Sept. 20, 1966 J. H. BEARD 3,273,490

PRESS ANVILS

Filed Sept. 24, 1964 3 Sheets-Sheet 1

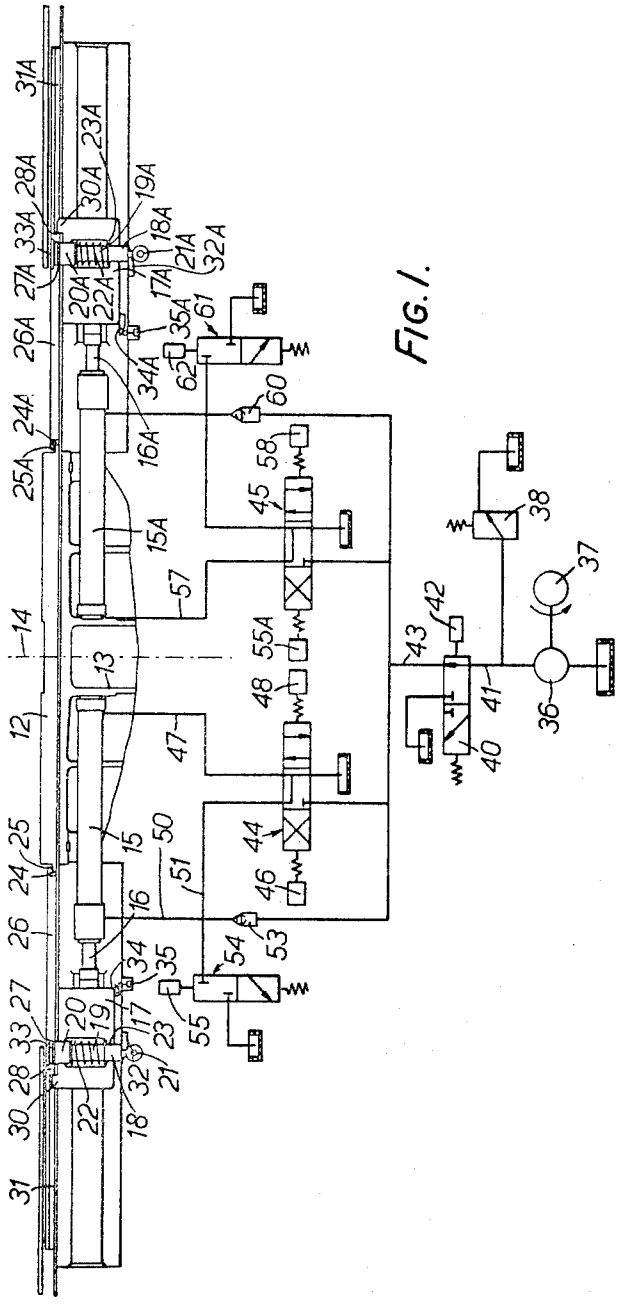


FIG. 1.

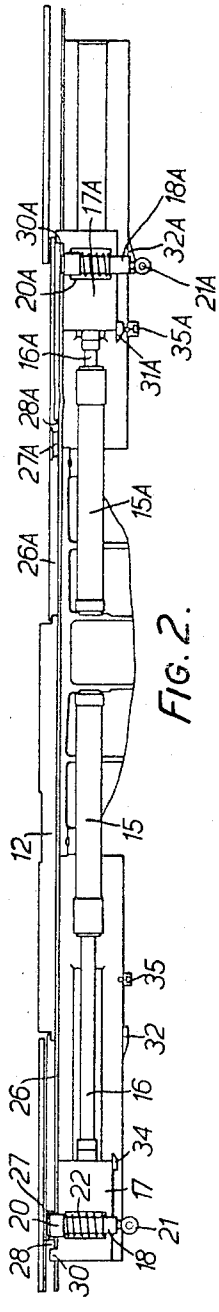


FIG. 2.

