Sept. 2, 1958 J. J. ELLIOTT 2,850,132

SINGLE STROKE PRESS CONTROL

Filed Aug. 17, 1954 3 Sheets-Sheet 1

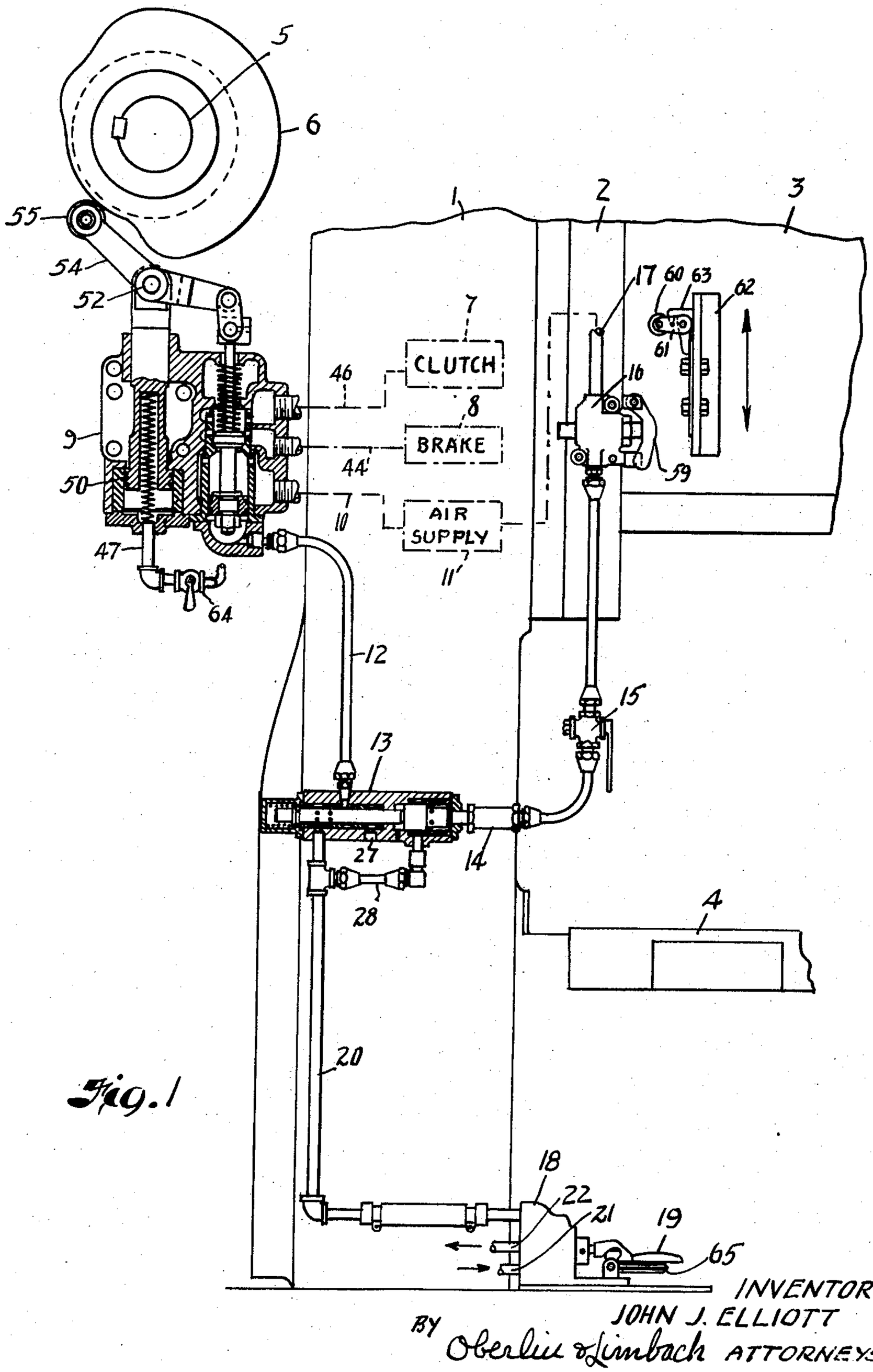

Fig. 1

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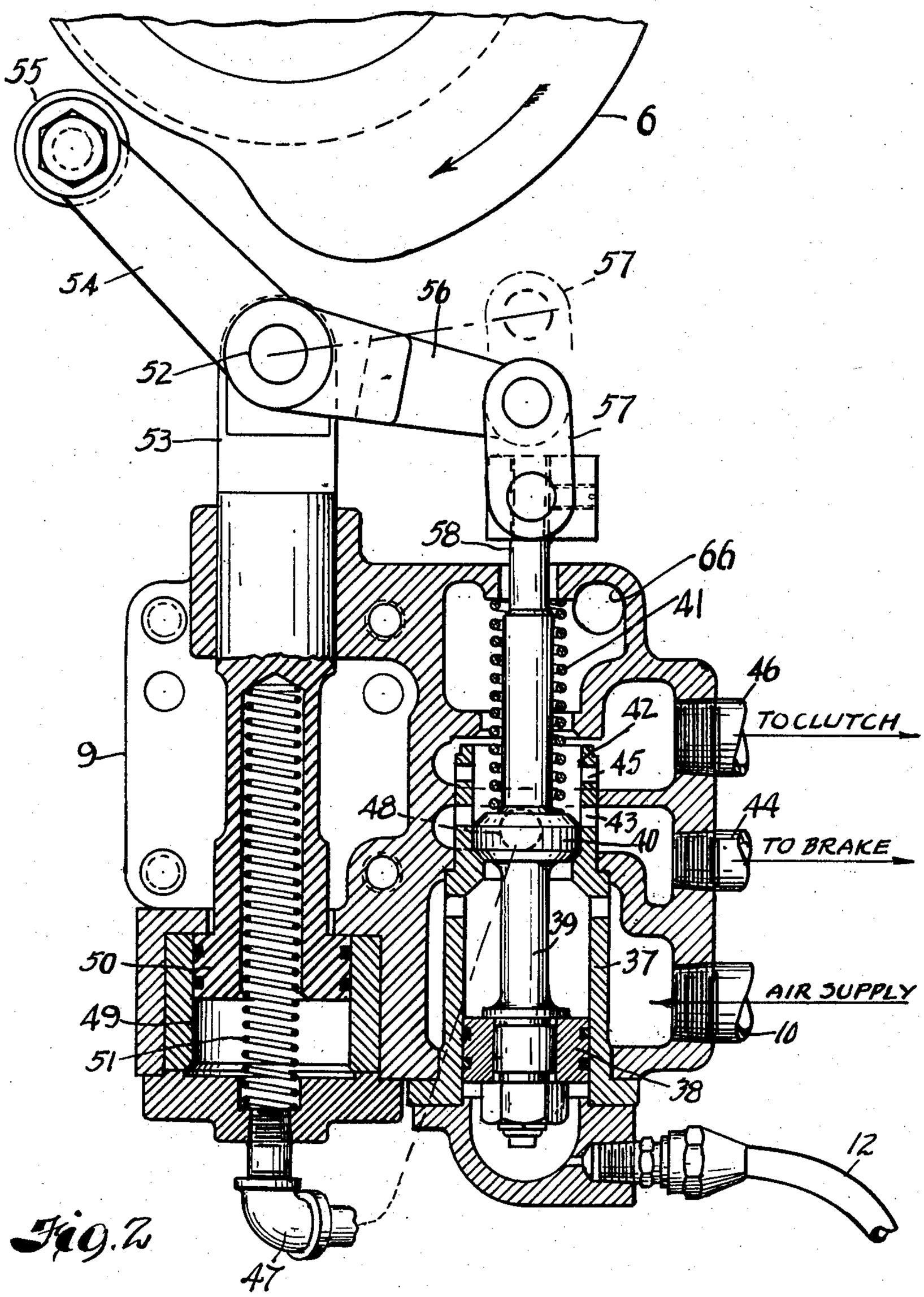

