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J. BLÄTTRY

3,369,464

METHOD OF AND APPARATUS FOR ACTUATING DOUBLE-ACTING ROTATABLE CLAMPING MEANS, ESPECIALLY FOR WORKING SPINDLES

Filed Jan. 22, 1965

5 Sheets-Sheet 1

Fig. 1

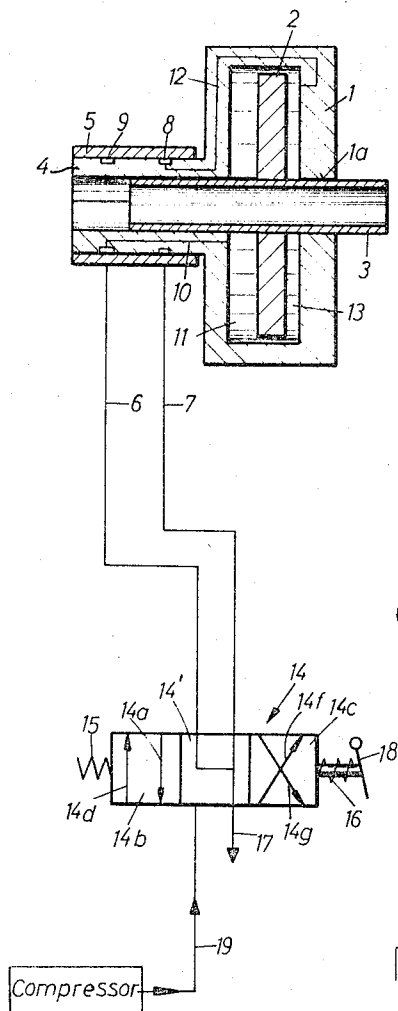


Fig. 1a

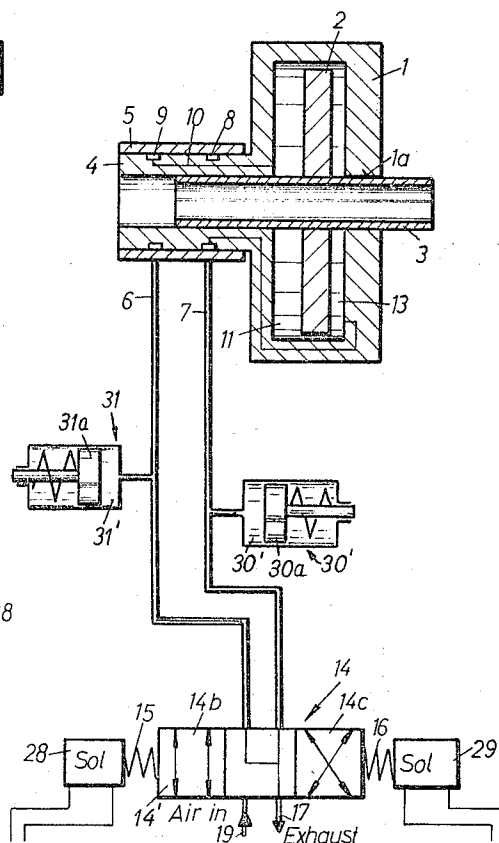
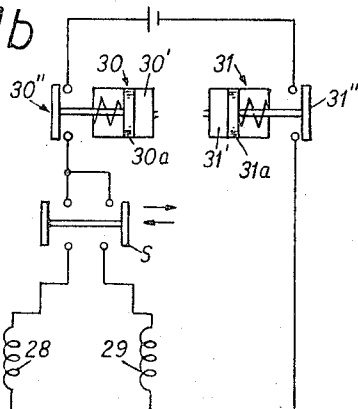


