Aug. 25, 1959 J. B. TIEDEMANN 2,900,943

CUSHIONING MEANS FOR DOUBLE ACTION PRESSES

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FIG. 1.

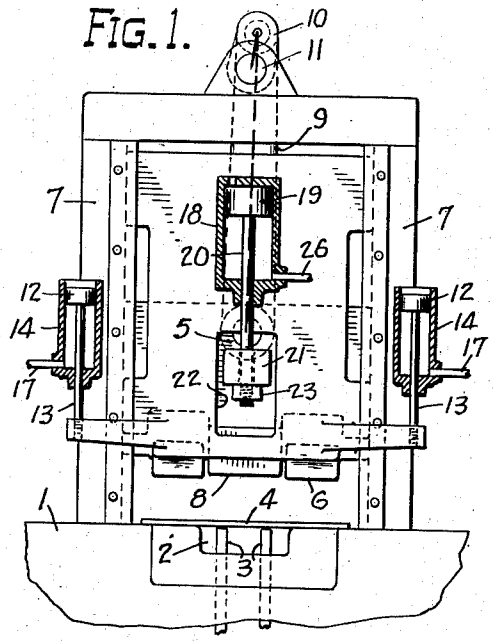


FIG. 2.

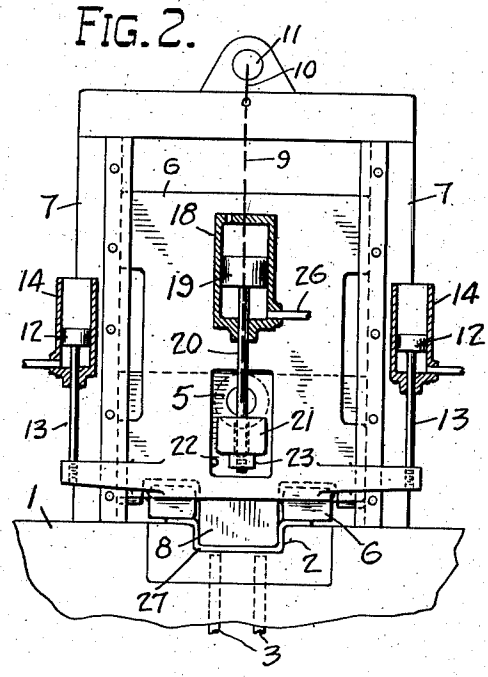


FIG. 3.

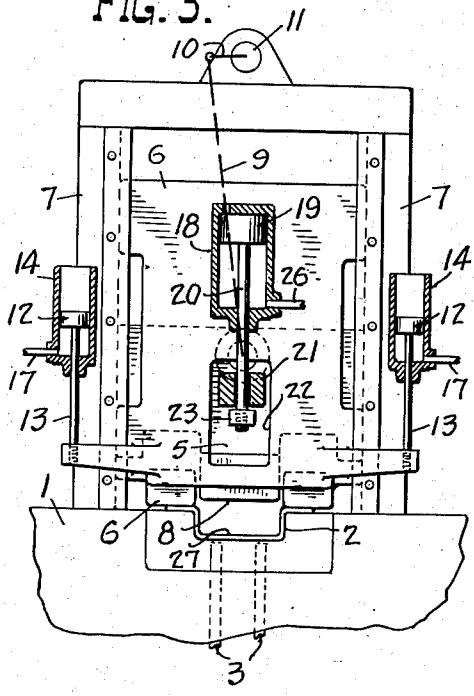
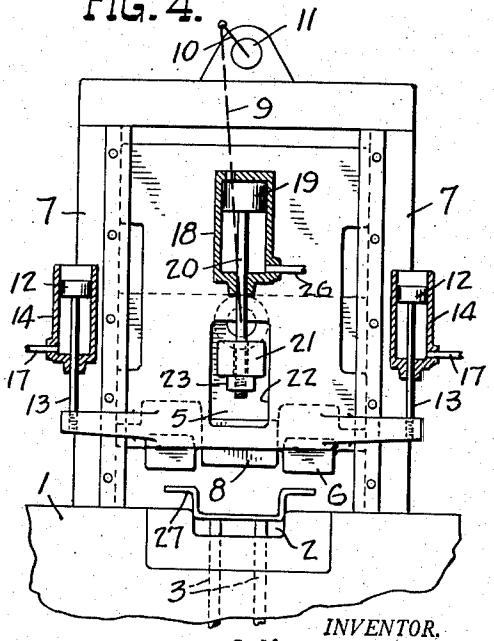


FIG. 4.