INVENTOR
JACK H. BEARD
BY
Holcombe, Wetherill & Brisbois
ATTORNEYS

Sept. 20, 1966 J. H. BEARD 3,273,490

PRESS ANVILS

Filed Sept. 24, 1964 3 Sheets-Sheet 2

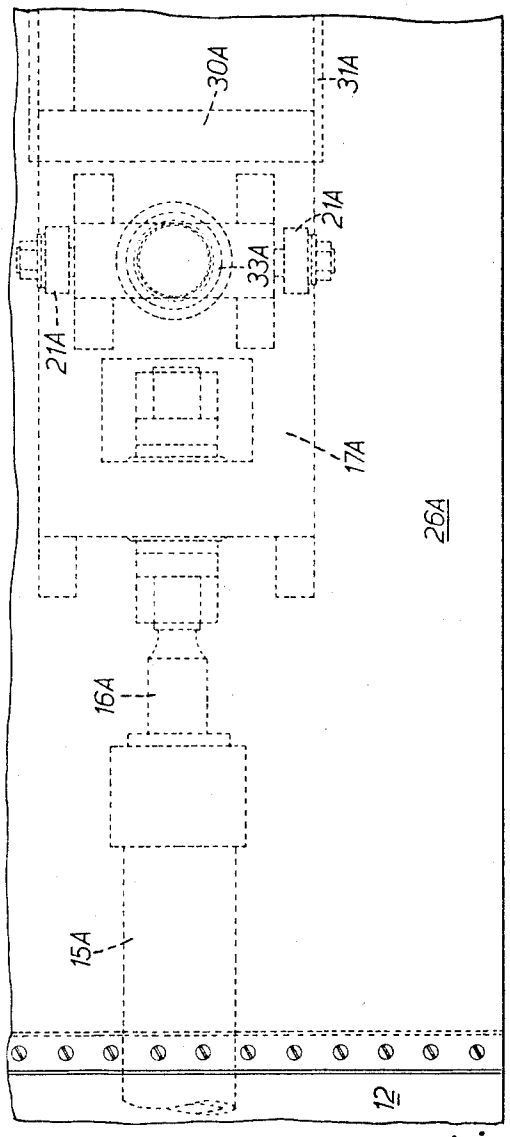


FIG. 3.

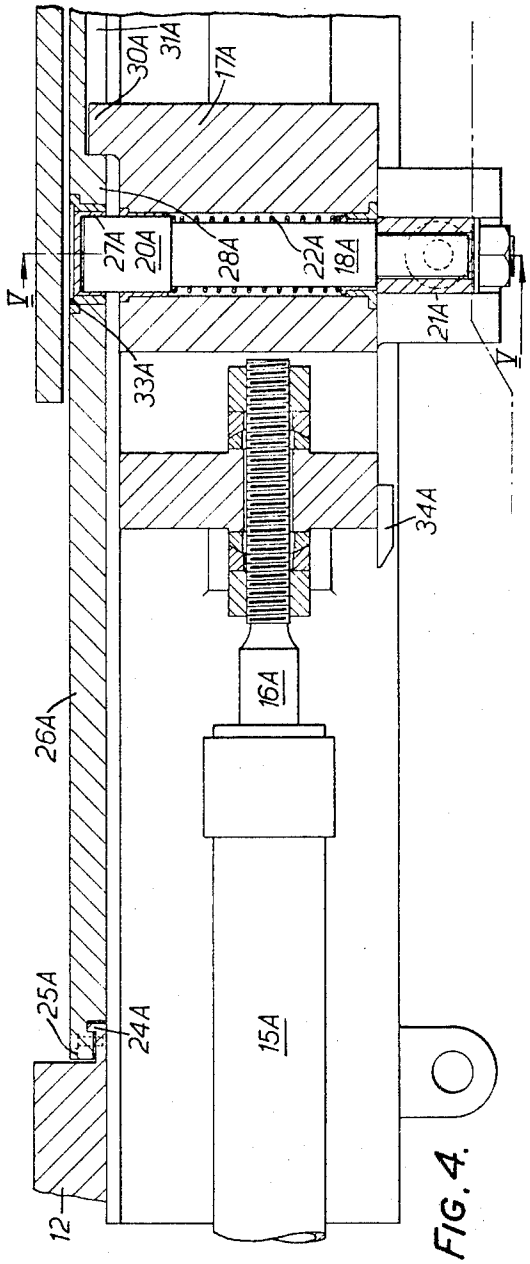


FIG. 4.

