

June 12, 1945.

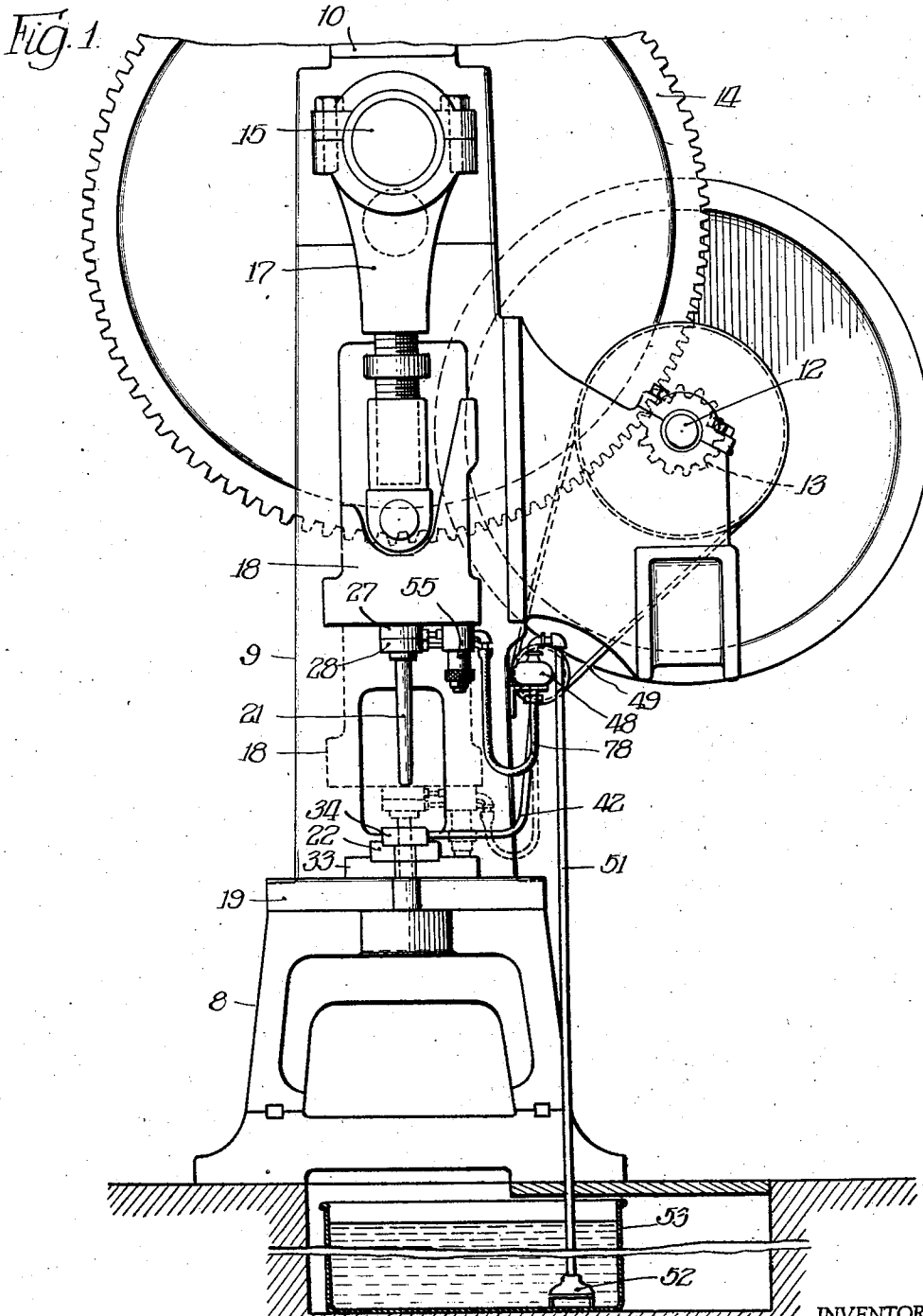
C. M. EASON

2,378,068

HYDRAULIC STRIPPER FOR PUNCH PRESSES

Filed June 8, 1942

2 Sheets-Sheet 1



INVENTOR.

