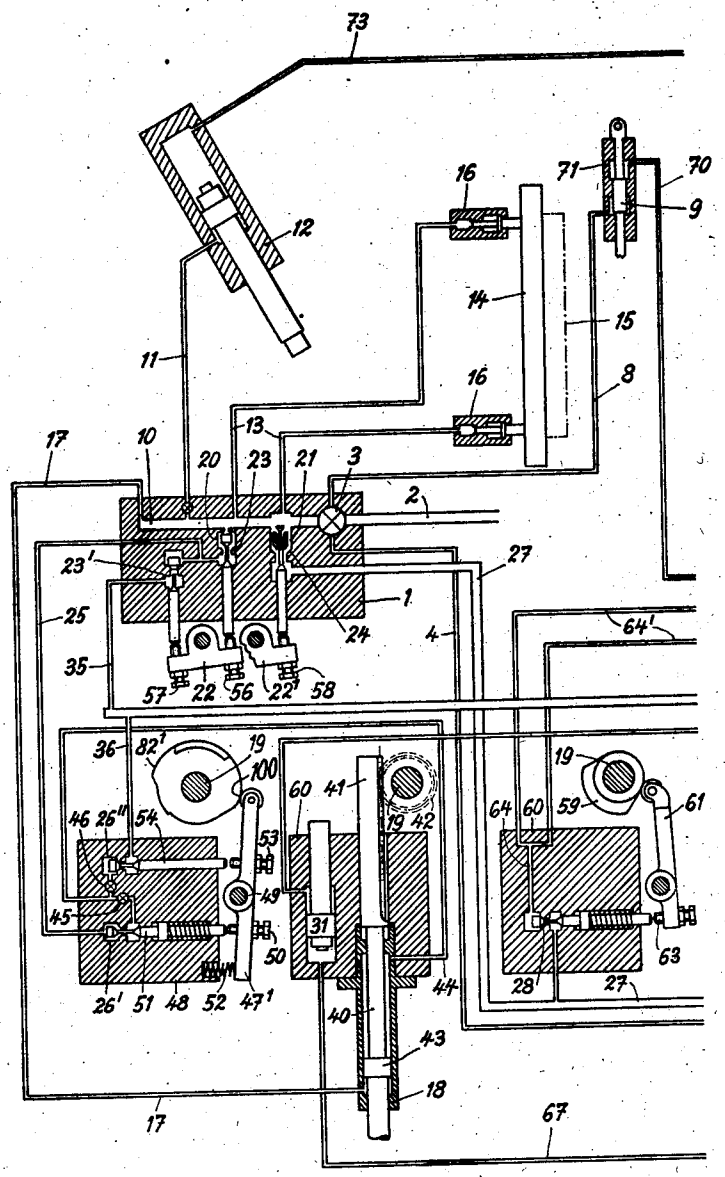
Sept. 24, 1940. J. VONTOBEL ET AL 2,216,059

HYDRAULIC CONTROLLING DEVICE IN MACHINES FOR DIE CASTING UNDER PRESSURE

Filed May 27, 1938 3 Sheets-Sheet 1

Fig. 1a.



