

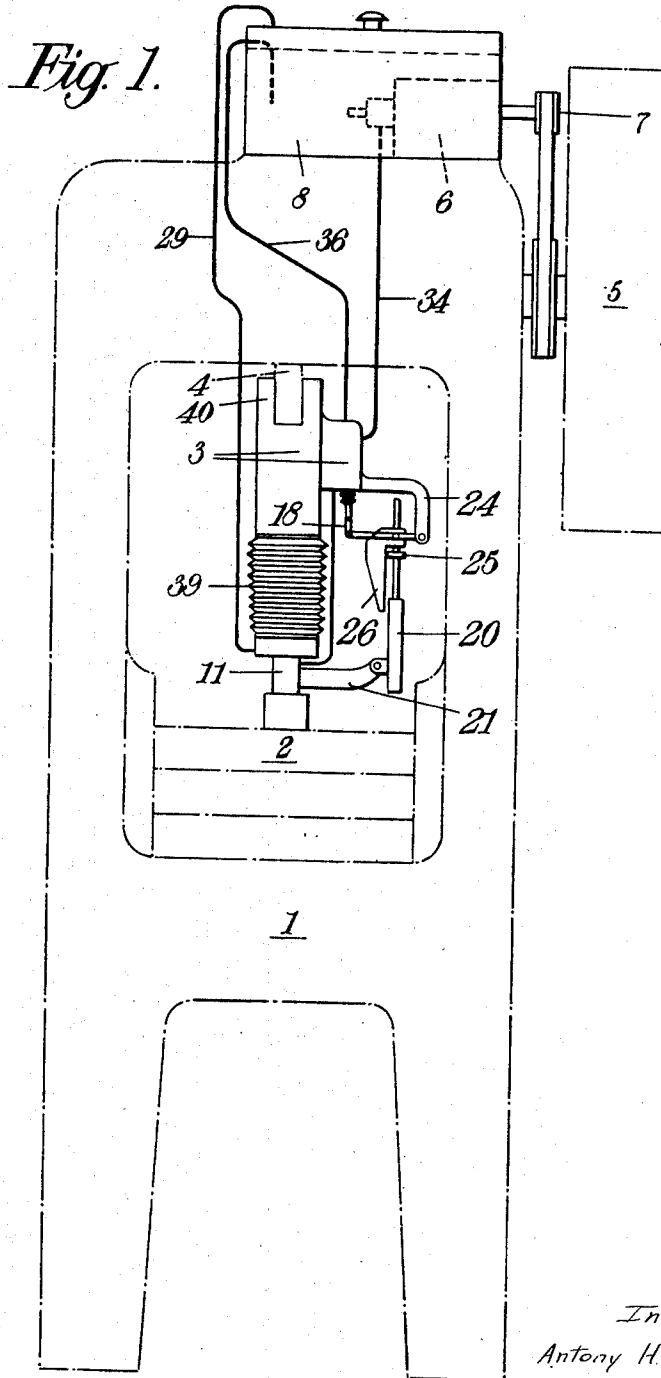
June 22, 1954

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POWER OPERATED PRESSES, PRESS-BRAKES, GUILLOTINE
SHEARS, AND LIKE MACHINES

