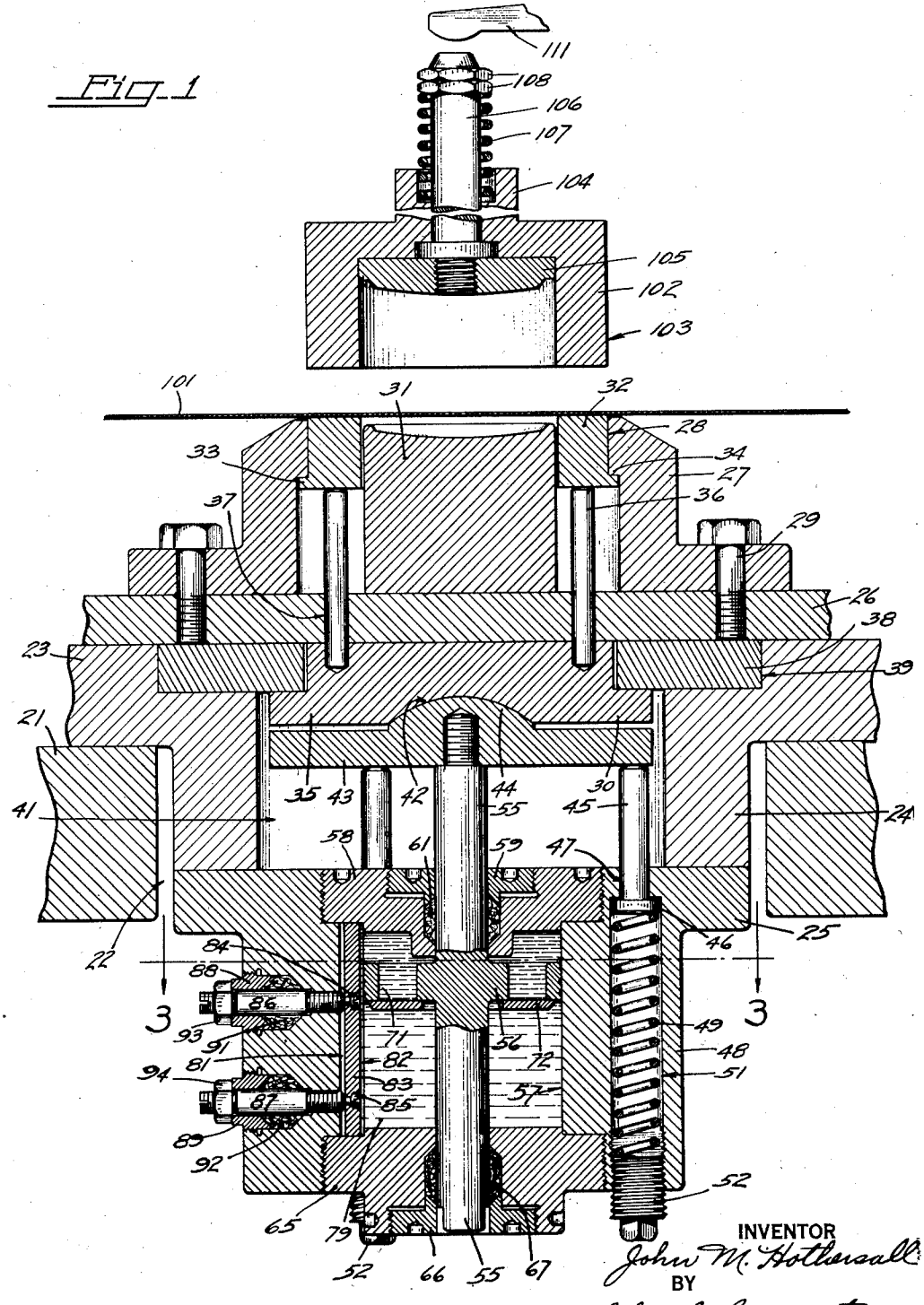
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DRAWING PRESS HYDRAULIC CUSHION