Clarence M. Eason,

BY

Brown, Jackson, Butler & Dineen

attys at

June 12, 1945.

C. M. EASON

2,378,068

HYDRAULIC STRIPPER FOR PUNCH PRESSES

Filed June 8, 1942

2 Sheets-Sheet 2

Fig. 2.

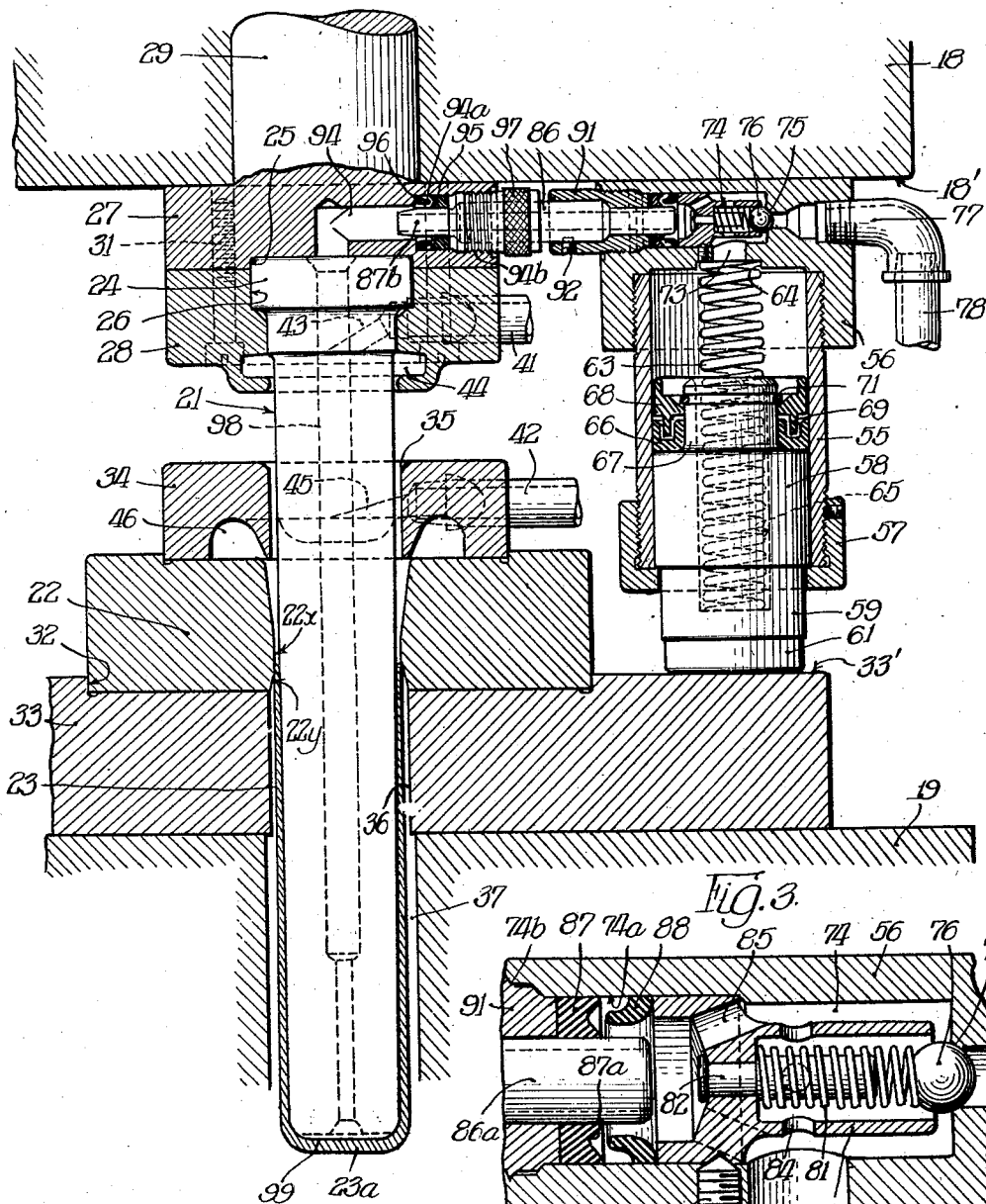
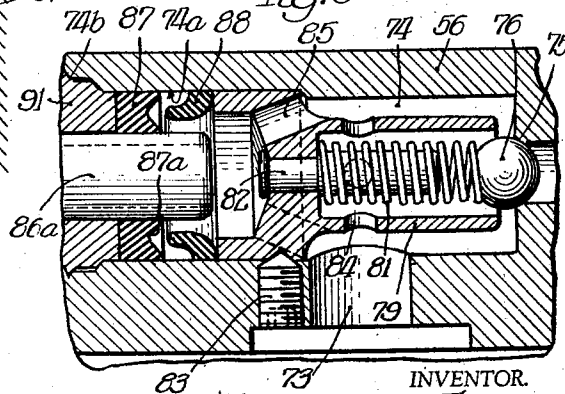