2,681,703

Filed Feb. 8, 1951

4 Sheets-Sheet 1



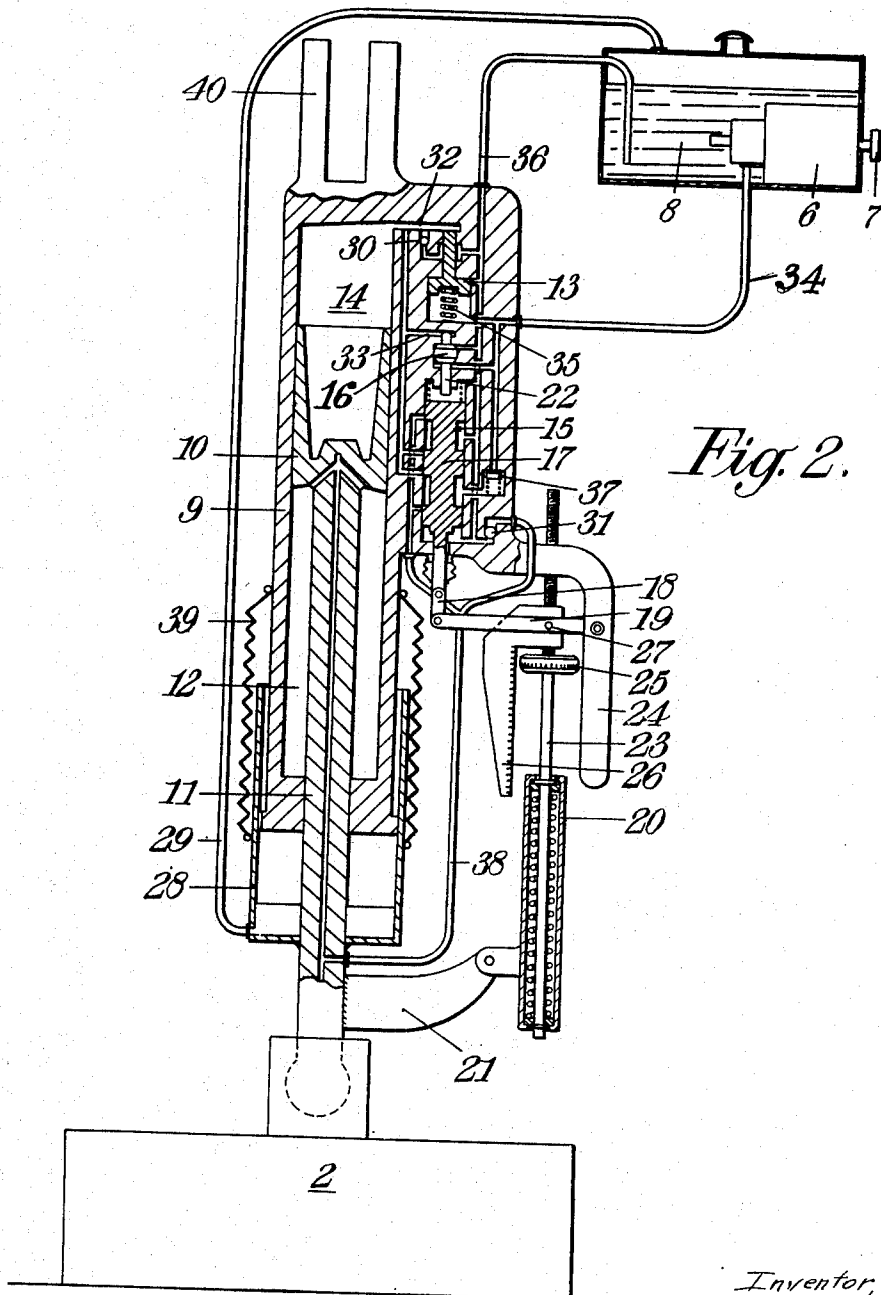
