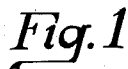


Filed June 12, 1943

DOUBLE SLIDE MECHANISM AND DOUBLE
ACTION DRAWING PRESS

7 Sheets-Sheet 1



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DOUBLE SLIDE MECHANISM AND DOUBLE
ACTION DRAWING PRESS

2,448,327

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7 Sheets-Sheet 2

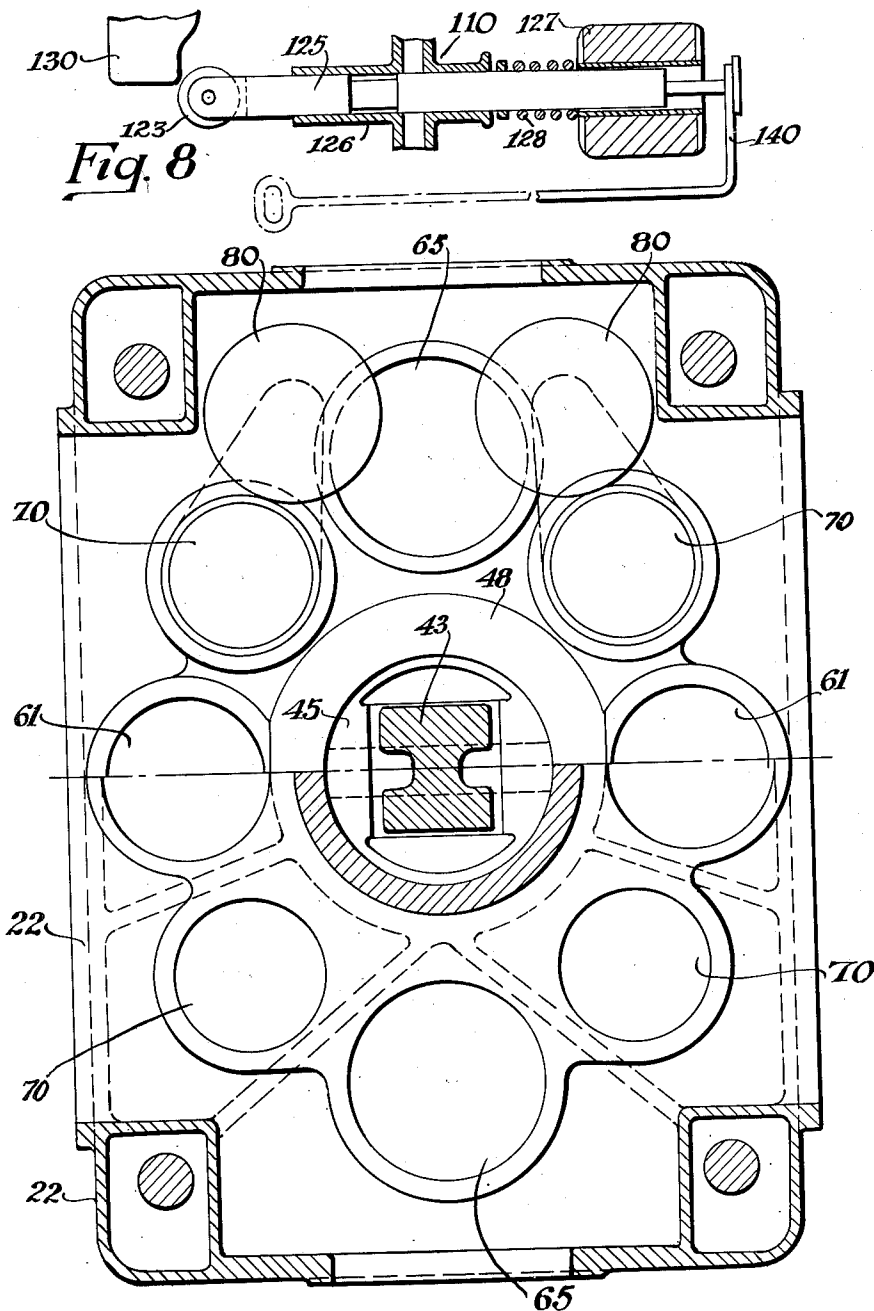


Fig. 2

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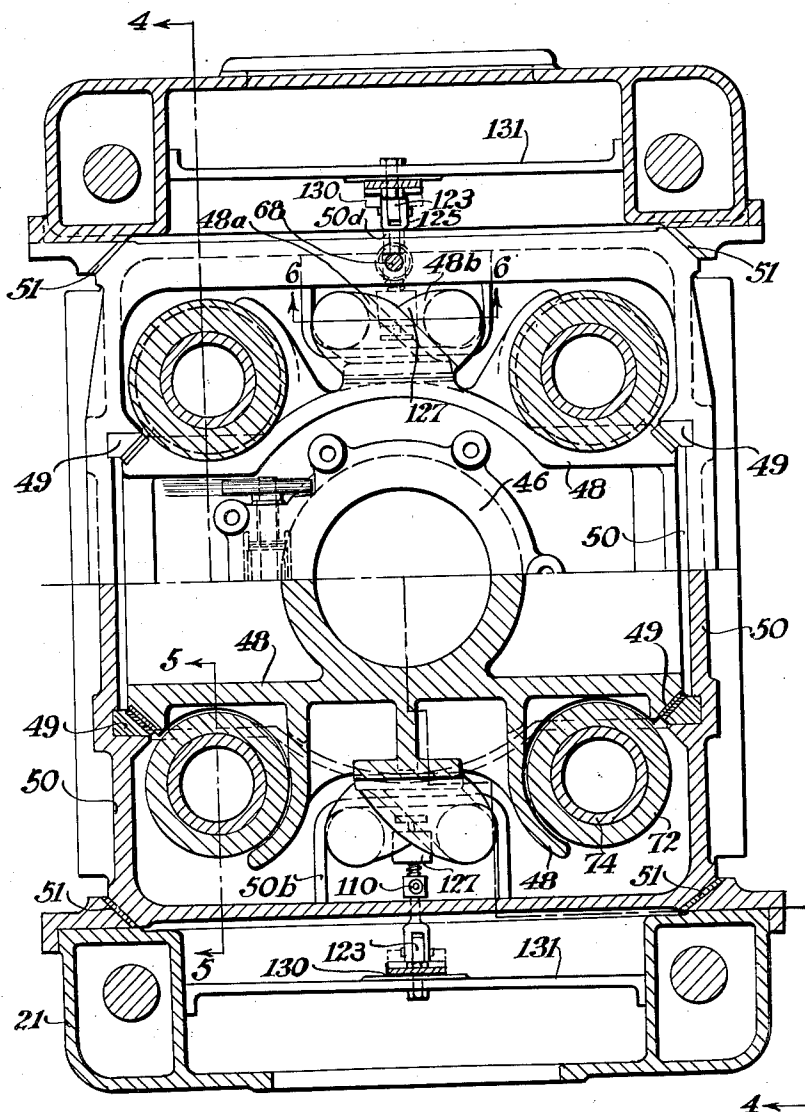


