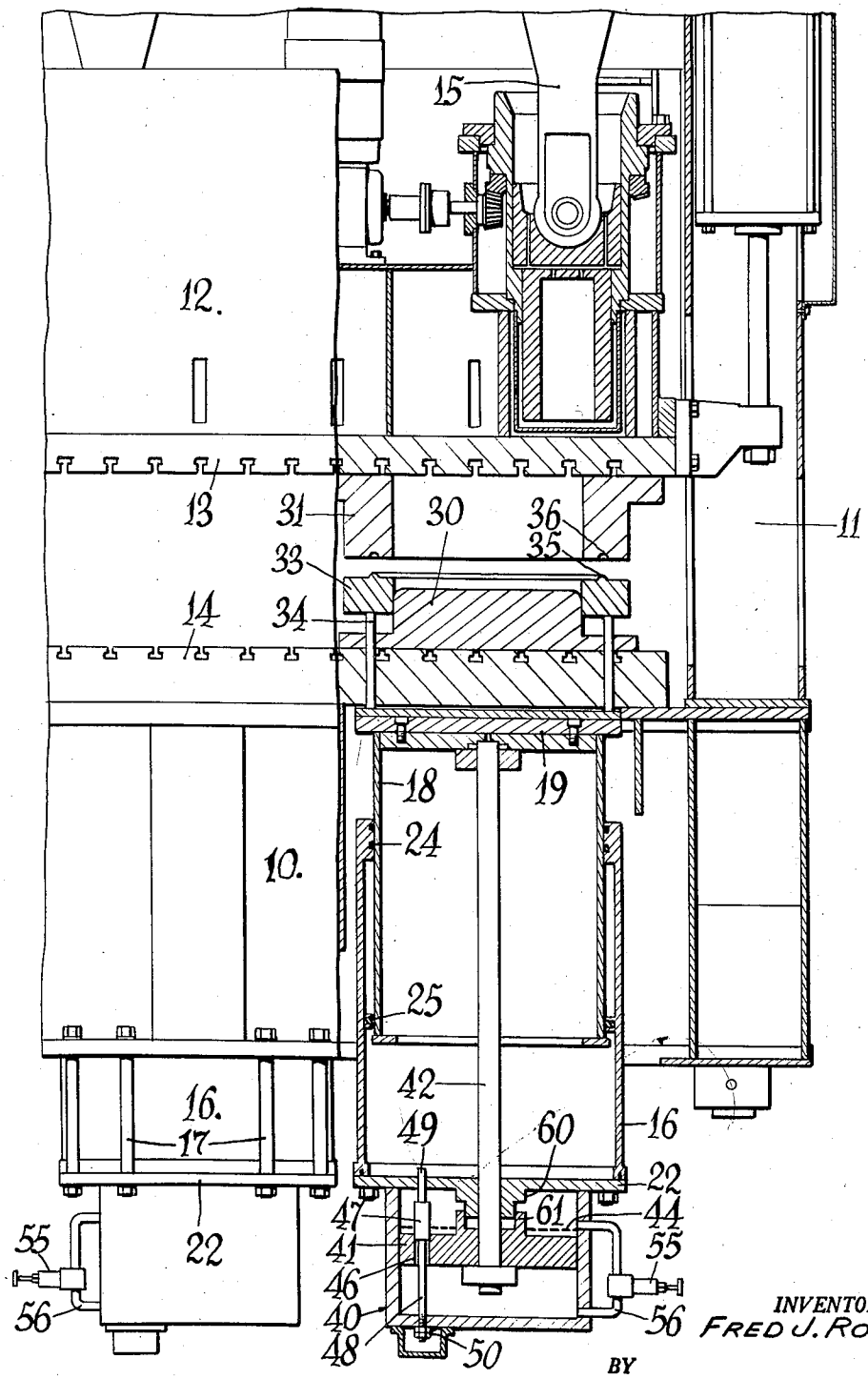
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CUSHION FOR POWER PRESSES

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CUSHION FOR POWER PRESSES

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1 Claim. (Cl. 267—1)

This invention relates to power presses and particularly to a novel cushion arrangement for the beds of such presses.

