Nov. 10, 1959 C. J. RHODES 2,912,037

PRESSURE-RESPONSIVE OVERLOAD RELEASE DEVICES

Filed Dec. 29, 1953 4 Sheets-Sheet 1

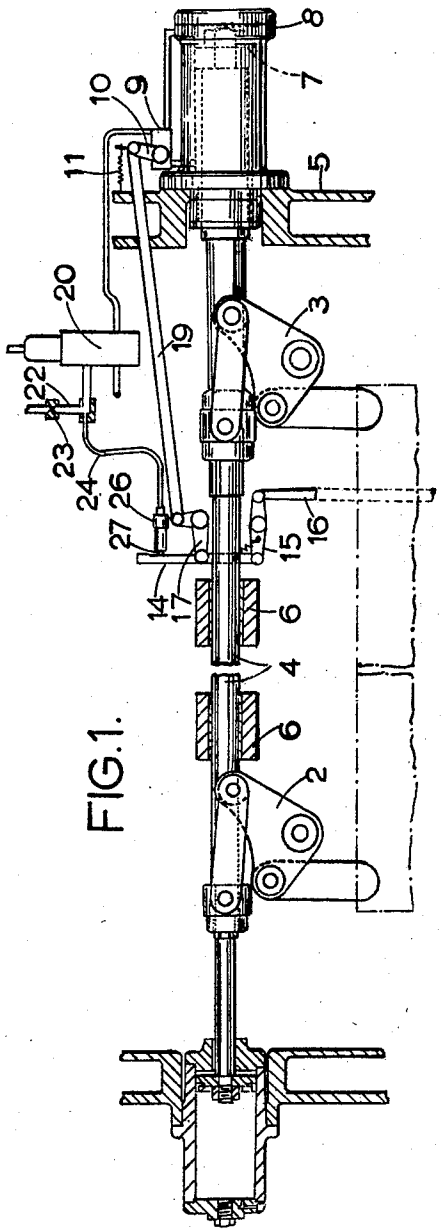


FIG. 1.

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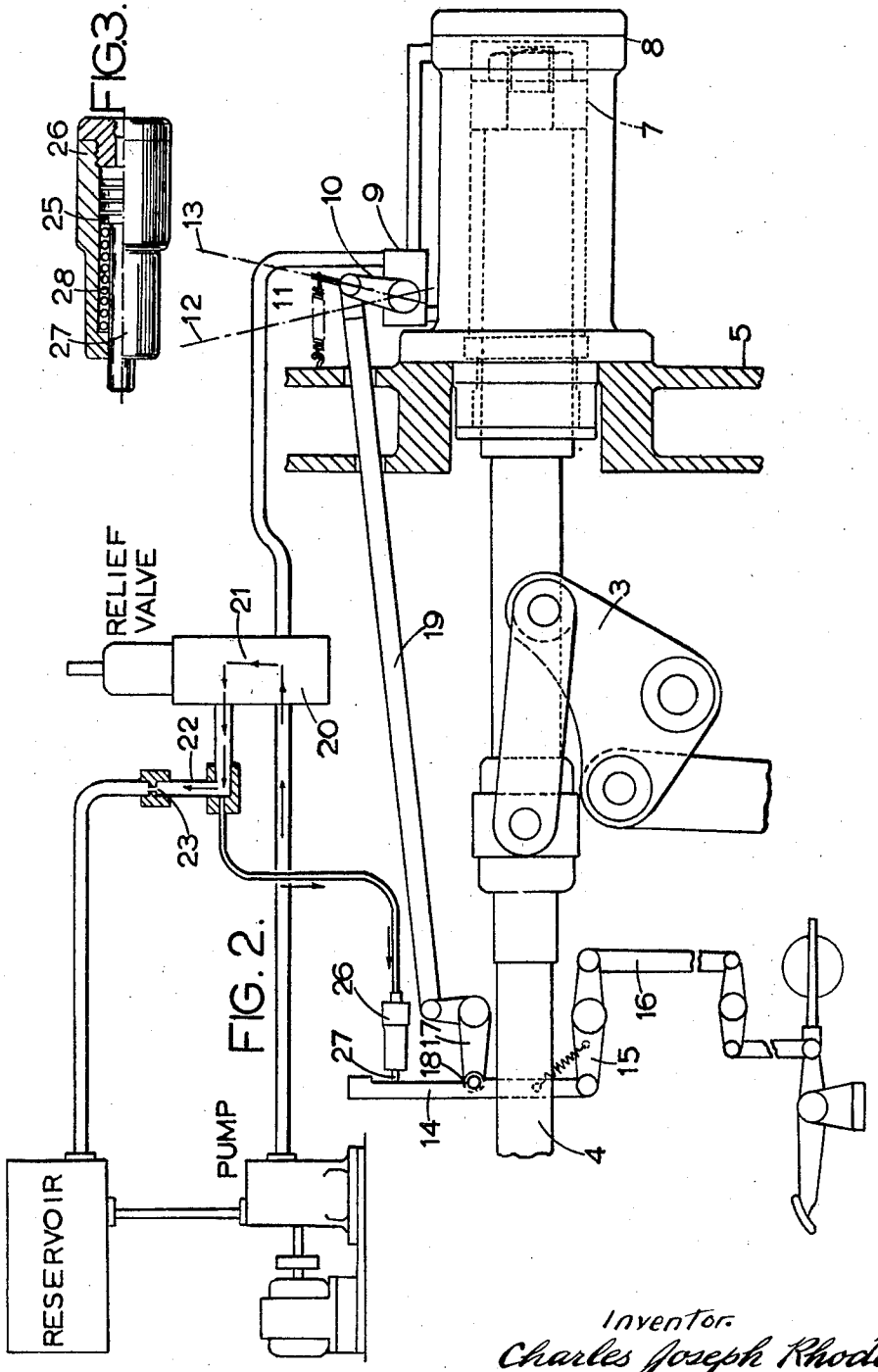