Fig. 3

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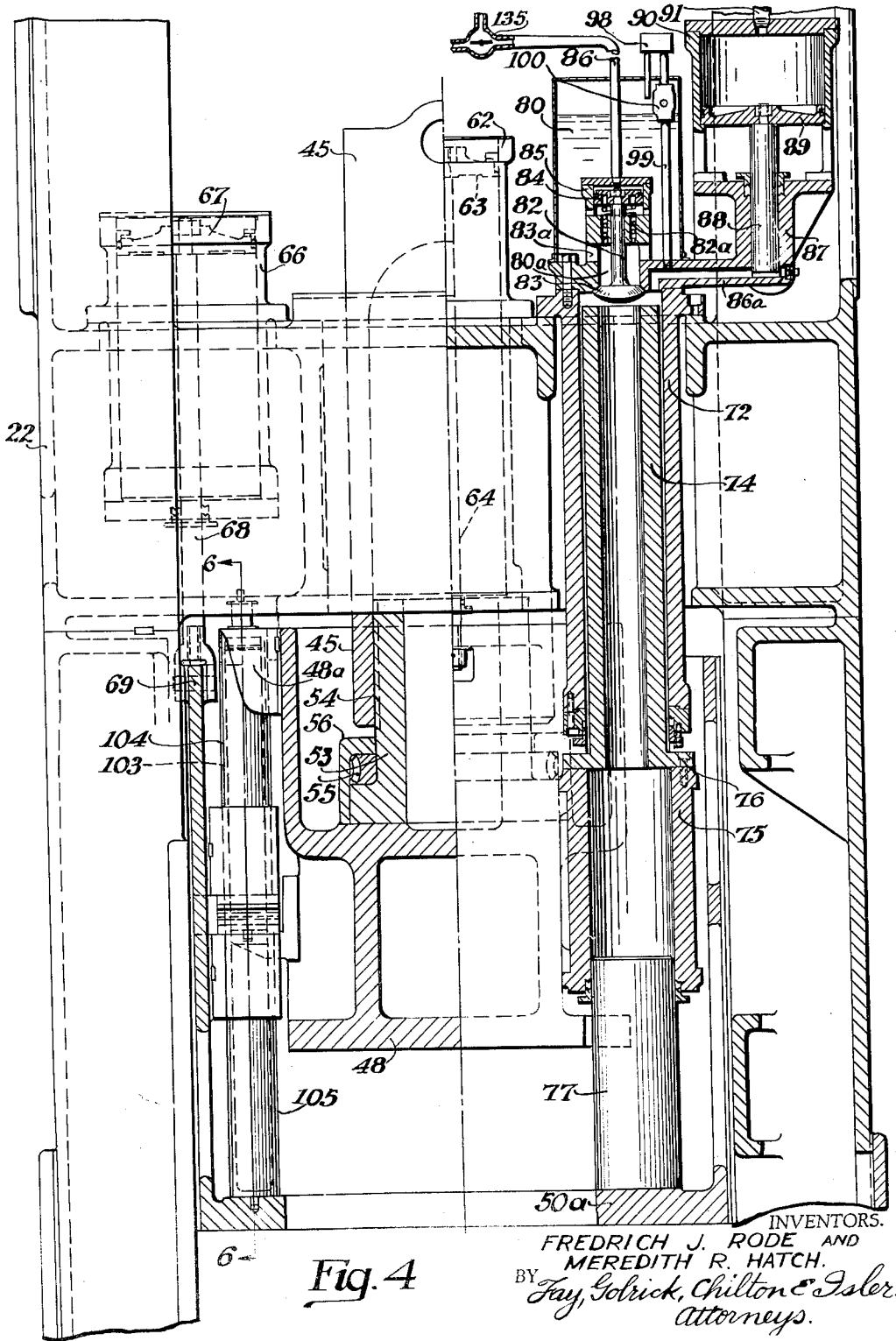
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7 Sheets-Sheet 5