It is conventional and well known to provide yieldable cushion means in or beneath the beds of power presses, such cushions being generally employed to yieldably support draw rings in connection with the use and operation of metal drawing dies although they may be employed for various purposes. The yieldable medium employed in power press cushions of this general type is most commonly air under pressure, the air in the cushion being compressed or additionally compressed during the working portion of a press cycle and acting to return the cushion and the parts supported thereby to their initial positions during the return portion of a cycle of operation.

In what is probably the most common form of draw die apparatus the male die member is fixed to the bed of the power press and the female member is fixed to the reciprocable slide above and in registry with the lower die member. A draw ring surrounds the male die member with its upper surface at or above the upper surface of the male die, so that a work sheet placed in the die rests on the draw ring and is gripped between the draw ring and the marginal surfaces of the female die member as the latter descends.

During further downward movement of the female die, after the work sheet is initially clamped between the draw ring and the female die, the draw ring is moved yieldably downward and the marginal portions of the metal of the workpiece are frictionally gripped between the draw ring and the female draw die in such a way that the metal may slide between the draw ring and the female die as it forms over the male die, more or less as additional metal is needed to produce the desired male die form.

If the pressure between the draw ring and the female die is too great the metal will not feed inwardly enough and the work sheet will tear or become unduly thin in places. If the pressure is not great enough the metal will slide between the draw ring and the female die too readily and wrinkles will result in the drawn piece.

As an additional means of producing enough gripping action between the draw ring and the female die it is known to provide their meeting surfaces with complementary groove and bead formations, the bead being in either the draw ring or the female die and the mating groove in the other. Such beads need not be continuous about the draw ring and may be located only where needed to properly restrain inward feeding of the work metal during drawing. Furthermore, the bead and groove formations may be varied as to depth to impose only the desired degree of restraint in this connection.

A common difficulty which finds no satisfactory solution in the practical prior art arises from the fact that the yieldable means supporting the draw ring, by the very nature of its yieldability, does not offer enough resistance or reaction force, at the time when the female die first meets the draw ring and the workpiece supported thereon,

to properly form the restraining beads in the workpiece.

For instance, and of course merely by way of example, the actual drawing operation may dictate the use of a cushion for supporting the draw ring with a resistance of say 20 tons, whereas proper formation of the marginal restraining beads in the workpiece, which of course must come at the very beginning of the drawing operation to be useful, may require a pressure between the draw ring and the female die of 50 tons.

The present invention provides simple and effective means whereby power press cushions used in metal drawing operations are arranged to offer a much higher yieldable resistance at the very beginning of the downward movement of the cushion, so that initially the draw ring affords enough resistance to the pressure of the female die to fully form the draw beads.

This is accomplished in such a way that only the normal resistance of the cushion is present immediately after the beginning of the working engagement between the female die and the draw ring is past. Furthermore, the arrangement of the present invention is such that the distance through which the greatly increased initial resistance is effective may be readily adjusted to suit a particular draw die set-up and insure power draw bead formation without imposing the increased initial resistance of the draw ring any longer than is necessary to secure full formation of the draw beads.

The arrangement of the present invention, in the form set forth herein by way of example, is further such that the degree of increased or augmented initial resistance is readily adjustable without affecting or disturbing the normal cushion resistance, design and arrangement.

A single embodiment of the present invention is shown somewhat schematically in the accompanying drawing and is described in the following specification. However, it is to be understood that such embodiment is by way of example only and that the principles of the invention are limited only as defined in the appended claim.

The single figure of the drawing is a fragmentary front elevational view of a power press provided with one form of the cushion control means of the present invention.

The power press illustrated fragmentarily in the drawing is a double crank or two-point eccentric straight side press which would normally be provided with two air cushions of the general type here under consideration. The drawing shows only the right-hand portion of the press in cross-sectional detail but it is to be understood that the left-hand side of the bed of the press would in the present instance be provided with a duplicate cushion and a single description will suffice for both.