Filed April 19, 1930 3 Sheets-Sheet 1

Fig. 1



INVENTOR
John M. Hothersall
BY
John C. Carpenter
ATTORNEY

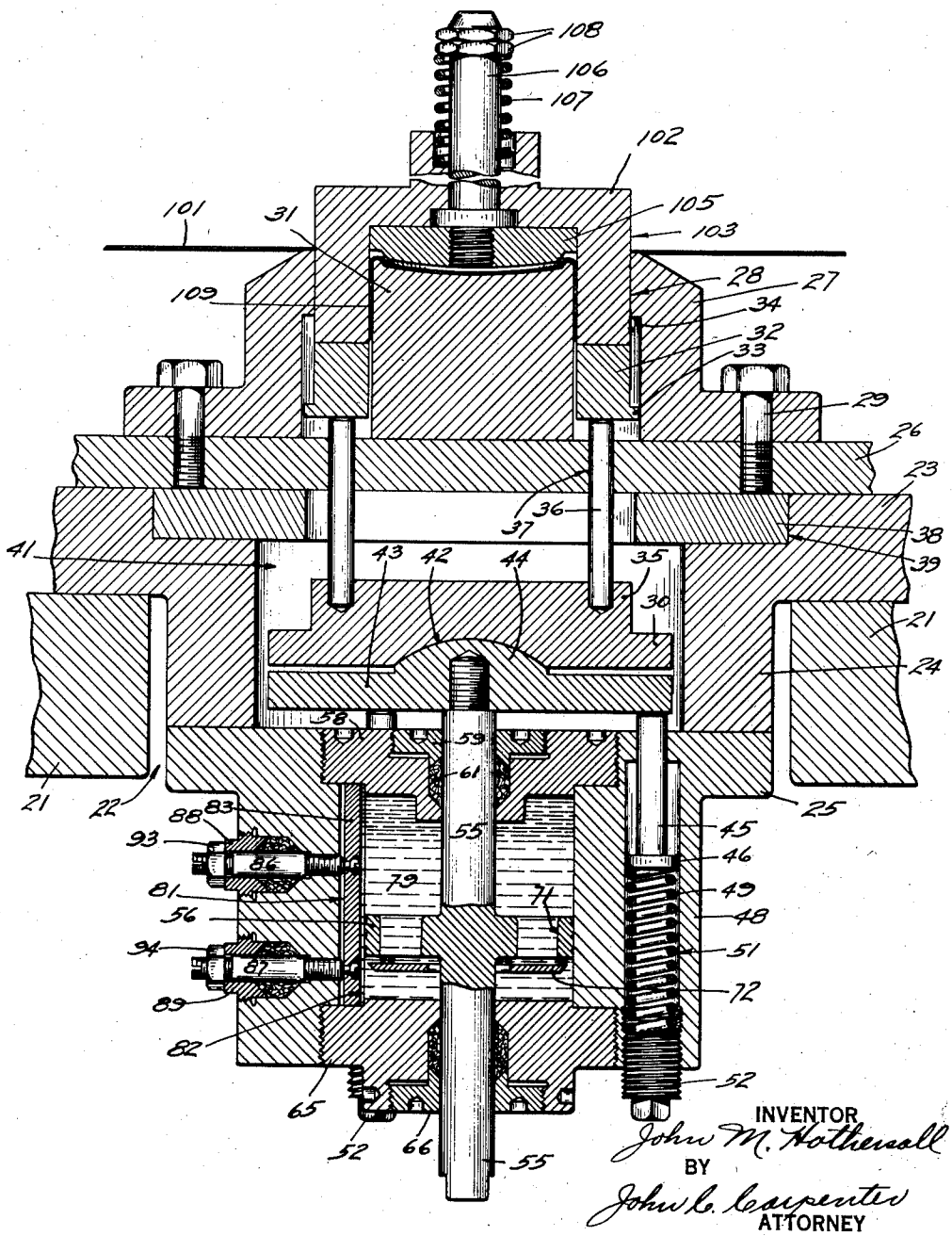
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Fig. 2