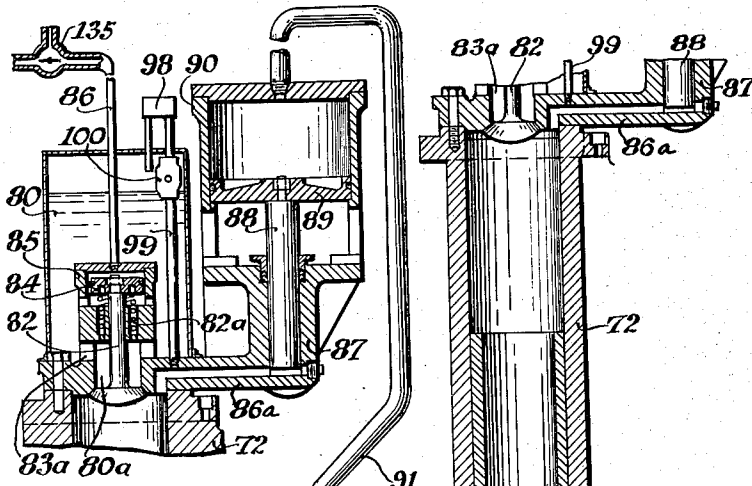


Fig. 9

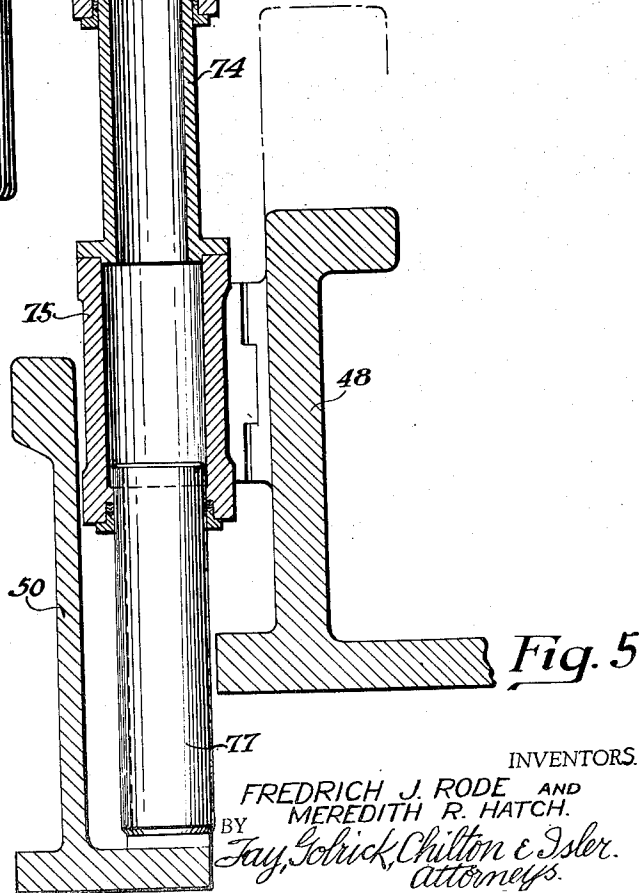
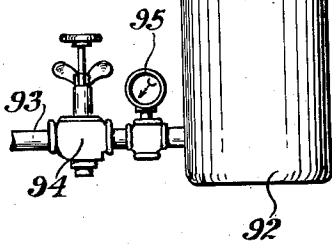