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FIG. 5

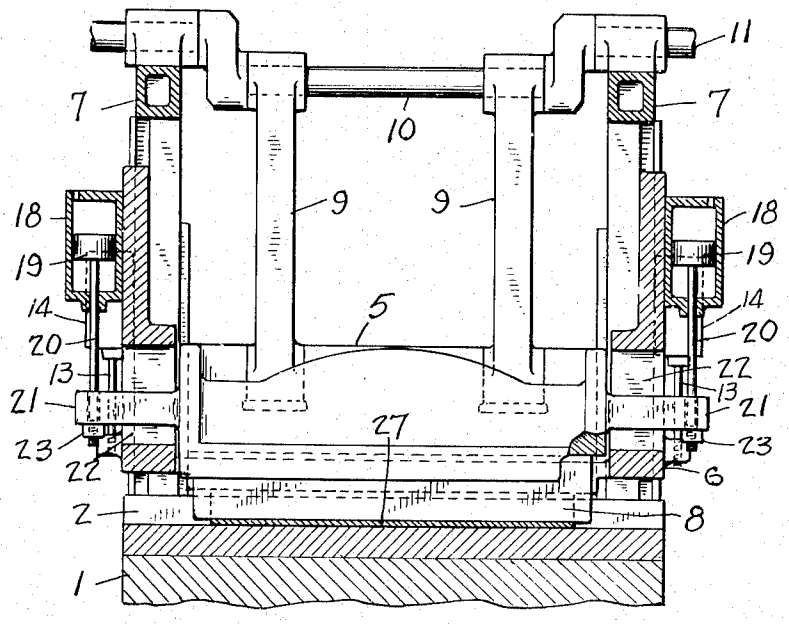
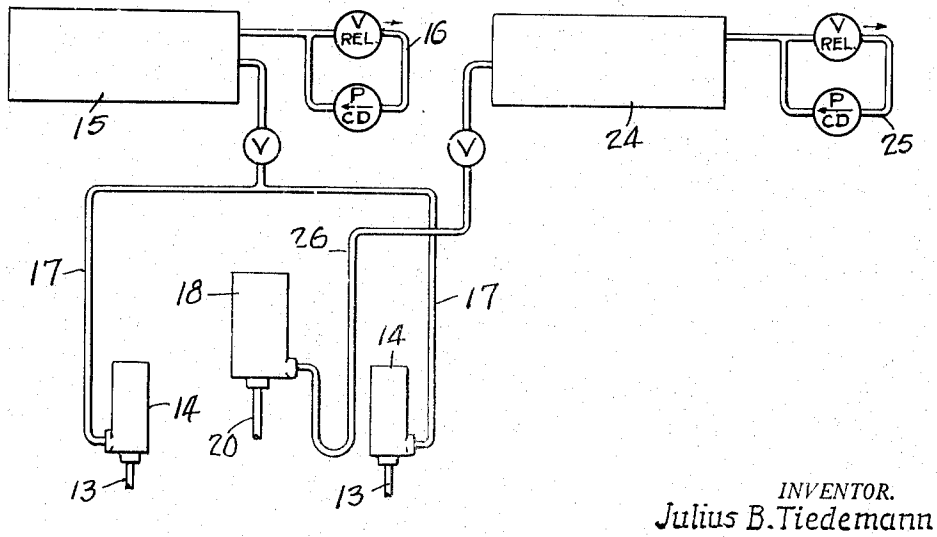


FIG. 6.



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FIG. 7.

