a blankholder press which may selectively be used for metal stretching or metal drawing.

It is a further object of the invention to provide a blankholder press, the bed of which may adjustably receive work pieces supporting members adaptable to various sizes of work pieces to be shaped.

A still further object of the invention is to provide a press of the type set forth in the preceding paragraph, in which the supporting members for the work pieces to be shaped may be used in connection with various blankholders for drawing as well as stretching or, if desired, without removal thereof, may be adjusted so as to allow the arrangement of matching dies on the press bed for drawing or stretching.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Figure 1 diagrammatically illustrates an embodiment of the invention.

Figure 2 is a section along the line 2—2 of Figure 1.

Figure 3 illustrates the connection of a work piece holding member to the blankholder.

Figure 4 illustrates a further embodiment of the invention.

Figure 5 shows the arrangement of Figure 4 so adjusted as to allow the mounting of a matching die on the press bed.

Figures 6 and 7 show details of the arrangement of Figure 4.

General arrangement

According to the present invention, a frame or spaced supporting members for the work piece are mounted on the press bed and the punch or form on which the metal is to be stretched is placed on the face of the pressing platen. With the press open and the blankholder extended, the sheet to be stretched is placed on top of the frame or supporting members, whereupon the blankholder is lowered so as to grip the sheet between the face of the blankholder and the top of the frame or supporting members. With the blankholder holding the work piece in this position, the pressing platen pushes the form down into the sheet and forms or stretches the metal around the punch. Although in many cases the work piece may be held fast at its rim portions by exerting a correspondingly great clamping pressure on the blankholder, it may be desirable to put recesses or elevations in the surface around the edge of the frame or supporting members and corresponding recesses or elevations on the face of the blankholder or the holding members connected therewith to keep the edges of the sheet from slipping while the piece is being stretched. The provision of such recesses and elevations makes it possible to reduce the clamping pressure.

According to the method of the invention, no bottom matching die is necessary, and the punch or stretching form may be made of any responsive material that will stand the stretching pressure.

To facilitate the universal use of a standard blankholder press for stretching as well as drawing, the supporting members for the work piece are, according to the invention, arranged on the press bed so as to allow a simple adjustment thereof, either to adapt the said supporting members to various sizes of a work piece to be shaped or to permit the arrangement of a matching die on the press bed for normal drawing operation.

When the supporting members for the work piece are provided with recesses, while the blankholder or the clamping members connected therewith are provided with elevations, the supporting members may also be used for supporting the work piece during a drawing operation, in which case only the blankholder or clamping members connected therewith are to be exchanged.

Structural arrangement

Referring to the drawings in detail, Figure 1 shows diagrammatically a hydraulic metal shaping press having a press bed 10 connected to the press head 11 by means of strain rods, not shown in the drawings. Mounted on the press bed 10 are supporting members 12 with cavities 13 therein for receiving and supporting the work piece 14. Cooperating with the supporting members 12 are clamping members 15 connected in any convenient manner, for instance by screws 16 (see

Figure 3), to the blankholder or clamping platen 17 and provided with an elevation 13a in correspondence to the recess 13 of the supporting members 12. It is, of course, understood that the elevations and recesses are by no means indispensable and that, instead thereof, the opposing surfaces of the members 12 and 15 may be corrugated in any desired manner. In many cases the opposing surfaces of the members 14 and 15 may even be smooth providing that, if a stretching operation is desired, a corresponding high pressure can be exerted upon the blankholder 17 so as to prevent sliding movement of the work piece.

The clamping platen 17 has connected therewith clamping plungers 18 extending into clamping cylinders 19 provided in the pressing platen 20. Each clamping cylinder 19 is provided with a packing 21 and gland 22 for preventing leakage from said clamping cylinders.

The pressing platen 20 is provided with bores 23 adapted to receive the rods 24, the lower ends of which are secured to the blankholder or clamping platen 17, and the upper ends of which are provided with nuts 25 threaded thereon. The upper ends of the rods 24 are also provided with threaded sockets 26 in which are inserted the threaded rods 27. This arrangement enables an adjustment of the effective length of the rods 24 and enables the point at which these rods 24 serve as knock-out rods to be varied as desired.

The clamping cylinders 19 are provided with passages 28 leading into tubular plungers 29 mounted upon the upper side of the pressing platen 20 and having bores 30 therethrough. The hollow plungers 29 pass through glands 31 and packings 32 compressed thereby into cylinders 33 arranged in the press head 11 and within the surge tank 34, filled with fluid, and mounted on top of the press head. From each cylinder 33 leads a conduit 35 through a check valve 36 to the interior of the surge tank 34. Each check valve 36 opens in the direction of the cylinders 33 so that the latter may draw in fluid upon the descent of the hollow plungers 29. The check valves 36, however, will close upon the ascent of the plungers 29.