FIG. 2.

FIG. 3.

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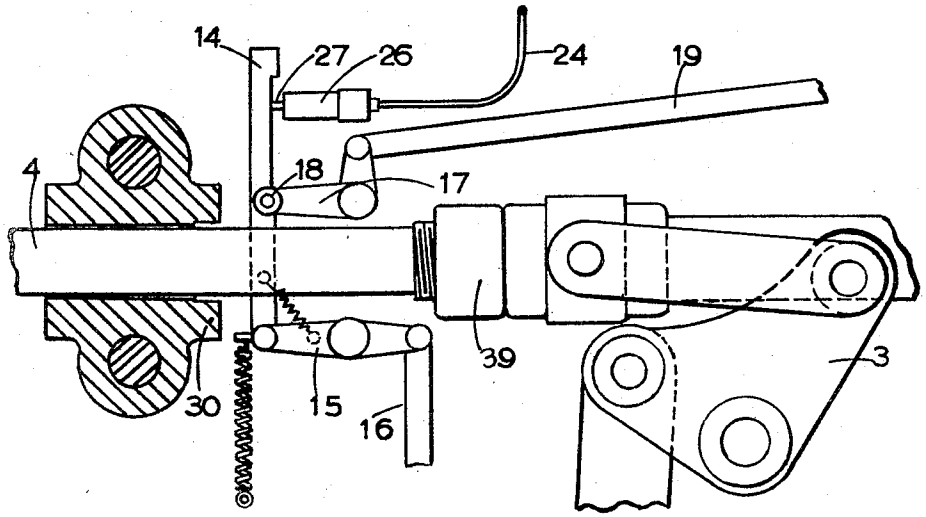