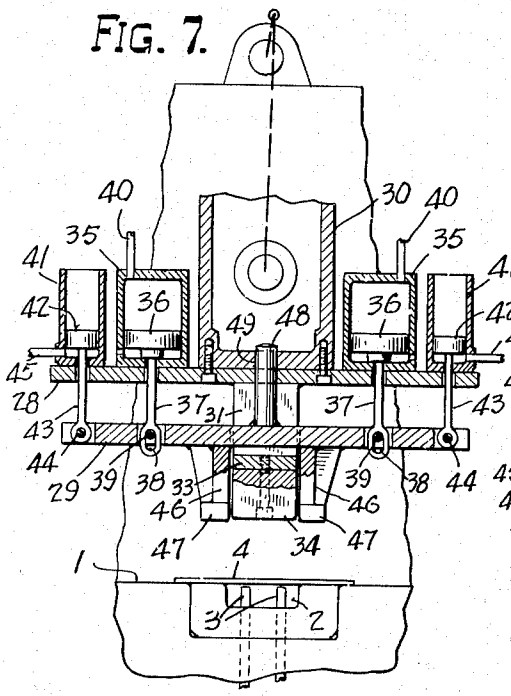


FIG. 8.

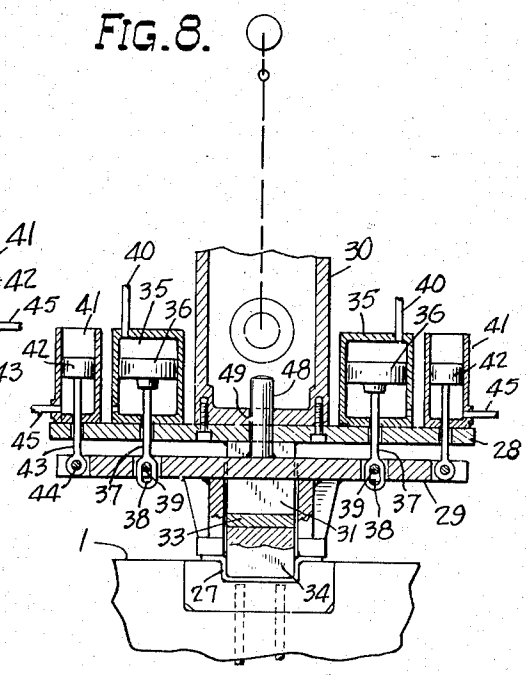


FIG. 9.

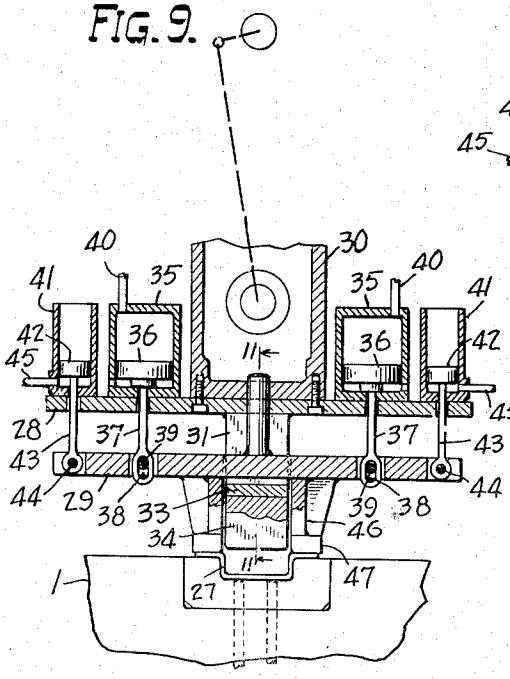


FIG. 10.

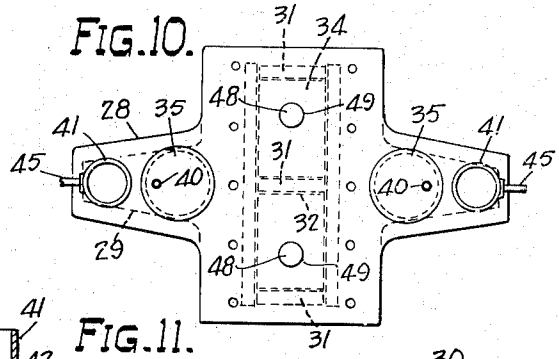
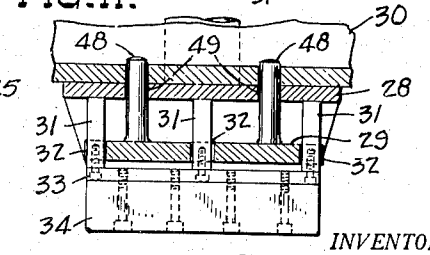


FIG. 11.