Fig. 2

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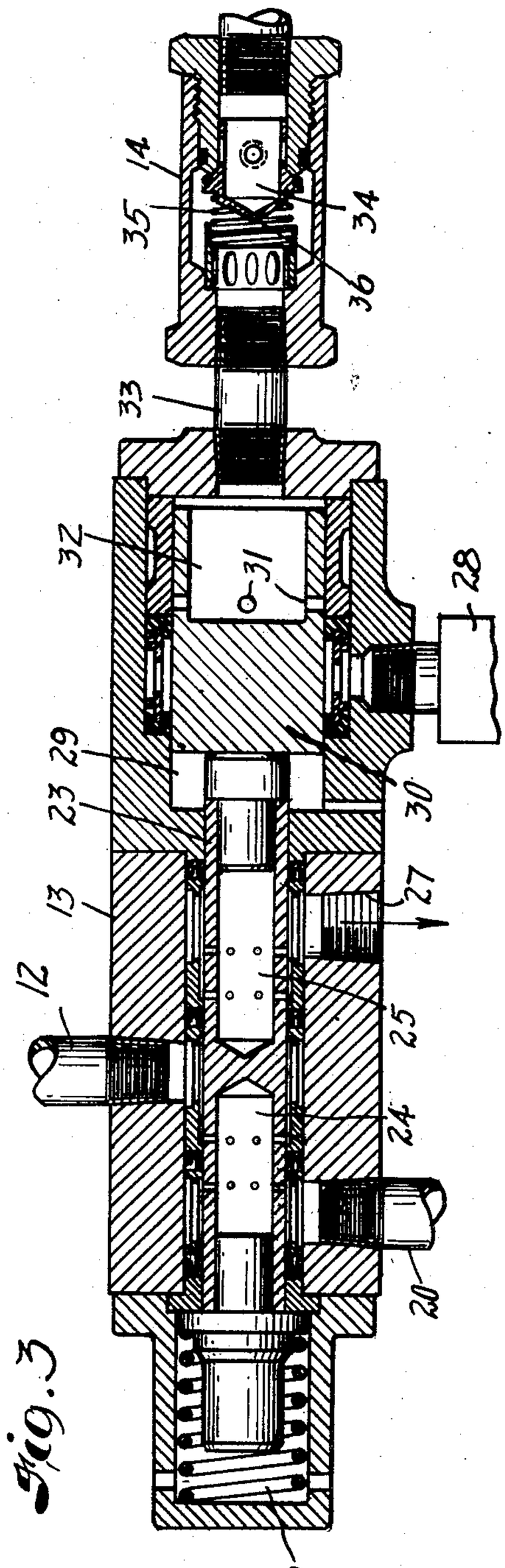