FIG. 4

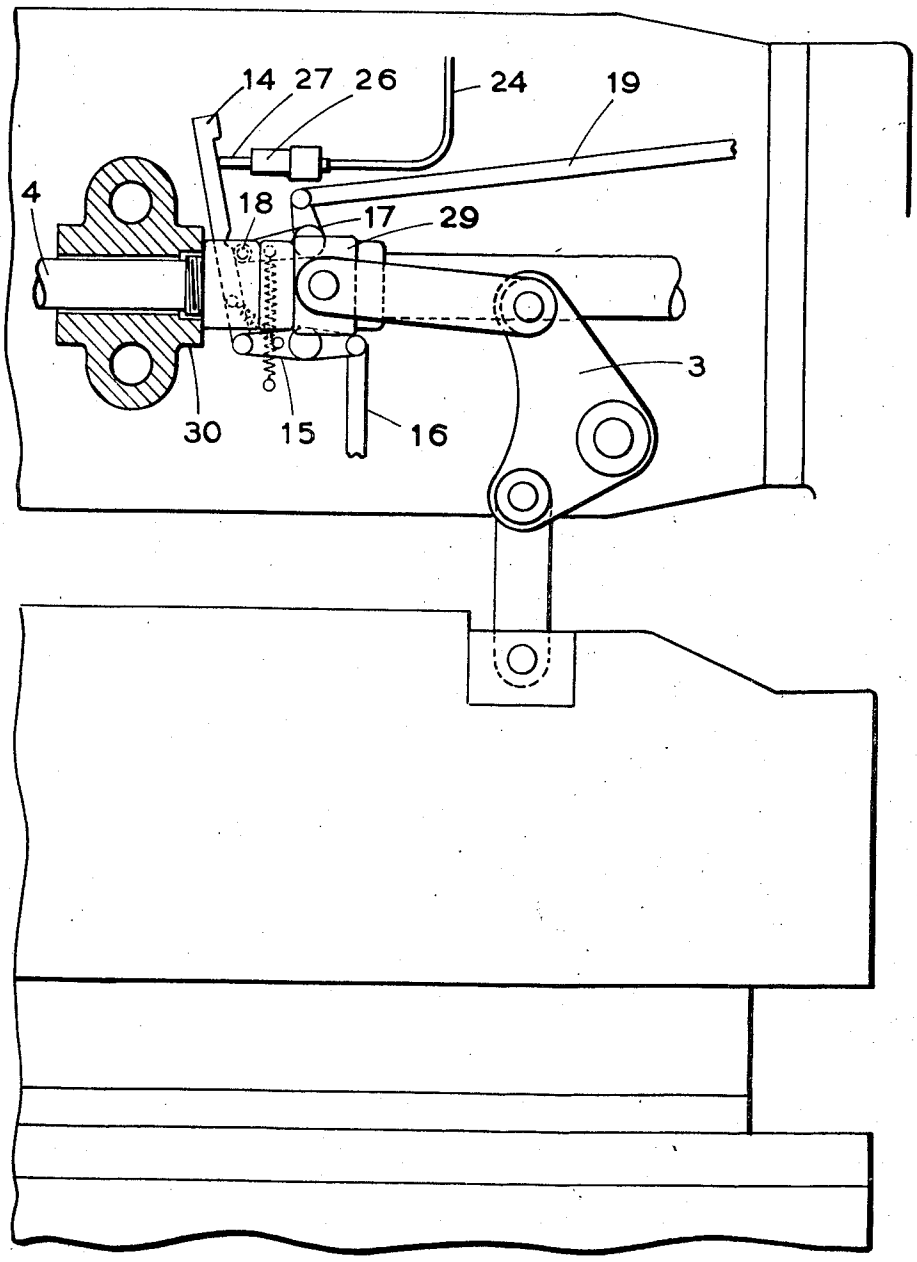
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FIG. 5.



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2,912,037

PRESSURE-RESPONSIVE OVERLOAD RELEASE DEVICES

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Application December 29, 1953, Serial No. 401,028
Claims priority, application Great Britain May 12, 1953
10 Claims. (Cl. 153—21)

This invention relates to machines for such purposes as bending, cutting or shearing metal plates in which the working and return strokes of a reciprocable tool carrying member are effected by hydraulic pressure. The present application is a continuation-in-part of applicant's application Serial No. 241,142 filed August 9, 1951 and now abandoned.

It is an object of the invention to provide a pressure-responsive overload release device for the hydraulic system of such machines, particularly bending presses which are frequently subjected to overloading and jamming. It is another object of the invention to provide a hydraulic bending press the hydraulic system of which press has a control valve which is automatically operable whenever the pressure in the system exceeds a predetermined level to return the tool-carrying member of the press to its inoperative position.

It is yet another object of the invention to provide a hydraulic bending press the tool carrying member of which will automatically return to its inoperative position after it has completed a working stroke of a desired length.

In the accompanying diagrammatic drawings which illustrate some embodiments of the invention:

Figure 1 is a diagram, partly in section, of part of a bending press.

Figure 2 is an enlarged elevation showing an overload release device of the press,

Figure 3 is an enlarged sectional elevation of an actuating plunger forming part of the press,

Figure 4 is a diagram illustrating parts of a modified press and

Figure 5 is a changed position showing the method of associating the control or overload release device of the press with the other portions thereof.