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CUSHIONING MEANS FOR DOUBLE ACTION PRESSES

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Application October 19, 1953, Serial No. 386,892

5 Claims. (Cl. 113—45)

This invention relates to double action presses and more particularly to a mechanism for such presses whereby the impact between a pair of relatively moving members and the vibrations due thereto are drastically reduced.

This invention is a continuation-in-part of the invention disclosed and described in an application by the same inventor filed on May 5, 1951, Serial No. 224,797, now abandoned, and entitled, "Work Forming Machine Having a Single Operating Drive Means."

According to the invention cushioning means are provided for the press whereby impact between the movable members and vibrations due to such impact are drastically reduced during the work forming operation.

More specifically the invention provides for a double action press wherein a single operating drive means actuates a die member which cooperates with a die cavity vertically aligned therewith to form a blank. A blank holder holds the blank during the forming operation and is motivated independently of the die actuating drive means. While the blank holder is dependent on the die actuating drive means for motivation downwardly toward the blank, it is separately motivated on the upstroke by a pressure means. This separate upstroke drive on the blank holder provided by the pressure means drastically reduces the impact and the vibrations due to impact generally encountered in the operation of such presses in effecting the relative movements of the members during the operating cycle.

The drawings furnished herewith and the description set forth hereinafter illustrate the invention as presently contemplated.

In the drawings:

Figure 1 is a front elevation of a press partially in section with the die member and blank holder in the fully raised position for loading or placing the work in the press;

Fig. 2 is a view similar to that of Figure 1 showing the die member and blank holder at the bottom of the working stroke;

Fig. 3 is a view similar to that of Figure 1 showing the die member on the upstroke and removed from the finished workpiece at the instant before the blank holder disengages the workpiece;

Fig. 4 is a view similar to that of Figure 1 showing the die member and blank holder during the remainder of the upstroke when the two have been reengaged;

Fig. 5 is a side elevation partially in section of the press shown in Figures 1–4 with the die member and blank holder at the bottom of the working stroke;

Fig. 6 is a diagrammatic view of the fluid pressure systems employed in the press operation;

Fig. 7 is a front elevation of a second embodiment of the invention partially in section showing the die member and blank holder in the fully raised position for loading;

Fig. 8 is a view similar to that of Fig. 7 showing the die member and blank holder at the bottom of the working stroke;

Fig. 9 is a view similar to that of Fig. 7 showing the die member on the upstroke removed from the finished workpiece at the instant before the blank holder disengages the workpiece;

Fig. 10 is a top plan view of the embodiment shown in Figs. 7 through 9; and

Fig. 11 is a vertical section taken on line 11—11 of Fig. 9.

In carrying out the invention the press shown in the drawings includes a bed 1 in which a die cavity 2 is disposed. Knock-out pins 3 are movably disposed in the bed beneath the die cavity 2 and may be moved upwardly to strip the formed workpiece from the cavity. The blank 4 to be formed is disposed on the bed 1 over the die cavity.

A press ram 5 and blank holder 6 are slidably disposed for vertical movement within frame elements 7 which are supported by bed 1 and extend upwardly therefrom. A die member 8 is secured to the underside of the press ram 5 and is adapted to cooperate with the die cavity 2 in the bed of the press to form the blank 4 as the press ram 5 is moved downwardly.

To actuate the ram 5, a pair of crank rods 9 are pivotally connected to the upper surface of press ram 5. The upper ends of the crank rods 9 are rotatably disposed on the crank 10 of shaft 11 which is driven at a given speed to actuate the ram 5 with attached die member 8 toward and away from the press bed 1 to form the blank 4.

The blank holder 6 generally surrounds the ram 5 and is supported by pistons 12 which are connected to the blank holder 6 by rods 13. The pistons 12 are operatively disposed within cylinders 14 affixed to the frame 7. Fluid pressure from receiver tank 15, controlled by suitable pressure supply devices shown diagrammatically as at 16, acts through pressure lines 17 to maintain a constant given pressure on the pistons 12 of adequate magnitude to accelerate the blank holder 6 upwardly, yet being yieldable to the downward force of the press ram 5.