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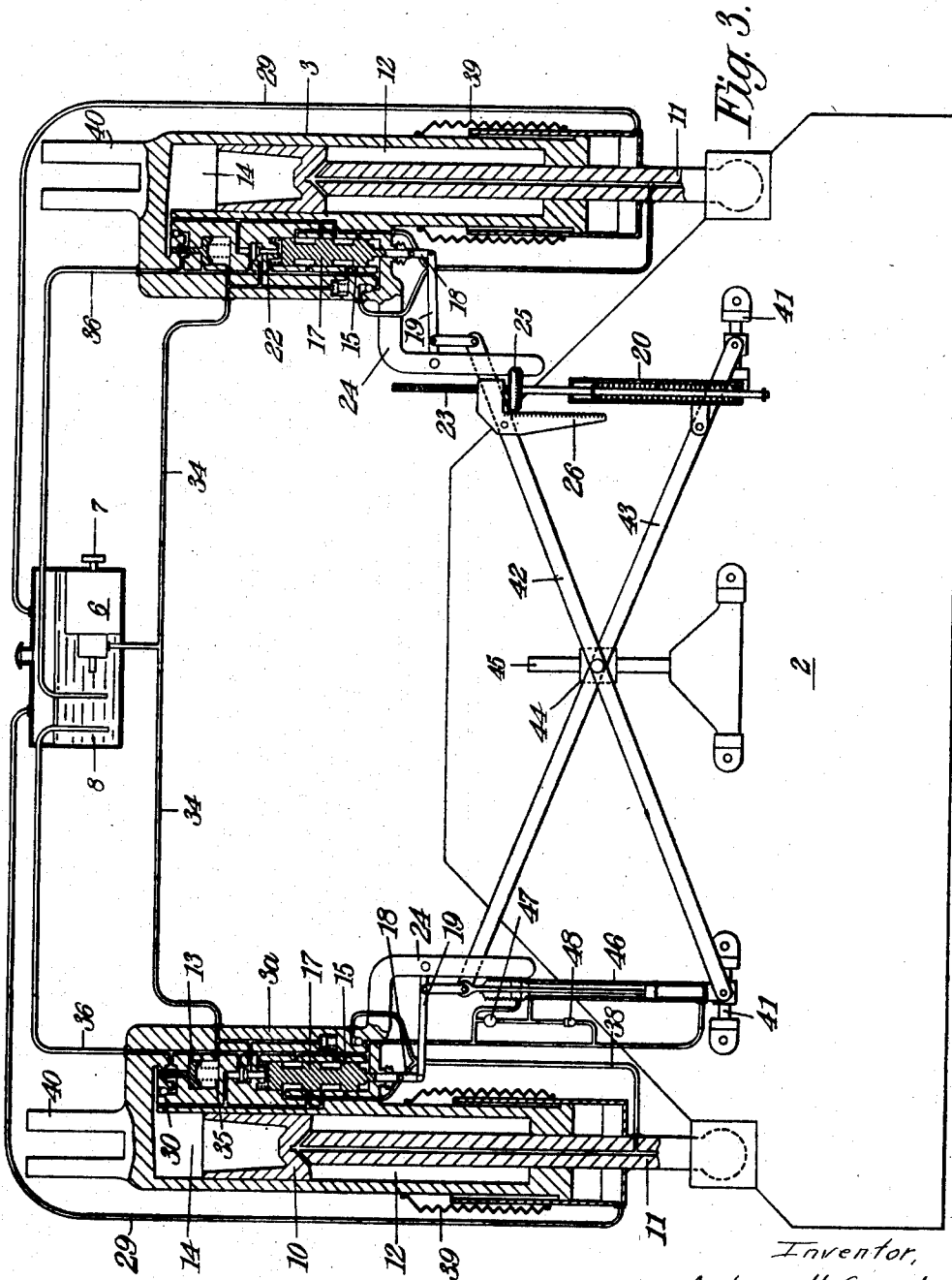
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