May 28, 1963 R. E. BECKER 3,091,256

CHUCK CONTROL CIRCUIT

Filed Sept. 6, 1960 2 Sheets-Sheet 1

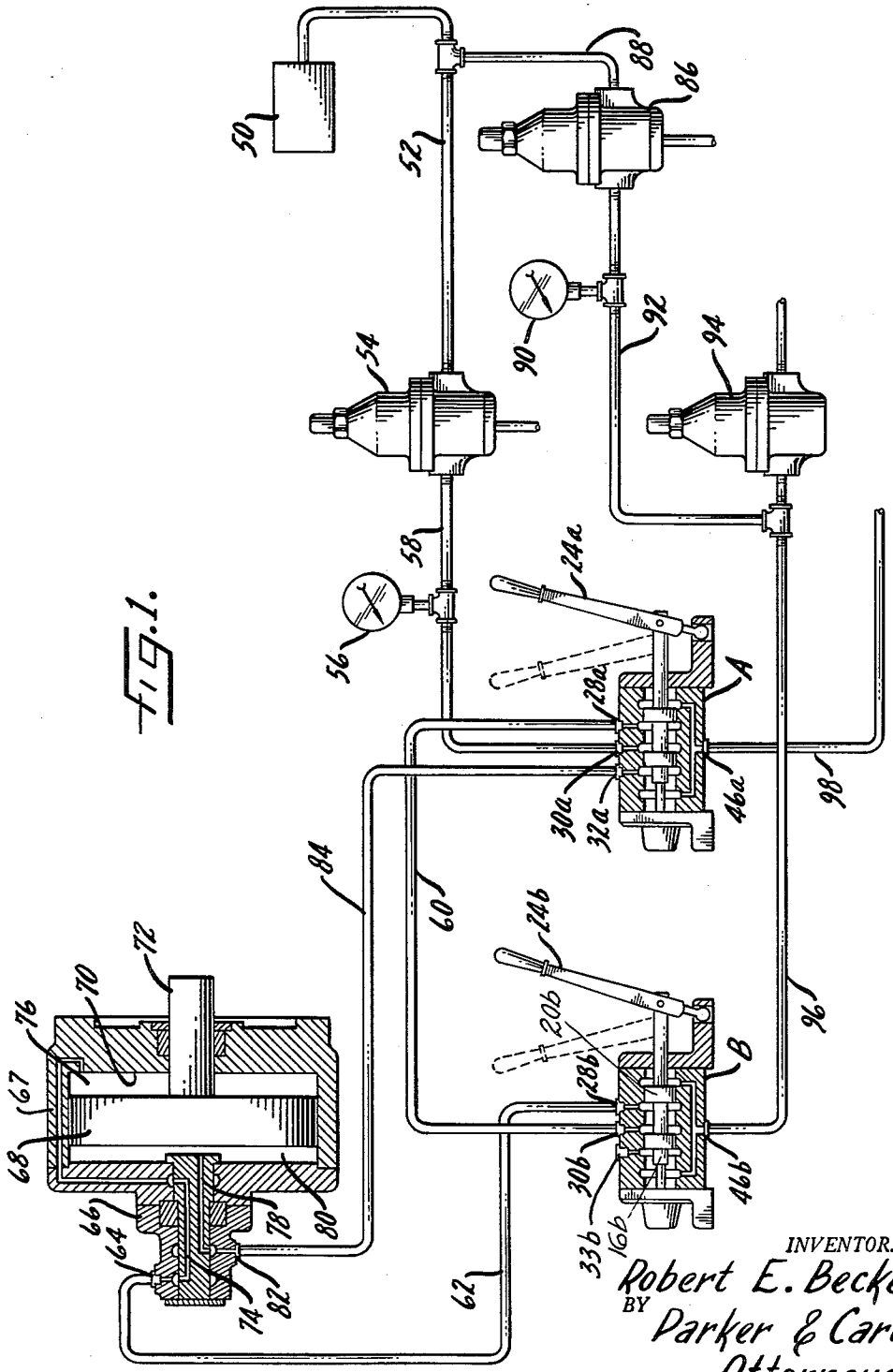


FIG. 1.