In the embodiment illustrated in Figures 1 to 3 the invention is applied to a bending press (i.e. a so-called press brake) in which a tool-carrying beam 1 is raised and lowered equally near each end towards and away from a work table (not shown), by linkages 2, 3 connected with a common rod 4 running parallel with the beam 1 and slidable in fixed guides in the main frame 5 of the machine. The rod 4 is slidable in bearings 6 in the main frame and one of its ends carries a piston 7 working in a double-ended hydraulic cylinder 8 mounted in one of the side members of the frame.

The supply of liquid to the opposite sides of the piston 7 for raising and lowering the beam 1 is controlled by a valve 9 having an operating lever 10 which can be rotated against the action of a return spring 11 from a return or up stroke position, indicated by broken line 12, to a working or down stroke position, indicated by broken line 13, by movement of a treadle connected with a pivoted trigger lever 14 by links 15, 16. It will be appreciated that other manually controlled devices can be used instead of a treadle. One arm of a bell crank lever 17 is releasably engaged in a notch 18 in the trigger lever 14 and the other arm is connected to the operating lever 10 by a

link 19. Thus, movement of the treadle will cause the operating lever 10 to rotate from one position to the other so that liquid pressure is applied to one side of the piston 7 to displace the rod 4 and lower or raise the beam 1.

If the machine becomes overloaded, (as when the beam 1 has reached bottom or the machine becomes jammed) the liquid in the hydraulic system can, when its pressure reaches a predetermined level, exhaust through a relief valve 20 of any suitable type arranged in its path from a pump to the cylinder 8; the liquid then flows to a reservoir tank by the path indicated by arrows 21. The exhaust conduit 22 is, however, provided with a constricted portion 23 as a result of which some of the exhaust liquid is caused to flow through a branch pipe 24 leading to one side of a piston 25 slidable in an overload release cylinder 26 shown in detail in Figure 3. The piston has a piston rod or plunger 27 extending out of one end of the cylinder 26 and bearing against the trigger lever 14. The piston 25 will be displaced, against the action of a coil spring 28 when liquid enters the cylinder 26 from the branch pipe 24 so as to rock the trigger lever 14 away from the bell crank lever 17. Thus, the bell crank lever is released from the notch 18 in the trigger lever 17 so that the operating lever 10 is moved to its return stroke position under the action of its return spring 11.

The modified construction illustrated in Figure 4 is intended for work in which it is not desired to allow the top die (not shown) carried on the beam 1 to reach bottom. For example, when it is desired to bend a plate to an obtuse angle, the top die must not reach bottom.

In this modified construction, a stop nut 29 is arranged on the slidable rod 4 so that after the rod has moved a predetermined amount in a direction to lower the beam 1, the nut 29 will collide with a fixed stop or abutment 30 mounted on the bridge (not shown) of the machine. When the stop nut 39 and the fixed stop 30 abut each other, the pressure in the hydraulic system will build up until an overload is caused whereupon the release mechanism will be set in operation to reverse the movement of the beam.

The relative position of the stop nut 29 and the fixed stop 25 can be selected so that this reversal of the movement of the beam will take place at any desired position in its down stroke. The position of the stop nut 29 can be adjustable as desired, but this is not always necessary as the adjustment of the tool can be made on the beam itself.

What I claim is:

1. Bending press comprising a reciprocable tool carrying beam; a hydraulic system including a liquid pressure motor for lowering and raising said beam towards and away from a work table; a valve in said system for controlling reciprocation of said beam; an operating lever which is movable between positions in which it respectively initiates the down stroke and up stroke of said beam; spring means tending to urge said operating lever into its up stroke position; a trigger lever which can be displaced manually to move said operating lever between its up and down stroke positions; a linkage associated with said operating lever which linkage can be releasably connected with said trigger lever in order to transmit motion from it to said operating lever; a relief valve in said hydraulic system through which valve liquid can pass automatically whenever pressure in said system exceeds a predetermined level; an exhaust conduit into which liquid can enter after passing through said relief valve; a branch conduit connected with said exhaust conduit; means for impeding the flow of liquid through said exhaust conduit so that some exhaust liquid passes into said branch conduit; a plunger displaceable by pressure of liquid in said branch conduit in order to release the connection between said linkage and said trigger lever

whereby said operating lever is returned to its up stroke position by said spring means; and a second spring means for returning said plunger to its inoperative position when the pressure in said branch conduit falls below a predetermined level.