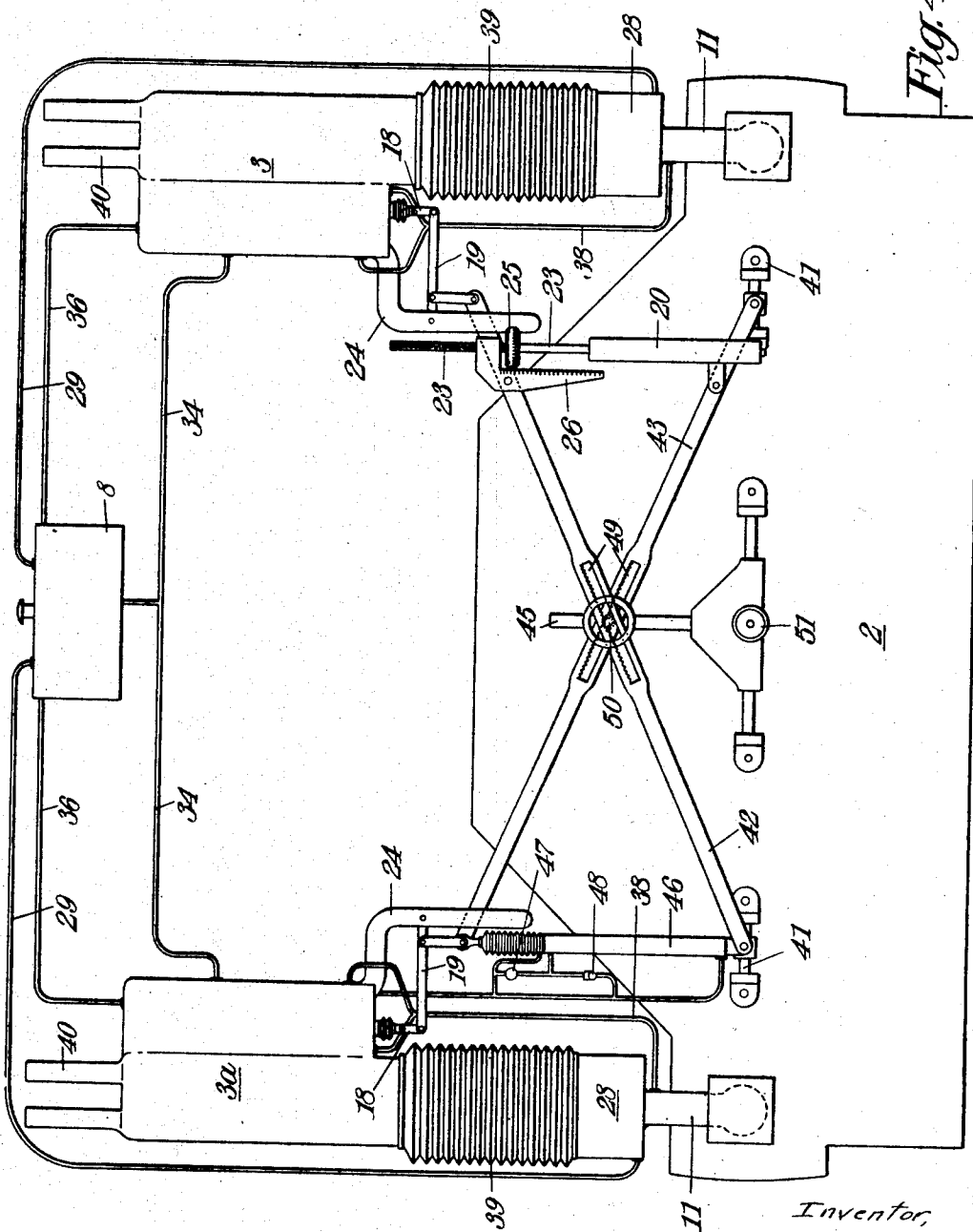
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Fig. 4.