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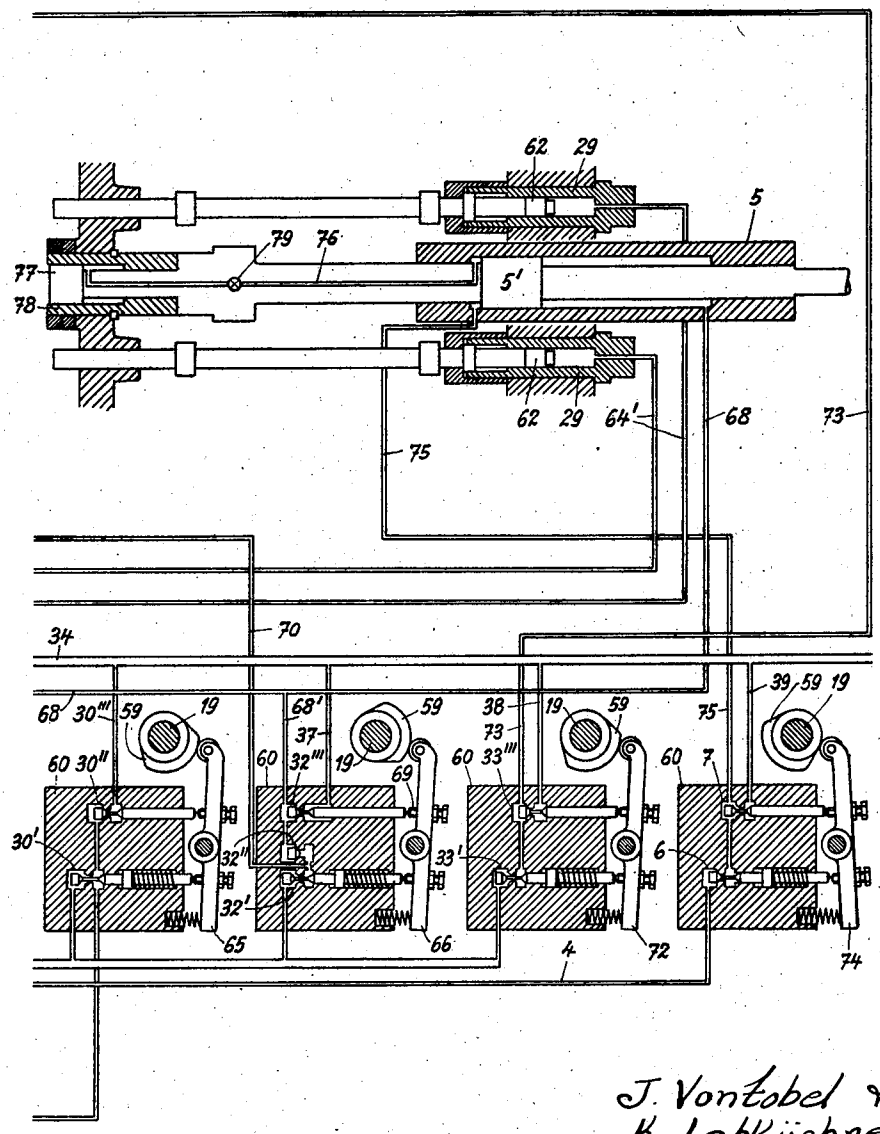
By: Glascock Downing & Seebold
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HYDRAULIC CONTROLLING DEVICE IN MACHINES FOR DIE CASTING UNDER PRESSURE

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Fig. 16.



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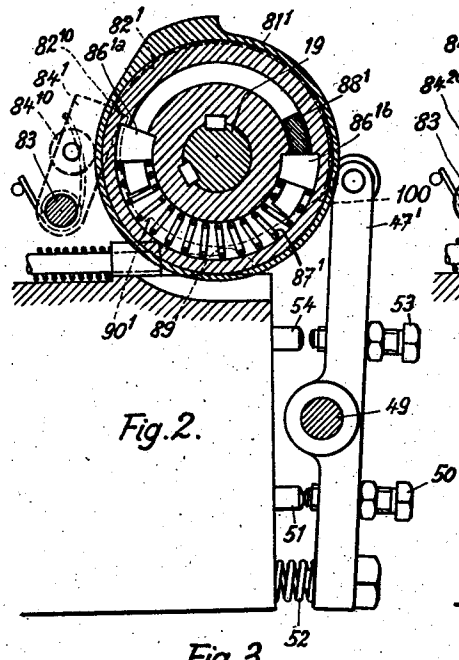


Fig.2.