2. Machine for bending, cutting and shearing metal plates comprising a reciprocable tool carrying beam; a hydraulic system including a liquid pressure motor for effecting the working and return strokes of said beam towards and away from a metal plate to be worked; a valve in said hydraulic system for controlling reciprocation of said beam; an operating lever for said valve, said lever having two operating positions in which it initiates said working and return strokes respectively; a manually controlled linkage releasably connected with said lever and adapted to place it in either of its two positions; a spring tending to urge said lever to its return stroke position; a relief valve in said hydraulic system through which valve liquid can exhaust automatically whenever pressure in said system exceeds a predetermined level; an exhaust conduit into which liquid can enter after passing through said relief valve said conduit having a constricted portion; a cylinder; a conduit branching from said exhaust conduit at a position between said relief valve and said constricted portion to convey to said cylinder liquid diverted from said exhaust conduit; a plunger displaceable by pressure of liquid in said cylinder to release said linkage from said lever so that said lever is moved by said spring to its return stroke position; and a second spring means for returning said plunger to its inoperative position when the pressure in said cylinder falls below a predetermined level.

3. Machine for bending, cutting and shearing metal plates comprising a reciprocable tool-carrying beam; a hydraulic system including a liquid-pressure motor for moving said beam in a working stroke towards, and a return stroke away from, a metal plate to be worked; a valve in said hydraulic system for controlling reciprocation of said beam; an operating lever for said valve which lever is rotatable between positions in which it initiates said working and return strokes respectively; spring means tending to urge said operating lever to its return stroke position; a bell crank operatively connected with said lever; a trigger lever having a notch in which an arm of said bell crank can be releasably engaged whereby said bell crank will rotate in response to movement of said trigger lever; manually controlled means for acting on said trigger lever to rotate said operating lever between its return and working stroke position; a relief valve in said hydraulic system through which valve liquid can pass automatically whenever pressure in said system exceeds a pre-determined level; an exhaust conduit into which liquid can enter after passing through said relief valve; a branch conduit leading from said exhaust conduit; means for impeding the flow of liquid in said exhaust conduit so as to divert some exhaust liquid into said branch conduit; a plunger displaceable by pressure of liquid in said branch conduit to disengage said bell crank arm from said notch whereby said operating lever is returned to its return stroke position by said spring means; and a second spring means for returning said plunger to its inoperative position when the pressure in said branch conduit falls below a predetermined level.

4. Machine for bending, cutting and shearing metal plates and the like comprising a reciprocable tool-carrying member; a hydraulic system including a liquid pressure motor for effecting the working and return strokes of said tool-carrying member; a valve controlling the operation of said hydraulic system; a mechanical linkage adapted to operate said control valve to initiate either said working or said return stroke; means tending to restore said control valve to its return stroke position; a pressure relief valve through which liquid from said hydraulic system can exhaust when the pressure in said system has exceeded a predetermined level during said working stroke; a plunger displaceable by hydraulic pressure to release said control valve from said mechanical linkage; and means for diverting part of the exhaust liquid from said hydraulic system to said plunger after it has passed through said relief valve whereby said plunger is displaced to release said control valve from said mechanical linkage and said control valve automatically returns to its return stroke position.

5. A press brake comprising a tool-carrying beam, a slidable rod running parallel with the beam, linkages connecting the rod with the beam to raise or lower the beam equally near each end on sliding movement of the rod, a hydraulic system comprising a liquid-pressure motor for effecting sliding movement of the rod, a valve controlling the hydraulic system which valve is effective to return said beam to its inoperative position whenever the pressure in the said hydraulic system exceeds a predetermined level, and means for causing the pressure in said hydraulic system to rise above said predetermined level when said tool-carrying beam has reached a predetermined position in its working stroke.

6. A press brake comprising a tool-carrying beam, a slidable rod running parallel with the beam, linkages connecting the rod with the beam to raise or lower the beam equally near each end on sliding movement of the rod, a hydraulic system comprising a liquid-pressure motor for effecting sliding movement of the rod, a valve controlling the hydraulic system which valve is effective to return said beam to its inoperative position whenever the pressure in said hydraulic system exceeds a predetermined level, a stop on said rod, and a fixed abutment arranged to be engaged by said stop whenever said rod had moved a preselected amount in a direction to effect the working stroke of said tool-carrying beam whereby the pressure in said hydraulic system is caused to rise above said predetermined level.