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POWER OPERATED PRESSES, PRESS-BRAKES, GUILLOTINE SHEARS, AND LIKE MACHINES

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Claims priority, application Great Britain
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24 Claims. (Cl. 164-86)

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This invention relates to power operated presses, press-brakes, guillotine shears and like machines, hereinafter referred to generally as presses.

The invention consists broadly in presses, as hereinbefore defined in which an hydraulic link associated with a pump is interposed between the mechanical mechanism to which the power is applied directly from the prime mover or indirectly through a flywheel acting as an energy storer or accumulator and the blade knife or former beam or the like means of the press.

In this way overload protection and substantial saving of material should result.

At this point it may be mentioned that it is an important feature of the invention that the hydraulic arrangements do not necessarily entail the inclusion of a high pressure type of hydraulic pump.

The hydraulic power source incorporated can also serve to provide power to actuate clutches and brakes and the like, often dealt with by ancillary pneumatic equipment on the more powerful presses in use to-day. The need for pneumatic bolsters and so forth also largely disappears, a considerable saving in outlay expense on "tooling up" some classes of operations. The need for an air compressor plant to feed the pneumatic equipment mentioned also, of course, disappears.

The invention may be applied to a single crank press or for a cropping or notching machine in which case a single ram will be employed as the hydraulic link.

For a press brake or a guillotine shear the hydraulic link will comprise a plurality, normally two, rams.

The accompanying drawings illustrate various embodiments of this invention in which:

Figure 1 is an elevation of a single crank press,

Figure 2 is a vertical section through the hydraulic link shown in Figure 1,

Figure 3 is a vertical section through part of a press brake embodying two hydraulic links and

Figure 4 is a vertical section through part of a guillotine embodying two hydraulic links.

In the embodiment illustrated in Figures 1 and 2, the press comprises a frame 1 having a working tool 2 attached to hydraulic link 3, attached in turn to crank 4, only the tip of which is shown. The crank is actuated by a motor, not shown, which is also connected to flywheel 5 and drives pump 6 by means of pulley drive 7, the pump being immersed in a reservoir 8 mounted at the top of frame 1.

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The hydraulic link 3 comprises a closed cylinder 9 within which slides piston 10 at one end of hollow piston rod 11, the interior of which is in communication with space 12 in cylinder 9 behind piston 10. Working tool 2 is attached to the other end of piston rod 11.

Link 3 further comprises relief valve 13, communicating with space 14 in cylinder 9 in front of piston 10, relay valve 15 and locking valve 16, valves 13, 15 and 16 being integral with cylinder 9. Relay valve 15 comprises a movable member 17 connected by link 18, multiplying lever 19, funk spring 20 and link 21 with piston rod 11, while locking valve 16 comprises plunger 22 adapted to bear upon member 17 and hold the same in the neutral position shown in circumstances hereinafter described.

Funk spring 20 comprises rod 23 slidably engaged in arm 24 integral with cylinder 9, and adjustable stop 25 is provided to engage arm 26 attached to pivot 27 of multiplying lever 19, adjustment of stop 25 adjusting the working stroke of the press.

At the bottom of link 3, sump 28 is fitted, attached to piston rod 11, to receive hydraulic fluid which may leak from cylinder 9, and the sump communicates with reservoir 8 by means of conduit 29. Suction valves 30 and 31 are provided, communicating with the spaces in cylinder 9 in front of and behind piston 10 respectively and with reservoir 8, to avoid cavitation within cylinder 9 during operation.

Relief valve 13 and locking valve 16 are each of the balanced pressure type, and communicate on one side with space 14 by means of conduits 32 and 33 respectively, and on the other side with pump 6 by means of branches from conduit 34, pressure from pump 6 being supplemented in the case of relief valve 13, by light spring 35. Conduit 36 from reservoir 8 serves valves 13, 15 and 31, while conduit 34 communicates also with valve 15 by way of a non-return valve 37. Branches from conduit 38, which leads through piston rod 11 to space 12, serve valves 31 and 14 respectively.

In operation, during a down-stroke, piston 10 will occupy a position in cylinder 9 predetermined by the setting of stop 25 and, during the pressing or cutting operation, member 17 will be in the neutral position as shown in Figure 2. In the course of such operation, the pressure in space 14 will greatly exceed that generated by pump 6, and will cause plunger 22 to thrust downwards on member 17 to hold the latter in the neutral position.

Should the press jam, or be arranged to give

a coining effect, the pressure in space 14 will exceed that provided for by relief valve 13, and fluid will escape to reservoir 8 by way of conduit 36, with consequent partial collapse of the link and relative upward movement of spring 20. This movement during the down stroke will be accommodated by spring 20 because member 17 is prevented from moving up relative to cylinder 9 by plunger 22, so that relative upward movement of rod 23 is prevented by stop 25.