Fig. 1b



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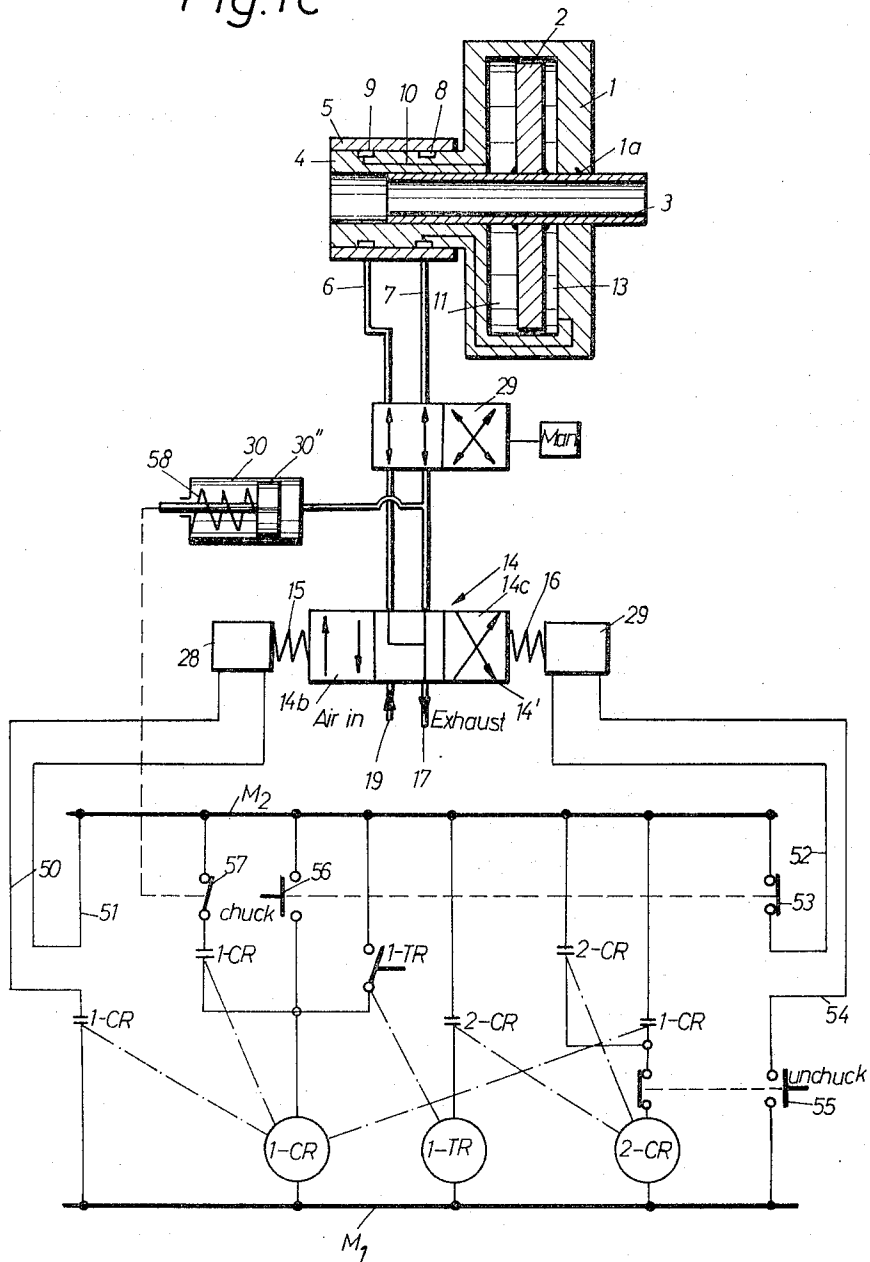
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Fig. 1c



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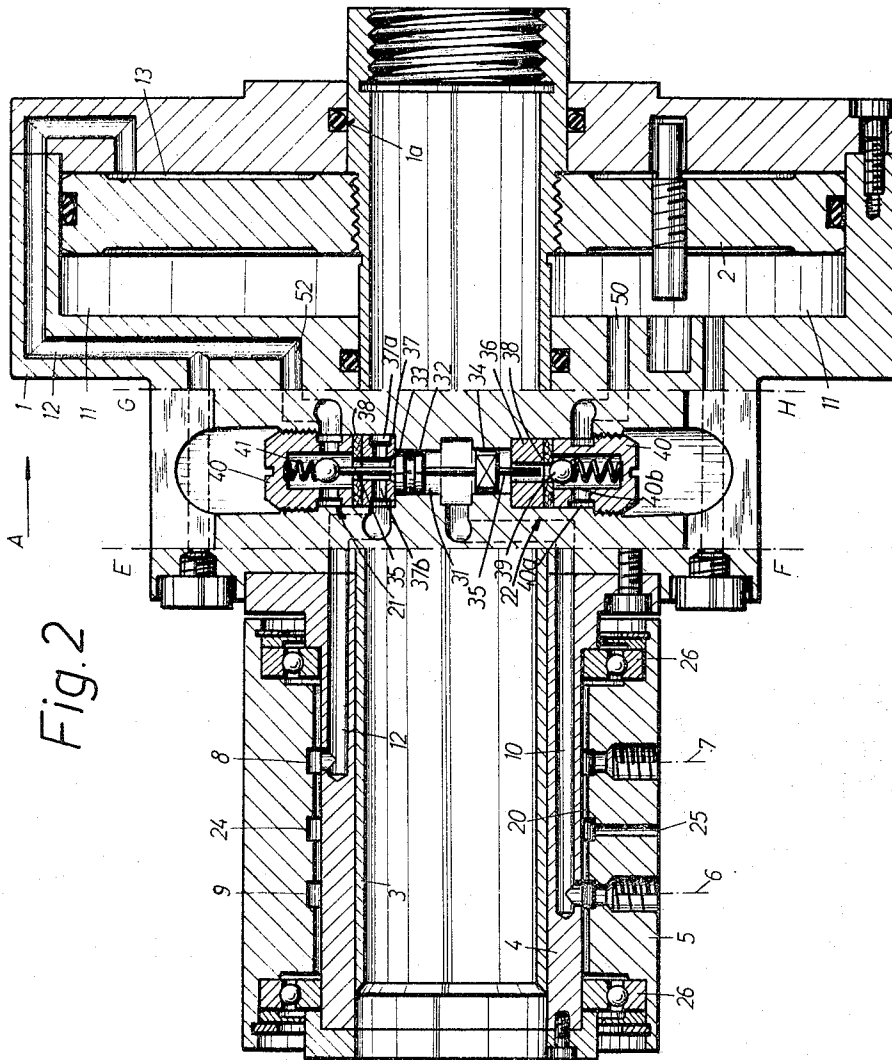