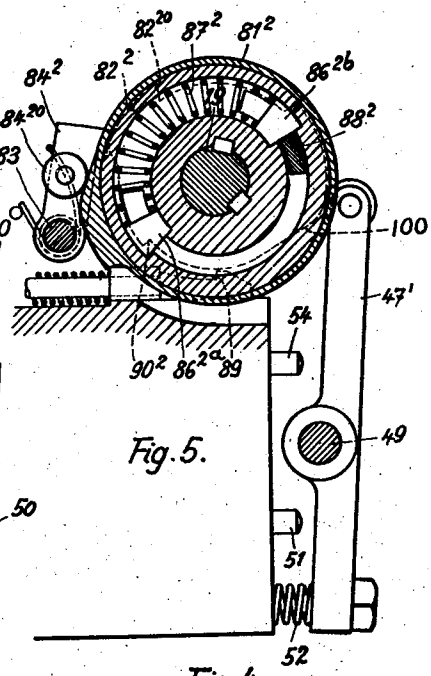


Fig.5.

Fig.3.

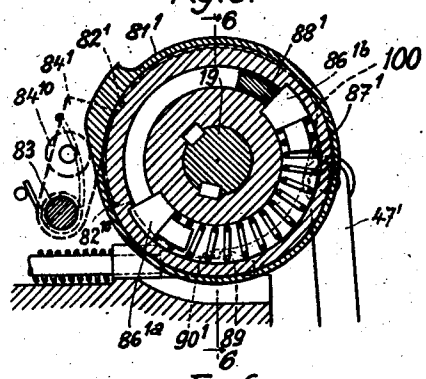


Fig.4.

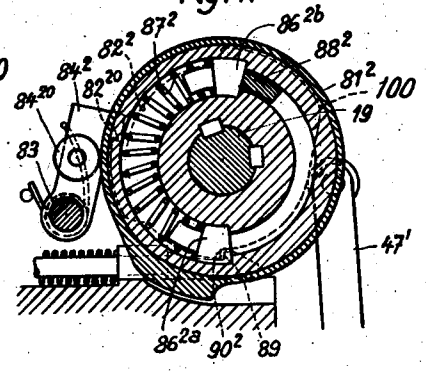


Fig.6.

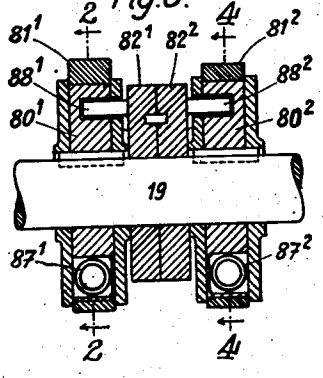
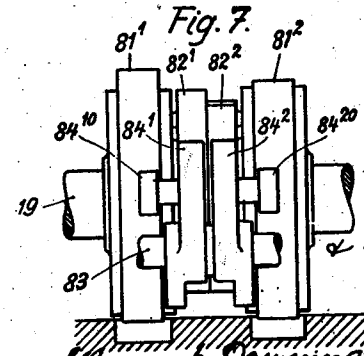


Fig.7.



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UNITED STATES PATENT OFFICE

2,216,059

HYDRAULIC CONTROLLING DEVICE IN MACHINES FOR DIE CASTING UNDER PRESSURE

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Application May 27, 1938, Serial No. 210,528
In Switzerland May 29, 1937

3 Claims. (Cl. 22—68)

The present invention relates to a hydraulic controlling device in machines for die casting under pressure, of the kind, where a reciprocating cam shaft is used for operating the controlling valves of the pressure piston, for closing and opening the mould and for the withdrawing of the cores.

The invention consists in the provision of an automatic reversing gear of a controlling device of the reciprocating movements of the cam shaft.

The annexed drawings show as an example an embodiment of the invention.