Fig. 5

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2,448,327

Filed June 12, 1943

7 Sheets-Sheet 6

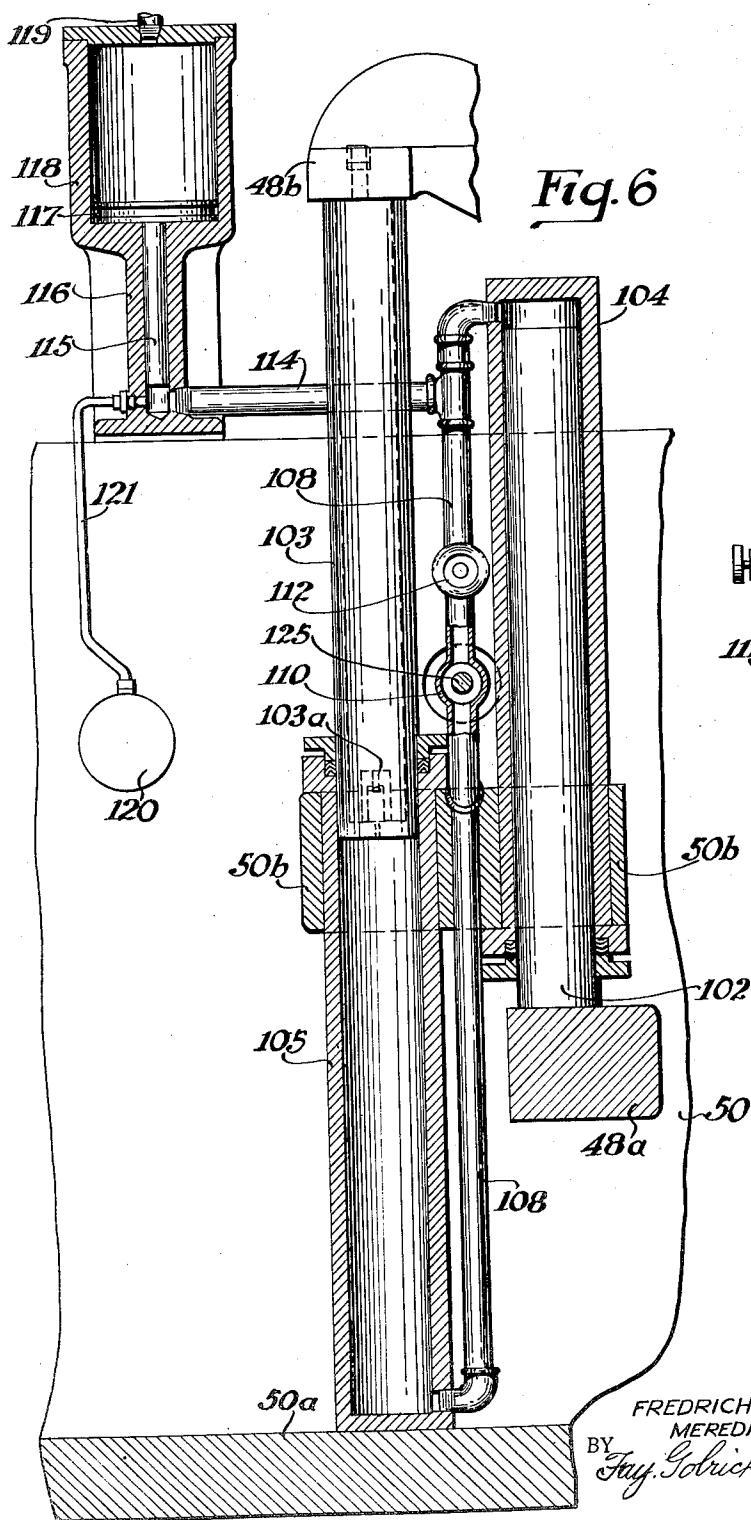


Fig. 6

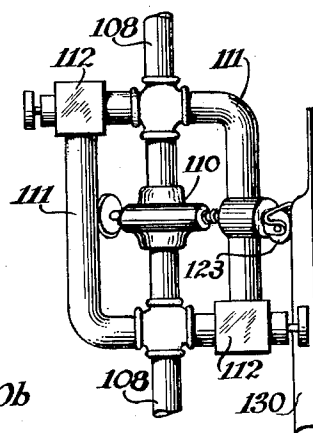


Fig. 7

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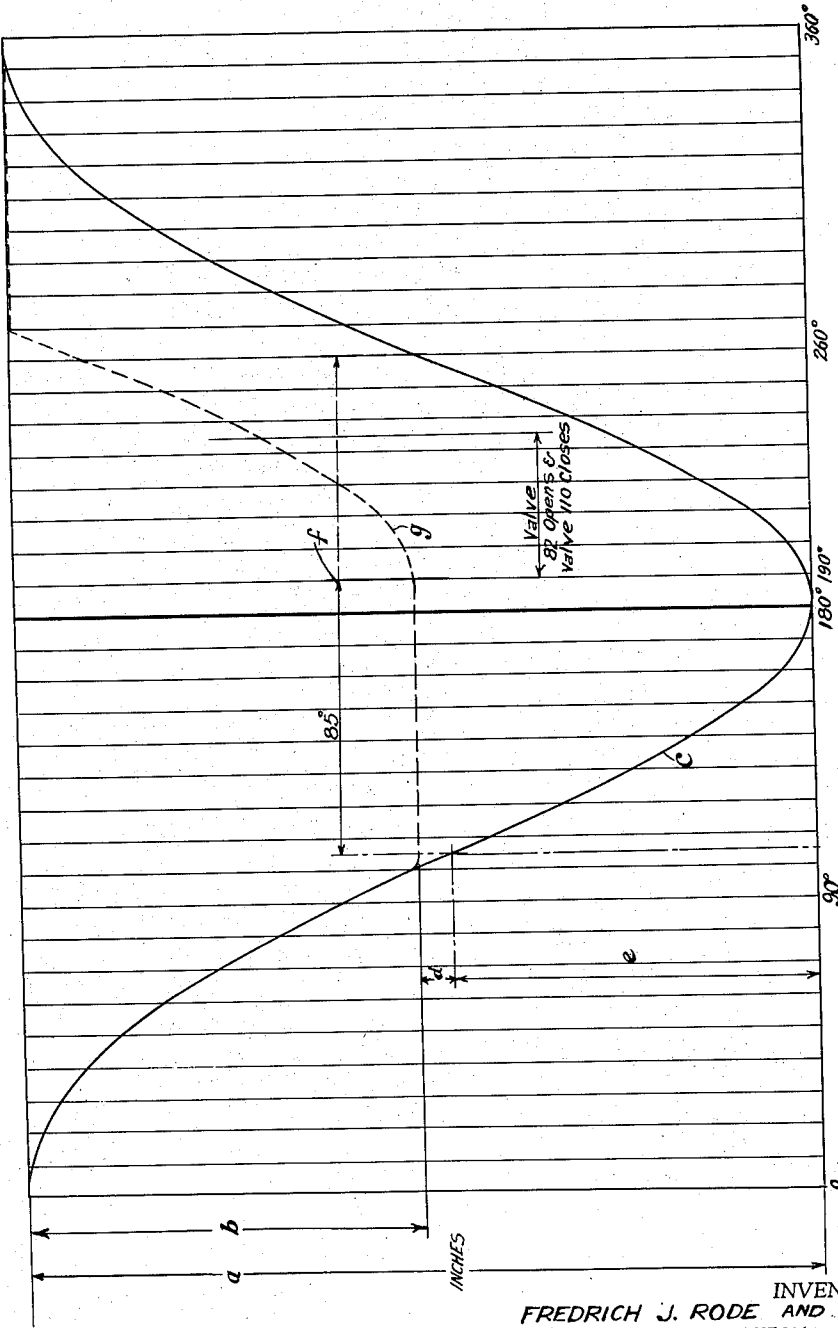


Fig. 10

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UNITED STATES PATENT OFFICE

2,448,327

DOUBLE-SLIDE MECHANISM AND DOUBLE-ACTION DRAWING PRESS

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Application June 12, 1943, Serial No. 490,600

2 Claims. (Cl. 113—45)

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This invention is concerned with production machines wherein two or more cooperating slide mechanisms are coordinated in cycles of movement to perform work such as is characteristic of sheet metal drawing presses, plastic molding presses and specialized machines of various types.

The general object of the invention is the provision of a double slide mechanism wherein the two slides during the course of the cycles of operation thereof may have relative movement mechanically and hydraulically effected in such manner that the slide mechanisms may be locked together hydraulically while mechanically moved in unison and one of the slide mechanisms may be moved mechanically relative to the other slide to produce hydraulic pressure upon the other of the slides and whereby both slides may perform work in cycles of operation that can be relatively varied at will.

Another object of the present invention is the provision of a double action press wherein both the die slide and the blank holder slide are locked together and are reciprocated in unison by mechanical means connected only to the die slide and wherein movement of the die slide relative to the blank holder slide produces a predetermined hydraulic pressure upon the blank holder when the blank holder is in contact with the blank, thereby eliminating from a double action press all separate mechanical means heretofore required for actuating the blank holder.