Fig. 3.



INVENTOR.

Clarence M. Eason,

BY

Brown, Jackson, Britton & Nienke
attys.

UNITED STATES PATENT OFFICE

2,378,068

HYDRAULIC STRIPPER FOR
PUNCH PRESSES

Clarence M. Eason, Waukesha, Wis.

Application June 8, 1942, Serial No. 446,311

7 Claims. (Cl. 113—50)

The present invention relates to hydraulic stripping mechanisms for punch presses and the like.

In performing deep drawing operations in a punch press, it is frequently difficult to effect mechanical release of the drawn blank from the punch upon the completion of the drawing operation without causing excessive mutilation of the upper edge of the blank where the mechanical stripper engages the blank. This is particularly true when performing deep drawing operations on tubular shells, such as steel cartridge cases, where the punches used in the last one or two draws have only a very slight taper and hence have a tighter binding action. Steel shells appear to be more difficult to strip from the punches than brass shells, and it may require the exertion of several thousand pounds pressure on the steel shell to strip it from the last punch. When the stock has been drawn down to a shell of very thin wall, the exertion of a high stripping pressure as a mechanical force against the upper edge of this thin walled shell is very likely to mutilate the upper edge of the shell so badly as to require that a considerable portion of the upper edge of the shell be cut off as waste scrap. This difficulty of mechanical stripping and resultant mutilation of the shells are entirely avoided by my improved hydraulic stripping mechanism.

The general object of the present invention is to provide improved hydraulic stripping mechanism which will strip the shell from the punch by the exertion of a hydraulic pressure between the lower end of the shell and the punch.

It is a further object of the invention to provide an improved hydraulic stripper characterized by a pressure cylinder which is arranged to respond to motion of the press ram, whereby an extremely high hydraulic pressure is only exerted for a brief interval on the shell, and whereby this hydraulic stripping pressure is timed to occur automatically just as soon as the shell has cleared the drawing die.

Another object of the invention is to provide an improved hydraulic stripper which is combined as a part of the conventional cooling and lubricating system which circulates the cooling and lubricating oil between and over the die parts. A portion of this cooling and lubricating oil is utilized as the hydraulic medium in each stripping operation, and hence the same lubricating medium performs the three-fold function of cooling, lubricating and stripping.

Other objects, features and advantages of the

invention will appear from the following detailed description of one preferred embodiment thereof. In the accompanying drawings illustrating such embodiment:

5 Figure 1 is a fragmentary vertical axial sectional view taken on a fore and aft plane through a conventional drawing press, showing my improved hydraulic stripping mechanism applied thereto;

10 Figure 2 is a detail sectional view on a larger scale through the stripping mechanism; and

Figure 3 is a detail sectional view on a larger scale showing the inlet valve and associated parts at the upper end of the hydraulic cylinder.

15 Referring to Figure 1, the press is of any conventional construction comprising the usual bed or base structure 8 formed with upwardly extending sides 9 and a crosshead 10. These presses are usually back-gearred to be driven from a back countershaft 12 carrying a pinion 13 which drives a large bull gear 14 at one end of the crank shaft 15. The crank on the crank shaft reciprocates a pitman 17 which reciprocates a ram 18 upwardly and downwardly along 20 vertical guideways formed on the side frame members 9.

