Oct. 30, 1956 M. J. LIESER 2,768,610

CONTROL MECHANISM FOR PRESSURE FLUID APPARATUS

Filed Nov. 12, 1953

Fig. 1

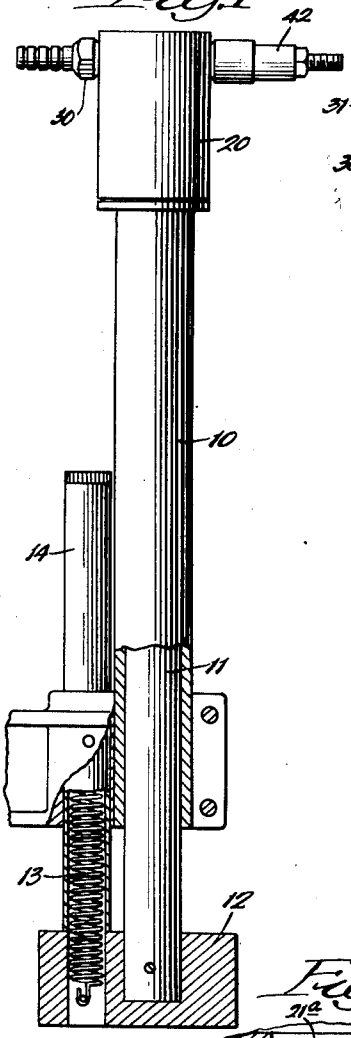


Fig. 2

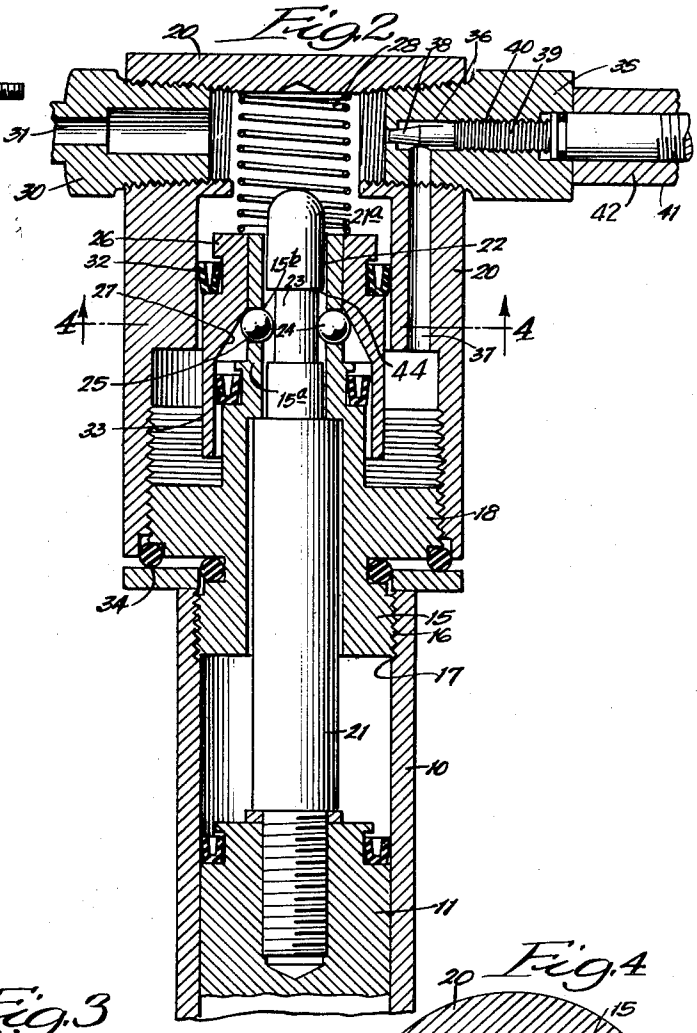


Fig. 3

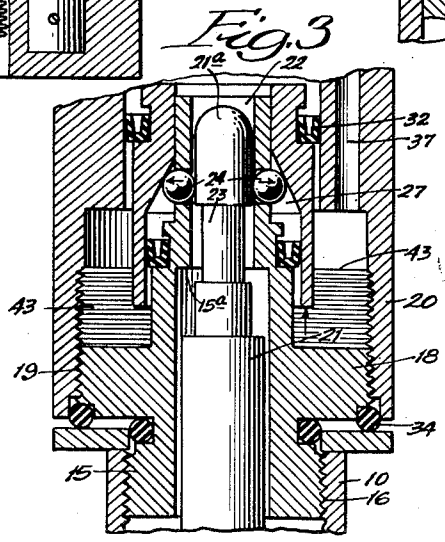
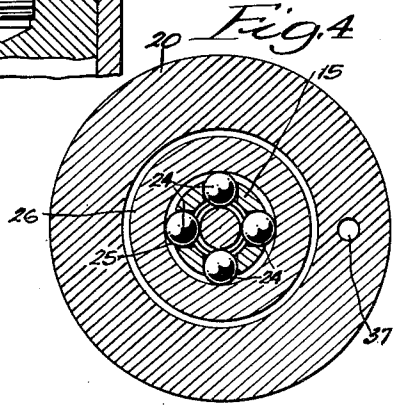


Fig. 4



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CONTROL MECHANISM FOR PRESSURE FLUID APPARATUS

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9 Claims. (Cl. 121—13)

This invention relates to control mechanism for pressure fluid apparatus. The invention is particularly useful in the control of an air hammer or ram.

In the operation of an air hammer or ram or similar work device, it is desired to delay the stroke of the work member until the pressure fluid has accumulated to a point near its maximum above the work or driving member. Various intricate devices have been proposed for restraining the stroke of the work member until such pressure accumulation has been reached.

An object of the present invention is to provide control mechanism for a pressure fluid driving device in which relatively simple parts are employed, the parts being compactly arranged in the inlet or upper portion of the cylinder. A further object is to provide control mechanism which may be regulated by an extremely simple means permitting accurate delay of the hammer or plunger action until the desired pressure has been built up. A still further object is to provide, in combination with a pressure fluid cylinder, a control mechanism housed in an upper portion of the cylinder or an extension thereof and cooperating with an extension of the ram or work member for retaining the ram in raised position until a restricted amount of pressure fluid has been admitted to bring about a release of the locking mechanism. Other specific objects and advantages will appear as the specification proceeds.

The invention is shown, in an illustrative embodiment, by the accompanying drawing, in which—

Figure 1 is a broken side view in elevation of a compressed air hammer, shown partly in section, and employing control mechanism embodying my invention; Fig. 2, a broken, enlarged, vertical sectional view of a portion of the cylinder and of the control mechanism, the control mechanism being shown in locking position; Fig. 3, a view similar to Fig. 2 but showing the mechanism in release position; and Fig. 4, a transverse sectional view, the section being taken as indicated at line 4—4 of Fig. 2.