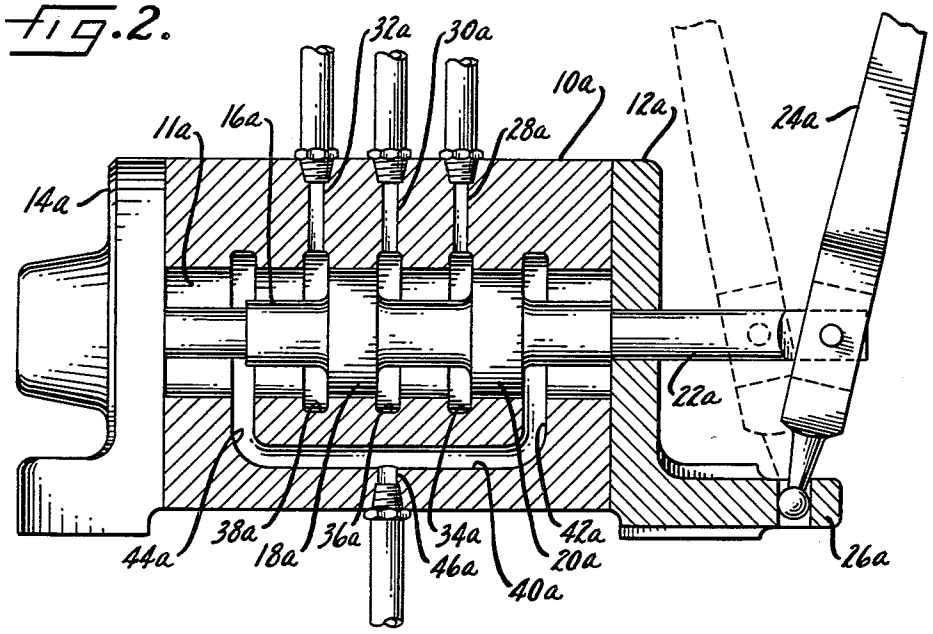
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Fig. 2.



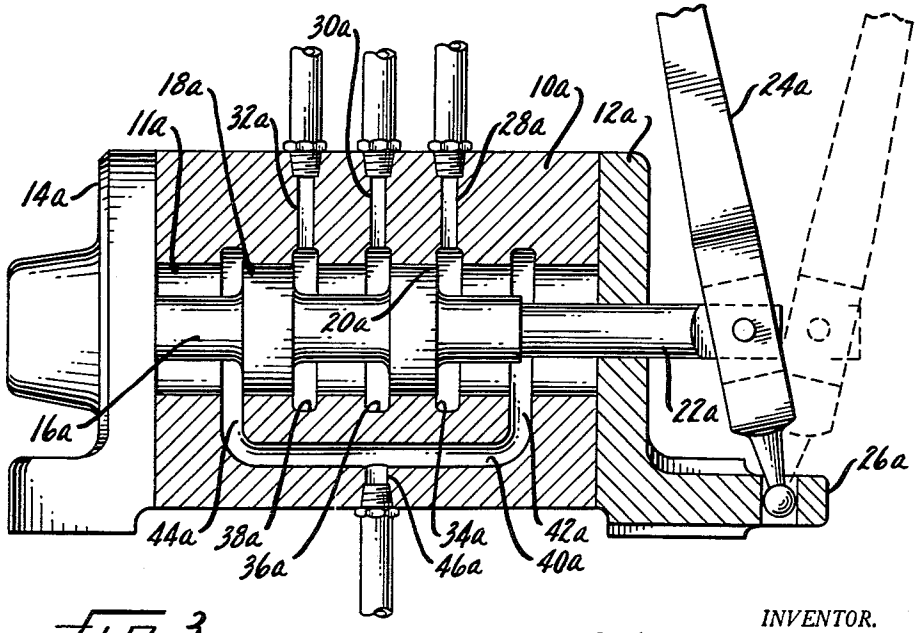


Fig. 3.