The two die members which perform the drawing operation are carried by the ram 18 and the stationary bolster or bed plate 19. For the 30 purpose of illustrating a typical deep drawing operation where my improved hydraulic stripper is of greatest utility, I have shown the punch press as being equipped with a punch 21 and a die 22 adapted to perform one of the last drawing operations on a 37 millimeter steel cartridge case, indicated at 23. It will be understood that I have chosen this construction and arrangement of die parts primarily for the purpose of apt illustration, and that the invention is not 40 essentially limited thereto. The drawing portion of the punch 21 has a relatively slight taper diminishing down towards its lower end, and the upper end of the punch is formed with a head flange 24. This flange is clamped in matching 45 cylindrical sockets 25 and 26 formed in the opposing faces of a punch holder 27 and a punch flange 28. The punch holder 27 may be releasably secured to the ram 18 through the instrumentality of an upwardly extending shank portion 29 which is detachably anchored in the ram, and the flange or cap member 28 is releasably 50 secured to the punch holder 27 by the cap screws 31.

The circular die 22 sets in a recessed opening 55 32 formed in the upper surface of a die shoe plate

33 which is suitably anchored to the bolster or bed plate 19. Seated in a recessed opening in the upper surface of the die 22 is a gauge ring 34. The throat of the drawing die 22 is formed with an upper drawing or forming portion 22x where the actual drawing operation is performed, and is also formed with a lower clearance portion 22y where the upper end of the shell 23 is cleared or freed of the drawing die. Openings 35, 36 and 37 are formed in the members 34, 33 and 19, respectively, in alinement with the die throat 22x for permitting the drawn shell 23 to be passed down through the assembly and to be ejected from the bottom side of the bolster or bed 19.

It is customary to supply a liquid coolant in the form of lubricating oil to the punch 21 and die 22 during the drawing operation, as illustrated by the inlet ducts 41 and 42 leading to the cap member 28 and to the gauge ring 34. The pipe 41 communicates through a lateral bore 43 with an annular discharge channel 44 formed in the cap member 28 around the shank of the punch 21, this channel causing the oil to flow down uniformly around the entire outer surface of the punch. The other pipe 42 similarly communicates through a lateral duct 45 with a distributing channel 46 formed in the under surface of the gauge ring 34, this channel distributing the oil uniformly down around the drawing throat 22x and over the exterior surfaces of the shell 23. The oil conduits 41 and 42 receive oil from the pressure pump 48 (Fig. 1) which is arranged to be driven from the countershaft 12 in any suitable manner, such as through the driving belt 49. The conduit 41 leading to the punch 21 is of flexible construction, or comprises a flexible length, to accommodate the vertical movement of the punch and ram. The pump 48 draws its supply through a suction pipe 51 which leads down to a strainer and foot valve 52 located in an oil sump 53 which may be recessed into the floor below the base of the punch press, whereby overflow of the oil occurs back into the sump.

Referring now to the hydraulic stripping mechanism, this comprises a hydraulic cylinder 55 which is secured directly to the under side of the ram 18, preferably in rear of the punch 21, as shown in Figure 1. The upper end of the cylinder screws into a mounting base 56 which is bolted to the under surface 18' of the ram 18. A retainer cap 57 screws over the lower end of the hydraulic cylinder 55 for retaining the piston 58 from outward displacement at the lower end of the cylinder. The piston is formed with a reduced extension 59 passing down through the aperture in the cap 57, and provided with a striking head 61 at its lower end. This striking head 61 is adapted to strike the upper surface 33' of the die shoe 33 substantially at that instant in the downward stroke of the ram 18 when the punch 21 has drawn the upper end of the shell 23 just past the drawing throat 22x and into the clearance space 22y. If desired, the striking head 61 may be composed of relatively hard rubber, fiber or other material effective to minimize the noise of impact. A compression spring 63 normally tends to hold the piston 58 at the bottom of its stroke against the closure ring 57, the upper end of this spring being seated in a counterbore 64 in the mounting base 56 and the lower end of the spring extending down into a central bore 65 formed in the piston 58.