INVENTOR
J. H. BEARD
BY
Holcombe, Wetherill & Brisebois
ATTORNEYS

Sept. 20, 1966 J. H. BEARD 3,273,490

PRESS ANVILS

Filed Sept. 24, 1964 3 Sheets-Sheet 3

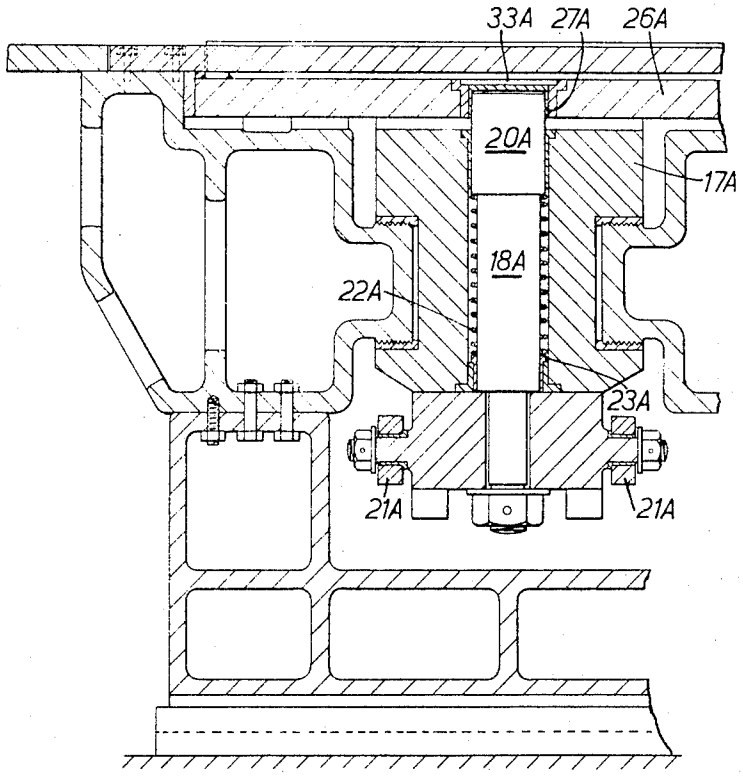


FIG. 5.

INVENTOR
J. H. BEARD
BY
Holcombe, Wetherill & Brisebois
ATTORNEYS

United States Patent Office 3,273,490 Patented Sept. 20, 1966

3,273,490

PRESS ANVILS

Jack Herbert Beard, Sheffield, England, assignor to Davy and United Engineering Company Limited, Sheffield, England

Filed Sept. 24, 1964, Ser. No. 399,018
Claims priority, application Great Britain, Sept. 26, 1963, 37,857/63
11 Claims. (Cl. 100—229)

This invention relates to press anvils.

In order to provide a sliding anvil with a stroke which is substantially greater than that of a hydraulic cylinder which can be manufactured economically, it is usual to attach the anvil to a drag bar by means of a "drop pin" and to attach the drag bar, in turn, to the cross heads of two opposed rams each having a stroke such that the stroke of the anvil is a multiple of it. To move the anvil through its full stroke, it is then necessary to move the anvil through one ram stroke, withdraw the drop pin by external means (e.g., a shop crane or independent hydraulic means), and return the rams to their original positions and replace the drop pin in the anvil to engage a second hole in the drag bar. A second stroke of the rams is then able to move the anvil a further distance equal to the stroke of the ram. This method has the disadvantage that the drag bar and its slides are expensive to manufacture and repositioning of the drop pin is both difficult and time-absorbing.

According to the present invention a press anvil is provided with a pair of double acting hydraulic piston and cylinder assemblies arranged on opposite sides of the press center, one assembly being couplable to the anvil to move the anvil toward and away from the press center position, and the other assembly being couplable to the anvil to move the anvil toward and away from the press center position on the other side of that position. The anvil is alternatively coupled to one or other of the assemblies according to its position.

Preferably the coupling means are arranged such that when the anvil, coupled to a first of the assemblies and disengaged from the second of the assemblies, is moved beyond a predetermined point toward the second assembly, the anvil is automatically decoupled from the first assembly and coupled to the second assembly.

In a preferred form the anvil is formed with a pair of recesses, and each assembly is provided with a pin attached to its movable member, normally a first of the pins associated with a first of the assemblies being engaged with its associated hole, while the other pin is held disengaged from the anvil, and including means for automatically releasing said other pin to engage its recess and automatically withdrawing the first pin from its recess, when the first assembly approaches the limit of its stroke in the direction towards the second assembly.