Fig. 3

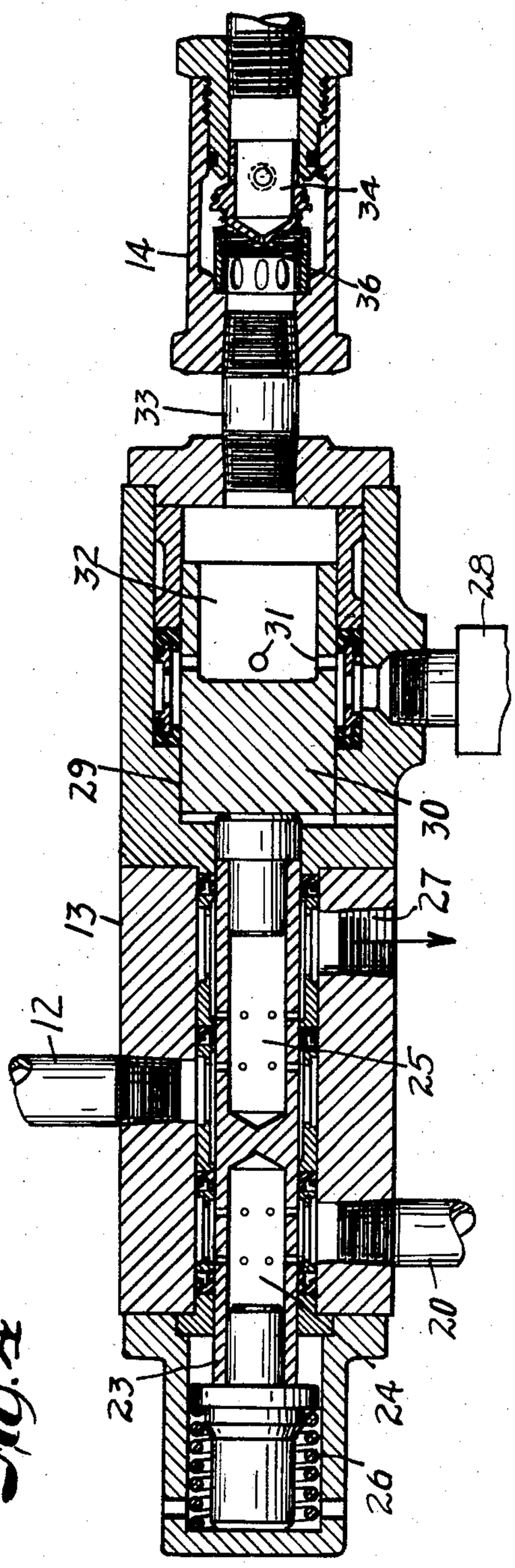

Fig. 4

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SINGLE STROKE PRESS CONTROL

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Application August 17, 1954, Serial No. 450,445

2 Claims. (Cl. 192—144)

This invention relates as indicated to control means for presses and the like, and more particularly to a single stroke or non-repeat control means for forging presses.

In Patents Nos. 2,217,332 and 2,357,779 to William W. Criley there are disclosed operating control mechanisms wherein the clutch and brake of the metal working machine are operated in timed sequence through the medium of a fluid pressure controlled valve, such valve being adapted to be initially operated through a manually actuated means and then operated by machine actuated means during the remainder of the working stroke or cycle of the machine. The machine actuated means for effecting the operation of the clutch and brake control valve in metal working machines of the nature to which the above-identified patents pertain is in the form of a cam mounted on a drive shaft of the machine and a cam follower whose motion is transmitted to the control valve proper to produce an automatic timed operation of the latter. The control valve being initially set or tripped by the manually actuated means such as a foot treadle is carried through its subsequent positions in the operating cycle by the machine actuated means or timer cam and follower and thus returned to its original starting position ready for another working cycle of the machine. Briefly, these control valve positions correspond to brake release, clutch engagement, clutch release, and brake engagement, sequentially.

In Criley Patent 2,496,040 there is disclosed and claimed an improved control mechanism of the general nature above indicated whereby the clutch and brake control valve will be opened to full clutch engaging position irrespective of the lightness or abruptness of operation of the manually actuated pressure valve or foot treadle, thus preventing subsequent stalling of the machine; such control valve mechanism also providing means for preventing the retripping or reopening of the clutch and brake control valve by the "coasting by" of the machine parts at the end of the working cycle.

The present invention relates to further improvements in control means of this general type whereby but a single cycle of operation is assured regardless of whether or not the operator removes his foot from the treadle at the proper time. In operating the usual control means, the operator is required to depress the treadle and to continue to hold it down for at least a certain minimum period of time. He must thereafter raise his foot before too long an interval or the cycle will repeat. It is accordingly a principal object of my invention to provide single cycle control means for presses and the like which will ensure but a single cycle of operation even when the actuating means such as a foot treadle or other manually operated device is held in operative position throughout the duration of such cycle.

A further object of my invention is to provide such control means whereby the cycle cannot repeat until the operator lifts his foot from the usual treadle and then replaces it again.

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Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a fragmentary semi-diagrammatic side elevational view, partly in cross-section, showing the interconnection of my new control means with various operating parts of a forging press;

Fig. 2 is a much enlarged sectional view of the valve means controlling the admission of fluid pressure to the clutch and brake; and

Figs. 3 and 4 are longitudinal sectional views of the pilot valve which I employ in conjunction therewith, showing different positions of the valve members therein.

It will be apparent that the control means of my invention is suitable for employment as one-cycle regulating means for any flywheel driven machine, but I will describe it as adapted for employment with a forging press, for which it is particularly well suited.

Referring first to Fig. 1 of the drawing, I show in fragmentary semi-diagrammatic fashion one of the side frame members **1** of a forging press provided with ways **2** guiding a ram **3** for vertical reciprocation toward and away from anvil **4**. The main drive shaft **5** is journalled for rotation in the side frame members of the press and has a control cam **6** keyed thereto adjacent one end. A fluid actuated clutch **7** and a fluid actuated brake **8** of conventional type are ordinarily mounted on a high speed drive shaft (not shown) connected with such main drive shaft **5** in driving engagement therewith.