The upper end of the piston 58 carries a packing ring 66 which is confined between the wall

of the cylinder and a cylindrical extension boss 67 extending upwardly from the piston. Such packing ring is preferably in the form of a Neoprene washer of substantially U-shaped cross-section. The washer or ring is maintained in proper position by an annular retainer 68 formed with a downwardly extending annular flange 69 which projects into the annular recess formed in the upper side of the packing ring 66. Upward movement of the retainer 68 along the central boss 67 is limited by a snap type of locking ring 71 which snaps into an annular groove formed in the upper portion of the boss 67.

The confining ring 68 serves to loosely confine the Neoprene ring 66 substantially in the position shown, with the inner and outer lips of this sealing ring bearing against the piston extension and against the cylinder wall, the confining ring 68 not exerting any mechanical pressure, however, against the Neoprene sealing ring.

Oil enters and leaves the cylinder 55 through an axial port 73 extending upwardly in the mounting block 56 and opening into a passageway 74 extending horizontally in the mounting block. The right hand end of the passageway 74 is formed with an inlet valve seat 75 against which a spring pressed inlet check valve 76 is adapted to seat. The inlet port 75 has connection through a suitable elbow fitting 77 with a flexible conduit 78 which extends to the oil pump 48, the flexibility of the conduit 78 accommodating the rise and fall of the mounting block 56 with the ram 18. As shown in Figure 3, the motion of the ball check valve 76 is confined within a valve cage 79, which also confines the compression spring 81 which bears against the valve. A stud 82 carried by the cage limits the unseating motion of the valve. The cage 79 is held in place in the bore 74 by a set screw 83. Ports 84 and 85 in the body of the cage 79 conduct oil from the passageway 73 and from intake port 75 to the right hand end of a coupling tube 86. A Neoprene sealing ring 87 surrounds the reduced right hand end 86a of the coupling tube, and has its outer surface seating in a counterbore 74a coextensive with the bore 74. The sealing ring 87 is formed with a V-shaped groove 87a in its pressure side to form inner and outer annular sealing lips, substantially comparable to the inner and outer sealing lips of the piston packing ring 66. Disposed between the cage 79 and the sealing ring 87 is a confining ring 88 which loosely confines the sealing ring 87 against endwise displacement, this confining ring being formed with a laterally projecting flange which is effective to engage in the V-shaped groove in the sealing ring. An outer coupling 91 surrounds the coupling tube 86 and screws into a threaded counterbore 74b formed in the mounting block 56, this coupling backing up the sealing ring 87. The coupling 91 is preferably anchored to the coupling tube 86 by a set screw 92.

The left hand end of the coupling tube 86 is adapted to have connection with the punch 21 through a passageway 94 formed in the punch holder 27. Another Neoprene sealing ring 95, similar to the sealing ring 87, has a sealing fit between the reduced left hand end 87b of the coupling tube and a counterbore 94a extending from bore 94. A confining ring 96, similar to the confining ring 88, loosely confines the sealing ring 95 against objectionable endwise displacement. A bushing 97, similar to the bushing 81, engages over the left hand portion of the coupling tube and screws into a threaded counter-

bore 94b in the punch holder 27. The oil is conducted from bore 94 into an axial passageway 98 which extends down through the entire length of the punch 21. The lower end of the passageway 98 opens into the small space 99 which always remains between the lower end of the punch 21 and the transverse bottom wall 23a of the shell 23. I have shown the punch 21 as having a very slight taper, such as would be used in performing the last one or two drawing operations on the shell. In the exemplary proportions illustrated, the taper of the punch is such that the side wall thickness at the upper end of the shell is extremely thin, approximately one half of the side wall thickness at the lower end of the shell.