A further object of the present invention is to provide a double action press having the above characteristics and wherein adjustable controls are provided which may be acted upon by one of the moving slides and thereby determine the timing of sequence of operation of the two slides.

A still further object is the provision of a double action sheet metal drawing press wherein the travel of the blank holder relative to the travel of the die slide, as well as the extent of the dwell of the blank holder can be varied expeditiously as required.

A still further object of the present invention is to provide a double action press having a blank holder pressure control medium for varying the pressure at several points on the blank holder structure whereby the blank holder pressure upon the blank may be varied and visibly indicated from zone to zone of the blank.

Another and further object of this invention is to provide a double action sheet metal drawing press which incorporates all of the foregoing features in a relatively simple compact and sturdy construction.

A further object is the provision of a double action press structure having only a single crank

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mechanism and having a novel arrangement of the slide mechanism and cooperating parts therefor.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a front elevation of a large capacity double action sheet metal drawing press incorporating the features of our present invention with the mechanical crank and drive diagrammatically indicated by dot and dash lines;

Fig. 2 is a top view of one of the main frame members of the machine which constitutes a ram bearing and top support for the hydraulic piston-cylinder mechanism;

Fig. 3 is a cross-sectional plan view taken substantially along lines 3—3 of Fig. 1;

Fig. 4 is an enlarged front elevation fragmentary view taken substantially along the planes indicated by lines 4—4 in Fig. 3 and as viewed from the front of the machine with the slides in up position;

Fig. 5 is a cross-sectional elevation of the piston and cylinder hydraulic differential mechanism interposed between the die slide and the blank holder slide and taken substantially along the plane indicated by the line 5—5 of Fig. 3 and with the slides having just been interlocked;

Fig. 6 is an enlarged cross-sectional view of the slide interlocking means taken substantially along the plane indicated by the line 6—6 of Fig. 3 or 4;

Fig. 7 is a detail view of a by-pass valve means incorporated in the interlocking mechanism shown in Fig. 6, but with the valve mechanism drawn as if swung to the right for the purpose of better illustrating the same;

Fig. 8 is a cross-sectional enlargement of a solenoid operated valve mechanism for the slide interlocking means;

Fig. 9 is a fragmentary view of a fluid reservoir and associated control means therefor as provided on each of the hydraulic generating mechanisms shown in Fig. 5; and

Fig. 10 is a cycle diagram showing the cycle of movement of the mechanically actuated die slide relative to the range of possible movement of the blank holder slide.

Heretofore it has been possible to provide, in a double action press, a mechanism for actuating

the blank holder slide by interposing a hydraulic piston and cylinder between the mechanically actuated die slide and the blank holder and which was also connected to the frame of the press. The arrangement was in the nature of a duplex piston and cylinder mechanism connected to an external source of high hydraulic pressure controlled by valve mechanism actuated by the crankshaft of the press, such for example as shown in the Beyer Patent 1,433,116. In hydraulic presses piston and cylinder interconnections between the blank holder and the die slide or ram have also been used. However, such machines have inherent disadvantages, one of the difficulties being that in the case of the mechanical press the die slide hydraulic pressure varied and increased as the die slide continued to descend after the blank holder had been arrested in its movement by contacting the work blank or bottom die mechanism. In the case of the hydraulic press it is well known that the production cycle of such a press is comparatively slow relative to the mechanically actuated die slide press. In both instances it was necessary to have a source of external hydraulic pressure connected into the machine to maintain pressure upon the die slide during the drawing action and during the first part of the upward movement of the die slide.

The present invention contemplates the overcoming of the foregoing disadvantages and other drawbacks to the use of a hydraulically operated work clamping slide or blank holder while attaining all of the advantages of a mechanically actuated die slide.

We have incorporated a hydraulic pressure producing means disposed between the work holder or work clamping slide and the die slide whereby relative movement between the two slide members produces the hydraulic pressure desired. Associated with this means is a constant pressure, constant volume maintaining means which may serve to maintain a predetermined clamping pressure upon the work or blank throughout the period of relative movement between the work clamping slide and the die slide or to any extent desired.

We also provide a hydraulic interlocking means which functions independently of any external source of hydraulic pressure for locking the work clamping slide to the die slide during certain parts of the cycle of operation of these two slides, and the interlocking device is such that the vertical elevation or disposition of the work clamping slide relative to the vertical elevation or position of the die slide can be varied as desired.

Various controls and safety features are incorporated in the machine illustrated in the drawings, as will be hereinafter set forth and the particular press disclosed has features of construction which are novel per se.

Referring to the drawings, in Fig. 1 we show a double action drawing press structure comprising a bed formation 20, side frame members 21 which may be integrally cast to the bed if desired, a central casting 22 affording a central ram bearing and supported by and resting upon members 21 and a box-like crown structure 23 resting on uprights 24^a. The crown structure supports on its top a motor 26 which drives a pulley 27 on shaft 28 supported by bearings 29 resting on the top of the crown. A magnetically operated clutch mechanism may be associated with the pulley 27 and shaft 28. Shaft 28 has a pinion 30 driving a large gear 31 carried on a shaft 32. Shaft 32

and a shaft 36 parallel thereto have bearings in the crown structure. Shaft 32 has a pinion 34 driving a large gear 35 carried on shaft 36. Shaft 36 carries a pinion 37 driving a large gear 38 which is mounted upon the main crankshaft 40. Crankshaft 40 is supported by bearings attached to the under side of the crown and is connected to a connecting rod 43, the lower end of which is connected by pin 44 to the top of a centrally disposed ram 45, which forms part of the die slide mechanism. The ram 45 is slidably positioned in a central bearing structure 46 comprising an integral part of the frame member 22. The die slide mechanism, moreover, comprises a lower die slide frame 48 which is in slidable engagement with a blank holder 50.