INVENTOR
John M. Hothersall
BY
John L. Carpenter
ATTORNEY

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Fig. 3

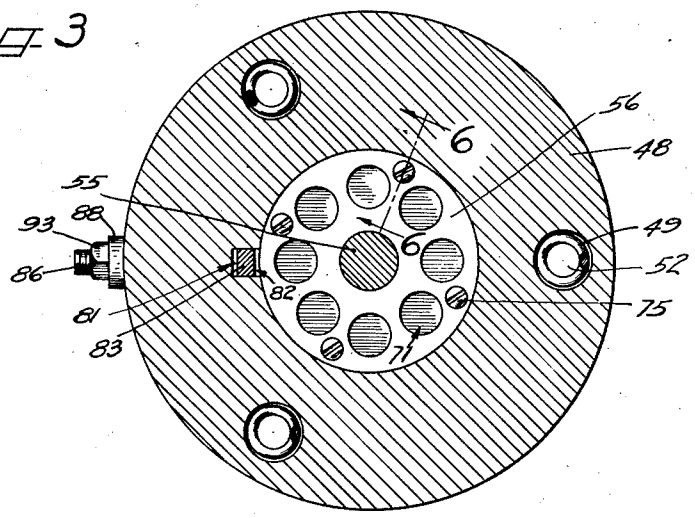


Fig. 4

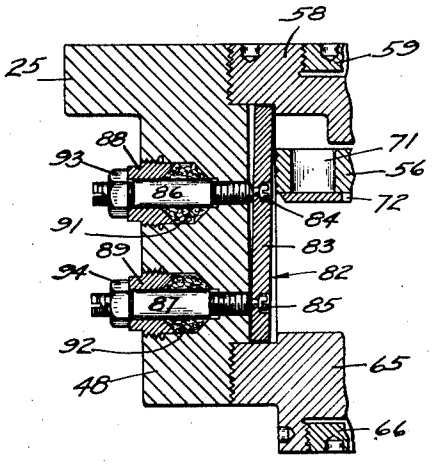


Fig. 5

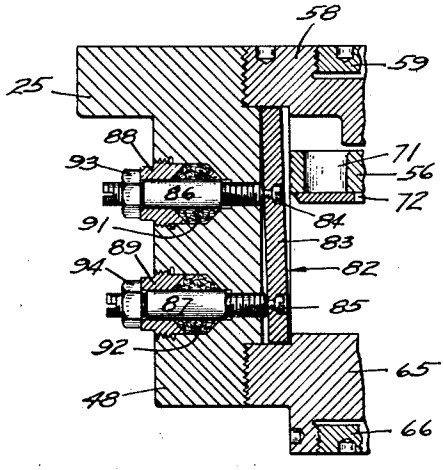
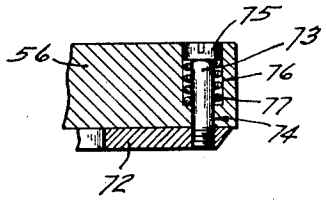


Fig. 6



INVENTOR
John M. Hothersall
BY
John C. Carpenter
ATTORNEY

Patented Oct. 25, 1932 1,884,700

UNITED STATES PATENT OFFICE

JOHN M. HOTHERSALL, OF BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN CAN COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY

DRAWING PRESS HYDRAULIC CUSHION

Application filed April 19, 1930. Serial No. 445,780.

The present invention relates to improvements in hydraulic cushions particularly adapted for use in the drawing of sheet metal.

The principal object of the present invention is the provision of an improved drawing press mechanism which uniformly holds the work being drawn with a slip grip having a clamping force created by an hydraulic cushion.

An important object of the invention is the provision of a mechanism for holding sheet material while being drawn in a slip grip exerting predetermined clamping forces throughout the entire drawing operation.

A further important object of the invention is the provision of an hydraulic cushion for a drawing press mechanism having a simple and efficient adjusting unit for effecting the resisting action of the cushion at various stages in the drawing operation.

The invention contemplates the use of a simple form of hydraulic cushion for a drawing press mechanism which embodies an improved form of by-pass for the liquid in the cushion, the adjustability of the by-pass determining the amount of clamping action delivered by the hydraulic cushion to the work being operated upon.

Numerous other objects of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:—

Figure 1 is a longitudinal sectional view of the principal parts of a die and press mechanism provided with the improved hydraulic cushion of the present invention, the parts being in the position assumed prior to operation.

Fig. 2 is a view similar to Fig. 1 illustrating the parts in the position assumed at the end of the drawing operation.

Fig. 3 is a sectional plan view of the hydraulic cushion being taken substantially along the line 3—3 in Fig. 1.

Fig. 4 is a fragmentary sectional view of one side of the drawing cushion illustrating the adjustable parts thereof in one position

Fig. 5 is a view similar to Fig. 4 illustrating the adjustable parts of the cushion in a different adjusted position.

Fig. 6 is an enlarged fragmentary sectional view taken substantially along the line 6—6 in Fig. 3.

The present invention contemplates the provision of an improved slip grip for holding the work being drawn in a press mechanism of the standard type, this improvement being effected by the use of an hydraulic cushion unit insertable in the die.