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CHUCK CONTROL CIRCUIT

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This invention relates to a fluid pressure control circuit for operating a hydraulic chucking cylinder.

One purpose of this invention is to provide a fluid pressure circuit of the type described which has a minimum of control elements and which is effective to provide a high and a low pressure at one side of the chucking cylinder and a high pressure at the opposite side.

Another purpose of this invention is to provide a fluid pressure circuit of the type described which is effective to move a chucking cylinder between an operating position and a release position.

Another purpose is to provide a hydraulic circuit of the type described which has three operating positions so that a work piece may be strongly gripped in a chuck, held at a reduced pressure in the chuck, and released from the chuck.

Another purpose is an improved method of operating a chucking cylinder through the use of a hydraulic circuit.

Other purposes will appear in the ensuing specification, drawings and claims.

The invention is illustrated diagrammatically in the following drawings wherein:

FIGURE 1 is a circuit diagram of the fluid pressure circuit disclosed herein,

FIGURE 2 is a section through one of the valves in the circuit showing the valve member in one position, and

FIGURE 3 is a section, similar to FIGURE 2, with the valve member in the opposite position.

Before describing the overall fluid pressure circuit and its operation, the valves A and B of the circuit will be described in detail. As valve A and valve B are identical, only one of these valves will be described. Like parts on valves A and B are designated by either (*a*) or (*b*) after the respective number.

Assuming that the valve of FIGURES 2 and 3 is valve A, the valve includes a valve housing **10***a* closed by cover plates **12***a* and **14***a*, which together define a valve chamber **11***a*. Mounted within the chamber **11***a* is a reciprocal valve member **16***a* having two spaced lands **18***a* and **20***a*. The valve member **16***a* may be reciprocated by a control rod or shaft **22***a* which is operated by a handle or the like **24***a* pivoted on a flange **26***a* of cover plate **12***a*. FIGURE 2 shows the valve in one position and FIGURE 3 shows the valve in the opposite position.

Formed in one side of the valve housing **10***a* are three spaced ports **28***a*, **30***a* and **32***a*. Each of these ports open into an annular groove formed on the inside surface of the housing **10***a*, the grooves being designated respectively at **34***a*, **36***a*, and **38***a*. There are two additional annular grooves formed on the inside surface of housing **10***a* which are connected together by a passage **40***a*, these grooves being designated at **42***a* and **44***a*. The passage **40***a* is connected to an exhaust port **46***a*.

Turning now to FIGURE 1, a source of pressure **50** may be connected by a suitable pipe or hose **52** to a high pressure regulator **54**, which preferably reduces the pressure from the source to a satisfactory operating level, such as 60 p.s.i. A pressure gauge **56** may be connected in line **58** which connects the high pressure regulator **54** to port **30***a* of valve A. A line **60** is connected between port **28***a* of valve A and port **30***b* of valve B. Port **28***b* on valve B is connected by a line **62** to inlet port **64** in rotating distributor shaft housing **66**.

A chucking cylinder **67** includes a piston **68** reciprocal in a chamber **70** and having a shaft **72** mounted thereon which is connected to the chuck. Movement of piston **68** in one direction, for example to the left, is effective to move the chuck to a closed position wherein it grips the work piece, and movement to the right is effective to release the work piece.

The chucking cylinder **67** and housing **66** include a passage **74** which connects the inlet port **64** with the right hand side **76** of the chamber **70** and a further passage **78** which connects the left hand side **80** of the chamber **70** and a second inlet port **82**. A line **84** connects the inlet port **82** and port **32***a* on valve A.