Both the die slide 48 and the blank holder 50 are provided with diagonal or corner slides and slide ways. Thus the die slide structure may comprise a single casting having a four-point slideway contact, indicated by reference numeral 49, with the blank holder or work clamping slide structure 50. The work clamping structure or blank holder 50 has a four-way sliding engagement 51 with the frame members 21 of the main frame.

Any suitable connecting means between the ram 45 and the die slide member 48 may be provided. We have shown an adjustable connection comprising a large thimble member 53 in threaded engagement at 54 with internal threads formed in the lower end of the ram 45. A worm wheel 55 is secured to the thimble member 53 and is disposed inside of a connecting member 56 forming part of or secured to the inner structure of the die slide 48. The worm wheel may be turned by a worm (not shown) in any suitable manner.

Referring to Fig. 2, which shows a top view of the central frame member 22, it will be noted that this member is a cellular structure comprising four pairs of cylindrical cavities, one pair of cavities being for the reception of pneumatic counter-weight means for the die slide, one pair for the blank holder slide and two of the pairs for the reception of the top cylinders of the duplex hydraulic piston and cylinder arrangement operatively disposed between the die slide and the blank holder slide, as will be described hereinafter. The cavities 65 are for the reception of cylinders 66 having flanges bearing upon the top of the central frame member 22 (note Fig. 4) and having the pistons 67 thereof connected by depending rods 68 to opposite sides of the blank holder slide at 69 in a convenient manner. As stated, the cavities 61 are for die slide counter-weight mechanisms comprising pneumatic cylinder 62 and piston 63, the piston being connected to the die slide by a downwardly extending piston rod 64 suitably connected to the die slide, all in the manner of the blank holder counterweight devices.

The four equally spaced cavities 70 are for the reception of four top cylinders 72 which comprise parts of four sets of duplex differential piston-cylinder mechanisms which are operatively disposed within the frame structure between the side walls of the two slide structures, as will be noted in Fig. 3. Each of these hydraulic mechanisms comprises further a hollow piston 74 disposed to operate within the top cylinder 72 and a cylinder 75 secured at 76 to the lower end of the top piston 74. The cylinder 75 reciprocates relative to a bottom piston 77 which rests upon an inwardly extending flange

50^a of the blank holder slide structure 50. The lower cylinders 75 are loosely mounted upon the die slide 48 for aligning purposes, the connection being such that when the die slide is mechanically reciprocated the upper piston 74 and lower cylinder 75 are reciprocated in unison therewith. Cylinders 75 are connected to die slide 48 in such a manner that a limited lateral, lost motion connection through a horizontal slideway between these cylinders and the die slide permits self aligning adjustment of the cylinders relative to their cooperating pistons. Piston 77 rests upon flange 50^a of the blank holder slide structure 50, and is movable laterally with respect thereto.

The effective diameters of the upper piston and cylinder relative to the diameters of the lower piston and cylinder is such that per an inch of travel of the die slide more fluid will be displaced by the telescoping of cylinder 75 down upon piston 77 than the amount of volumetric space afforded by the same downward movement of piston 74 relative to the top fixed cylinder 72. Accordingly, provision is made to compensate for this differential action between the upper piston cylinder and lower piston cylinder, particularly during the period fluid is trapped within the piston and cylinder system, which is during that period of the cycle of operation of the two slides when certain relative movements are taking place therebetween. This device, to be hereinafter described, will be called a constant pressure constant volume maintaining means. When no relative movement is taking place between the two slide mechanisms, the piston and cylinder systems are open to fluid reservoirs 80 which may be located at any convenient place, but are shown mounted directly above the upper structures of the fixed cylinders 72. A pneumatically operated valve member 82 is adapted to open and close a fluid port 83 and passageway 83^a which establishes connection between reservoir 80 and the piston-cylinder system. The valve 82 is operated by a pneumatic piston 84 disposed within a cylinder 85 and a pneumatic conduit 86 leading from a source of pneumatic pressure is connected to the pneumatic cylinder 85. The conduit 86 is controlled by valve mechanism operated from, or controlled by, movement of one of the slides of the machine, as will be described.

The constant pressure constant volume maintaining means acting on the fluid in the piston-cylinder system when the same is under pressure or closed will now be described. It will be noted in Fig. 4 that the base 80^a of the reservoir 80 comprises a valve housing from which a conduit 86^a branches off, which is integral with a cylinder formation 87 having a piston 88 disposed therein. The piston 88 is opposed by a pneumatic piston 89 disposed within a pneumatic cylinder 90 having a pneumatic line 91 connected thereto, through which air, at any desired predetermined pressure, passes to the cylinder 90. The line 91 connects to a surge tank 92 and the surge tank 92 is connected to a pneumatic line 93 communicating with a source of air pressure. A pressure reducing valve mechanism 94 is provided in the line 93 whereby the air pressure within the tank 92, and consequently within cylinder 90, can be established at any practical value, the same being indicated by a gauge 95. It is to be understood that there are four of the constant pressure mechanisms just described and disposed with the valve 94 and gauges 95 conveniently located. Also it is to be understood that there are dif-

ferential piston-cylinder systems disposed between the die slide and blank holder slide structure adjacent the four corners thereof.

Briefly, if the valve 82 is maintained closed, hydraulic pressure is created within the piston-cylinder structures just described while relative downward movement between the slides takes place and by reason of the difference in the diameters of the upper and lower pistons and cylinders a small surplus of the fluid within the system must be forced somewhere and accordingly the pneumatically urged pistons 88 are forced upwardly, as viewed in Fig. 4, against the predetermined air pressures in the cylinders 90. Such pressures will be maintained on the die holder during part of the down stroke of the die slide as well as during part of the initial upward movement of the die slide and the four pressures may be uniform or may vary from region to region of blank holder in accordance with the individual pressures set by the operator by manipulation of the four valves 94.