A preferred form of die parts for carrying out the present invention is illustrated in the drawings as being partially supported on a bolster plate 21 in the usual or preferred manner, the lower die unit containing the improved hydraulic cushion being located in a central opening 22 extending through the bolster plate. This die unit is carried by a bed plate 23 which rests directly upon the bolster plate 21, being provided with a downwardly extending tubular section 24, to which is secured the hydraulic cushion broadly referred to by the numeral 25.

Other die parts are carried by the bed plate 23, these constituting a die plate 26 and a lower die member 27 provided with a cutting edge 28 formed interiorly of and located adjacent its upper end. Bolts 29 are used for holding the member 27 on the plate 26.

An anvil 31 is mounted on the die plate 26 and is disposed centrally of the die member 27 and it is over this anvil that the material is drawn and shaped during the drawing operation. A draw ring 32 is located between the anvil 31 and the die member 27 and has sliding movement relative to these parts. The draw ring 32 is provided with an annular projecting edge 33 adjacent its bottom and this edge engages a shoulder 34 formed in the die member 27 adjacent its cutting edge 28. The shoulder 34 provides a locating stop for the draw ring definitely placing it when in raised position.

A pin plate 35 is located beneath the die plate 26 and carries a series of upwardly extending pins 36 having sliding movement within vertical bores 37 formed in the die plate. The draw ring 32 rests upon and is

supported by the pins 36, as illustrated in Figs. 1 and 2. The pin plate 35 is provided with a peripheral flange 30 adapted to engage a ring 38 seated in a counter bore 39 formed in the bed plate 23 being firmly held therein by the die plate 26.

The pin plate 35 has vertical movement within an opening 41 of the tubular section 24 and is provided with a spherical indentation 42 formed in its lower surface. A disc 43 has similar vertical movement in the member 24 being provided with a projecting boss 44 shaped to snugly fit within the depression 42 and to form a rocking thrust connection between the parts 35 and 43.

The disc 43 rests upon a plurality of pins 45, each pin being provided with a head 46 and having sliding movement within a vertical bore 47 formed in a cylinder 48 which constitutes a casing or housing for the hydraulic cushion. The head of each pin is engaged by a return spring 49 located in a vertical channel 51 formed in the cylinder 48, the lower end of the spring resting against a plug 52 threadedly engaging the cylinder 48. The springs 49 form resilient supports for the pins 45 and disc 43 and are utilized as lifting elements for these parts after the drawing operation.

The disc 43 carries a vertical stem 55 threadedly secured thereto and extending downwardly through the cylinder 48. The stem 55 at an intermediate point is enlarged to form a piston 56 which has sliding movement within a chamber 57 located interiorly of the cylinder 48.

The upper part of the chamber 57 is closed by a disc 58 threadedly engaged in the upper end of the cylinder 48 and the stem 55 above the piston 56 passes through this disc. A stuffing box gland 59 surrounds the stem 55 and is threadedly engaged in the disc 58 providing a retaining member for a packing 61 which forms a liquid-tight sliding fit between the stem and the disc.

The lower end of the chamber 57 is closed by a disc 65 threadedly engaged in the cylinder 48 and the lower end of the stem 55 has sliding movement through this disc. A stuffing box gland 66 surrounds the lower end of the stem and is threadedly secured within the disc 65, providing a retaining member for a packing 67 surrounding the stem at this point. These two sliding joints make the top and bottom walls of the chamber 57 liquid-tight.

The piston 56 is provided with a series of vertical openings 71 (Figs. 1, 2 and 3) adapted to be closed, during certain press operating periods, by a valve plate 72 surrounding the stem 55 and yieldingly connected with the piston 56 (see also Fig. 6). The valve plate 72 has a series of bolts 73 threadedly secured thereto, each having sliding movement within a bore 74 formed in the piston 56 and each being formed with an enlarged head 75 having sliding movement within a counter bore 76 formed in the piston. A spring 77 surrounds each bolt 73 and is interposed between its head 75 and the base of the counter bore 76. Under the action of the springs 77 the valve plate 72 normally presses against the lower side of the piston 56 and in such position closes the openings 71.

A liquid 79 is provided for the hydraulic cushion and completely fills the chamber 57. This liquid may be oil, glycerine or any suitable hydraulic substance, such as is used in devices of this character.

A rectangular channel 81 (Figs. 1 and 3) is cut in one side of the vertical wall of the cylinder 48 communicating directly with the chamber 57 and extending vertically between the discs 58 and 65. The vertical opening formed by this channel as it extends along the piston provides a by-pass 82 through which part of the liquid 79 is adapted to flow during certain periods in the operation of the press mechanism. A by-pass plate 83 is located within the channel 81 and is loosely connected at 84 and 85 to the ends respectively of adjusting screws 86 and 87 extending through the wall of the cylinder 48, and threadedly connected therewith.