From each cylinder 33 leads also a T-shaped conduit 37 to a safety valve 38 and a pressure relief valve 39. These valves 38 and 39 discharge into the discharge conduit 40 leading to the interior of the surge tank 34. A pressure gauge 41 is connected with each conduit 37 by a conduit 42 to indicate the pressure existing in the clamping cylinders 19. Extending from each cylinder 33 is a conduit 43 having therein a check valve 44 opening in a direction away from the adjacent cylinder 33. Beyond the check valves 44 the conduits 43 join a common conduit 45 leading to a normally open valve 46 having a discharge conduit 47 leading therefrom to the surge tank 34. The valve 46 is provided with a valve rod 48 having an adjustable stop 49 thereon adapted to be engaged by the end 50 of a platen arm 51 secured to the pressing platen 20.

Connected with the pressing platen 20 is the double-acting pressing plunger 52 having a piston head 53 thereon. The piston head 53 is reciprocably mounted in the pressing or main cylinder 54 associated with the press head 11. The main cylinder 54 is provided with upper and lower ports 55 and 56 on opposite sides of the piston head 53 and adapted, by means of conduits 57 and 58, to supply pressure fluid to advance or retract the plunger 52, according to the manner in which the four-way valve 59 is manipulated. This valve 59 may be of any suitable type known to those skilled in the art and forms no part of the present invention.

Leading from the four-way valve 59 is the pressure conduit 60 connected at its opposite end to the pump 61. A discharge conduit 62, also connected to the four-way valve 59, leads into the interior of the surge tank 34. The pump 61 is also provided with a suction line 63, likewise leading into the interior of the surge tank 34. The main cylinder 54 is provided, near the mouth of its bore 64, with a packing ring 65, beyond which is a packing 66 adapted to be compressed by a gland 67 so as to prevent leakage around the plunger 52.

As will be seen from Figures 1 and 2, the supporting members 12 are slidably mounted on the press bed 10 by means of slide blocks 68 and bolts 69 with nuts 70. The slide blocks 68 are adapted to slide in T-slots 71 in the press bed.

While in the embodiment of Figures 1 and 2 only two supporting members 12 are shown, which would be quite sufficient if metal strips are to be stretched, it is, of course, understood that also supporting members connecting the supporting members 12, or arranged therebetween, may be provided. To this end, a hollow cast iron frame may be set on the bed of the press and connected therewith, or the arrangement of Figure 4 may be selected. According to Figure 4 the transverse supporting members 72 are hinged by means of a hinge 73 to the press bed 10a, whereas the longitudinal supporting members 74 are slidably mounted in T-slots 75 provided in the press bed 10a. In this instance it is possible to use only the supporting members 74 in which case the supporting members 72 are lowered, as indicated in Figure 6, or, if desired, the supporting members 74, together with the supporting members 72, may be employed. In the last mentioned instance the supporting members 72 are lifted, as indicated in Figure 7, so as to lie between the supporting members 74. The supporting members 74 may be held in their desired position in a similar manner as the supporting members 12 shown in Figures 1 and 2.

If it is desired to effect a normal drawing operation or a stretching operation with matching dies, it is merely necessary to move the supporting members apart from each other so as to be able to insert therebetween the lower die 76, as indicated in Figure 5.

Operation

In the operation of the form of press shown in Figure 1, the pump 61 is started in any convenient manner and delivers pressure fluid to the four-way valve 59 which, in turn, is set to deliver pressure fluid through the conduit 57 and port 55 into the space above the piston head 53. This pressure forces the pressing plunger 52 and the pressing platen 20 connected therewith downwardly, carrying with them the blankholder or clamping platen 17 with the clamping members 15 and the hollow plungers 29. The suction thereby created in the cylinders 33 opens the check valves 36 and causes fluid to be drawn into the cylinders from the surge tank 34. When the blankholder or clamping platen 17 descends to a point where the clamping members 15 connected therewith engage the work piece 14, however, a relative motion occurs between the now halted blankholder 17 and the pressing platen 20 as the latter continues to advance and move its draw-

ing die or punch 77, supported by the platen 20, into engagement with the work piece 14.

Pressure thus accumulates in the clamping cylinders 19 and is transmitted through the passages 28 of the hollow plungers 29 into the cylinders 33. Normally, this pressure would be free to pass through the conduits 43, check valves 44, conduit 45, normally open valve 46 and conduit 47 into the surge tank 34. By this time, however, the platen 20 has descended to a point where the end 50 of the platen arm 51 has engaged the stop and moves the valve rod 48 downwardly, thereby closing the normally open valve 46 and cutting off this means of escape for the fluid from the cylinders 33. The check valves 36 in the conduits 35 also close against the pressure in the cylinders 33. This leaves the conduits 37 as the sole means of escape for the fluid. Consequently, when the pressure in each conduit 37 exceeds the setting of its relief valve 39, the latter will open and discharge fluid through its discharge conduit 40 into the surge tank 34. In the event that the pressure relief valve 39 jams, or fails for other reasons, the safety valve 38, which is set for a higher pressure, will open and discharge the fluid thereby preventing damage to the press. By adjusting the relief valves 39 to discharge at different pressures, the clamping cylinders 19 and the clamping plungers 18 may be caused to exert different clamping pressures on the periphery of the work piece 14 so that selectively the rim portion of the work piece 14 may be clamped, either so as to allow a sliding movement thereof or not to allow such sliding movement, depending on whether a drawing or stretching operation is desired. It is, of course, also possible to adjust the individual relief valves so as to cause the blankholder to apply different amounts of pressure to different points on the periphery of the work piece. In this instance, the check valves 44 prevent the equalization of pressure between the several cylinders 33. Consequently, the intensified pressure built up in the clamping cylinders 19 acts against the clamping plungers 18 to clamp the work piece 14. At the same time a portion of this pressure fluid passing through the bore 28 of each hollow plunger 29 acts against the annular top surface thereof and urges each plunger 29 in a downward direction, thereby assisting the action of the main plunger 52, which causes the punch 77 to shape the work piece 14.