In the illustration given, 10 designates a cylinder in which is mounted a ram 11 secured at its base to a head 12. A spring 13 is anchored within a tube 14 and is extended when the head 12 is driven downwardly and then returns the head after the compressed air has been exhausted through a lower port in the cylinder. The foregoing structure, which is herein used as an illustration of a mechanism which may be employed with my control device, is shown in greater detail in Mead Patent 2,567,390. Since the foregoing mechanism is well known in the art, a further detailed description is herein believed unnecessary.

While, in the ensuing description, I shall describe my control apparatus in connection with the ram device illustrated, it will be understood that any type of piston or work member may be substituted for the ram 11.

In the specific illustration given, a union member 15 is provided at its bottom with a reduced threaded portion 16 engaging the internal threads 17 with which the upper end of cylinder 10 is provided. The member 15 is provided with an enlarged threaded portion 18 threadably engaging the inner threaded portion 19 of the control casing 20. The union member 15 is centrally apertured to receive a ram extension 21 which has a reduced upper portion 22 provided with an annular recess 23. Interlocking with the annular recess 23, as illustrated in Fig. 2, are locking members shown as locking balls 24 (four in number), which are mounted within apertures 25 in the reduced extension 15a of the union member 15.

A movable control member 26 is provided with cam walls 27 adapted to retain the balls 24 in locking engagement with the groove 23 of extension 21. When the control member 26 is in the lower position, as illustrated in Fig. 2, the member 26 is normally urged downwardly by air pressure thereon and, if desired, a spring 28 may also be employed to exert pressure upon the member 26.

Any means for introducing pressure fluid into the upper end of the control casing or cylinder 20 may be provided. In the specific illustration given, I provide a threaded inlet fitting 30 having a passage 31 leading to a source of compressed air or other pressure fluid. Any suitable sealing means may be provided. In the illustration given, I provide V-shaped annular sealing members 32 in the area between the member 26 and the casing side walls, and I provide similar sealing members 33 between the extension 15a and the control member 26. Sealing rings 34 are also employed between the member 15 and the casing 10 and casing 20.

