

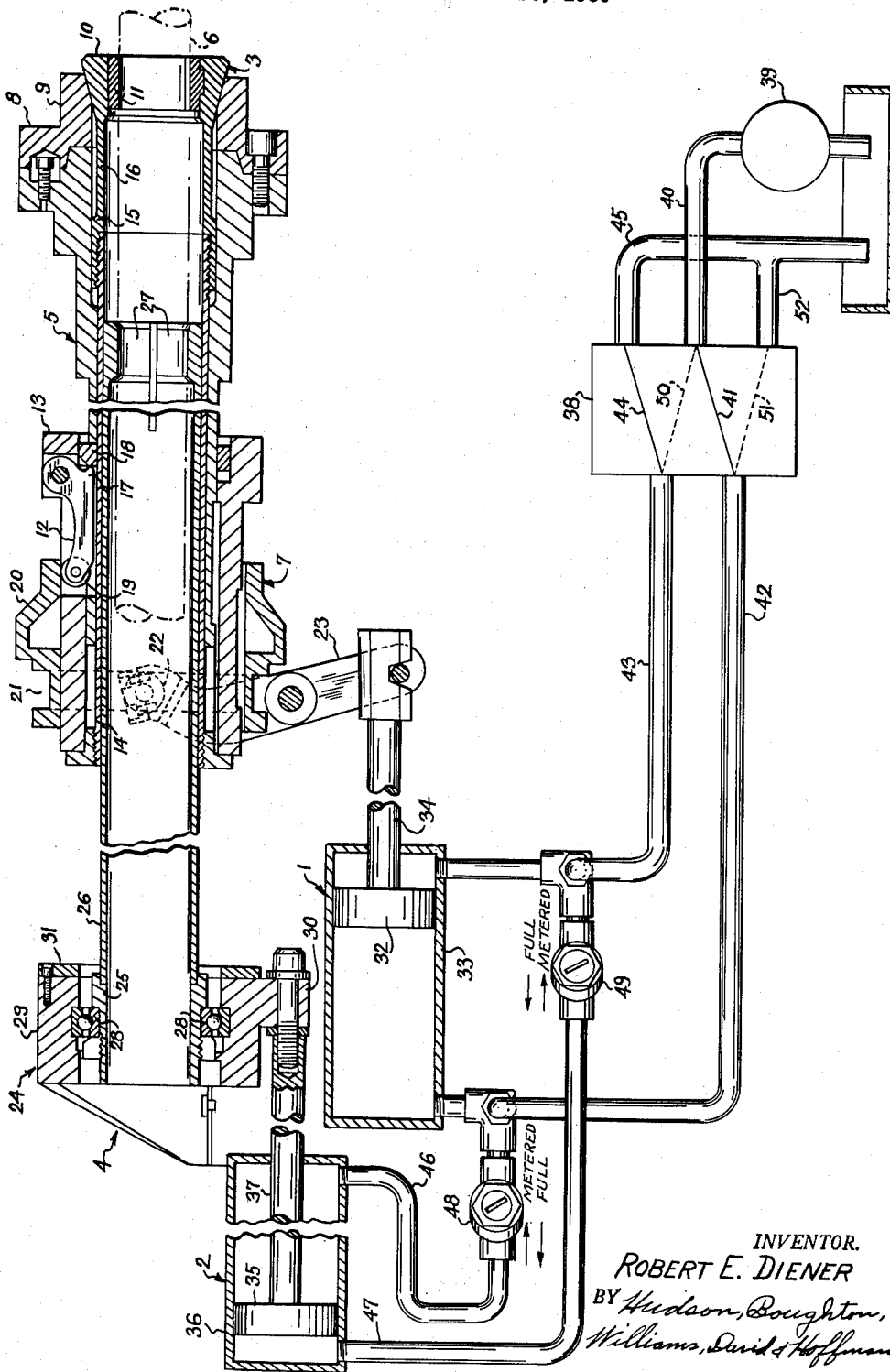
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FLUID SYSTEMS

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FLUID SYSTEMS

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This invention relates to fluid systems and particularly to means for controlling actuation of a plurality of fluid actuated devices.