In order to break the pressure in the systems a pressure breaking valve 98 is provided which controls a conduit 99 connected into the hydraulic system. This breaker valve 98 may be operated by control mechanism actuated by one of the slides of the press, or if desired it may be solenoid operated with the circuit of the solenoid being controlled by a switch operated from the crankshaft of the press or one of the slides. We also provide an overload relief valve 100 in the line 99 as a safety measure should the valve 98 fail to operate and should an excess of pressure begin to be built up within the system, the disposition of the line 99 being such that any fluid passing therethrough will discharge into the reservoir 80.

It is apparent from the foregoing description that no mechanical means is provided for operation of the blank holder slide mechanism, the same being actuated intermittently by the die slide mechanism. For this purpose a separate hydraulic interlocking mechanism, which is independent of the hydraulic pressure creating means above described, is disposed between the side walls of the two slide structures, as shown in Figs. 3 and 6. This locking mechanism comprises a piston 102 resting upon and reacting against a shelf or lug 48^a extending outwardly from the wall of the die slide structure 48. A second piston 103, which is preferably hollow to carry a fluid supply, is secured to a branch or lug structure 48^b extending outwardly from the top of the die slide structure 48. A cylinder 104 cooperates with piston 102 and a cylinder 105 cooperates with piston 103 and both of these cylinders are supported by a suitably bored lug formation 50^b on the blank holder slide 50. Cylinder 105 also rests upon the bottom inner flange 50^a of the blank holder slide 50. A check valve mechanism 103^a controls the flow of oil from the interior of the piston 103 to the cylinder 105 when fluid is required in the system. The bottom of cylinder 105 is connected to the top of cylinder 104 by a fluid line 108 controlled by automatically operated valve mechanism 110 so that when the valve mechanism 110 is open relative movement between the two slide structures, insofar as the overlapping parts thereof will permit, can take place. Closing of this valve mechanism will lock the two slides in whatever relative position they may be at the time of the closing of the valve mechanism. This valve mechanism 110 is shown in more detail in Fig. 7 while

a different valve operating mechanism is illustrated in Fig. 8. Valve mechanism 110 may be electrically, mechanically and manually operated, as will be described.

We provide a pair of by-pass lines 111 controlled by pressure relief valves 112 of known purpose and construction, should an overload under any circumstances take place in opposition to the proper upward and downward functionings of the two slide mechanisms. One of these valve mechanisms may also be such that the clamping slide can be raised against an upper stop and the die slide have further upward travel thereafter if desired.

Connected into line 108, below the top of cylinder 104 is a branch line 114 extending to a shock absorber mechanism comprising a plunger 115 disposed within a cylinder 116 in communication with line 114 and line 108. The plunger 115 in cylinder 116 is opposed by a pneumatic piston 117 disposed within a pneumatic cylinder 118 connected to a source of air pressure through a conduit 119. By predetermining the amount of pneumatic pressure within the cylinder 118 a cushion is provided for the fluid within the hydraulic locking system described whereby the shock of the slide 50, when brought into contact with the work by the die slide 48, can be absorbed. The shock absorber also serves as a safety factor against any slight over travel effect of the die slide relative to the arrested blank holder slide or time lag in the unlocking operation of the valve mechanism 110.

The valve mechanism, as shown in Fig. 7 may be mechanically actuated by a cam 130, two such cams being attached to the frame of the machine by brackets 131 (Fig. 3) and being operated upon upward movement of the blank holder slide. We also prefer to use an electrically operated valve mechanism, operable when the blank holder approaches or reaches the bottom of the stroke; this valve mechanism may also be manually operated by the operator when setting up the press. In Fig. 8 this valve mechanism 110 is shown to comprise a cylindrical plunger valve 125 disposed within the valve body 126, which may be shifted to an open position by energization of a solenoid coil 127 and urged to a closing position by spring 128, or vice versa. The plunger 125 extends through an opening 50^d in the side wall of the blank holder structure 50 and carries a roller 123 disposed to be acted upon by the mechanism 130 carried by the bracket 131. The leads to the solenoid may be controlled by an adjustably mounted switch (not shown) which can be closed or opened by action of one of the moving slide mechanisms or an adjustable controller driven by the crankshaft. An end forked lever 140, carried on the outside of the blank holder slide at a convenient location, may be provided for manual operation of the valve 110 when desired.

We also provide a pressure responsive electric switch mechanism 120 connected to the shock absorber cylinder in line 121 which serves the purpose of effecting disconnection of the clutch of the press if any excessive or damaging pressures tend to build up within the hydraulic locking system. A similar device may also be added for the up stroke shock should an up stop be used for the clamping slide as referred to above.

Referring to the diagram in Fig. 10, it will be seen that the vertical marginal line or ordinate *a* represents twice the maximum crank throw or the maximum vertical movement of the die slide mechanism and the abscissa represents one com-

plete cycle of the crank in degrees. Curve C represents one complete cycle of the die slide movement. For a vertical distance *b*, which can be any distance within distance *a* less the distance of the depth of draw being effected by a die carried by the die slide, the work holder slide is locked to the die slide by reason of the valve mechanisms 110 being in a closed condition. When both slides have reached the bottom point after having traveled the distance *b* the blank holder engages the work blank and its movement is arrested. The original relative positions of the two slides is such that the die on the die slide has not reached the work blank. Valve mechanisms 110 have just been opened by action of the solenoids. The die slide continues through a further short downward movement *d* during which the controls of pneumatic valves 135 have functioned to permit closing of the valves 82 by the springs 82^a, to close the four differential piston-cylinder mechanisms and the pressure therein builds up to the predetermined desired values. The position of the crank is then at 105° and drawing of the work then starts and continues through distance *e* and to 180° of the crank cycle or to the bottom of the die stroke. During this drawing period valves 110 have been maintained open by the solenoid and valves 82 closed. From 105° to 180° of the crank motion a constant or uniform pressure is maintained on the die slide which can be prolonged to any desired extent past the bottom dead center of the crank. The chart indicates the closing of the valve mechanisms 110 at the 190° position of the crank or abscissa distance *f*.