Figs. 1*a* and 1*b* represent together a diagrammatic view of the required controlling mechanisms,

Figs. 2 to 7 relate to the reversing gear,

Figs. 2 and 3 are cross sections on the line 2—2 in Fig. 6, showing the parts in different positions,

Figs. 4 and 5 are cross sections on line 4—4 in Fig. 6 showing the parts in different positions,

Fig. 6 is a longitudinal central section on the line 6—6, Fig. 3, and

Fig. 7 a lateral view.

According to Figs. 1*a* and 1*b* a distributing plate 1 carries a main cock 3 controlling the main pressure conduit 2 fed by an accumulator not shown. From this main cock are branched off firstly a conduit 4 controlled by the valves 6 and 7 for the opening of the mould closing cylinder, secondly a conduit 8 leading to one end of a cylinder 9 controlling a knock off device for the castings and thirdly a distributing conduit 10 which feeds on one side a conduit 11 leading to the pressure cylinder 12, two conduits 13 leading to the buffer cylinders 16 which push off the left hand half of the mould 15 carried by plate 14 from the injecting spout not shown and a fourth conduit 17 leading to the controlling cylinder 18 of the cam shaft 19. On the other side from this distributing conduit 10 are branched off two conduits 20, 21 feeding the valves 23, 24 and 23' controlled by a hand operated double lever 22, 22' serving as starting and stopping member. Valve 23 is connected by a conduit 25 to the controlling valves 26', 26'' operated by the cam shaft 19 and relieve valve 24 feeds a distributing pressure conduit 27 whereas valve 23' will operate the communication between the pressure conduit 25 admitting of regulation with a drain conduit 34. From this distributing conduit 27 are branched off the following pressure conduits, firstly a conduit leading to the controlling valve 28 of the buffer cylinders 29 which have to stop the carrier plate of the right hand half of the mould for the purpose of withdrawing the cores; secondly a conduit leading to the controlling valves 30', 30'' of one side of a so called multiplicating cylinder 31, thirdly a conduit leading to the controlling valves 32', 32'', 32''' feeding the other side of the cylinder of the knock off device and the other sides of the multiplicating cylinder and the mould closing cylinder and fourthly a conduit leading to the controlling valve 33' of the pressure cylinder 12.

Besides the main pressure conduit 2 there is also a collecting conduit 34 without pressure serving as return conduit into a not represented reservoir feeding the pump. The following conduits are connected with this collecting conduit: a conduit 35 coming from the relieve valve 23', a conduit 36 coming from the relieve valve 26'' and four conduits 30''', 37, 38, 39 coming from the relieve valves 30'', 32''', 33''' and 7.

With exception of the buffer cylinders all other operating cylinders, to wit: pressure cylinder, closing cylinder, multiplicating cylinder and controlling cylinder are arranged as differential cylinders.

An extension of the piston rod 40 of the controlling cylinder carries a rack 41 imparting to pinion 42 fast to the cam shaft an oscillating movement of 180° when differential piston 43 is operated by means of the pressure conduits 17 and 44. A regulating valve 45 is provided in the pressure conduit 44 and a regulating valve 46 in the relieve conduit 36 before the relieve valve 26''. In the pressure conduit system must be distinguished the conduits branched off directly from the distributing conduit 10 all fed with constant pressure and the conduits branched off from the valves 23, 24 fed with pressure admitting of regulation. Now valves 26', 26'' transmit such a regulated pressure operating on the larger surface of the differential piston 43 and moving, while valve 26' and regulating cock 45 are opened, the rack 41 downwards and the cam shaft in an anticlockwise direction. If however valve 26' is shut and valve 26'' opened the larger surface of piston 43 will be relieved by conduit 36 and the pressure of conduit 17 will rotate the cam shaft in a clockwise direction. This alternate rotation is operated by a pivoted lever 47^1.