The illustration herein of a double crank or two-point eccentric press and a dual cushion arrangement is again merely by way of example and the cushion control principles set forth herein may be applied to any type of power press or similar machine where a cushioning means of the type set forth herein may be gainfully employed. Furthermore, the principles of the present invention are the same and are equally applicable where one, two or any other number of cushions are employed in a press.

Referring to the drawing, the power press fragmentarily depicted therein is entirely conventional excepting for the cushion apparatus and comprises a bed **10**, side columns, one of which is designated **11**, and a vertically reciprocable slide **12** having a die or punch holding platen **13** at its lower face. The bed **10** is provided with a die receiving bolster **14** in conventional manner and the slide **12** is reciprocated by cranks or eccentrics disposed at the upper portion of the press (not shown) and is connected to the cranks or eccentrics by the usual connections or pitmans, one of which is designated **15** in the drawing.

The bed structure of the press is provided with a pair of air cushion cylinders **16** which are fixed with respect to the bed **10** as by bolts and tie rods designated **17** in the drawing. A drum-type piston member **18** enters the upper end of each of the cylinder members **16** and is provided with a head plate structure **19** which will usually, although not necessarily, be square or rectangular in shape and extend into an opening of corresponding shape in the upper plate member of the bed, so that head plate **19** of the cushion is disposed more or less directly beneath bolster **14** when the press is in a rest position, as shown in the drawing.

The bottom ends of the cylinders **16** are provided with heads or closure plates **22** and the bearing surfaces of piston members **18** and cylinders **16** are provided with suitable bearing and packing or sealing means as at **24** and **25** in the drawing.

The foregoing cushion constructions are entirely conventional. In operation any desired degree of air pressure is maintained in the cylinders **16** to urge the pistons **18** upwardly with the required force to accomplish proper draw ring operation and to return them to their upper idle positions after the pistons have been depressed during a cycle of operation of the power press in conventional manner. So much of the cushion piston and cylinder construction as has been thus far described is conventional and well known in the prior art.

By way of illustration the drawing shows a male draw die member **30** positioned on the bolster **14** with a complementary female draw die member **31** fixed to the platen **13** of slide **12** of the press. A draw ring **33** is supported upon the upper ends of a series of pressure pins **34** which extend slidably through suitable openings in bolster **14** and rest at their lower ends upon the upper surfaces of cushion plate **19**. Thus the downward pressure of female die **31** against draw ring **33**, with a work sheet normally held between these two members, is resiliently opposed by the air pressure in cylinder **16**.

Draw ring **33** is shown provided with a draw bead **35** and the engaging surface of female draw die member **31** is provided with a corresponding groove **36**, these formations being provided to produce the draw beads hereinfore referred to for restraining the slippage of the metal between the draw ring **33** and the lower surface of female draw die **31**. As further mentioned above, the bead and groove formations **35** and **36** may be reversed, may be disposed intermittently at various places about the draw die as the need presents itself, and may be of any desired depth to produce a given desired restraining action.

The means provided by the present invention in the form set forth herein by way of example for establishing an initial cushion resistance substantially exceeding the normal cushion resistance, for the purpose of forming the draw bead as described generally above, comprises a hydraulic system which will now be described and which is housed generally in a cylindrical casing **40** which is fixed axially to the bottom end of each cushion cylinder **16**.

Hydraulic cylinder **40** is provided with a piston **41** which is fixed for movement with cushion head **19** by means of a connecting shaft **42**. The piston **41** is not packed or sealed with respect to the walls of cylinder **40** and is provided with a slight clearance with respect thereto. The oil level in cylinder **40** is indicated at **44**.