In a further aspect the invention provides apparatus for moving a horizontally slidable press anvil, comprising a first double acting piston and cylinder assembly located on one side of the press center line, first coupling means for coupling the first assembly to the anvil for moving the anvil on that side of the press center line, a second double acting piston and cylinder assembly located on the opposite side of the press center line, second coupling means for coupling the second assembly to the anvil for moving the anvil on that side of the press center line, and means for automatically disengaging the anvil from either assembly when it approaches the limit of the stroke of that assembly in a direction towards the other assembly, and automatically coupling that other assembly to the anvil.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings of which:

FIGURE 1 is a diagrammatic view of an anvil and means for moving the anvil, the anvil being shown in its central position;

FIGURE 2 is a view showing the anvil of FIGURE 1 in its furthest left position;

FIGURE 3 is a partial plan view on an enlarged scale showing in greater detail the portion of the application illustrated at the extreme right of FIGURE 1;

FIGURE 4 is a partial vertical section showing the portion of the apparatus illustrated in FIGURE 3 and taken in a plane passing through the longitudinal axis of the piston rods **15***a*, **16***a*; and

FIGURE 5 is a partial vertical section taken along the line V—V of FIGURE 4.

An anvil **12** is slidable on support **13** to the left or right of the drawing about a press center line **14**. A pair of cylinders **15**, **15***a* located on opposite sides of the press center line, have piston rods **16**, **16***a* attached to cross-heads **17**, **17***a*. Carried in recesses **19**, **19***a* in the cross-heads respectively are vertical slidable pins **18**, **18***a* having heads **20**, **20***a* and carrying rollers **21**, **21***a* at their bases. The pins are biased upwardly by springs **22**, **22***a* compressed between heads of the pins and the bases **23**, **23***a* of the recesses **19**, **19***a*.

Slidable floor plates **26**, **26***a* are coupled to opposite sides of the anvil by cooperating pairs of hook-like abutments **24**, **25** and **24***a* and **25***a*. The floor plates **26**, **26***a* are formed with recesses **27**, **27***a* respectively in their bases arranged to receive the heads **20**, **20***a* of the pins **18**, **18***a*. An abutment **28** on the floor plate **26** is arranged to engage an abutment **30** on the cross-head **17** to drive the anvil to the right when cross-head **17** is driven to the right by piston rod **16**. Similarly, abutments **28***a* on floor plate **26***a* and **30***a* on cross-head **17***a* are arranged to engage one another when the anvil is driven to the left by piston rod **16***a*. Thus the cross-heads and slide plates are not driven through the pins **20**, **20***a* except on the outward extending strokes of the piston rods **16**, **16***a*. When abutments **28**, **28***a* engage abutments **30**, **30***a*, respectively, the pins **20**, **20***a* are coaxial with recesses **27**, **27***a*, respectively. Channels **31**, **31***a* are provided in the base of the floor plates **26**, **26***a*, respectively, to clear the abutments **30**, **30***a* on the cross-heads.

Wedges **32**, **32***a* are mounted on the support **13** so as to engage the rollers **21**, **21***a*, respectively, in the withdrawn position of the piston rods **16**, **16***a*. As each piston rod approaches its fully withdrawn position its associated roller rides up its associated wedge to withdraw the head of the pin from its recess in the floor plate. Each roller will rest on the thickest part of the wedge with the head of the pin entirely withdrawn from its recess when the piston rod is fully withdrawn, having reached the limit of its stroke towards the press center line and the other piston and cylinder assembly.

The recesses **27**, **27***a* are covered by cover plates **33**, **33***a* respectively to prevent ingress of scale. The cross-heads **17**, **17***a*, respectively carry strikers **34**, **34***a* which are arranged to actuate limit switches **35**, **35***a*, respectively.

The stroke of each of the piston and cylinder assemblies slightly exceeds half the stroke of the sliding anvil, the excess stroke being used to disengage the connecting pin between one assembly and the anvil whilst engaging the connecting pin between the other assembly and the anvil. In the center position of the anvil, shown in FIGURE 1, neither piston rod is entirely withdrawn. FIGURE 2 shows the position of the anvil after a full stroke to the left. In this position the piston rod **16** is fully extended while piston rod **16***a* is fully withdrawn, the pin **20** is engaged in the recess **27** while pin **20***a* is withdrawn against the action of springs **22***a* by wedge **32***a*, and limit switch **35***a* is depressed by striker **34***a*.