The blank holder 6 is connected to ram 5 through a fluid pressure system which includes a pair of hold-down cylinders 18 secured to the end surfaces of blank holder 6 and which are adapted to move therewith. Pistons 19 are operatively disposed in the cylinders 18 and are provided with downwardly extending rods 20. Laterally extending projections or arms 21 provided on the press ram 5 extend through openings 22 in the ends of the blank holder 6. The rods 20 of pistons 19 extend downwardly through holes in the arms 21 and are each provided with an abutment 23 below the arms 21. Fluid pressure from receiver tank 24, controlled by suitable pressure supply devices shown diagrammatically as at 25, acts through pressure lines 26 to maintain a constant given pressure on the pistons 19. The fluid pressure within cylinders 18 is considerably greater than the pressure within cylinders 14.

In the loading position of the press shown in Figure 1, the crank 10 has carried the press ram 5 to its uppermost station. The pressure on pistons 19 of cylinders 18 maintain the pistons at the top of their stroke. Concurrently the pressure in cylinders 14 acting on pistons 12 is holding the blank holder 6 in its maximum raised position. In the loading position of the blank holder the abutments 23 on piston rods 20 engage the underside of arms 21 of the press ram 5, as shown.

As the press members are actuated downwardly from the loading position by operation of crank 10, the arms 21 of ram 5 acts against abutments 23. As the pressure in cylinders 18 is of a greater magnitude than the pres-

sure in cylinders 14, the pistons 12 will be forced downwardly in cylinders 14 and the blank holder 6 will move with the die member 8. With no relative movement therebetween, the ram 5 and the blank holder 6 move downwardly together to engage the blank 4.

When, on the downward stroke of the ram 5 and blank holder 6, contact is made between the blank 4 and the blank holder 6, travel of the blank holder 6 is interrupted and it assumes its function of holding the blank while the die member 8 continues downwardly to form the blank 4. As the crank forces the press ram 5 with attached die member 8 downwardly relative to the blank holder 6 to form the finished workpiece 27, as shown in Fig. 2, the arms 21 on the press ram 5 carry the abutments 23 on rods 20 downwardly with it. Thus, pistons 19 in cylinders 18 are moved downwardly from the top of their stroke against the pressure therein. The pressure within cylinders 18 with pistons 19 displaced from the top of their stroke react on the blank holder 6 to hold the blank during the forming operation. Meanwhile, with the blank holder 6 at the bottom of its stroke in engagement with the formed workpiece 27, the pistons 12 of cylinders 14 are situated at the bottom of their stroke with the pressure tending to raise the pistons. Thus, the reaction pressure holding down blank holder 6 against the blank is actually the differential pressure between the pressures of cylinders 18 and cylinders 14.

As the crank proceeds to withdraw the die member 8 from the formed workpiece 27 on the return stroke, the reaction pressure on the blank holder 6 continues. The blank holder therefore acts as a stripper mechanism holding the workpiece 27 in place while the die member 8 is removed. As the ram 5 continues to move upwardly on the return stroke, the pressure in cylinders 18 moves pistons 19 toward the top of their stroke. When pistons 19 reach the top of their stroke, the pressure acting to hold down the blank holder 6 is removed. As the ram 5 and attached arms 21 continue upward to their original loading position, the pressure in cylinders 14 acting on pistons 12 carry the blank holder 6 upwardly while the knock-out pins 3 are caused to move upwardly to strip the formed workpiece 27 from the die cavity 2.

If the lifting pressure in cylinders 14 is properly adjusted, the continuous motion upwardly of the ram 5 will cause arms 21 to momentarily rise above abutments 23 while the blank holder 6 has had time to accelerate from zero velocity to the speed of the ram. This action is shown in Fig. 3. After the pressure of cylinders 14 has had adequate time to accelerate the blank holder 6 and the abutments 23 have overtaken the arms 21 of the press ram, the pressure in cylinders 14 will retain the arms and abutments in contact during the remainder of the upstroke, as shown in Fig. 4. Since reengagement of the blank holder 6 and ram 5 is accomplished while these members are both advancing upwardly and at only slightly varying speeds the impact between these members is drastically reduced over similar presses wherein the moving ram must accelerate the dead weight of the blank holder from its position at rest on the press bed by metal to metal contact.