In the present invention a system is provided wherein a plurality of fluid actuated devices are controlled in a novel manner so as to be actuated in a preselected sequence. The control arrangement operates to control the flow of actuating fluid for one of the devices such that when the devices are substantially simultaneously supplied with fluid actuation of the one device is delayed so that it is actuated subsequent to actuation of another of the devices.

The fluid actuated devices are operatively connected to pressure fluid source means through a movable control valve means and through conduits providing pressure and drain connections. A novel valve arrangement is associated with the conduits for the device which is to be delayed and operates to restrict or meter the flow of fluid for such device to effect a delay in the actuation of the device when the movable valve means is actuated and the devices are substantially simultaneously supplied with fluid.

Although the invention has many and varied uses it is of particular advantage in the control of fluid actuated motors which effect movement of a bar gripping chuck and a bar feed device in a bar machine. In a machine of this type the chuck is movable between open and closed positions for respectively releasing and gripping the bar, and the bar feed device is movable between advanced and retracted positions to feed the bar through the chuck. It is necessary that these devices be moved in the sequence wherein the chuck opens, the bar feed device advances, the chuck closes and the bar feed device retracts.

Each of the fluid motors may be of the double acting type actuatable in two directions for effecting the two movements of its associated device. Preferably, the motors are connected to a single source of pressure fluid through interconnected conduits and through a conventional two-position valve device to control the directions of actuation of the motors. The fluid control means are arranged to meter the flow of actuating fluid in the conduits of the motor for the bar feed device so that such device is advanced subsequent to opening of the chuck when the control valve is moved to one of its positions and is retracted subsequent to closing of the chuck when the control valve is moved to the other of its positions.

The fluid control valves are of the type which permit normal full fluid flow in one direction therethrough and which restrict or meter the flow of fluid in the opposite direction therethrough. These valves are preferably associated with the conduits for the motor to be delayed such that full flow is permitted to the motor and restricted flow is provided from the motor. The other, non-delayed device is actuated in the normal manner under full flow conditions so that the device it operates, such as a chuck device, is moved prior to movement of the delayed device, such as a bar feed device. The control valves are adjustable to vary the metering action so that the amount of delay may be varied as desired.

It is, therefore, an object of the invention to provide a fluid system including a plurality of fluid actuated devices with an improved fluid control arrangement for effecting actuation of the devices in a preselected sequence.

It is another object of the invention to provide a system as defined in the preceding object wherein the fluid control

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arrangement includes means for restricting or metering the flow of actuating fluid for one of the devices.

It is a further object of the invention to provide a fluid system including a plurality of fluid actuating devices operatively connected to a source of pressure fluid through a two-position valve device and through interconnected conduits which have valve means arranged to permit full flow of fluid to one of the devices and which restrict the flow of fluid from the one device.

It is still another object of the invention to provide a fluid system including fluid actuated motors controlling movements of a bar gripping chuck device and a bar feed device with improved fluid control means for controlling actuation of the motors to effect movement of the devices in a preselected sequence.

It is a still further object of the invention to provide a system as defined in the preceding object wherein the fluid control means includes valve means for restricting or metering the flow of actuating fluid for the bar feed device to delay movement of the bar feed device until the chuck device has been moved.

Other objects of the invention will become apparent from the following description taken in conjunction with the accompanying drawing in which the single FIGURE illustrates a fluid system incorporating the teachings of the present invention.

It is to be understood that the invention is susceptible of various applications, modifications, constructions and arrangements and is particularly applicable for employment in a machine tool wherein a bar-gripping chuck device and a bar feed device are to be moved in a preselected sequence.