The control valve body **9** is mounted on one of the side frame members of the machine, and such valve serves to control the flow of fluid pressure from the main pressure supply line **10** leading from air supply **11** to the clutch **7** and the brake **8**. Such valve **9** is also adapted to be connected with air supply **11** through line **12**, pilot valve **13**, check valve **14**, shut-off cock **15**, trip valve **16**, and line **17**. Treadle valve **18** is adapted to be operated by foot treadle **19** to connect line **20** alternatively with line **21** leading from air supply **11** and with exhaust **22**.

Now referring more particularly to Figs. 2–4 inclusive of the drawing, the construction of the pilot valve **13** and control valve **9** will be described in somewhat greater detail. Valve piston **23** of pilot valve **13** has two axially spaced inner chambers **24** and **25** having lateral vents adapted to communicate with line **12**, chamber **24** being in communication with line **12** in the normally open position of the valve as shown in Fig. 3, and chamber **25** being in communication with line **12** when valve piston **23** has shifted to the left against the action of compression spring **26** as shown in Fig. 4. Other vents from such piston chamber **24** are at all times in communication with line **20**, and vents from piston chamber **25** are at all times in communication with exhaust port **27**. Accordingly, when valve member **23** is in its normally open position as shown in Fig. 3, air under pressure will be admitted from line **20** to line **12** leading to control valve **9**. When valve member **23** has been shifted to the left as shown in Fig. 4, line **12** will be placed in connection with exhaust port **27** through chamber **25** and will no longer be connected with line **20**.

A branch line **28** connects with the side of cylinder **29** in which piston **30** is fitted for reciprocation. Piston **30** bears against one end of piston **23** so that such two

pistons are adapted to be reciprocated in unison, with spring 26 tending to hold both pistons shifted to the right as shown in Fig. 3. Vents 31 extend through the wall of piston 30 from inner chamber 32 and are adapted to communicate with branch line 28 when such piston has been shifted to the left as shown in Fig. 4. The right-hand end of valve chamber 32 is open and therefore in communication with tubular fitting 33 leading to check valve 14. Such check valve includes a plunger 34 normally held seated in closed position by spring 35 and serving to restrict fluid flow from valve 13 toward shut-off cock 15, such restricted flow being afforded only by bleed hole 36. When valve member 34 is shifted to the left as viewed in Figs. 3 and 4, it permits free fluid flow through fitting 33 into the end of cylinder 29.

As best shown in Fig. 2, the machine actuated control valve 9 comprises a cylinder 37 to the lower end of which line 12 connects and having a piston 38 fitted for reciprocation therein. The upwardly extending rod 39 of such piston carries a valve member 40 normally held seated by compression spring 41 to close the upper end of cylinder 37. Cylinder 37 above piston 38 is at all times in communication with air supply 11 through line 10. A second cylinder 42 above cylinder 37 has lower lateral ports 43 in communication with line 44 leading to brake 8 and upper lateral ports 45 in communication with line 46 leading to clutch 7. It will thus be seen that when piston 38 is raised in response to admission of fluid pressure through line 12, ports 43 will first be placed in communication with air supply line 10, and subsequently ports 45 will be placed in communication with such air supply line.

A line 47 leads from port 48, which is adapted to be placed in communication with cylinder 37 immediately when piston 38 begins to rise, to the lower end of a parallel cylinder 49 having a piston 50 fitted therein. Such piston is held in normally lifted position as shown in Fig. 2 through the action of compression spring 51. Pivotally mounted at 52 on the upper end of rod 53 is a rocker arm 54 carrying a cam roller 55 at its end adapted to be engaged by cam 6 on shaft 5. The opposite extension 56 of the rocker arm is pivotally connected by means of link 57 to the upper end portion 58 of piston rod 39.

Trip valve 16 is normally closed but may be opened when cam 59 is engaged by roller 60 carried by arm 61 pivotally mounted on bracket 62 on the vertically reciprocable press ram 3. A torsion spring (not shown) acts to hold arm 61 in normally extended position against back-up lug 63. It will thus be seen that on the descending stroke of ram 3, roller 60 will be effective to engage the cam 59 to reciprocate the plunger of trip valve 16 as it passes by, but upon the return stroke of the ram, arm 61 will swing downwardly when it engages cam 59 without exerting sufficient pressure again to reciprocate the valve plunger.