During the subsequent up or return stroke, tool 2 will be suspended from piston rod 11, with the result that the pressure in space 14 will fall to zero, with consequent upward motion of plunger 22 and member 17 under thrust from spring 25. Such upward motion of member 17 will establish communication between pump 6 and space 14 across valve 15 to restore piston 10 to its original predetermined position. Overshooting is prevented because it would entail downward movement of parts 21, 23, 19, 18, and hence of member 17, establishing communication across valve 15 between pump 6 and space 12 by way of conduits 34 and 38, this latter communication also making good any leakage which may arise from space 12 whilst piston rod 11 is suspending tool 2.

Sump 28, attached to piston rod 11, slidably embraces cylinder 9 and is sealed by flexible membrane 39. Cylinder 9 is also provided with member 40 for engagement with crank 4.

In the press brake, part of which is illustrated in Figure 3, those members similar to those of Figures 1 and 2 are similarly numbered. The brake comprises two hydraulic links 3 and 3a attached to each side of working tool 2, but instead of utilising link 21 attached to piston rod 11 the linkage from the relay valve member 17 is taken through working tool 2 by way of saddles 41. Two levers 42 and 43 are provided, pivoted at their centres to block 44 sliding on upright rod 45 secured to working tool 2, and sliding at their lower ends on saddles 41, to form scissor arms cross-linking multiplying levers 19 to cause these to move in unison. Further, in conjunction with hydraulic link 3a, dashpot 46 is substituted for funk spring 20 to smoothen the movements of relay valve members 17, this dashpot having a restrictor 47 and a non-return valve 48. Reservoir 8 and pump 6 are common between the two hydraulic links.

The guillotine, part of which is shown in Figure 4, is essentially similar to the press brake shown in Figure 3 except that provision is made for varying the position at which levers 42 and 43 are pivoted together, by forming internally racked slots 49 in these levers and passing a small pinion 50 through the intersection of the slots, the pinion being turned by locking handle 51 to alter the rake of working tool (knife) 2.

I claim:

1. In a mechanically actuated press provided with at least one hydraulic safety link between the working tool of the press and the thrust-applying part of the actuating mechanism, the hydraulic safety link comprising a relief valve for limiting the thrust transmitted thereby to a predetermined value, means comprising a valve and a hydraulic pump, continuously driven when the press is in operation, for restoring the hydraulic links to a working condition after operation of said relief valve.

2. A press as set forth in claim 1, wherein said pump is operatively associated with, suitably by immersion in, a fluid reservoir, the reservoir being connected with said relief valve for the reception

of fluid from said hydraulic link when said predetermined value is exceeded.

3. A press as set forth in claim 1, wherein a relief valve is provided in association with the delivery side of said pump.

4. A press as set forth in claim 1, wherein said working tool is suspended from said hydraulic link, and said restoring takes place in the course of a return stroke.

5. A press as set forth in claim 1, wherein the valve included in said means for restoring the link to a working condition is a relay valve comprising a hollow casing with connections to said pump, reservoir and to the cylinder of said link on each side of the piston thereof, and a valve member in the casing arranged to move from a neutral position in response to movement of said piston from a predetermined position in relation to said cylinder and thereby to effect appropriate communication between said connections for restoring said piston to said predetermined position in relation to said cylinder.

6. A press as set forth in claim 5, wherein said casing is integral with said cylinder.

7. A press as set forth in claim 5, wherein said valve member is arranged to move longitudinally in said casing and is linked with said piston to follow its motion relative to said cylinder, at least when the latter is in the vicinity of said predetermined position.

8. A press as set forth in claim 7, wherein a multiplying lever is inserted in the linkage between said piston and valve member to magnify said relative motion, together with means such as a dead centre-type funk spring to accommodate such of said motion as is beyond said vicinity.

9. A press as set forth in claim 5, wherein said relay valve further comprises locking means responsive to overload pressure in said hydraulic link for preventing the operation of said relay valve during overload conditions.

10. A press as set forth in claim 9, wherein said locking means comprises a plunger responsive to overload pressure in said hydraulic link in a manner causing it to bear upon and hold said valve member in said neutral position during overload conditions.