At the 190° crank position the die has been initially stripped from the work piece and the pneumatic pressure has maintained the pressure within the systems through the functioning of piston 88 even though the pressure producing action of the differential piston-cylinder mechanisms has been reversed to some extent by the slight upward movement of the die slide. The pressure in the differential piston-cylinder mechanisms is then broken by magnetic operation of the pressure breaker valves 98. Thus, the blank holder remains at rest upon the flange of the formed work piece to the 190° or past down center of the crank. The solenoids of valves 110 are de-energized, the valves close and the die slide continues to move upwardly carrying the blank holder slide with it until the crank practically reaches the 260° position. Opening of valve mechanisms 110 by cams 130 then unlocks the blank holder from the upwardly moving die slide mechanism and finally the die slide reaches its maximum up position, i. e., the 360° position of the crank, at which point the drive is declutched in a well known manner by operation of the clutch on shaft 28.

If desired the valves 110 may be closed slowly shortly after the 190° position of the crank, thus effecting a gradual locking of the two slides together as indicated by the dotted curve *g*. The blank holder will then be raised to its top position against a frame stop and the increased pressure at this point will open one of the valves 112 to by-pass the locking fluid until the die slide reaches its up position.

As stated, when the blank holder slide has been elevated to the desired position by the upwardly moving die slide valves 110 are opened by cams 130. These cams can be adjusted vertically on the brackets 131 at any desired position. The tendency of the blank holder slide

at this time is to drop, being only held suspended by its counterweight mechanism which is arranged to slightly under counterbalance the slide whereby the blank holder slide will actually lower sufficiently (after being unlocked from the die slide) to move roller 123 off the cam. Valves 110 close or tend to close. Thus this action is momentarily to rise and fall, depending upon the position of roller 123 upon the cam and the state of open and shut condition of valve mechanisms 110. To assure stoppage of the upward movement of the blank holder slide at the station of cam 130 the valves 82 may be closed for a very short period when the interlocked two slides reach the station of cam 130 in their simultaneous upward movement. This closing of valves 82 will cause the hydraulic piston-cylinder system to act as a momentary stop for the blank holder slide, whereupon valves 82 are opened again immediately thereafter so as not to interfere with the continued upward movement of the die slide.

It will be obvious that the controller for the valve mechanisms 110 can be such that cams 130 would not be used, the solenoid serving the purpose of keeping the valve mechanism open instead of cams 130. In such event a more accurate balancing of the counterweight mechanism for the blank holder slide would be advisable and an adjustable friction snubber would be used to hold the blank holder slide in the up arrested position. The solenoids would then be deenergized just before the end of the upward strokes of the die slide.

Also to those skilled in the art it will be apparent that in some types of production work the die slide could be raised to retract the die on the die slide from the lower die before the blank holder slide is locked to the die slide. In this instance the two slide mechanisms would remain locked together except during a period extending from slightly before drawing commences to a point slightly beyond the lower dead center of the crank. Hence the cycles of the two slides can be varied in accordance with the type of work being drawn by the dies.

It is to be understood that the pneumatic operation of the valve 82 takes place after the pressure is broken. This is effected by solenoid operation of a two-way air valve 135 in the line 88. The solenoid circuit is controlled by switch mechanism (not shown) which may be of any of the known forms suitable for the purpose. The switch mechanism is conveniently disposed for operation by the movement of the die slide mechanism. The valve mechanism 135 is such that when in one position pneumatic pressure is connected to the piston 84 to force the reservoir valve open, while in another position the air pressure within cylinder 85 is exhausted to the atmosphere. This is the condition when the differential piston-cylinder system first begins to tend to build up pressure. If desired, the valve 82 can be more positively operated in both directions by the use of a double acting piston and cylinder structure with suitable valve mechanism for the same.

To those skilled in the art it will be apparent that the differential piston-cylinder pressure producing system and the hydraulic interlocking means between two slide mechanisms which move both in unison and relatively during the course of one cycle of operation thereof can be utilized, for example, in a plastic press where an inter-

rupted unidirectional movement of a ram structure action is desired.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In a double action press of the character described having, a mechanically reciprocable die slide, a blank holder slide, an hydraulic interlocking system having tandem cylinder-plunger mechanism operatively disposed between and interconnecting the die slide and the blank holder slide when the latter is brought into and away from work clamping position, valve and fluid interflow control means between the tandem hydraulic units operable upon reciprocation of one of said slides to disconnect the slides and allow predetermined relative vertical movement of the slides during draw and withdrawal portions of the die slide work cycle, an hydraulic pressure system in the form of a differential duplex piston and cylinder mechanism for pressure retention of the blank holder slide in work clamping position during the draw and withdrawal action of the die slide, comprising, an upper cylinder fixed to and within the press frame, an upper cooperating piston therefor, a lower cylinder rigidly secured to said upper piston, a lower cooperating piston reciprocable within said lower cylinder and resting upon the blank holder slide, and means for connecting said lower cylinder with the die slide, said means providing for limited lateral, lost motion movement between said cylinder and die slide to permit self-aligning adjustment of said cylinder relative to its cooperating piston.

2. In a double action press of the character described having, a press frame, a mechanically reciprocable die slide, a blank holder slide, an hydraulic pressure system in the form of a differential duplex piston and cylinder mechanism for retaining the blank holder slide in work clamping position during the draw and withdrawal action of the die slides, comprising, an upper cylinder fixed to and within the press frame, an upper cooperating piston therefor, a lower cylinder rigidly secured to said upper piston, a lower cooperating piston reciprocable within said lower cylinder and located upon and laterally movable with respect to the blank holder slide, and means for connecting said lower cylinder with the die slide, said means providing for limited lateral, lost motion movement between said cylinder and die slide to permit self-aligning adjustment of said cylinder relative to its cooperating piston.

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