A second pressure regulator valve **86** is connected by line **88** to the source of pressure **50** and preferably is set at a low pressure, for example 15 p.s.i. A pressure indicating dial **90** may be placed in line **92** which connects the pressure regulator **86** and an exhaust regulating valve **94**. The exhaust valve **94** is preferably set to open at a pressure of approximately 20 p.s.i., for a purpose that will appear hereinafter. A line **96** connects the exhaust regulator **94** with exhaust port **46***b* of valve B. An exhaust line **98** is connected to exhaust port **46***a* to complete the hydraulic circuit shown. Both the exhaust line **98** and the exhaust valve **94** may either be connected to a suitable storage tank, or may open to atmosphere.

The use, operation and function of the invention are as follows:

Shown and described herein is a fluid pressure circuit for operating a chucking cylinder and which is effective to both move the chuck into position to grip the work piece and to release the work piece. In addition, the hydraulic circuit is effective to reduce the clamping pressure with which the chuck holds the work piece.

The operation will be illustrated in connection with hydraulic pressure, although the system may also be pneumatically operated. When valves A and B are in the position shown in FIGURE 1, high pressure hydraulic fluid will pass through the pressure regulator **54**, where the pressure is reduced to approximately 60 p.s.i., and then to valve A. It should be pointed out that the various pressures mentioned are for purposes of illustration only and may be varied. The pressure fluid will flow through port **30***a* into chamber **11***a* and out of port **28***a* through line **60** to port **30***b* of valve B. At valve B the pressure fluid will flow into chamber **11***b*, then out port **28***b* through line **62** to inlet port **64** on the housing **66**. The pressure fluid will then pass through passage **74** to the right hand chamber **76** and so move piston **68** to the left, as shown in FIGURE 1, so that the chuck is moved to the operating position and firmly grips the work piece. As piston **68** moves to the left, the pressure fluid in the left hand chamber **80** will be exhausted through passage **78**, port **82** and line **84** to port **32***a* of valve A. Port **32***a* is in communication through chamber **11***a* with passage **44***a* and hence to exhaust port **46***a*. In other words, the pressure fluid in the left hand chamber **80** will be exhausted through valve A to line **98** and to either atmosphere or a suitable storage tank.

It is at times desirable to hold the work piece in the chuck jaws at reduced pressure. For example, when finishing rings or similar parts, it is customary to start with stock having a relatively heavy wall section. Such a part may be gripped tightly in the chuck for an initial rough cut. After the rough or heavy cut, the wall thickness is reduced to a point where the work piece should be gripped with less force in order to prevent distortion of the finished article. To reduce the pressure on the chuck, valve A remains in the position shown and the operator moves valve B to the position of FIGURE 3. As the valve member **16***b* moves to the left, as shown in the

drawings, land 20*b* will close off the passage between ports 30*b* and 28*b* and hence stop any high pressure fluid from flowing to the chucking cylinder.

Low pressure fluid, preferably at about 15 p.s.i. is continuously flowing through line 92 and line 96 to valve B. The low pressure fluid flowing in the line does not have sufficient pressure to operate the exhaust valve 94 which is preferably set a few p.s.i. higher than the pressure in the line, for example 20 p.s.i. This low pressure is always present at valve B, but is contained in chamber 11*b* by plug 33*b* in port 32*b*. Valve B is now in the position of FIGURE 3 and hence port 28*b* is in communication through chamber 11*b* with port 42*b* and the exhaust port 46*b*. The low pressure fluid will then flow through valve B, and line 62 to chamber 76.