7. A press brake comprising a reciprocable tool carrying beam; a slidable rod running parallel with said beam; linkages connecting said rod with said beam to raise and lower said beam equally near each end on sliding movement of said rod; a hydraulic system including a liquid pressure motor for effecting sliding movement of said rod; a valve in said system for controlling sliding movement of said rod; an operating lever which is movable between positions in which it respectively initiates the down stroke and up stroke of said beam; spring means tending to urge said operating lever into its up stroke position; a trigger lever which can be displaced manually to move said operating lever between its up and down stroke positions; a linkage associated with said operating lever which linkage can be releasably connected with said trigger lever in order to transmit motion from it to said operating lever; a relief valve in said hydraulic system through which valve liquid can pass automatically whenever pressure in said system exceeds a predetermined level; an exhaust conduit into which liquid can enter after passing through said relief valve; a branch conduit connected with said exhaust conduit; means for impeding the flow of liquid through said exhaust conduit so that some exhaust liquid passes into said branch conduit; a plunger displaceable by pressure of liquid in said branch conduit in order to release the connection between said linkage and said trigger lever whereby said operating lever is returned to its up stroke position by said spring means; and a second spring means for returning said plunger to its inoperative position when the pressure in said branch conduit falls below a predetermined level; a stop on said rod; and a fixed abutment arranged to be engaged by said stop whenever said rod has moved a preselected amount in a direction to effect the down stroke of said beam whereby the pressure in said system is caused to rise above predetermined level.

8. Machine for bending, cutting and shearing metal plates comprising a reciprocable tool carrying beam; a

hydraulic system including a liquid pressure motor for effecting the working and return strokes of said beam towards and away from a metal plate to be worked; a valve in said hydraulic system for controlling reciprocation of said beam; an operating lever for said valve, said lever having two operating positions in which it initiates said working and return strokes respectively; a manually controlled linkage releasably connected with said lever and adapted to place it in either of its two positions; a spring tending to urge said lever to its return stroke position; a relief valve in said hydraulic system through which valve liquid can exhaust automatically whenever pressure in said system exceeds a predetermined level; means for automatically causing the pressure in said hydraulic system to rise above said predetermined level when said beam has reached a preselected position in its working stroke; an exhaust conduit into which liquid can enter after passing through said relief valve said conduit having a constricted portion; a cylinder; a conduit branching from said exhaust conduit at a position between said relief valve and said constricted portion to convey to said cylinder liquid diverted from said exhaust conduit; a plunger displaceable by pressure of liquid in said cylinder to release said linkage from said lever so that said lever is moved by said spring to its return stroke position; and a second spring means for returning said plunger to its inoperative position when the pressure in said cylinder falls below a predetermined level.

9. A machine for such purposes as bending, cutting, and shearing metal plates and sheets, said machine comprising a tool-carrying beam, a slidable rod disposed in parallel relationship with respect to said beam, linkages connecting said rod with said beam and effective to move said beam transversely with respect to said rod between an operative and an inoperative position, a hydraulic system comprising a pressure pump, a liquid pressure motor for effecting sliding movement of said rod, a valve controlling the application of liquid pressure to said motor, and means disposed in the hydraulic system intermediate said pump and said valve, said means cooperating with

said valve to effect the return of said beam to its inoperative position when the pressure in the hydraulic system intermediate said pump and said valve exceeds a predetermined level.

10. A machine for such purposes as bending, cutting and shearing metal plates and sheets, said machine comprising a tool-carrying beam, a slidable rod disposed in parallel relationship with respect to said beam, linkages connecting said rod with said beam and effective to move said beam transversely with respect to said rod between an operative and an inoperative position, a hydraulic system comprising a pressure pump, a liquid pressure motor for effecting sliding movement of said rod, a control valve regulating the application of liquid pressure to said motor, a relief valve disposed in the hydraulic system intermediate said pump and said control valve, an exhaust line for said relief valve having a constricted portion spaced from said relief valve, and piston means hydraulically connected to said exhaust line intermediate the restricted portion thereof and said relief valve, said exhaust line constricted portion and said piston means cooperating with said control valve to effect the return of said beam to its inoperative position when the pressure in the hydraulic system intermediate said pump and said control valve exceeds a predetermined level.

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