Operation

For set-up purposes, shut-off cock 15 may be closed so that operation of trip valve 16 will have no effect on pilot valve 13. Manually operated valve 64 in line 47 may also be closed. Under these circumstances, operation of foot treadle 19 serves directly to control reciprocation of valve member 40 against the action of spring 41. Since no air pressure is admitted to the lower end of cylinder 49, piston 50 will simply be reciprocated against the action of compression spring 51 through action of cam 6 and accordingly the position of valve member 40 will not be affected thereby. Under some special circumstances, it may be desired to lock the treadle down for continuous automatic operation of the machine with the valves 15 and 64 being closed as just explained. Of course, the special one-cycle control means of this invention are not then operative.

Figures 1, 2 and 3 of the drawing show the mechanism when the press is in its normal stop position. The ordinary operation of the machine will now be described. Valves 15 and 64 are opened and treadle lock 65 released. The operator now steps on treadle 19 to connect line 20 with air pressure line 21. Since valve member 30 is in Fig. 3 position under the action of spring 26, there is no air flow through branch line 28. Air under pressure, however, does pass through valve chamber 24 to line 12 leading to cylinder 37.

The air pressure in the lower end of such cylinder acts to shift piston 38 and valve member 40 first to connect air supply line 10 with brake line 44 to release the brake, and then subsequently to connect line 10 through ports 45 with clutch line 46 to engage the clutch and thereby start the press in operation.

The shifting of valve member 40 also served to uncover port 48 to place line 47 in communication with air supply line 10 so that air under pressure is admitted to the lower end of cylinder 49 prior to engagement of clutch 7. Piston 50 is, of course, already in elevated position under the influence of spring 51 but is now firmly held in such elevated position as a result of the build-up of air pressure in cylinder 49.

The ram 3 is, of course, now descending and drive shaft 5 is turned to bring the high rise of cam 6 into engagement with cam roller 55 on arm 54. Since the pivot 52 of the rocker arm is firmly supported in its elevated position, rocking of arm 54 by cam 6 would serve to rock such arm to lift piston rod 58 if the parts were still in the positions shown in Fig. 2. Piston 38 has, however, already been reciprocated to seat valve member 40 in the upper end of cylinder 42 so that no further lift of rod 58 is possible. The engagement of the high rise of cam 6 with cam roller 55 accordingly merely results in depressing piston rod 53 very slightly against the action of spring 51 and the air pressure in cylinder 49. Close engagement of roller 55 with cam 6 is thereby assured without the necessity of extremely precise adjustments. Cam 6 continues to turn with its high rise engaging roller 55 in a manner to prevent rocking of arm 54 upwardly even if the air pressure were to be relieved from the underside of piston 38. In other words, valve member 40 is positively held in its uppermost position during this period.

Shortly prior to completion of the downward stroke of the ram, cam trip roller 60 engages cam 59 momentarily to open valve 16 to connect pilot valve 13 to the air supply. The air thus admitted to the end of cylinder 29 of pilot valve 13 serves to shift piston 30 and piston 23 as a unit to the left against the action of compression spring 26 (Fig. 4), thereby cutting off communication between lines 20 and 12 and instead connecting line 12 with exhaust port 27 through valve chamber 25. The shifting of piston 30 also places line 17 momentarily in communication with branch line 28, the latter ordinarily still being in communication with air supply line 21. Valve 16, however, immediately closes as roller 60 passes cam 59 and remains closed as the ram rides upwardly again. Accordingly, it is only maintenance of air pressure in lines 20 and 28 which is effective to continue to hold pistons 30 and 23 to the left as shown in Fig. 4. Check valve 14, of course, permits only very slow escape of pressure from the end of cylinder 29, valve 16 including provision for venting such escaping air when it is in normally closed position, shutting off communication with line 17.