Fig. 2

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Fig. 3

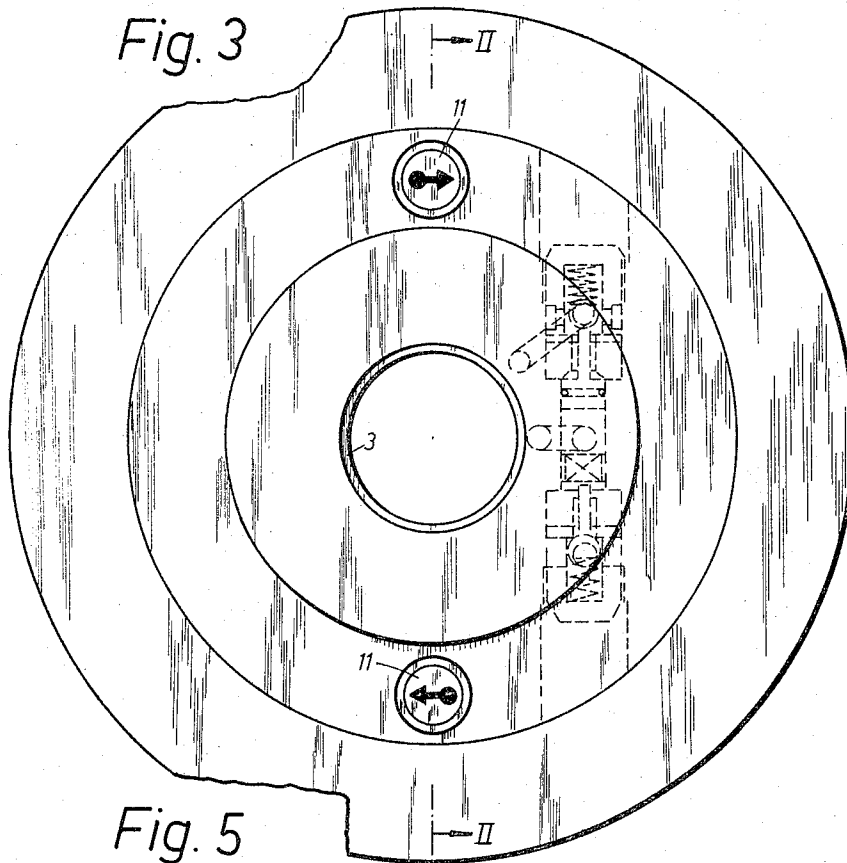
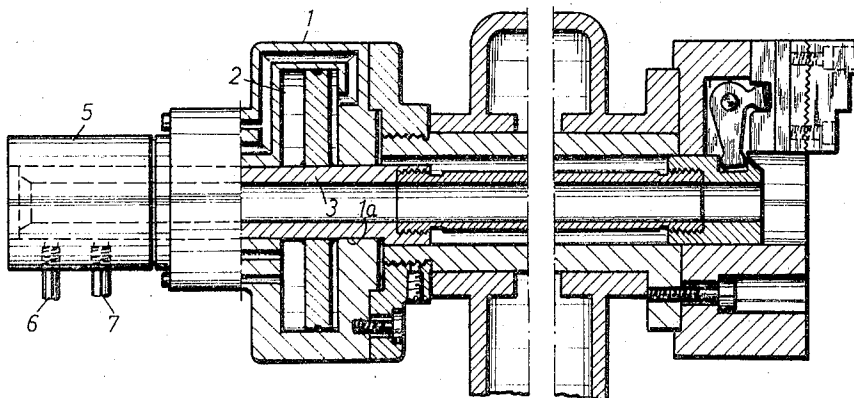


Fig. 5



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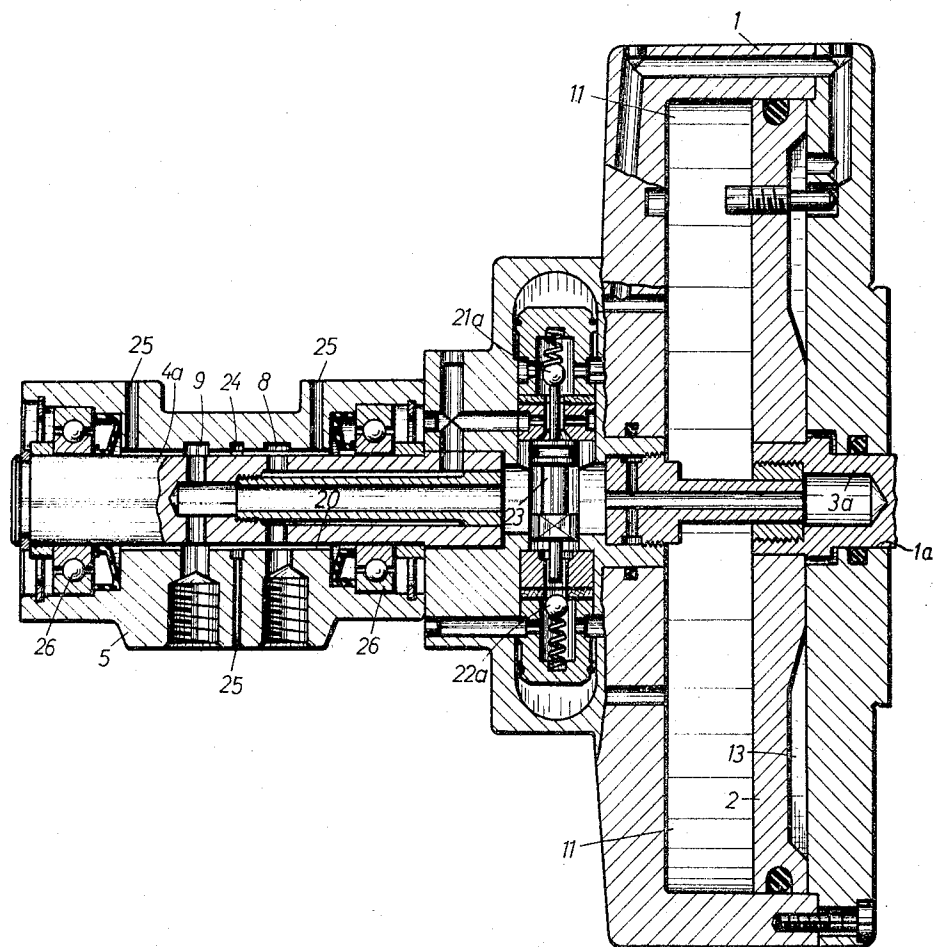
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Fig. 4