As soon as the shaping operation has been completed, the operator shifts the four-way control valve 59 to cause the pump 61 to discharge pressure fluid through the conduit 58 into the space beneath the piston head 53. This pressure raises the pressing plunger 52 and the platen 20, together with the hollow plungers 29. At the start of this operation, however, the platen arm 51 is still holding the normally open valve 46 in a closed position, hence, the plungers 29 cannot return against the pressure already built up in the cylinders 33 without displacing fluid into the clamping cylinders 19 within the platen 20. This pressure fluid, so displaced, acts against the clamping plungers 18 and tends to separate the platen 20 and the blankholder 17 until both have traveled a distance sufficient to enable the platen arm 51 to release the stop 49 upon the valve rod 48 and permit the valve 46 to resume its normal open position, for instance, by means of a spring urging said valve toward open position. When this occurs the fluid can escape from the cylinders 33 through the conduit 43, the check valves 44 and the conduit 47 into the surge tank 34, permitting the entire assembly to execute its return stroke. The adjustable arrangement shown on the rods 24 serves to separate the platen 20 and the blankholder 17 in a positive manner in case both of these should be held together by reason of the work piece 14 adhering to the drawing die or punch 77. The work piece 14 may then be removed and, after the replacement of a new work piece therefor, a new cycle may be started.

As previously mentioned if, instead of the stretching operation illustrated in Figure 1, a drawing operation is to be performed, the supporting members 12 are moved away from each other so as to allow the insertion of a lower die 76, as illustrated in Figure 5. The platen 17 is then replaced by a platen 17*a*, while the operation of the press is the same as described in connection with Figure 1.

Although the present invention has been described in connection with a blankholder press of the type shown in Figure 1 it is, of course, understood that any other type of blankholder press may be used in connection with the present invention. By a "blankholder press" is meant a press having a stationary base member for supporting a blank, a hydraulic cylinder, a plunger therein, a platen operated by the plunger and the usual clamping piston and cylinder assemblies.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination in a press, a press bed, supporting members mounted on said press bed for supporting rim portions of a work piece, said supporting members being hinged to said press bed so as selectively to allow movement of said supporting members into a position substantially flush with the upper surface of said bed or into a position protruding beyond said upper bed surface for spacing a work piece therefrom, a pressing platen, and a blankholder operatively connected with said pressing platen, said blankholder being provided with clamping portions for selectively clamping rim portions of a work piece against said supporting member.

2. In combination in a press, a press bed, a supporting frame for supporting rim portions of a work piece, said frame having two pairs of side members, one pair of which is hinged to said bed and adapted selectively to be moved into a recess in said bed, while the other pair of said side members is detachably connected to said bed and movable in a direction transverse to the side members of said first pair, a pressing platen, a punch supported by said pressing platen for shaping a work piece, and a blankholder operatively connected with said pressing platen and provided with clamping members for selectively clamping rim portions of a work piece against said frame.

3. In combination in a press, a press bed, spaced supporting members movable relative to each other and connected with said bed for supporting a metal sheet, each of said supporting members having a substantially plane surface portion and a grooved surface portion, said grooved surface portion being adapted selectively to receive a rim portion of said metal sheet, a press platen for subjecting said metal sheet to

a shaping operation, a reciprocable blankholder having a substantially plane surface adapted to clamp a rim portion of said metal sheet against said plane surface portion of said supporting means so as to permit a limited sliding movement of said metal sheet relative to said blankholder during the shaping operation, and holding means detachably connected to said plane surface of said blankholder and adapted to enter said grooved surface portions of said supporting members for holding said metal sheet clamped therebetween so as selectively to prevent said clamped metal sheet portion from sliding.

4. A method of metal stretching on a hydraulic blankholder press, which comprises the steps of placing a work-piece upon spaced supporting members, preliminarily engaging the workpiece on adjacent marginal portions thereof to hold the same in proper position, exerting stretching pressure on that part of the workpiece between and spaced from said supporting members without supporting the center portion of said workpiece, while simultaneously conveying a portion of the stretching pressure to the workpiece to greatly increase the clamping pressure on the marginal portions of the workpiece and causing deformation of at least a part of the marginal portions of the workpiece to hold the latter in clamped immovable position during the stretching operation.

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