Opposite the inlet fitting 30 is an air control fitting 35 having a longitudinal passage 36 extending therethrough and communicating with a vertical passage 37 in the control casing 20. To control the flow of pressure fluid through passage 36 and passage 37, I provide a needle valve 38 having a threaded portion 39 engaging an internally threaded recess 40. A threaded member 41 engages internal threads with which the casing 35 is provided in alignment with the needle valve 38, and a control extension 42 is provided for adjusting the member 41 so as to control the action of the valve 38 in admitting pressure fluid into passage 36.

In the operation of the structure, compressed air or other pressure fluid is admitted through the passage 31 into the chamber at the upper portion of the cylinder or extension thereof provided by casing 20. The action of the compressed air upon the uppermost portion of ram extension 21 moves the ram downward from the position shown in Fig. 2 until the upper lip 44 of annular recess 23 engages the locking balls 24, which are urged outward because of the angular contact between the curved surface of the balls and the lip of annular recess 23. The angular contact between the outwardly urged locking balls 24 and the cam wall 27 results in the exertion of an upward force upon movable control member 26. The downward biasing force of spring 28, coupled with the pressure exerted by the compressed air on the upper surfaces of control member 26, exert downward pressure on the control member which in turn urges locking balls 24 inwardly with a force sufficiently greater than the outward force exerted on the balls to prevent further downward movement of ram 11. Therefore, when fluid pressure initially builds up within the upper portion of the cylinder or cylinder extension 20, control member 26 is directed downwardly and the cam faces 27 urge the locking balls 24 inwardly into engagement with the annular recess 23 of the ram extension 22 so as to thus latch the ram or work member in raised position. As the pressure continues to build up within the upper portion of the cylinder or cylinder extension 20, air bleeds by the valve 38 and passes downwardly through the passage 37 and pressure is built up within the chamber 43 below the movable control member 26. As the pressure builds up within the chamber below the member

26, there has also been some passage of air downward about the locking balls 24 and thence around the ram extension 21 so that pressure is built up against the upper face of the ram 11. The passage for air of pressure fluid around the locking balls and ram extension, when the ram extension 21 is depressed by fluid pressure in the upper portion of cylinder extension 20 causing the lip 44 of the annular groove 23 to abut locking balls 24, may be observed in Fig. 2. As the compressed air increases the pressure about the lower face of the movable member 26, there is a tendency to balance or offset the pressure exerted upon the upper face of the member 26, and this effect, coupled with the increased pressure upon the face of the ram 11 and the outward force exerted upon locking balls 24 in angular contact with lip 44 of the annular groove of ram extension 21, causes the member 26 to move upwardly slightly so as to allow the locking balls 24 to move outwardly to non-locking position, as illustrated in Fig. 3, thus releasing the extension 22 and permitting the ram 11 to be moved downwardly under the full force of the accumulated air pressure to accomplish its working stroke. The supply of pressure fluid furnished to the intake passage 31 is usually controlled by a foot valve or hand valve which operates to first admit the pressure fluid and then to exhaust it. Upon the exhausting of the compressed air through the valve (not shown), spring 13, which has been placed under tension by the downward stroke of the ram 21, now draws the ram 21 upwardly, returning the parts to the position illustrated in Fig. 1. The spring 28 is effective in bringing about a quick locking action of the control member 26 by causing its upper rounded face 21*a* to engage the balls 24 and urge them laterally. In the operation, it will be noted that the recess 23 within the member 21 is relatively long, and this length is desired for bringing about smooth and effective operation of the device.

If desired, the trip can be made inactive by loosening the screws securing the tube 10 and pushing the tube upwardly, thus preventing the trip from operating and enabling a very light hammering action to take place.

In the operation described, a single hammer action is obtained by one operation of the valve which supplies air to the hammer device and exhausts air therefrom.

As already stated, the control mechanism may be housed within the upper end of the cylinder or within a separate casing forming an extension of the cylinder. The working parts are all concealed within the casing structure, the only exposed part being the control stem 42.

While I have described the control mechanism in conjunction with a ram device, it will be understood that various types of fluid-responsive devices may be used. The cylinder may be of any cross-sectional shape or type, and the piston or work device may be of any desired type. I prefer to employ compressed air as the motive fluid, but it will be understood that any suitable form of pressure fluid may be used.