The screws 86 and 87 pass through stuffing box glands 88 and 89 threadedly secured in the cylinder wall and these respective glands retain in position packings 91 and 92 which provide liquid-tight and air-tight joints between the cylinder wall and the screws. Lock-nuts 93 and 94 threadedly connected with the screws clamp against the gland members and hold the screws in adjusted position.

The distance between the adjacent wall of the piston 56 and the inner face of the plate 83 within its channel 81 determines the size of the by-pass 82 for any particular position of the piston 56 during its movement longitudinally of the chamber 57 and this in turn influences the resistance offered by the liquid 79 in the hydraulic cushion during downward movement of the piston 56, as will now be described.

Sheet material 101 may be used in the formation of articles by the drawing press mechanism herein disclosed and such a sheet is fed in any suitable manner over the draw ring 32 and associated parts. Any proper type of movable punch member 102 may be provided, this member having vertical walls corresponding with the vertical walls of the draw ring 32. The outer, lower edge of the punch member 102 constitutes a cutting edge 103 which cooperates with the cutting edge 28 of the die member 27, as the punch member 102 is lowered. Punch member 102 is provided with a stem 104 adapted to be clamped in the standard form of punch slide, not shown.

A knockout pad 105 is located interiorly of the punch member 102 and is threadedly secured to the lower end of a knockout stem 106. A spring 107 surrounding the stem 106 is interposed between the upper end of the stem 104 and adjusting locknuts 108 threadedly carried on the stem 106.

As the member 102 is lowered for a press operation the cutting edge 103 cooperates with the cutting edge 28 and severs a disc from the strip 101 the disc being then held between the lower face of the member 102 and the upper face of the draw ring 32. These holding members constitute a slip grip for the blank as it is further drawn over the anvil 31. This lowering of the member 102 correspondingly moves the draw ring 32 against a resistance provided by the liquid 79 in the hydraulic cushion 25, this resisting action resulting from the liquid beneath the piston 56 and such resistance is transmitted upwardly through the stem 55, the disc 43, plate 35, pins 36 and draw ring 32.

The force exerted by the descending member 102 acting through the draw ring 32 and the other members just mentioned presses against the non-compressible liquid 79 and some of this liquid is forced from beneath the piston 56 into the space above by way of the by-pass 82. It is obvious that the size of opening of the by-pass for any position of the piston 56 determines the amount of resistance offered by the liquid 79 in the cushion inasmuch as only a given amount of liquid can flow through such a restricted opening in a given time. Adjustment of position of the plate 83 within the channel 81 permits a simple and accurate determination of the size of the by-pass and the resulting clamping force exerted against the draw ring 32.

In Fig. 4 the plate 83 is illustrated in position to exert the greatest resistance in the cushion for the beginning part of the stroke and this resistance uniformly decreases as the piston 56 moves downwardly. In other words, the by-pass 82 at the beginning of the stroke has the smallest area in cross-section but as the piston advances alongside of the sloping wall of the plate 83, the effective area of the by-pass increases and it offers less resistance to the descending piston.

In Fig. 5, the reverse position is illustrated and the resistance offered by the hydraulic cushion at the beginning of the stroke is relatively light but increases as the piston 56 moves downwardly. In Fig. 1 the plate 83 is illustrated in vertical position and the resistance offered by the liquid flowing through the by-pass 82 is, therefore, constant throughout the entire stroke of the piston. All of these resistances influence the work being drawn by effecting certain clamping actions in the slip grip.

It will be readily understood that through this range of adjustment of the size of opening of the by-pass the resistance offered by the liquid of the cushion is under complete control at all periods of the drawing operation. Any clamping action in the slip grip within the range of the mechanism may thus be had, be it a uniform clamping force throughout the working stroke or an increasing or decreasing force as the drawing proceeds. This adjustment of position of the plate 83 is obtained by rotation of the screws 86 and 87, the slotted heads of which extend to the outside of the drawing unit where they may be engaged by the ordinary screw driver or other suitable tool.