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METHOD OF AND APPARATUS FOR ACTUATING DOUBLE-ACTING ROTATABLE CLAMPING MEANS, ESPECIALLY FOR WORKING SPINDLES

Johann Blättry, Dusseldorf, Germany, assignor to Paul Forkardt Kommanditgesellschaft, Dusseldorf, Germany
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5 Claims. (Cl. 91—420)

The present invention relates to a method of and apparatus for actuating a double-acting compressed air operable clamping cylinder piston system for rotatable working spindles of machine tools, especially lathes.

Compressed air operable cylinder piston systems of the above general type are known in which both piston sides respectively communicate with air passages. Each of said air passages has immediately adjacent said cylinder arranged therein a check valve. Each of said check valves will be opened when it is desired to vent the respective adjacent piston side. In this connection, between the two check valves there may be provided compressed air operable control piston means operable to actuate said valves. Such an arrangement prevents the clamping force of a rotating clamping cylinder piston system from becoming ineffective when the connection from the compressed air feeding line to the cylinder should be interrupted for some reason, for instance by tearing off the connecting hose. In other words, with the above-mentioned heretofore known arrangements, the pressure fluid conveying check valve remains open during the clamping action of said cylinder piston system so that one side of the clamping piston is in continuous communication with the air pressure source. During the clamping action of said cylinder piston system, the said check valves close only when an interruption in the compressed air supply line occurs. Such an arrangement, therefore, consumes a considerable amount of compressed air.

It is, therefore, an object of the present invention to provide a pressure fluid operable clamping cylinder piston system which will overcome the above-mentioned drawback.

It is another object of this invention to provide a pressure fluid operable clamping cylinder piston system for spindles which, while assuring a simple and safe supply of pressure fluid, will safely maintain the clamping pressure during the machining time of the respective machine tool equipped with such device without the necessity of maintaining continuous connection of a pressure fluid source with the respective pressure actuated side of the double-acting cylinder piston system.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIGURE 1 diagrammatically illustrates a clamping cylinder piston system with control valve for a hollow spindle;

FIGURE 1a is a modification over the arrangement of FIGURE 1 inasmuch as it additionally comprises pressure responsive control means responsive to the fluid pressure acting on the respective pressure side of the cylinder piston system and operatively connected to the control valve;

FIGURE 1b shows an electric circuit;

FIGURE 1c shows a modification;

FIGURE 2 represents a more detailed longitudinal section through the arrangement of the upper portion of

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FIGURE 1 and, more specifically, along the line II—II of FIGURE 3;

FIGURE 3 is an end view of FIGURE 2 as seen in the direction of arrow A thereof;

FIGURE 4 is a modification over the arrangement of FIGURE 2 and, more specifically, represents a longitudinal section through an arrangement according to the present invention without hollow spindle and in connection with a piston rod;

FIGURE 5 is a longitudinal section showing the device connected to a chuck having radially moveable jaws.

The present invention is characterized primarily in that for controlling the clamping and unclamping of a workpiece through a four-way, three-position valve, fluid, e.g., air, under pressure is conveyed to the respective pressure side of the clamping cylinder piston system through a stationary sleeve and a feeder shaft only until the piston has completed its clamping stroke and the full pressure has been established in the respective pressure section of the cylinder. In an arrangement according to the present invention, the control valve is loaded, for instance by springs which cause the valve spool automatically to occupy an intermediate position when the valve is in its rest position. When said valve spool occupies its intermediate position, the two connections of the non-rotating part of the air feeding system are connected with an exhaust so that both air conduits will be under atmospheric pressure. In this way, the pressureless condition is no longer dependent on the operator's attention, because immediately the operator withdraws his hand from the control handle, the valve spool will automatically move to its intermediate position.

According to a further feature of the present invention, the stationary sleeve is, between two conduits or passages for the air under pressure and the venting, provided with a continuously vented annular chamber. In this way it will be assured that during the reversing of the piston movement, the air pressure prevailing on one cylinder chamber section cannot spread through said annular gap into the other chamber and thus affect the safe operation of the automatic check valve control.