A further embodiment of the invention is shown in Figs. 7 through 11. The invention is shown herein incorporated into a unit by which a single action press is readily converted to a double action press. According to this embodiment, a pair of horizontal plate members 28 and 29 are disposed for relative vertical movement with respect to each other. The upper plate member 28 is fixedly secured to the ram 30 of a single action press. The ram 30 may be vertically actuated by a crank as was described in connection with the first embodiment or by any other means.

Centrally of the ram 30 a plurality of transversely spaced die support posts 31 extend downwardly from the plate member 28 through a plurality of openings 32 in the lower plate member 29. A die support plate 33 is secured to the lower ends of the posts 31 below plate member 29 and a die member 34, in turn, is secured to plate 33 and extends downwardly therefrom. As was described in the first embodiment, the die member 34 cooperates with a die cavity 2 disposed in the bed 1 of the press to form a blank 4. Suitable knock-outs 3 are provided to strip the finished workpiece 27 from the die cavity 22 in proper sequence.

Hold-down cylinders 35 are mounted on the upper plate member 28 on either side of the ram 30. Pistons 36 are operatively disposed in cylinders 35 and are provided with rods 37 extending downwardly therefrom through openings in the upper plate member 28. The lower end of rods 37 are each provided with a vertical slot 38 through which pins 39, secured to the lower plate member 29, are slidably disposed. Slots 38 permit limited relative movement between the rods 37 and the lower plate member 29. A fluid pressure system similar to that of tank 24 and supply control devices, shown diagrammatically as at 25 in Fig. 6, acts through lines 40 to maintain a constant given pressure in cylinders 35 above the pistons 36. The cylinder and piston arrangement 35, 36 is equivalent to that of cylinder and piston arrangement 18, 19 of the first embodiment.

Outwardly of cylinders 35, lift cylinders 41 are mounted on the upper plate member 28. Pistons 42 are operatively disposed in cylinders 41 and are provided with downwardly extending rods 43. The rods 43 extend downwardly through openings in the upper plate member 28 and are pivotally secured to the lower plate member 29 by pins 44.

A fluid pressure system similar to that of of tank 15 and supply control devices shown diagrammatically as at 16 in Fig. 6, acts through lines 45 to provide a constant given pressure beneath the pistons 42 tending to raise the lower plate member 29. The cylinder and piston arrangement 41, 42 is equivalent to the cylinder and piston arrangement 14, 12 of the embodiment described hereinbefore.

A plurality of hold-down brackets 46 are secured to the underside of plate member 29 and extend downwardly therefrom on either side of die member 34. A pair of hold-down bars 47 are secured to the lower ends of brackets 46 and are adapted to engage the marginal portions of the blank 4.

Plate members 28 and 29 are guided in vertical relative movement to each other by the support posts 31 which are slidably disposed in the openings 32 of lower plate 29. To further guide the plate members with respect to each other, a plurality of guide pins 48 mounted on the lower plate member 29 are slidably disposed in openings 49 extending through the upper plate member 28 and the lower face of ram 30.

In Fig. 7 the mechanism of the second embodiment is shown in the loading position wherein the ram 30 is in its uppermost station. The cylinders 35 and 41 are subjected to their proper respective pressures. The fluid pressure of cylinders 41 supports the lower plate member 29 in a fixed spaced relation from plate member 28.

As the ram 30 is actuated downward by the movement of the crank or other means the fluid pressure in hold-down cylinders 35 maintains the plate members 28 and 29 in their spaced relation until the hold-down bars 47 on plate member 29 contact the blank 4. Upon contact with the blank 4, downward travel of lower plate member 29 is interrupted. The ram 30, however, continues downward to the bottom of its stroke causing the die member 34 to move relatively to hold-down bars 47 and cooperate with die cavity 2 to form the finished workpiece 27 as shown in Fig. 8. After travel of lower plate member 29 has been interrupted, the cylinders 35 mounted on plate member 28 advance downwardly with the ram 30 and unseat pistons 36 from the bottom of the cylinders and thereby subject the lower plate member 29 to the down-

ward pressure on the pistons to hold the blank during the forming operation.