This lever 47' pivotally held by an axis 49 and arranged on a plate 48 bears by means of an adjustable screw 50 upon the stem 51 of valve 26^1 and rests with its one end on a helical spring 52. On the other side of pivot 49 lever 47^1

carries an adjustable screw 53 which may come into contact with the stem of the relieve valve 26'' and carries at its other end a roller operated by a cam nose 100 common to the two relatively fixed cam disks 81^1 and 82^2 (Figs. 2 to 7) rotatably mounted on the cam shaft 19 and controlling the oscillations of lever 47'. The cam disks 82^1 and 82^2 form parts of the reversing gear illustrated by Figs. 2 to 7 as will be hereinafter more fully described.

The valves 23, 23' and 24 are controlled in a like manner by the handoperated pivoted lever 22 and lever 22' rigidly connected therewith. When valve 23 is opened by lifting the adjustable screw 56 and when by the liquid pressure and by lowering the adjusting screw 57 valve 23' has been closed, the pressure in conduit 25 will move the controlling piston 43 downwards. At the same time by lifting the adjusting screw 58 the distributing conduit 27 will be put under pressure. If the pivoted levers 22, 22' are in a median position valves 23 and 24 will be closed and relieve valve 23' remains closed likewise. The liquid under pressure in conduit 25 between valve 23 and piston 43 is therefore cut off and prevents any further movement of controlling piston 43. Likewise in this median position of the pivoted levers the distributing conduit becomes relieved from pressure, and all movements of the machine controlled by this conduit are stopped at once.

By commuting the position of lever 22, 22' into a third position relieve valve 23' will be opened, while valves 23 and 24 remain closed. The constant pressure in conduit 17 operating on the smaller surface of controlling piston 43 will move now piston 43 upwards, since the liquid enclosed between valve 23 and piston 43 can pass through the opened valve 23' and conduit 35 into the drain conduit 34. By the upwards movement of piston 43 also the direction of revolution of cam shaft 19 will be reversed and therefore the machine be restored to its initial position.

The manner of distributing the available working pressure combined with the manually operated lever permits, after having stopped at once all movements of the machine, to continue the movements of the machine at once or to restore the initial position by a simple commuting of said manual lever.

By conveniently adjusting the regulating valves 45, 46 the cross section of conduits 36, 44 leading to the controlling piston 43 and therefore also the speed of its movement may be regulated continuously.

Figs. 1*a* and 1*b* represent the position of parts at the moment after casting, that is shortly before the reversing of the machine to open the mould.

The controlling of the valves by the cam shaft is operated by cam 59 in a like manner as described for cam 82'. A single valve 28 operated by the adjusting pin 63 suffices for the first pivoted lever 61 which is arranged with the controlling cylinder 18 on the same plate 60 and serves for controlling the buffer pistons 62. While this valve remains closed also the pressure liquid between piston 62 and valve 28 is shut off and permits a return of the buffers only, when the valve is opened by adjusting pin 63. This occurs at the opening stroke to withdraw the cores. At the closing stroke said valve acts as a non return valve.

The pressure conduit 64 controlled by this valve 28 is branched into two conduits 64' for the two buffer cylinders 29. Pivoted lever 66 controls the two valves 32' and 32'''. The first transmits the pressure of conduit 27 through conduits 68' and 68 to the larger piston surface of pressure cylinder 5' and effects the closing of the mould, while valve 32''' serves as relieve valve for the larger piston surface. At the same time through the opened valve 32' the working pressure is transmitted through conduit 70 to the larger piston surface of a knock off device 71, intended to knock off the castings expelled from the mould. With a view of obtaining a higher closing pressure of the mould a multiplicator 31 has been provided having also a differential piston. Pivoted lever 65 controls this cylinder through the valves 30' and 30'', the latter serving as relieve valve of the pressure acting upon the larger piston surface and valve 30' transmitting the pressure of conduit 27 to the pressure conduit 67 of the multiplicator. The smaller piston surface transmits the pressure considerably increased by the difference of area of the two piston surfaces to the larger piston surface of cylinder 5 through conduit 68. A non return valve 32'' prevents a transmitting of the increased pressure through the open valve 32' to the pressure conduit 27. The multiplicator is operated only when the mould has been closed.