In operation, to move the anvil from its fully left position shown in FIGURE 2, to its fully right position, first the annulus side of cylinder 15 is supplied with pressurized oil which drives the piston rod 16 to the right. This drives the anvil 12 to the right through cross head 17, abutment 30, abutment 28, and floor plate 26. Shortly before roller 21 begins to engage the thin end of wedge 32, and shortly before the anvil reaches the press center position, the abutment 28*a* engages the abutment 30*a*, and the recess 27*a* is aligned with the pin 18*a*. As the anvil moves to the press center position roller 21 begins to ride up the wedge 32 withdrawing pin 18 from the recess 27, against the action of spring 22, while roller 21*a* moves down the wedge 32*a* releasing the pin into the recess 27*a*. This motion of pin 18*a* is caused by the abutment of 28*a* and 30*a* which causes the floor plate 26*a* to drive the cross head 17*a* to the right beginning to extend piston 16*a*. During movement of the rollers 21, 21*a* over the wedges 32, 32*a* the pins and their recesses remain coaxial, so that there is no resistance to movement of the pins. As soon as crosshead 17*a* begins to move to the right the striker 34*a* releases the limit switch 35*a*. Just after roller 21 has reached the thickest part of wedge 32 so that pin 18 is entirely withdrawn and pin 18*a* entirely located in the recess 27*a*, striker 34 will depress limit switch 35, which is arranged to operate the hydraulic circuit to redirect pressurised oil from the annular side of cylinder 15 to the head end of cylinder 15*a*. The anvil 12 will then be moved to its fully right position by the pin 18*a* pulling the anvil, until the piston rod 16*a* is fully extended.

FIGURE 1 also shows a hydraulic circuit diagram, suitable for operating the piston and cylinder assemblies 15, 15*a*. A pump 36 powered by motor 37, and having a relief valve 38 provides a pressurised supply to valve 40 on line 41. Valve 40 is normally biased to a closed position in which the line 41 is connected to a drain, but can be energised by solenoid 42 to connect the supply to a line 43. Line 43 is connected to valves 44, 45, which are shown in their off positions in which the output terminals are both connected to a drain. Energization of solenoid 46 of valve 44 connects line 43 to the head end of cylinder 15 through line 47. Energization of solenoid 48 of valve 44 connects line 43 with the annulus end of cylinder 15 through lines 50, 51 and non-return valve 53. The annulus side of cylinder 15 is also connected to line 43 through the non-return valve 53, and to a valve 54. Valve 54 is biased to connect the line 50 to a drain, but can be energized by solenoid 55 to disconnect line 50 from the drain. Energization of solenoid 48 also connects line 47 to a drain.

Energization of solenoid 55A of valve 45 connects line 43 to the annulus end of cylinder 15*a* through a non-return valve 60, while connecting the head end of cylinder 15*a* to a drain through line 57. Energization of solenoid 58 of valve 45 connects the line 43 to line 57. The annulus end of piston 15*a* is further connected to line 43, and to valve 61. The valve 61 is normally biased to connect the annulus end of cylinder 15*a* to a drain, but can be operated by energization of solenoid 62 to disconnect this end of cylinder from the drain.

Thus, to move the anvil towards the press center line from a position well to the left of center, operation of an electrical control will energize solenoids 55, 48 and 42. Hydraulic fluid will then flow to the annulus of cylinder 15, fluid from the head end being exhausted to drain. When the piston 16*a* is pulled out of its cylinder 15*a* as previously described, fluid will be drawn into the head end through the valve 45, and fluid will be exhausted from the annulus through the valve 61. When the limit switch 35 is depressed solenoids 55 and 48 will be de-energized and solenoids 62 and 58 will be energized. Thus, piston rod 16 will stop and piston rod 16*a* will continue the movement in the same direction. Movement from a position well to the right of center will similarly be accomplished by energizing solenoids 42, 55A and 62, and later by means of limit switch 35*a* de-energizing solenoids 62 and 55A and energizing solenoids 46 and 55.