After the workpiece **27** has been formed the ram **30** starts upward on its return stroke carrying the attached upper plate member **28** with it. The downward pressure on pistons **36** of cylinders **35** remains effective to cause the hold-down bars **47** to hold the workpiece **27** while die member **34** is removed therefrom. When the upper plate member **28** has been moved upwardly a sufficient distance to attain its original spaced relation with respect to plate member **29**, the pistons **36** are at the bottom of the cylinders. In this position, as shown in Fig. 9, the pressure on pistons **36** is no longer effective to hold down workpiece **27**. As the ram **30** continues upwardly to the top of its stroke the fluid pressure beneath pistons **42** in the lift cylinders **41** carries the lower plate member **29** to the top of the stroke while knock-out pins **3** remove the finished workpiece **27** from the die cavity **2**.

If the fluid pressure in cylinders **41** is of the proper amount, lower plate member **29** will be lifted with a minimum impact between the plate members. As the ram carries piston **36** upwardly after the same becomes reseated, the upper end of slots **38** of rods **37** will only momentarily be disengaged from the pins **39**, as shown in Fig. 9, until the fluid pressure acting on pistons **42** has had time to accelerate the lower plate members **29** to the original spaced relation between the plate members. Reengagement between the plate members **28** and **29** is effected with only slightly varying speeds between the members so that impact therebetween is greatly minimized.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. An assembly for attachment to a vertically driven ram of a single action press to convert the same into a double action press, comprising means to drive said ram, a die carrying member to be rigidly attached to the press ram, a die member extending downwardly from the die carrying member and being disposed to cooperate with a die cavity in the press bed to form a blank disposed on the press bed to the shape of the cavity as said ram is moved downwardly relative to the press bed, a blank holder disposed to each side of the die member for engaging and holding the blank during the forming of same, guide means disposed between said blank holder and said die carrying member to prevent relative horizontal movement therebetween, a hold-down pressure cylinder mounted on the die carrying member, a piston operatively disposed within the hold-down cylinder, a rod extending downwardly from the piston through the die carrying member and provided with a vertically extending slot in the lower end thereof, abutment means provided on said blank holder and disposed within said slot and normally engaging the upper end of the slot, fluid pressure means acting on said piston to normally maintain the blank holder and die member in fixed relation and exerting a downward force on the blank holder as the die member is moved relatively thereto after the blank holder engages the blank, and biasing means constantly exerting an upward force on said blank holder of lesser magnitude than the downward force of said pressure means but great enough to accelerate the blank holder upwardly independently of the driven ram after the downward force of the piston on the blank holder is removed, said slot in the piston rod permitting a momentary disengagement between the abutment means on the blank holder and the upper end of the slot until the force exerted by said biasing means has had adequate time to accelerate the blank holder upwardly to effect a reengagement between the abutment means and the upper end of the slot with minimum impact.

2. An assembly for attachment to a vertically driven ram of a single action press to convert the same into a double action press, comprising means to drive said ram, a die carrying member to be rigidly attached to the press ram, a die member extending downwardly from the die carrying member and being disposed to cooperate with a die cavity in the press bed to form a blank disposed on the press bed to the shape of the cavity as said ram moves downwardly relative to the press bed, a blank holder disposed to each side of the die member for engaging and holding the blank during the forming of same, guide means disposed between said blank holder and said die carrying member to prevent relative horizontal movement therebetween, a plurality of hold-down pressure cylinders mounted on the die carrying member symmetrically of the press ram, a piston operatively disposed within each of the hold-down cylinders, a rod extending downwardly from each piston through the die carrying member, each of said rods being provided with a vertical slot in the lower end thereof, abutment means provided on said blank holder and disposed within said slots and normally engaging the upper ends of said slots, fluid pressure means acting on said pistons to normally maintain the blank holder and die member in fixed relation and exerting a downward force on the blank holder as the die member is moved relatively thereto after the blank holder engages the blank, lift cylinders mounted on the die carrying member symmetrically of the press ram, a piston operatively disposed in said lift cylinders, a piston rod extending downwardly from each of the lift cylinder pistons through the die carrying member and connected to the blank holder, said lift cylinder piston being constantly acted upon by pressures exerting an upward force on the blank holder of lesser magnitude than the force exerted by the hold-down pistons but great enough to accelerate the blank holder upwardly independently of the press ram after the downward force of the hold-down cylinders on the blank holder is removed, said slots in the hold-down piston rods permitting a momentary disengagement between the abutment means on the blank holder and the upper end of the slots until the lifting pressure in the lift cylinders has had adequate time to accelerate the blank holder upwardly to effect a reengagement between the abutment means and the upper end of the slot with minimum impact.