Referring to the single figure, there is shown a fluid system including a pair of fluid actuated devices 1 and 2 which are to be actuated in a preselected sequence. The devices 1 and 2 may assume various forms and in the illustrated embodiment comprise fluid actuated motors of the double acting piston-cylinder type for operating any suitable mechanisms. The operated mechanisms, for example, may comprise parts of a machine tool such as a bar-gripping collet chuck 3 and a bar feed device 4 employed in a bar machine.

The chuck 3 is located at the outer end of a rotatable spindle 5 for rotation therewith and is of conventional construction being movable between open and closed positions for respectively releasing and gripping bar stock 6. In order to actuate the collet chuck there is provided in a conventional manner a chuck actuating mechanism 7 which will be described hereinafter.

The bar feed device is also of conventional construction and is designed to move longitudinally of the spindle axis to advance the bar stock through the chuck 3 subsequently to opening of the chuck. The bar feed device operates to advance the bar stock and then retracts to its rear position relative to the advanced bar stock. As will appear hereinafter, the bar feed mechanism is automatically operated to advance the bar stock subsequent to opening of the collet chuck to a bar releasing position.

The spindle 5, at its right hand end as viewed in the drawing, has an annular flange 8 secured thereto which has an extending nose 9 with a frusto-conical opening in which are received jaws 10 of the collet chuck. As is conventional in the art, resilient pads 11 may be secured to the jaws 10 to grip the bar stock 6. In order to open and close the collet chuck there is provided a plurality of pivoted fingers 12 (only one of which is shown) which are pivoted to a housing 13 secured as by threading to the outer surface of a sleeve 14, which is slidable freely within the spindle 5. The sleeve 14 is secured as by threading to an extension 15 of a flexible thin wall section 16 connected to the jaws 10. The section 16 forms a resilient mounting for the jaws 10.

The fingers 12 include short projections 17 which engage a reaction ring 13 forming part of the spindle. The fingers 12 carry rollers 19 which cooperate with an inner tapered surface of a hollow cone 20 which is slidable on the outer surface of the housing 13. The cone 20 includes an annular groove 21 in which may be positioned a pair of rollers 22 (only one of which is shown) carried by forked extensions of a lever 23 which is pivotally secured intermediate its ends to a portion of the machine.

When the lever 23 is pivoted it effects sliding movement of the cone 20 relative to the housing 13 and relative to the fingers 12 so that the fingers 12 are pivoted and the sleeve 14 is moved to the right or left, depending upon the direction of pivotal movement of the lever. As a result the collet chuck can be opened or closed by actuation of the lever 23. The chuck is shown in its closed, bar gripping position in the drawing. If the lever 23 is pivoted in a clockwise direction as viewed in the drawing, then the cone 20 is moved to the right and fingers 12 are pivoted in a clockwise direction by the resilience of the jaws 10 so that the sleeve 14 is moved to the right which opens the collet. Pivoting of the lever 23 in a counterclockwise direction operates to close the collet chuck.

The bar feed device 4 is shown as including an axially movable, nonrotatable head assembly 24 surrounding an inner hollow sleeve 25 which has secured thereto as by welding a feed finger tube 26 extending freely within the collet actuating sleeve 14. The tube 26 carries at its right hand end a plurality of resilient fingers 27 which are arranged to frictionally grip the bar stock 6 during advancement of the bar feed device to move the bar forward through the open chuck, and which slide along the bar stock relative thereto when the bar feed device is retracted subsequent to closing of the collet chuck. The fingers 27 are designed to be in continuous engagement with the bar stock.

The sleeve 25 together with the tube 26 secured thereto are supported for rotation with the spindle 5 relative to the head assembly 24 by means of a bearing 28 between the head assembly 24 and the sleeve 25. The head assembly 24 includes an annular part 29 having a depending portion 30 on each side thereof to which are secured hollow members (not shown) through which extend ways (not shown) for slidably supporting the bar feed device. A ring 31 is attached to the right-hand face of the part 29 to surround the finger tube 26.