When valve B initially moves to the position of FIGURE 3, the pressure in chamber 76 is at approximately 60 p.s.i. As this chamber is now connected to a line where the pressure is at approximately 15 p.s.i., the pressure in chamber 76 will reduce to approximately 15 p.s.i. or slightly above. The hydraulic fluid from chamber 76 will exhaust through exhaust regulator 94 which is set for a few p.s.i. higher than the incoming line pressure of 15 p.s.i. Piston 68 will not move. However, the pressure in chamber 76 is reduced such that the pressure exerted by the chuck on the work piece is materally reduced. In other words, when valve B is moved to the position of FIGURE 3 the hydraulic fluid in chamber 76 is vented or exhausted through lines 62 and 96 and through the exhaust regulator 94 until the pressure is at a level such that the exhaust regulator can close. This pressure level will be between 15 and 20 p.s.i.

When the operator wishes to completely release the work piece, valve B is moved back to the position of FIGURE 1 and valve A is moved to the position of FIGURE 3. With the valves in this position, high pressure fluid will flow into valve A through port 30*a*, out port 32*a*, through line 84, to port 82. As port 82 is connected by passage 78 to left hand chamber 80, the high pressure fluid will move piston 68 to the right as shown in FIGURE 1 or to the release position. As the piston moves to the right the remaining pressure fluid in the chamber 76 will be exhausted through passage 74, line 62 to valve B. As valve B is now in the position of FIGURES 1 and 2, ports 28*b* and 30*b* are connected together such that the exhausted pressure fluid will flow through line 60 to port 28*a* and thence through port 46*a* to exhaust line 98.

In order to repeat the cycle the operator need only move valve A back to the FIGURE 1 position.

The invention has been illustrated as using manual handles 24*a* and 24*b* for operating the valve members A and B. It should be understood however that these valves may be operated automatically in the same sequence as described. Furthermore, handles are not necessary for manual operation of the valves, as other means may be used.

Whereas the preferred form of the invention has been shown and described herein, it should be realized that there are many modifications, substitutions and alterations thereto within the scope of the following claims.

I claim:

1. A fluid control system for use with a chucking cylinder or the like including a source of fluid pressure and a valving system connected thereto, said valving system including a first valve and a second valve, each having a reciprocal valve member movable between a first and second station, each of said valves being connected to said source of fluid pressure, a first fluid conduit connected to said first valve and a second fluid conduit connected to said second valve, said valve members being movable between a first position in which said first fluid conduit is connected to exhaust and said second fluid conduit is connected to the source of fluid pressure, and a second position in which the pressure supplied to said second fluid conduit is reduced from the pressure supplied when the valve members are in the first position, said valve members being movable to a third position in which said first fluid conduit is connected to said source of fluid pressure and said second fluid conduit is connected to exhaust.

2. The structure of claim 1 further characterized by a low pressure regulator connected between said source of fluid pressure and said second valve member.

3. The structure of claim 2 further characterized by an exhaust regulator valve connected between said low pressure regulator and said second valve, said exhaust regulator valve being set at a pressure intermediate the source pressure and the setting of said low pressure regulator.

4. The structure of claim 1 further characterized in that when said valve members are in said first position, said second fluid conduit is connected through both of said valves to said source of fluid pressure, in the second position said second conduit is connected through one of said valves to said source of fluid pressure, and in said third position said second fluid conduit is connected through both of said valves to exhaust.

5. A fluid control system for use with a chucking cylinder or the like including a source of fluid pressure and a valving system connected thereto, said valving system including a first valve and a second valve, each having a reciprocal valve member movable between a first and second station, said first valve being connected to said source of fluid pressure and a high pressure regulator connected between said source of fluid pressure and said first valve, said second valve being connected to said source of fluid pressure and a low pressure regulator connected between said second valve and said source of fluid pressure, an exhaust valve connected between said low pressure regulator and said second valve and being set at a pressure intermediate the settings of said regulator valves, a first fluid conduit connected to said first valve and a second fluid conduit connected to said second valve, and an exhaust connection from said first valve, said valves being effective to direct high pressure fluid to said second conduit when the valve members are in the same position, said valves being effective to direct high pressure fluid to said first conduit when said valve members are in opposite positions, said valves being effective to direct low pressure fluid to said second conduit when said valve members are reversed from said second position.

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