After the drawing action, the member 102 is raised whereupon the springs 49 acting through the parts 45, 43, 35 and 36 return the draw ring 32 to normal position with its flange 36 engaging the shoulder 34 of the die member 27. During this upward movement of the disc 43, the stem 55 connected therewith has carried the piston 56 upwardly and at this time the resistance of the liquid above the piston is sufficient to overcome the action of the springs 77 in the piston 56 and the valve plate 72 is moved away from the face of the piston (Fig. 2) and the openings 71 are uncovered whereupon liquid 79 above the piston flows freely through the openings into the space below the piston.

The drawn shell 109 is lifted with the punch member 102 in the regular manner and as this member approaches the upper end of its stroke the stem 106 engages any suitable stationary part 111 whereupon the knockout pad 105 moves outwardly overcoming the spring 107 and the drawn shell is discharged from the punch member.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof for supplying a clamping force in said slip grip, means for closely confining said cushion so that it has no empty space, and means for adjusting the resistance of said cushion and controlling the clamping action of said slip grip.

2. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, an hydraulic cushion connected to one of said in-

strumentalities and resisting movement thereof, and an adjustable by-pass extending along the edge of the piston for the liquid in said hydraulic cushion.

3. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof, an adjustable by-pass formed in the side of the cylinder for the liquid in said hydraulic cushion, and means for altering the size of said by-pass and thereby controlling the resisting action of said cushion.

4. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, a cylinder and piston, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof and entirely filling the cylinder on both sides of the piston, means for moving said instrumentalities against the resistance of said cushion to effect a drawing of said material, a by-pass for the liquid in said hydraulic cushion, and an adjustable member for providing a predetermined effective working area in said by-pass at each stage in the drawing operation for effecting the resistance in said slip grip at such time.

5. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, a cylinder and piston, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof, means for moving said instrumentalities against the resistance of said cushion to effect a drawing of said material, a by-pass formed in the side of the cylinder for the liquid in said hydraulic cushion, means for altering the size of said by-pass and thereby controlling the resisting action of said cushion during the drawing operation, and auxilary means for nullifying the resistive forces of the cushion immediately following the drawing operation.

6. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, a cylinder and piston, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof for supplying a clamping force in said slip grip and entirely filling said cylinder, means for cutting a disc from said material while held in said slip grip, an adjustable by-pass for the liquid in said hydraulic cushion, and adjusting means for regulating the size of said by-pass whereby there is obtained control of the resistive action of said cushion and the resulting clamping action in said slip grip.

7. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, a cylinder and piston, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof, means confining the cushion against the opposite sides of the piston and against the interior of the cylinder, means for moving said instrumentalities against the resistance of said cushion during the working stroke of the press to effect a drawing of said material and for returning one of said instrumentalities to normal position during the idle stroke of the press, and a by-pass for the liquid in said cushion to permit movement of said instrumentalities while maintaining said resistive action during said working stroke.

8. In a drawing press mechanism, the combination of a pair of opposed, substantially concentric instrumentalities for clamping material to be drawn in a slip grip, an hydraulic cushion connected to one of said instrumentalities and resisting movement thereof, means for moving said instrumentalities against the resistance of said cushion during the working stroke and also the idle stroke of the press, to effect a drawing of said material and for returning one of said instrumentalities to normal position during the idle stroke of the press, independent means for returning the other of said instrumentalities to normal position during said idle stroke, and a by-pass for the liquid in said cushion to permit movement of said instrumentalities while maintaining said resistive action during said working stroke.

9. An hydraulic cushion for a drawing press, comprising a cylinder adapted to contain a liquid, a piston having movement in said cylinder, a by-pass formed in one wall of said cylinder and extending along the edge of the piston in various positions of the latter, through which by-pass liquid flows from one side of said piston to the other side during movement thereof, and means for altering the size of said by-pass.

10. An hydraulic cushion for a drawing press, comprising a cylinder adapted to contain a liquid, a piston having movement in said cylinder, a by-pass formed in one wall of said cylinder and having an open side along which the piston travels and through which liquid flows from one side of said piston to the other side during movement of the piston in one direction, and a valve located in said piston and adapted to open during the movement of the piston in the opposite direction to permit return of the liquid to one side of said piston.

11. An hydraulic cushion for a drawing press, comprising a cylinder for a liquid, a piston having longitudinal movement in

said cylinder, a channel extending longitudinally of said cylinder wall and opening thereinto by means of an open inner side and providing a by-pass through which liquid flows from one side of said piston to the other side during movement of the piston to various positions, an adjusting plate located inside of said channel and restricting the by-pass formed thereby, and means for locating said plate relative to said piston to provide a predetermined size of by-pass.

JOHN M. HOTHERSALL.