11. A press as set forth in claim 5, wherein a non-return valve is inserted in the connection between said pump and relay valve to prevent flow from said relay valve to said pump.

12. A press as set forth in claim 1, in which the relief valve with which said hydraulic link is provided is of the balanced pressure type, one face of the valve being exposed to pressure within the link and another, larger face of the valve to pressure from said hydraulic pump.

13. A press as set forth in claim 12, in which said relief valve is provided with a light spring to supplement the pressure supplied by said hydraulic pump.

14. A press as set forth in claim 5, in which sudden movements of said valve member are minimised by operative connection of said member to a dashpot.

15. A press as set forth in claim 7, wherein two hydraulic links are provided, each having a relay valve, wherein the linkage set forth between the valve member of each relay valve and its associated hydraulic link is modified by cross-linkage so that the relay valve of each hydraulic link responds to relative movement of the piston and cylinder of the other hydraulic link.

16. A press as set forth in claim 15, wherein

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said cross-linkage comprises two levers pivoted together, suitably at their centres, to give a scissor-like action.

17. A press as set forth in claim 15, wherein said working tool is a guillotine shear, and said cross-linkage is provided with means for varying the tilt of said shear.

18. A press as set forth in claim 17, wherein said means for varying the tilt comprises means for varying the position at which said levers are pivoted together.

19. A hydraulic link suitable for use in a press as a safety link, comprising a closed hydraulic cylinder, a piston slidably engaged in the cylinder, and a relay valve integral with the cylinder, the relay valve being connected or adapted to be connected with hydraulic fluid within said cylinder on each side of said piston, with a pump for the supply of hydraulic fluid under pressure, and with a reservoir for hydraulic fluid, the cylinder being provided with a relief valve, suitably leading to a conduit connected or adapted to be connected with said reservoir, the relay valve comprising an inner movable member linked with said piston to move from a neutral position in response to movement of said piston from a predetermined position in relation to said cylinder and, in so moving, to effect intercommunications within the relay valve appropriate, when the relay valve is connected as aforesaid, to restore said piston to said predetermined relative position said movable member and piston being linked by means comprising a spring adapted to accommodate movement of said piston beyond the vicinity of said predetermined relative position.

20. A hydraulic link as set forth in claim 19, wherein said means further comprise a multiplying lever for transmitting to said movable member in a magnified degree movement of said piston relative to said cylinder in the vicinity of said predetermined relative position.

21. A hydraulic link as set forth in claim 19 wherein said link further comprises a member responsive to pressure of hydraulic fluid in the link to hold said movable member in said neutral position when said pressure is equal to or in excess of that required to operate said relief valve.

22. A press as set forth in claim 1, wherein the valve included in said means for restoring the

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link to a working condition is a relay valve comprising a hollow casing with connections to said pump, reservoir and to the cylinder of said link on each side of the piston thereof, and a valve member in the casing connected linkage to said piston so as to move from a neutral position in response to movement of said piston from a predetermined position in relation to said cylinder and thereby to effect appropriate communication between said connections for restoring said piston to said predetermined position in relation to said cylinder, said linkage incorporating adjusting means whereby said predetermined position can be varied.

23. A hydraulic link suitable for use in a press as a safety link, comprising a closed hydraulic cylinder, a piston slidably engaged in the cylinder and servo mechanism adapted, in response to movement of said piston from a predetermined position in relation to said cylinder, to establish communication between said cylinder and a source of high pressure hydraulic fluid to restore said piston to said predetermined relative position, the servo mechanism comprising a relay valve having connections for hydraulic fluid within said cylinder on each side of said piston, with a reservoir for hydraulic fluid, and having a connection with a source of hydraulic fluid under pressure, the cylinder being provided with a relay valve, and the relay valve comprising an inner movable member linked with said piston to move from a neutral position in response to movement of said piston from said predetermined position.

24. A hydraulic link as set forth in claim 23, in which said linkage is adjustable to permit variation of said predetermined position.

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