The fourth pivoted lever 72 controls the pressure conduit 73 acting upon the larger piston surface of the pressure cylinder 12 adapted to operate upon the metal in the mould. Here valve 33''' acts as relieve valve, while valve 33' transmits the pressure from conduit 27. The fifth pivoted lever 74 controls the so called constant pressure fed directly from the distributing conduit 10 through valve 6, valve 7 serving as relieve valve, and acting upon the smaller piston surface of the closing piston 5'. During the closing of the mould valve 6 is opened and relieve valve closed; so that the pressure acting on the smaller area counteracts the pressure acting on the larger area. During the pressing valve 6 is closed by cam 59 while operating the pivoted lever 74 and the relieve valve 7 is opened, so that the smaller piston surface 5' becomes without pressure and the closing pressure becomes increased. The respective pressure chamber of the closing cylinder 5 communicates through an axial bore 76 with the pressure chamber behind the piston 77 of the hydraulic coupling 78 between mould carrier and piston 5', so that through conduit 78 also the hydraulic coupling will be controlled. A cut off valve 79 permits to render this controlling possibility impossible.

According to Figs. 2 to 7 the reversing gear comprises two spring boxes 80^1, 80^2 keyed to the cam shaft 19 and rigidly connected with two annular cams 81^1, 81^2; besides his two rigidly connected cam disks 82^1 and 82^2 are loosely arranged on shaft 19 between said spring boxes. While the spring controlled pawls 84^1, 84^2 arranged loose on a common axis 83 cooperate with the circumferentially opposed radial teeth 82^{10} and 82^{20} of the cam disks 82^1, 82^2, the noses of the annular cams 81^1, 81^2 are intended for controlling said pawls by means of laterally projecting cam rollers 84^{10}, 84^{20} provided on said pawls. Somewhat more than half of the annular hollow inside of the springboxes are occupied by springs 87^1, 87^2 provided respectively with the head pieces 86^{1a}, 86^{1b} and 86^{2a}, 86^{2b} serving as pressing members, while catches 88^1, 88^2 projecting laterally at corresponding points from the opposite sides of the cam disks 82^1, 82^1 are ex-

tended into the still remaining free spaces of the spring boxes and are adapted for stressing said springs 87^1, 87^2 by means of the spring head pieces 86^{1a}, 86^{1b} and 86^{2a}, 86^{2b}.

This reversing gear operates as follows:

In both of Figs. 2 and 5, the cam disks 82^1 and 82^2 are in the position in which the nose 100 engages the lever 47' and Fig. 5 shows the moment when the reversing gear has closed the valve 26'' and opened the valve 26'. Thus, the pressure liquid enters the upper end of the cylinder 18 and the piston 43 and rack 41 move downwardly. Shaft 19 now begins its counter-clockwise movement carrying therewith the two spring boxes 80^1 and 80^2 and the springs 87^1 and 87^2 and associated head pieces 86^{1a}, 86^{1b}, and 86^{2a}, 86^{2b}. The cam disks 82^1, 82^2 are prevented from participating in this movement by tooth 82^{10} of disk 82^1 meeting with pawl 84^1 and after movement of the spring boxes from the position shown in Fig. 5 to that in Fig. 2 the head pieces 86^{2a}, 86^{1b} of springs 87^1, 87^2 meet with the catches 88^1, 88^2 extended into the spring boxes 80^1, 80^2. The boxes continue rotating and stress thereby said springs until the annular cam 81^1 meeting with the roller 84^{10} disengages the pawl 84^1 from the tooth 82^{10} as shown in Fig. 3. The cam disks 82^1, 82^2 are thus released and kicked suddenly in an anticlockwise direction by the springs 87^1, 87^2 acting on the catches 88^1, 88^2, so that lever 47^1 drops with a jerk off of the nose 100 closing thereby valve 26^1 and opening valve 26'' both with a sharp quick action. The piston 43 is reversed and the rack 41 rises again and rotates shaft 19 in a clockwise direction. This adjustment of the nose 100^1 and lever 47^1 is illustrated in Fig. 3.