Referring now to the drawing in detail and FIGS. 1, 2 and 3 thereof in particular, the arrangement shown therein comprises a double-acting rotatable compressed air operable clamping cylinder 1 having a relatively large transverse bore 1a. Reciprocably mounted in said bore 1a is a clamping piston 2 having connected thereto in any convenient manner a piston tube 3. Piston tube 3 is connected to a sleeve (not shown) which is guided in the hollow working spindle of a machine tool. Connected to cylinder 1 is a feeder shaft 4 surrounded by a stationary sleeve 5. Stationary sleeve 5 has connected thereto conduits 6 and 7 for feeding compressed air to and releasing air from the clamping cylinder. As will be seen from FIG. 2, feeder shaft 4 is rotatably journaled in stationary sleeve 5 by means of anti-friction bearings 26 while an annular gap 20 prevails between stationary sleeve 5 and feeder shaft 4.

Feeder shaft 4 has its inner circumferential surface provided with annular grooves or passages 8 and 9 of which passage 9 communicates through a conduit 10 with cylinder chamber section 11, whereas annular passage 8 communicates through a passage 12 with cylinder chamber section 13. Interposed in conduits 10 and 12 are check valves 22 and 21 respectively (FIG. 2).

In the bottom of cylinder 1 there is a transverse bore 31 (FIG. 2) which comprises a central narrower portion having reciprocally mounted therein a double acting con-

control piston 32. One shoulder 33 of piston 32 is provided with a seal while the second shoulder 34 has grooves for the free passage of compressed air. Control piston 32 has to opposite sides thereof connected thin pins 35 which extend into the valve chambers proper which are formed in the two outer portions of bore 31.

Two rings 36 and 37 rest against the shoulders of bore 31 while two valve seats for valve balls 39 rest on rings 36 and 37 respectively. Valve seats 38 and rings 36, 37 are pressed against the shoulders of bore 31 by threaded stoppers 40. Each of the balls 39 is by one valve spring 41 in stopper 40 pressed against valve seat 38 as long as it is not prevented from doing so by the respective adjacent pin 35. Valve balls 39 with the valve seats 38 and springs 41 thus form two ball check valves.

Conduit 10 leads into the narrow section of bore 31 below shoulder 33 of control piston 32. Upper ring 37 is provided with an outer annular groove 37a and radial bores 37b. Conduit 12 communicates with annular groove 37a through a passage adjacent thereto. Thus, the two conduits 10 and 12 remain separated from each other by the sealed shoulder 33, and each of said conduits leads to a point in front of the two check valves. Each of the two stoppers 40 has an annular groove 40a and a plurality of radial bores 40b. Adjacent the two annular grooves there start conduits 50 and 52 leading to the cylinder chambers. Each check valve permits compressed air coming from passage 10 or 12 respectively to flow to conduit 50 and 52 respectively.

When the supply of compressed air stops, the respective check valve closes and contains the compressed air in the respective cylinder chamber 11 or 13.

However, when filling a cylinder chamber another important point is to be noted. When, for instance, chamber 11 is filled through conduits 10 and 50, the pressure of the inflowing air acts upon the bottom side of sealed shoulder 32 and moves piston 32 upwardly. Upper pin 35 thus lifts upper ball 39 against the thrust of spring 41 and therefore opens the connection between conduits 12 and 52. Therefore, if it should happen that from a preceding operation compressed air was still in chamber 13, this air can escape in an unimpeded manner through passages 52, 12, 8, 7 and the respective conduits and valves communicating therewith. Piston 32 will keep open this connection as long as compressed air flows into chamber 11 so that simultaneously with the filling of chamber 11, chamber 13 will be vented. Piston 2 will then occupy its FIG. 2 position in which the chuck is open.

If for chucking a new work piece, piston 2 is to be moved toward the left side and to be subjected to pressure, control valve 14 is shifted accordingly so that compressed air is conveyed to conduit 12 while conduit 10 is vented. The air pressure then acts upon the top side of shoulder 33, presses piston 32 downwardly and lower pin 35 opens the lower check valve so that the latter will permit the venting of chamber 11 through conduits 50 and 10. Piston 2 will then be moved toward the left by the air pressure increasing in chamber 13 until the jaws of the chuck engage the work piece. Compressed air continues flowing until in chamber 13 the same pressure has been built up as in the conduit system. The supply of compressed air will be stopped in the manner described above, the upper check valve closes and maintains the air pressure in chamber 13 so as to maintain the clamping force of the chuck jaws.

Referring back to FIG. 1, it will be noted that the conduits 6 and 7 communicate with a four-way, three-position valve generally designated 14, the valve spool 14' of which is normally held in a central position by springs 15 and 16 so that the two conduits 6 and 7 in said central position of valve spool 14' communicate through valve spool section 14a with the atmosphere through an exhaust 17.

When shifting valve spool 14', for instance by lever 18 against the bias of spring 16, toward the right with regard

to FIG. 1, valve spool section 14b will establish communication between a pressure conduit 19 connected to a compressor and conduit 6 through valve spool passage 14d, whereas valve spool passage 14a will establish communication between conduit 7 and exhaust 17. As a result thereof, clamping piston 2 will move toward the right with regard to FIGS. 1 and 2. FIGURE 1a shows solenoids 28 and 29 for shifting valve member 14' in respectively opposite direction from a centered position which it normally occupies due to springs 15, 16.