In order that the velocity of the anvil shall remain substantially constant, the areas of annulus and piston rod of each piston are made substantially the same and the flow from the annulus is passed to the inlet side of the directional control valve 44 or 45 to join the pump output to the head side. Thus in one direction the pump is effectively operating on the piston rod area and in the other direction it is operating on the area of the annulus. As stated, if those areas are substantially equal then the velocities of movement in either direction will be substantially the same.

It will be appreciated that should movement to the right be required when limit switch 35 is already depressed when solenoids 42, 62, 58 will automatically be energized immediately instead of solenoids 42, 55 and 48 to effect the movement. Similarly if limit switch 35*a* is already depressed and a movement from right to left is required, then solenoids 42, 55 and 46 will automatically be energized instead of solenoids 42, 62 and 55A in order to effect the movement.

I claim:

1. Apparatus for moving a press anvil relative to a press center position midway of the path of travel of said anvil, said apparatus comprising a pair of double acting hydraulic piston and cylinder assemblies arranged on opposite sides of said press center position, means for coupling one assembly to the anvil to move the anvil towards and away from the press center position on one side of the press center position, and means for coupling the other assembly to the anvil to move the anvil toward and away from the press center position on the other side of that position.

2. Apparatus for moving a horizontally slidable press anvil relative to a press center line bisecting the path of travel of said anvil, said apparatus comprising a first double acting piston and cylinder assembly located on one side of the press center line, first coupling means for coupling the first assembly to the anvil for moving the anvil on that side of the press center line, a second double acting piston and cylinder assembly located on the opposite side of the press center line, second coupling means for coupling the second assembly to the anvil for moving the anvil on that side of the press center line, and means for automatically disengaging the anvil from either assembly when it approaches the limit of the stroke of that assembly in a direction towards the other assembly, and automatically coupling that other assembly to the anvil.

3. Apparatus according to claim 2 comprising limit means defining the strokes of the first and second assemblies driving the anvil, said limit means being so positioned that said strokes overlap at the press center line.

4. Apparatus according to claim 3 in which each coupling means includes a part provided with a recess and movable with said anvil and a coupling member carried by its associated assembly, said coupling member being movable vertically to engage in or disengage from said recess.

5. Apparatus according to claim 4 in which each coupling means includes means arranged to urge the coupling member into engagement in its associated recess.

6. Apparatus according to claim 4 in which each assembly carries an abutment arranged to engage an associated abutment carried by the anvil when its coupling member is aligned with the associated recess.

7. Apparatus according to claim 6 in which each assembly is arranged to drive the anvil through engagement of its associated abutments for movement towards the other assembly, and is arranged to drive the other assembly through engagement of the other pair of abutments during the overlapping portions of the strokes of the assemblies.

8. Apparatus according to claim 4 in which the means

for automatically disengaging the coupling means from the anvil, comprises a withdrawal member carried by each coupling member and a fixed wedge arranged to engage with its associated withdrawal member when that withdrawal member approaches the limit of its stroke towards the other assembly, such that the withdrawal member rides up the wedge to withdraw the coupling member from its associated recess.

9. Apparatus according to claim **2** in which each assembly carries a striker and including fixed limit switches associated with the assemblies and arranged to be actuated by the associated strikers when each striker is at the end of its stroke towards the other assembly, together with means actuated by said limit switches for individually connecting and disconnecting said cylinders to a source of fluid pressure.

10. Apparatus according to claim **9** in which the limit switches are arranged to operate hydraulic valves to redirect pressure fluid from one assembly to the other assembly.

11. Apparatus according to claim **10** in which each

piston is mounted at one end of a piston rod and in which the cross-sectional areas of each piston rod and the annular portion of each piston encircling said rod are made substantially the same, and including means for directing the flow of pressure fluid from the side of each piston from which its rod projects to join the flow of pressure fluid to the head side of that piston.

References Cited by the Examiner

UNITED STATES PATENTS

2,176,543	10/1939	Norton	83—563
2,940,384	6/1960	Munschauer et al.	100—214
2,996,025	8/1961	Georgeff	72—446

FOREIGN PATENTS

678,935	7/1939	Germany.
960,209	6/1964	Great Britain.

WALTER A. SCHEEL, *Primary Examiner.*

BILLY J. WILHITE, *Examiner.*