In the operation of the stripping mechanism, oil is supplied to the hydraulic cylinder 55 from pump 48 at pressures typical of the discharge pressures of these gear pumps, i. e., somewhere between say 10 pounds and 60 pounds per square inch. This pressure is effective on the piston 58 and assists the spring 63 in keeping the hydraulic cylinder distended. This pressure also transmits oil past the check valve 76 and on through the coupling tube 86 to the passageway 98 extending down through the punch 21. This flow of oil through the punch, occurring before the actual stripping operation, tends to cool the punch and lubricate the punch and blank in the drawing operation. As previously described, this cooling and lubricating flow of oil also occurs through the conduits 41 and 42 for lubricating the outer surface of the blank and for lubricating the forming throat of the die 22 during the drawing operation. As the ram 18 moves downwardly and the punch 21 forces the blank 23 down through the drawing die 22, the hydraulic cylinder 55 moves down concurrently with the ram through an idling travel. As soon, however, as the upper end of the blank 23 has cleared the drawing throat 22x and is in or below the clearance area 22y, the striker head 61 of the piston 58 strikes the upper surface 33' of the die shoe plate 33. Thereupon, continued downward movement of the ram 18 causes relative upward travel of the piston 58 within the cylinder 55 and exerts a tremendous pressure on the oil contained within the cylinder. It will be evident that it is possible to obtain an extremely high pressure within the cylinder because drawing presses capable of drawing these steel shells have a capacity ranging anywhere from 150 to 350 tons, and any portion of this capacity is available for creating pressure within the cylinder 55 at this instant because the drawing operation on the blank has been completed and no further downward pressure need be exerted on the punch. A pressure ranging from 10 tons to 20 tons is adequate on the hydraulic cylinder 55 for average working conditions, these pressures creating fluid pressures in the oil in the neighborhood of 3000 pounds to 6000 pounds per square inch for average working conditions. It will be understood that these pressures and proportions are merely illustrative and the invention is not necessarily limited thereto. These fluid pressures are transmitted through the coupling tube 86 and passageway 98 to the space 99 between the lower end of the punch and the lower end of the shell. These extremely high pressures are effective to instantly free the shell from the punch, even against the most adverse circumstances of drawing steel shells on punches of very slight taper. The parts may be so proportioned with respect to stroke of ram, stroke of hydraulic cylinder, etc., that the extremely

high pressures generated within the cylinder are transmitted through the punch over a sufficient interval to perform the entire stripping operation; or the parts may be so proportioned that these extremely high pressures are of shorter duration for the purpose of breaking the extremely high adhesion between the punch and the blank, following which the much lower pressures transmitted from the pump 48 are utilized to complete the final operation of sliding the shell downwardly off the end of the punch.

It will be evident that my improved hydraulic stripping mechanism exerts no endwise pressure whatever against the extremely thin wall at the upper end of the shell. Hence, there is no stripping mutilation of the upper end of the shell. Because it is not necessary to cut off a substantial portion of the upper end of the shell, as is usually true when stripping the shell by mechanical stripping mechanism, it follows that a shorter length of draw may be employed, which means that a shorter length of press or a shorter throw of crank may be used. This is all in addition to the reduced expenditure of energy involved in the shorter length of draw and the avoidance of the considerable portion of scrap waste which must be cut from the upper end of a mutilated shell. My improved hydraulic stripping mechanism may be employed in the performance of several of the end drawing operations, particularly where the shell has been drawn down to such a thin wall that mechanical stripping mechanism is very likely to damage the upper edge of such thin wall.

While I have illustrated and described what I regard to be a preferred embodiment of the invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention. For example, while the feed of the oil from a positive pressure pump, such as the pump 48, is desired under most operating conditions, it will be understood that the oil might be supplied to the cylinder 55 from a gravity head reservoir, from an air chamber, or from any other suitable source of supply. The mechanism may also be provided with automatically actuated valves for automatically stopping and starting the flow of oil at predetermined times, i. e., for example, to shut off the flow through the punch during the time that the ram 18 is at top dead center whereby the next shell to be drawn can be set over the punch without the objection of cooling oil splashing over the parts and over the operator. If desired, this automatic valve arrangement might also be arranged to shut off the die coolant liquid so that the entire volume of the pump 48 would be forced through the punch 21 while the punch is being withdrawn from the shell, i. e., for about $\frac{3}{4}$ of an inch above lower dead center. The automatic valve arrangement could be such that both the oil line to the punch and the oil line to the die would be opened up to the full capacity of the pump after the punch had passed the above point, so as to get the maximum cooling effect of the oil on the punch and on the die.

I claim:

1. In a punch press comprising a reciprocating ram, the combination of punch and die members adapted to be moved toward and from each other by the reciprocation of said ram for drawing a metallic blank, means for circulating a cooling liquid through one of said members, and hydrau-

lic stripping means for utilizing said liquid to release the blank from said latter member, said hydraulic stripping means comprising a hydraulic cylinder responsive to said ram for creating a momentary high pressure surge in said flow of cooling liquid to release the blank from said member.