The chuck and bar feed devices are actuated by the fluid motors 1 and 2. The motor 1 for the chuck may include a piston 32 positioned within a hollow cylinder 33 and having a piston rod 34 extending outwardly of the cylinder and operatively connected to the lever 23. In a similar manner, the motor 2 includes a piston 35 within a cylinder 36 and having a rod 37 operatively connected to the part 29. Displacement of the pistons 32 and 35 within the cylinders 33 and 36 is controlled by a main control valve 38 including a shiftable valve body which may be shifted under the control of an operator.

The body of the valve 38 is shown in its normal position and for this position of the valve body the collet chuck is closed and the bar feed device is retracted. With the valve body in its normal position a suitable fluid such as air or oil is supplied under pressure from a conventional pump 39 through a supply conduit 40 which connects through a passage 41 of the valve to a conduit 42 leading to the left-hand end of the cylinder 33. This urges the piston 32 to its illustrated position to position the lever 23 for closing the chuck. Fluid is drained from the cylinder 33 through a conduit 43 which connects through a passage 44 of the valve to an outlet conduit 45 leading to drain. The operation of the main control valve 38 alternatively and selectively functions to cause the pair of conduits 42 and 43 to become, respectively,

one an inlet conduit and the other an exhaust conduit or vice versa.

The motor 2 is operatively connected to the pump 39 and the sump through branch conduits 46 and 47 connected to the cylinder 36 and to the conduits 42 and 43 respectively through control valves 48 and 49. When the valve 38 is in its normal position fluid under pressure from the pump 39 is supplied to the cylinder 36 through the branch conduit 46 and fluid is drained from the cylinder 36 through the branch conduit 47. This urges the piston 35 to its illustrated position to retract the bar feed device. The branch conduits 46 and 47 become either branch inlet conduits or branch exhaust conduits depending upon the current functional characteristic of the particular conduit of the pair of conduits 42 and 43 to which the branch conduits are connected respectively.

The valves 48 and 49 operate to delay actuation of the motor 2 so that the motor 2 is actuated subsequent to actuation of the motor 1. The valves 48 and 49 are of a commercially available type which permit normal full fluid flow therethrough in one direction, and which restrict or meter fluid flow therethrough in the opposite direction. Each of the valves 48 and 49 is adjustable to permit variation of the fluid metering action by rotatable screws forming a part of the valves and which are rotatable by a suitable tool such as a screw driver engageable with a slot in the heads of the screws and which upon rotation vary the restriction in the valve. Flow control valves suitable for use in the present invention are supplied by the Schrader division of Scovill Manufacturing Company, Incorporated, under Schrader numbers 3250, 3250A, 3250B, 3250C and 3250D.

If it is desired to open the chuck and to advance the bar feed device, the valve 38 is actuated so that fluid under pressure flows from the pump 39 through the conduit 40, a passage 50 of the valve 38 and the conduit 43 to the cylinder 33. At the same time fluid flows through the conduit 47 and the valve 49 to the cylinder 36. The piston 32 is thereby urged to the left to pivot the lever 23 in a clockwise direction to open the chuck. Fluid is drained from the cylinder 33 through the conduit 42, a passage 51 of the valve 38 and a conduit 52 to drain.

The fluid under pressure supplied to the cylinder 36 through the valve 49 tends to move the piston 35 toward the right but such movement is resisted by the metering action of the valve 48 on the fluid drained from the cylinder 36 through the conduit 45. In other words, due to such metering action the initial differential pressure in the cylinder 36 is not great enough to move the piston toward the right. As a result the piston 32 will be moved to the left and the chuck will be opened prior to appreciable advancement of the bar stock. When the piston 32 has been moved to its extreme left hand position, pressure of fluid in the conduit 47 will build up and the piston 35 will be moved to the right.