As ram 3 reaches a point on its return about one-third of the distance from the bottom of its stroke, the roller 55 reaches the drop-off of cam 6 so that valve member 40 can now drop under the influence of compression spring 41 and the air pressure from line 10 acting on the upper surface of piston 38 (which is of somewhat greater area than valve member 40), thereby first cutting off ports 45 from the air supply and per-

mitting venting of air through exhaust port **66**. With further drop-off of cam **6**, valve member **40** continues to descend to seal off ports **43** from communication with air supply line **10** and likewise to vent line **44** with resultant application of the brake. Final seating of valve member **40** also places port **48** out of communication with air supply line **10** and vents such port to exhaust through port **66** so that piston **50** is now supported in cylinder **49** only by compression spring **51**. Cam **6** is, of course, contoured to time the foregoing action to bring the ram to rest close to its uppermost position, and all parts are now returned to their initial starting position since the operator releases treadle **19** so that lines **28** and **20** are placed in communication with exhaust **22**, thereby permitting immediate return of pistons **23** and **30** under the action of spring **26**.

It will be seen from the foregoing that the operator must initially hold the treadle down until the roller **55** rides up on the high rise of cam **6**. Thereafter, it is immaterial whether the operator continues to rest his foot on the treadle or immediately releases the same. If line **20** is continued in communication with air supply line **21**, line **12** will not be exhausted until operation of trip valve **16** causes shifting of pilot valve **13** to connect line **12** with exhaust port **27**. On the other hand, if the operator removes his foot from the treadle as soon as the high rise of cam **6** engages roller **55** and before trip valve **16** has been actuated, line **20** will then have been connected with exhaust **21** and line **12** will simultaneously be exhausted, pilot valve piston **23** still being in the Fig. 3 position.

Assuming that the operator continues to rest his foot on treadle **19**, trip valve **16** will be momentarily opened as the ram approaches the bottom of its stroke and pilot valve piston **23** will be shifted to the left as viewed in Fig. 4 positively to ensure venting of line **12** and piston **23** will be maintained in such Fig. 4 position by the air pressure in line **20** and branch line **28**. A repeat of the press cycle is accordingly prevented when the ram has returned to the top of its stroke, and indeed even slight overrunning past the top of the stroke may be prevented. The operator, in normal operation of the press, need merely step on the treadle for a long enough period to ensure that cam roller **55** has been engaged by the high rise of cam **6** and thereafter he may raise his foot when he pleases. A new cycle cannot be initiated until he has raised his foot and then again depressed the treadle. This arrangement not only considerably increases the safety of operation but also permits relatively rapid operation without requiring careful and precise attention to be given to the timing of the actuation of the treadle valve.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in

any of the following claims or the equivalent of such be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In single cycle control means for forging presses and the like of the type having fluid pressure operated clutch and brake means, a cam turning with the press drive means, normally closed valve means adapted to be regulated by said cam to control de-energization of said clutch and energization of said brake to stop the cycle, fluid pressure means adapted to open said valve means, a fluid pressure line leading to said fluid pressure means including therein a manually operated valve adapted when opened to admit fluid pressure to said line and when closed to vent said line and fluid pressure means, whereupon said cam becomes effective as the sole regulatory means for said first valve means; safety means for ensuring non-repeat of the press cycle despite continued open of said manually operated valve comprising a normally open piston valve interposed in said line intermediate said manually operated valve and said fluid pressure means, a branch line leading from said first line intermediate said manually operated valve and said piston valve to an end of the piston of said piston valve when the latter has been shifted to closed position only, effective to hold said piston thus shifted through fluid pressure admitted by said manually operated valve, said piston valve in closed position being effective to vent said fluid pressure means, a third line leading from a fluid pressure source to such end of said piston, a normally closed valve in said third line arranged and disposed for brief actuation by movement of the press mechanism to admit fluid pressure thus to shift said piston to closed position to vent said fluid pressure means, and a check valve interposed between such end of said piston and said valve in said third line effective to prevent return of said piston valve to normally open position despite venting of said third line upon return of said normally closed valve therein to closed position, such return of said piston therefore being dependent wholly upon closing of said manually operated valve to vent said branch line.

2. The apparatus of claim 1, in which said check valve is provided with a small bleed passage to permit very slow fluid flow therethrough with consequent eventual return of said piston valve to open position when said third line has been relieved.

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