2. In a punch press comprising a reciprocating ram, the combination of punch and die members adapted to be moved toward and from each other by the reciprocation of said ram for drawing a metallic blank, a pump for circulating a cooling or lubricating liquid through said punch member, a hydraulic cylinder responsive to the motion of said ram for creating an augmented pressure in said liquid to utilize the liquid for stripping the metallic blank from said punch member, and a check valve for preventing such augmented pressure being transmitted back to said pump.

3. In a punch press comprising a reciprocating ram, and bed, the combination of punch and die members carried by said ram and bed and adapted to perform a drawing operation on a metallic blank, a hydraulic cylinder and piston mounted on said ram and adapted to engage a striking surface on said bed to create a high hydraulic pressure in said cylinder in predetermined timed relation to the completion of the drawing operation, and means for utilizing the hydraulic pressure created in said cylinder for stripping the blank from said punch member.

4. In a punch press comprising a reciprocating ram and bed, the combination of punch and die members carried by said ram and bed and adapted to perform a drawing operation on a tubular blank, a hydraulic cylinder and piston carried by said ram and adapted to be relatively actuated when said ram approaches the lower end of its stroke, and a high pressure duct carried by said ram and moving bodily with said hydraulic cylinder, said duct conveying to the punch the hydraulic pressure created in said cylinder for stripping the blank from said punch.

5. In a drawing press comprising a reciprocating ram and bed, the combination of punch and die members carried by said ram and bed and adapted to perform a drawing operation on a tubular blank, a fluid passageway extending through said punch, a hydraulic cylinder carried by said ram, means for supplying oil to said cylinder, a piston in said cylinder adapted to engage said bed and to cause relative motion between the cylinder and piston when the ram approaches the bottom of its stroke, whereby to create a large hydraulic pressure in said cylinder substantially at the instant that the drawing operation on said blank is completed, and a high pressure conduit moving bodily with said ram for conducting oil under

pressure from said cylinder to the passageway in said punch for stripping the tubular blank from said punch.

6. In a drawing press of the class described, the combination of a bed, a ram adapted to reciprocate relatively to said bed, a circular die carried by said bed, a punch carried by said ram and adapted to move down through said circular die to perform a drawing operation on a metallic shell, an oil pump, means for conducting cooling and lubricating oil from said pump to said die and punch, a hydraulic cylinder carried by said ram, a piston within said cylinder projecting from the lower end thereof and adapted to engage a striking surface on said bed when said ram approaches the lower end of its stroke, spring means normally holding said piston at the lower end of its stroke in said cylinder, means for conducting oil from said pump through an inlet port to said cylinder, a check valve at said inlet port preventing return flow from said cylinder to said pump, and means for conducting oil from said cylinder to the lower end of said punch, whereby when said ram approaches the lower end of its stroke substantially at the completion of the drawing operation said piston encounters the striking surface on said bed and creates a hydraulic pressure in said cylinder which is transmitted to the space between the lower end of said punch and the lower end of said shell for stripping the shell from said punch.

7. In a drawing press of the class described, the combination of a bed, a ram adapted to reciprocate relatively to said bed, a circular die carried by said bed, a punch carried by said ram and adapted to move down through said circular die to perform a drawing operation on a metallic shell, an oil pump, means for conducting cooling and lubricating oil from said pump to said die and punch, a hydraulic cylinder carried by said ram, a piston within said cylinder projecting from the lower end thereof and adapted to engage a striking surface on said bed when said ram approaches the lower end of its stroke, means for conducting oil from said pump through an inlet port to said cylinder, a check valve at said inlet port preventing return flow from said cylinder to said pump, and means for conducting oil from said cylinder to the lower end of said punch, whereby when said ram approaches the lower end of its stroke substantially at the completion of the drawing operation said piston encounters the striking surface on said bed and creates a hydraulic pressure in said cylinder which is transmitted to the space between the lower end of said punch and the lower end of said shell for stripping the shell from said punch.

CLARENCE M. EASON.