When the bar stock has been fed by movement of the piston 35 to the right, an operator actuates the valve 38 so that fluid under pressure flows from the pump 39 through the conduit 42 into the cylinder 33 to displace the piston 32 toward its illustrated position. At the same time, fluid under pressure flows through valve 48 and conduit 46 into the cylinder 36 and displacement of the piston 35 is delayed due to the metering action of valve 49 of fluid drained from the cylinder 36. Consequently, the chuck will be closed prior to appreciable retraction of the bar feed device.

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications are possible and it is desired to cover all modifications falling within the spirit and scope of the appended claims.

Having described my invention, I claim:

1. A pressure fluid supply and control system for a pair of double acting pressure fluid motors each having

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a cylinder and a piston movable therein and with the pistons of the motors being adapted to be operatively connected respectively to different movable elements of a mechanism and one of which elements is to have delayed actuation relative to the actuation of the other of said elements; said system comprising a pair of conduits connected to the cylinder of one of said motors on opposite sides of the piston thereof, pressure fluid supply and exhaust means including supply and outlet conduits, a main control valve for interconnecting said supply and outlet conduits with said pair of conduits to selectively and alternatively make one of said pair of conduits an inlet conduit and the other an exhaust conduit to supply pressure fluid to said cylinder of said one motor on one or the other side of the piston thereof and exhaust pressure fluid from said last named cylinder on the opposite side of the piston thereof, a pair of branch conduits connected to the cylinder of the other of said motors on opposite sides of the piston thereof and each being connected respectively to a different one of said pair of conduits; and valves in said branch conduits and exclusively of the type providing for free pressure fluid flow therethrough from the pair of conduits to said cylinder of the other of said motors and a restricted pressure fluid flow therethrough from said last named cylinder to said pair of conduits whereby the pistons of said motors will be simultaneously subjected to pressure fluid from the supply conduit of the pressure fluid supply and exhaust means while the exhaust of pressure fluid from the cylinder of the other of said motors is restricted relative to the exhaust of the pressure fluid from the cylinder of said one motor thus causing delayed actuation of the other of said motors relative to said one motor.

2. A pressure fluid supply and control system as defined in claim 1 and wherein the flow control valves in said branch conduits are adjustable to vary the restriction to the flow of pressure fluid from the cylinder of said other of said motors to the conduits of said pair of conduits to which the branch conduits are connected.

3. A pressure fluid supply and control system for a pair of double acting pressure fluid motors each having a cylinder and a piston movable therein and with the pistons of the motors being adapted to be operatively connected respectively to different movable elements of a

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mechanism and one of which elements is to have delayed actuation relative to the actuation of the other of said elements; said system comprising a pair of conduits connected to the cylinder of one of said motors on opposite sides of the piston thereof, pressure fluid supply and exhaust means including supply and outlet conduits, a main control valve for interconnecting said supply and outlet conduits with said pair of conduits to selectively and alternatively make one of said pair of conduits an inlet conduit and the other an exhaust conduit to supply pressure fluid to said cylinder of said one motor on one or the other side of the piston thereof and exhaust pressure fluid from said last named cylinder on the opposite side of the piston thereof, a pair of branch conduits connected to the cylinder of the other of said motors on opposite sides of the piston thereof and each being connected respectively to a different one of said pair of conduits; and valves in said branch conduits and exclusively of the type providing for free pressure fluid flow therethrough in one direction to said cylinder of the other of said motors and a restricted pressure fluid flow therethrough in the opposite direction whereby the pistons of said motors on one side thereof will be simultaneously subjected to pressure fluid from the supply conduit of the pressure fluid supply and on the other side thereof will be simultaneously connected to the exhaust conduit with the movement of the piston of the other of said motors being delayed by the metering action of said flow control devices and being at a controlled velocity.

4. A pressure fluid supply and control system as defined in claim 3 and wherein the flow control valves in said branch conduits are adjustable to vary the restriction to the flow of pressure fluid through the device in a metered direction.

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