The low portions of the cam disks 82^1, 82^2 remote from the nose 100 possesses also a tooth 90^1 which becomes engaged by the spring controlled pawl 89, Fig. 3, when the cam disks are kicked in the counter-clockwise direction by the springs 87^1, 87^2. In this first phase of operation of the reversing gear the shaft 19 completes one half of a revolution.

At the beginning of clockwise rotation of the shaft 19 and spring boxes 80^1—80^2 the disks 82^1—82^2 are held against rotation by the pawl 84^2 engaging the tooth 82^{20} as shown in Fig. 4. The rotation of the spring boxes continues independently of the disks 82^1—82^2 until the head pieces 86^{2b} and 86^{1a} of the spring abut the catches 88^2 and 88^1, the abutment of the head piece 86^{2b} being shown in Fig. 4.

While shaft 19 continues rotating in a clockwise direction the springs 87^1, 87^2 held fast by the catches 88^1, 88^2 are compressed until the annular cam 81^2 meets roller 84^{20} and throws pawl 84^2 out of gear as shown in Fig. 5. By this action the cam disks 82^1, 82^2 will become freed and be kicked clockwise by the compressed springs 87^1 and 87^2 from the position shown in Fig. 4 to that of Fig. 5, the nose 100 being sharply forced beneath the end of lever 47^1. Thereby valve 26'' becomes suddenly closed and valve 26'. opened and thus the rotation of the shaft 19 will again be changed into an anticlockwise direction. Due to the jerk-like opening and closing of the commuting valves this change is effected suddenly.

What we claim is:

1. In a hydraulic controlling device in machines for die casting under pressure, an oscillating cam-shaft for operating the valves adapted to control the different working-actions of the machine, a cylinder containing a hydraulically operated piston for driving the cam-shaft, valves for controlling said piston, a member for actuating said piston controlling valves, and a reversing gear driven by the cam-shaft for controlling said member, said reversing gear including an actuating cam for said member and means operable by the cam shaft for alternately applying oppositely directed resilient forces to said actuating cam and releasing said cam to perform snap movements in opposite directions.

2. In a hydraulic controlling device in machines for die casting under pressure, an oscillating cam-shaft for operating the valves adapted to control the different working-actions of the machine, a cylinder containing a hydraulically operated piston for driving the cam-shaft, valves for controlling said piston, spring-boxes fixed to said cam-shaft, cam-discs rigidly connected to each other and loosely arranged on said cam-shaft and adapted to control said valves, stopping means adapted to stop the cam-discs, annular cams on the outer surface of said spring-boxes, adapted to disengage said stopping means from said cam-discs, springs in said boxes and catches laterally projecting from said cam-discs, said springs being adapted to be loaded with the help of said catches when the cam-discs are stopped and to swing the latter when these are disengaged from the stopping means.

3. In a hydraulic controlling device in machines for die casting under pressure, an oscillating cam-shaft for operating the valves adapted to control the different working-actions of the machine, a cylinder containing a hydraulically operated piston for driving the cam-shaft, valves for controlling said piston and a spring-operated reversing gear arranged to be brought into acting-position by means of the cam-shaft and adapted to operate said piston-controlling valves by jerks, a main supply conduit for the pressure medium, conduits branched off from said main supply conduit and leading to the cylinder containing the cam-shaft-driving piston and to a waste conduit, a distributing conduit branched off from said main supply conduit and adapted to lead the pressure medium to the other cylinders of the machine, valves adapted to control the supply of said branched off conduits and the distributing conduit and a hand-operated double-lever for the operating of the said supply-controlling valves, the machine by this double-lever may thus be started, suddenly stopped or returned to the outgoing-position at any given moment.

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