3. In a double action press, a die member, means to actuate the die member, the said die member being disposed to cooperate with a die cavity in the press bed to form a blank disposed across said cavity as the die member is motivated downwardly relative to the press bed, a blank holder disposed independently of the die member for engaging and holding the blank during the forming of the same, abutment means provided on the die member, a hold-down cylinder mounted on the blank holder, a piston disposed in said cylinder and having a rod extending downwardly through the die member abutment means, abutment means provided on the piston rod beneath the die member abutment means, fluid pressure means acting on said piston to normally maintain the respective abutment means in engagement and the blank holder and die member in fixed relation during the downstroke of the die member, said piston being movable relative to the cylinder as the die member moves relative to the blank holder after the blank holder engages the blank to exert a downward blank holding force on the blank holder, and biasing means exerting a constant upward force on the blank holder of lesser magnitude than the downward force of said pressure means but great enough to accelerate the blank holder upwardly independently of the die member after the downward force of the fluid actuated piston on the blank holder is removed, said abutment means on the die member and the blank holder momentarily disengaging after the die member is moved upwardly until the biasing means accelerates the blank holder upwardly to effect a reengagement of the abutment means with minimum impact.

4. In a double action press, a press bed to support

a workpiece to be formed, guide means associated with said bed, a die member being slidably disposed in said guide means, means to move the die member reciprocally relative to said press bed between a retracted position spaced from said press bed and a fully advanced position as determined by the forming of a workpiece in the press bed, a blank holder disposed independently of the die member for engaging and holding the blank during the forming of same, abutment means connected to the die member, hold-down cylinders mounted on the blank holder, pistons operatively disposed in said hold-down cylinders and having a rod extending downwardly through said die member abutment means, abutment means provided on each said hold-down piston rod beneath the die member abutment means, fluid pressure means acting on said hold-down pistons to maintain the respective abutment means in engagement and the blank holder and die member in fixed relation during the downstroke of the die member, said hold-down pistons being movable relative to said cylinders to exert a downward force on the blank holder as the die member moves relative thereto to form the blank and withdraws from the formed blank, lift cylinders mounted on the guide means, pistons operatively disposed in said lift cylinders and having a rod extending downwardly and being connected to said blank holder, and fluid pressure means acting on said lift cylinder pistons to constantly exert an upward force on the blank holder great enough to lift the holder and of lesser magnitude than the downward force of the hold-down cylinders and thereby tending to retain the respective abutment means in engagement on the upstroke of the die member after the hold-down pressure is removed, said respective abutment means momentarily disengaging until the lift cylinder pistons accelerate the blank holder upwardly to effect a reengagement between the respective abutment means with minimum impact.

5. In a double action press having a bed and a ram, means to actuate said ram upwardly and downwardly, a die member attached to the press ram and being disposed to cooperate with a die cavity in the press bed to form a blank disposed on the press bed to the shape of the cavity as the ram is moved downwardly relative to the press bed, a blank holder for engaging and holding the blank during forming of the same, said die member being adapted to move relatively with respect to the blank holder to form the blank after said blank holder engages the blank, fluid actuated piston and cylinder members with one of said members connected to the die member and the other of said members connected to the blank holder and with the piston member disposed to normally maintain the blank holder and die member in fixed relation and exerting a downward force on the blank holder as the die member moves downwardly relative thereto after the blank holder engages the blank, biasing means constantly exerting an upward force on said blank holder of lesser magnitude than the force exerted by said fluid actuated piston but great enough to accelerate the blank holder upwardly independently of the press ram, and lost motion means provided in the connection between the fluid actuated piston and the blank holder and providing for relative movement therebetween on the upstroke to thereby minimize the impact in said lost motion means between the die member and the blank holder on their upstroke after the downward force of the piston on the blank holder is removed.

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