Piston **41** is provided with a bore **46** and a plug valve **47** is disposed with its lower end in the upper end of bore **46** when the power press is in an initial position. Valve **47** is supported upon a stem **48** and guided at its upper end in the bottom head **22** of cylinder **16** by virtue of a further stem member **49**. The lower end of stem **48** is provided with adjusting nuts **50** by virtue of which the vertical position of valve **47** with respect to piston **41** may readily and accurately be adjusted.

It will be seen from the foregoing that an initial impact against draw ring **33**, which occurs when female die **31** engages the draw ring, or more properly the work sheet resting thereon, at the beginning of a cycle of operation, occurs with plug valve **47** closing the bore **46** in piston **41**.

Since the cushion can yield downwardly only by movement of piston **41** downwardly in hydraulic cylinder **40**, downward movement of the cushion can occur only by the relatively restricted leakage of hydraulic fluid upwardly between the periphery of piston **41** and the interior wall of cylinder **40**, albeit this clearance is sufficient to permit downward movement of the piston under a pressure at least high enough to fully form the draw beads through the means of the beads **35** and the grooves **36** in the draw ring and the female die, respectively.

The plug valve **47** is so adjusted that this initial resistance obtains just long enough to fully form the beads, whereupon piston **41** has moved downwardly a sufficient distance to open the bore **46**, by movement thereof downwardly past plug valve **47**. This opening of the bore **46** substantially neutralizes the deterrent effect of piston **41** and the remainder of the downward operation of the air cushion mechanism is conventional and takes place merely against the pneumatic resistance within cylinder **16**.

An adjustable pressure relief valve **55** is disposed in a bypass conduit **56** which communicates with cylinder **40** above and below the piston **41**. Adjustment of pressure relief valve **55** permits selective adjustment of the initial bead forming pressure or resistance of the cushion, since any pressure developed against the draw ring in excess of the setting of relief valve **55** bypasses hydraulic fluid from the bottom to the top of cylinder **40**.

In a copending application filed of even date herewith and bearing Serial No. 487,167 I have disclosed and claimed a novel dash pot arrangement for slowing the return movement of the pressure pad of a punch press on the upstroke of a power press as the pressure pad reaches its upper position. One form of this pressure pad return dash pot arrangement is illustrated herein in conjunction with my present invention, which thus relates primarily to the initial high pressure or high resistance operation of the pressure pad and secondarily to the novel combination whereby the high pressure operation and the return stroke dash pot operation are achieved in a combined apparatus in a novel, simple and effective manner.

In the drawing the numeral **60** designates a collar which is fixed to the underside of the bottom head **22** of cylinder **16** and has a reduced annular downward extension. The numeral **61** designates a cup-shaped annular member which is fixed to the upper side of piston **41** or, in any event, to shaft **42**, for movement therewith. Thus each down stroke of the pressure pad results in the cup-shaped member **61** becoming filled with hydraulic fluid and as the terminal portion of the upstroke is approached, the reduced lower extension of collar **60** enters cup-shaped member **61**.

The hydraulic fluid thus trapped in the cup-shaped member has limited egress between the upper interior periphery of the cup-shaped member **61** and the outer periphery of the reduced lower extension of collar **60**, thus slowing the upward movement of piston **18** and pressure pad **19**, which upward movement is being accomplished under air pressure within the cylinder **16** and within the body of the piston **18**.

What is claimed is:

In a sheet metal drawing press, a die supporting bed having a pressure pad associated therewith, fluid pressure means for yieldably resisting movement of the pressure pad in the direction of a working stroke of said press, and auxiliary resistance means comprising a hydraulic cylinder and a piston movable therein upon movement of said pressure pad, relatively restricted hydraulic fluid passage means past said piston to permit movement thereof under a pressure against the pressure pad in said working stroke direction substantially greater than the normal resistance of the first fluid pressure means, and

hydraulic pressure relief means operable automatically to neutralize said auxiliary resistance means upon completion of a predetermined initial movement of said pressure pad in said working stroke direction, and hydraulic dash pot means comprising a pair of relatively movable members associated with said cylinder and said piston, respectively, and operable to damp the final return movement of said pressure pad.

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