Correspondingly, when valve spool 14' is moved from its FIG. 1 position toward the left in FIG. 1, valve section 14c will, through valve spool passage 14f, establish communication between pressure conduit 19 and conduit 7, whereas conduit 6 will, through valve spool passage 14g, communicate with exhaust 17. Consequently, clamping piston 2 will be moved toward the left with regard to FIGS. 1 and 2. With an arrangement according to the present invention the friction encountered by the rotating feeder shaft 4 will be limited to a minimum.

When valve member 14' is in a centered position, both of conduits 6, 7, are connected to exhaust.

Inasmuch as in the position of piston 2 of FIG. 2, the air in cylinder section 11 is under pressure, it will be appreciated that check valve 21 in conduit 12 is open so that while clamping piston 2 moves rightwardly with regard to FIG. 2, cylinder chamber section 13 will, through conduit 12 and annular groove 8, communicate with conduit 7 which in its turn at this time communicates with exhaust 17.

Air under pressure passes, during the rightward movement (with regard to FIG. 2) of piston 2, from conduit 6 through annular groove 9 and conduit 10 through check valve 22 (open during said piston movement) to cylinder chamber 11.

As will be evident from FIG. 2, stationary sleeve 5 is between the two annular grooves or passages 8 and 9 provided with an annular groove or passage 24 which is continuously vented and communicates, for instance with the atmosphere through a plurality of venting bores 25 (one only being shown). These bores 25 are important inasmuch as these bores prevent air under pressure from passing from one cylinder chamber section to the other cylinder chamber section through annular gap 20 and thus prevent an otherwise possible disorder in the check valve control. Thus, venting bores 25 in combination with annular gap 20 act as a seal between annular passages 8 and 9. While, when air under pressure is conveyed through either one of conduits 6 and 7, air can pass through annular gap 20 in both directions, it will be appreciated that since gap 20 is of a relatively small cross-section with regard to grooves 8 and 9 and passages 12 and 10 respectively connected thereto, the air pressure will quickly be conveyed through conduits 10 and 12 and the respective valve to the respective cylinder chamber section to be placed under pressure for effecting the desired movement of piston 2. The losses in compressed air through the venting bores 25 during this adjustment of piston 2 are rather low because the adjusting movement of piston 2 lasts only a few seconds, and as soon as the adjustment is effected, the operator releases lever 18 of control valve 14 so that valve spool 14' will automatically return to its intermediate position in which both conduits 6 and 7 are vented and the check valves 21 and 22 are closed. The clamping pressure in the respective cylinder section will thus be maintained and no further supply of air under pressure is necessary until the clamped-in work piece is to be released from its clamped condition.

If control valve 14 were actuated too fast, it could occur that the pressure in one of the cylinder chambers has not reached its full height when the operator releases handle 18. In order safely to avoid such a situation, and in order to obtain a fully automatic operation of valve 14, the system of FIG. 1 may be modified in conformity with FIG. 1a. According to FIG. 1a, control valve 14 is pro-

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vided with electromagnets 28 and 29 adapted when energized to move valve spool 14' in one or the other direction. These magnets may be energized manually or by machine control whenever it is desired to convey compressed air into one or the other of the cylinder sections 11 or 13. However, the said magnets 28 and 29 can be de-energized by pressure responsive means 30, 31 only, said pressure responsive means being connected to conduits 6 and 7 respectively between control valve 14 and cylinder 1. In this way, it will be assured that the full pressure will build up only when the movement of clamping piston 2 has been completed and the respective cylinder chamber is under full pressure.

More specifically, a control circuit for the arrangement of FIG. 1a is shown in FIG. 1b in which the elements corresponding to those of FIG. 1a are designated with the same reference numerals as in FIG. 1a. The control circuit of FIG. 1b operates in the following manner. Assuming that it is intended to energize solenoid 29 to move valve member 14' of FIG. 1a toward the right in order to convey pressure into cylinder chamber 11, switch S of FIG. 1b is shifted toward the left to thereby close the circuit through solenoid 29. Consequently, fluid pressure is conveyed into cylinder chamber 11 and moves piston 2 toward the right to actuate the chuck accordingly. As soon as a certain pressure has built up in cylinder chamber 11, this pressure is conveyed to chamber 31' of cylinder 31 with the result that piston 31a opens switch blade 31'' thereby breaking the circuit for solenoid 29. Consequently, springs 15 and 16 can now return valve member 14' to its center position.

If it is desired to move piston 2 toward the left with regard to FIG. 1a for unchucking, manual switch S is shifted toward the right with regard to FIG. 1b so that solenoid 28 will be energized. After a certain pressure has been built up in cylinder chamber 13 of FIG. 1a, this pressure is conveyed to chamber 30' of cylinder 30 so that piston 30a opens blade 30'' and breaks the circuit for solenoid 28 whereupon springs 15 and 16 again center the valve member 14'.

FIG. 1c illustrates a further modification which differs from that of FIGS. 1a, 1b in the control circuit for the pressure fluid control, while the remaining elements correspond to those of FIG. 1b and have been designated with the same reference numerals as in FIG. 1b.

In contrast to FIG. 1b, the fluid pressure control circuit of FIG. 1c contains means which automatically assure that the desired fluid pressure will be maintained in cylinder 1 in the chucking position if for instance a certain leakage from the respective cylinder pressure chamber should occur. To this end, the electromagnet or solenoid 28 is adapted by means of conductors 50 and 51 to be connected to the network main lines M₁ and M₂ respectively. Similarly, electromagnet or solenoid 29 is adapted by means of conductors 52 and chuck switch blade 53 to be connected to main line M₂ and through conductor 54 and unchuck switch blade 55—when closed—to be connected to main line M₁. The control circuit of FIG. 1c furthermore comprises in parallel arrangement to each other a contactor coil relay 1-CR, a timer 1-TR and a further contactor coil relay 2-CR. Relay 1-CR controls its relay blades 1-CR', 1-CR'' and 1-CR''', while relay 2-CR controls its relay blades 2-CR' and 2-CR''. The timer 1-TR controls its relay blade 1-TR'.

The operation is as follows: Assuming that a chucking operation is desired, the operator briefly presses down chuck switch 56 which while moving switch blade 53 into open position closes the energizing circuit for relay 1-CR. As a result thereof, relay blades 1-CR', 1-CR'' and 1-CR''' close. Closure of blade 1-CR' closes the energizing circuit for solenoid 28 so that valve member 14' moves toward the left against the thrust of spring 15. Closure of blade 1-CR'' establishes a holding circuit for relay 1-CR so that the latter remains energized when the operator

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withdraws his hand from chuck switch 56 so that the latter and blade 53 return to their FIG. 1c position.

Inasmuch as valve member 14' is now in its left-hand position with regard to FIG. 1c, air under pressure passes into cylinder chamber 13 while cylinder chamber 11 is vented. Therefore, cylinder 2 now moves toward the left with regard to FIG. 1c. After piston 2 has reached its left-hand position and a certain desired pressure has been built up, this pressure is conveyed through conduit 7 into cylinder 30 so that piston 30'' moves toward the left against the thrust of spring 58 and opens blade 57 thereby breaking the energizing circuit for relay 1-CR. This causes blade 1-CR' to open and thereby to break the circuit for solenoid 28 so that springs 15 and 16 can again return valve member 14' to its neutral or center position.

At the time when relay 1-CR was energized, it had also closed relay 1-CR''' as mentioned above. This in turn closed the energizing circuit for relay 2-CR with the result that the latter closed its blade 2-CR' and 2-CR''. 2-CR' establishes a holding circuit for relay 2-CR so that that relay 2-CR remains energized when relay 1-CR is de-energized and blade 1-CR''' opens. Closure of blade 2-CR'' closes an energizing circuit for timer 1-TR. Timer 1-TR has connected thereto a switch blade 1-TR' and as long as timer 1-TR remains energized, it will in certain time intervals for which the timer has been set close and open switch 1-TR'.

It will be appreciated that each time 1-TR' is closed, relay 1-CR is energized so that the latter, as described above, will bring about energization of solenoid 28 and thereby a shifting movement of the valve member 14' to again establish connection between the pressure line 19 and cylinder chamber 13 through conduit 7. This pressure connection is maintained until the desired pressure has been established and conveyed to cylinder 30 in the manner described above.

When it is desired to unchuck, the unchuck button 55 is closed whereupon the holding circuit for relay 2-CR is broken so that blade 2-CR'' opens and the timer is de-energized. Also, solenoid 29 is energized to bring about unchucking movement of piston 2. While FIG. 1c shows the control circuit completed for one side only, it will be appreciated that corresponding connections are also provided for the other side.

If the piston 2 is to move rightwardly for a chucking operation and leftwardly for an unchucking operation, valve 29' can be shifted and the same electric circuit employed in the same manner as described above.

While, with the arrangement of FIGS. 1 to 3, the double-acting cylinder piston systems 1 and 2 is shown in cooperation with a hollow spindle, the arrangement of FIG. 4 shows a device according to the present invention without a hollow spindle in connection with a piston rod 3a. Also with this embodiment of the invention, compressed air is through stationary sleeve 5 and feeder shaft 4a conveyed to the respective cylinder chamber section 11 or 13 only until clamping piston 2 has completed its clamping stroke, and the complete clamping pressure has built up in the respective cylinder chamber. Also in this instance, an annular gap 20 is provided between that portion of stationary sleeve 5 which serves for conveying compressed air from valve 14 to cylinder 1, and feeder shaft 4a. Feeder shaft 4a is likewise journaled in anti-friction bearings 26 mounted in stationary sleeve 5 so that also with the arrangement of FIG. 4, the friction encountered by rotatable feeder shaft 4a is limited to a minimum. The arrangement of FIG. 4 is likewise provided with check valves 21a, 22a which, while slightly differing in construction from check valves 21 and 22 of FIG. 2, fully correspond in operation to that of check valves 21, 22.

It is, of course, to be understood, that the present invention is, by no means, limited to the particular arrangements shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A method of controlling a double-acting clamping cylinder piston arrangement for rotatable spindles, which includes the steps of: conveying a gas under pressure in a continuous flow to one side of said cylinder piston arrangement while venting the other side thereof to thereby move said cylinder piston arrangement to a first position, effecting said conveying of gas and the venting thereof at respective spaced regions of adjacent rotary and stationary parts of said cylinder piston arrangement, sensing the pressure of a gas on said one side of said cylinder piston arrangement, operating a control valve in response to sensing a predetermined pressure on said one side, entrapping the gas under pressure acting upon said one side when said pressure upon said one side has reached a certain minimum value while simultaneously interrupting further supply of gas under pressure to said one side, effecting said entrapping and interrupting on the side of said spaced regions toward the piston of said arrangement, and venting the space between said regions to the atmosphere and substantially preventing communication of gas between the regions.

2. A double-acting clamping cylinder piston arrangement for rotatable working spindles of machine tools, which includes: a cylinder, a double-acting piston reciprocable in said cylinder and having a first side and a second side, a rotatable member connected to said cylinder and provided with first and second passage means respectively communicating with said first and second side, a stationary tubular member surrounding said rotatable member in radially slightly spaced relationship thereto so as to confine with said rotatable member a relatively narrow annular gap, said tubular means having its inner periphery provided with axially spaced first and second annular groove means arranged within the range of said annular gap, said first and second annular groove means respectively communicating with said first and second passage means, first and second check valve means respectively interposed in said first and second passage means and operable to open in response to a certain pressure in the respective groove means, first control means interposed between said check valve means and movable from a central position to a first end position and an oppositely located second end position in response to a certain minimum pressure in said first and second groove means respectively to open that one of said check valves which is associated with the respective piston side to be vented, second control means operatively connected to said first and second groove means and operable to vent said first and second groove means when said piston has completed its clamping stroke to thereby cause both of said check valves to close and a venting bore intermediate said grooves continuously venting the radial space between said tubular member and said rotatable member at a point therealong between said grooves to the atmosphere.

3. A double-acting clamping cylinder piston arrangement for rotatable working spindles of machine tools, which includes: a cylinder, a double-acting piston reciprocable in said cylinder and having a first side and a second side, a rotatable member connected to said cylinder and provided with first and second passage means respectively communicating with said first and second side, a stationary tubular member surrounding said rotatable member in radially slightly spaced relationship thereto so as to confine with said rotatable member a relatively narrow annular gap, said tubular means having its inner periphery provided with first and second annular groove means arranged within the range of said annular gap, said first and second annular groove means respectively communicating with said first and second passage means, first and second check valve means respectively interposed in said first and second passage means and operable to open in response to a certain pressure in the respective groove means, first control means interposed between said check valve means

and movable from a central position to a first end position and an oppositely located second end position in response to a certain minimum pressure in said first and second groove means respectively to open that one of said check valves which is associated with the respective piston side to be vented, second control means for controlling the supply of pressure fluid to and discharge of fluid from said first and second annular groove means, first and second conduit means leading from said second control means to said first and second annular groove means respectively, said second control means including valve means movable from a central position for venting both of said first and second annular groove means selectively into a first end position to supply pressure fluid to one of said annular groove means while venting the other one of said groove means and into a second end position for supplying pressure fluid to the other one of said annular groove means while venting said one groove means, spring means continuously urging said valve means to occupy its central position, electric circuit means including electromagnetic means energizable to move said valve means selectively to said first and to said second end position against the thrust of said spring means, and fluid pressure responsive means respectively interposed in said first and second conduit means and comprising means interposed in said circuit means and adapted to break the energizing circuit means for the respective electromagnetic means in response to a predetermined pressure built up on that side of said piston which faces in the direction opposite to the direction of the respective last movement of said piston to thereby permit said spring means to return said valve means to its central position.

4. A double-acting clamping cylinder piston arrangement for rotatable working spindles of machine tools, which includes: a cylinder, a double-acting piston reciprocable in said cylinder and having a first side and a second side, a rotatable member connected to said cylinder and provided with first and second passage means respectively communicating with said first and second side, a stationary tubular member surrounding said rotatable member in radially slightly spaced relationship thereto so as to confine with said rotatable member a relatively narrow annular gap, said tubular means having its inner periphery provided with first and second annular groove means arranged within the range of said annular gap, said first and second annular groove means respectively communicating with said first and second passage means, first and second check valve means respectively interposed in said first and second passage means and operable to open in response to a certain pressure in the respective groove means, first control means interposed between said check valve means and movable from a central position to a first end position and an oppositely located second end position in response to a certain minimum pressure in said first and second groove means respectively to open that one of said check valves which is associated with the respective piston side to be vented, second control means for controlling the supply of pressure fluid to and discharge of fluid from said first and second annular groove means, first and second conduit means leading from said second control means to said first and second annular groove means respectively, said second control means including valve means movable from a central position for venting both of said first and second annular groove means selectively into a first end position to supply pressure fluid to one of said annular groove means while venting the other one of said groove means and into a second end position for supplying pressure fluid to the other one of said annular groove means while venting said one groove means, automatic means operatively connected to said second control means and operable automatically at desired time intervals to move said reciprocable means of said second control means to that one of its end positions which it occupied last and subsequently after a certain time to return said reciprocable means to its central position.

5. An arrangement according to claim 4, including electric circuit means which comprises solenoid means for controlling said reciprocable means and also comprises timer means and relay means for controlling said timer means.

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MARTIN P. SCHWADRON, *Primary Examiner.*

G. N. BAUM, *Assistant Examiner.*