While, in the foregoing specification, I have shown a specific structure in considerable detail for the purpose of illustrating my invention, it will be understood that such details of construction may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. A control member for pressure fluid apparatus, comprising a cylinder, a work member mounted therein for movement under the influence of pressure fluid, means for admitting pressure fluid into the top portion of the cylinder, a control member movably mounted in the top portion of the cylinder and provided with an inner cam face inclined downwardly and outwardly, a fixed member apertured to receive locking balls, locking balls therein, an extension secured to said work member and having an annular groove receiving said balls when said control member is in lowered position, said balls being forced outwardly by the upper edge of said groove and biasing said control member upwardly by contact with said cam face when the work member is pressed in a downward direction by said pressure fluid, said control member restrained from upward movement by fluid pressure upon the upper side of said control member, and means for admitting a restricted stream of pressure fluid into the cylinder below said control member to balance the pressure on the upper side of the control member and to increase the pressure on said work member, whereby said control member is raised slightly to release said balls from said groove and to permit said work member to be forced downward.

2. A control mechanism for pressure fluid apparatus, comprising a cylinder having a top portion and a lower portion, means for admitting pressure fluid into the top portion of the cylinder, a work member mounted within said cylinder for movement from a raised position to a lowered position under the influence of fluid pressure, a control member slideably mounted for movement between a lowered position and a raised position in the top portion of the cylinder and normally pressed into lowered position by pressure fluid above said control member, means biasing said control member toward raised position and exerting a force of lesser magnitude than the force created by the pressure fluid thereabove pressing it into lowered position, a locking member coacting with said work member and with said control member and movably disposed to engage a portion of said work member for holding said work member in raised position only when said control member is in lowered position, means for admitting a restricted stream of pressure fluid into the cylinder below said control member to offset fluid pressure above the control member, whereby said biasing means moves said control member to raised position upon equalization of fluid pressure above and below said control member and said locking member disengages said work member permitting said work member to move to lowered position under the influence of fluid pressure.

3. The structure of claim 2, in which said control member is provided with a cam, said work member is provided with a grooved portion, and said locking member comprises locking balls which are urged by said cam into engagement with the grooved portion of said work member for holding said work member in raised position only when said control member is in lowered position.

4. The structure of claim 1, in which the means for admitting a restricted stream of pressure fluid into the cylinder below said control member comprises a separate passage through the cylinder and connects the top portion of the cylinder with the cylinder portion below said control member.

5. The structure of claim 4, in which an adjustable valve mounted in said separate passage controls the flow of pressure fluid therethrough.

6. In an air ram equipped with a cylinder in which a ram is movably mounted and having means provided for raising the ram after the downward stroke thereof, a control mechanism for said ram comprising a cylinder extension, a ram extension within said cylinder extension having an annular groove, means for admitting compressed air into the top portion of said cylinder extension for moving said ram downwardly, a fixed member within said cylinder extension having an aperture therein receiving said ram extension and provided with apertures, balls movably mounted within said apertures to engage the annular groove of said ram extension and to lock said ram in raised position, a movable cam member mounted in said cylinder extension and having an inner cam face inclined downwardly and outwardly and coacting with said balls, a restricted air passage connecting the cylinder extension above said cam member and the cylinder extension below said cam member, said annular groove of said ram extension being adapted to urge said balls outwardly against the inclined face of said cam member and forcing said cam member upwardly to re-

lease said balls from engagement with said ram extension only when the fluid pressure below and above said cam member is substantially the same, whereby, upon the building up of air pressure below said cam member and the building up of air pressure on the top of said ram, said ram is released from locked position with said balls and is forced downward through the cylinder by said air pressure.

7. The structure of claim 6, in which said cylinder extension is releasably connected to said cylinder.

8. In a compressed air device equipped with a cylinder and a movable work member therein provided with a reduced extension, a control housing mounted upon said cylinder and receiving therein the reduced extension of said work member, means for admitting compressed air into the upper portion of said housing, a control member movably mounted in said housing and normally pressed downwardly by the compressed air therein, a spring biasing said control member downwardly, a locking member coacting with both the control member and the work member and positioned to engage said work member for latching said work member in raised position when said control member is held in downward position by the bias of said spring and by air pressure above said control member, means for passing a restricted stream of compressed air at a predetermined rate into the housing below said control member to offset pressure on the upper side of said control member, said locking member positioned between said control member and said work member to urge said control member upwardly against the bias of said spring and to move it upwardly when said work member is forced downwardly by said air pressure and when the air pressure above and below the control member is substantially the same, whereby, the upward movement of said control member disengages said locking

member from said work member and said work member is forced through the cylinder by said compressed air.

9. In an air ram structure, a casing providing a cylinder therein, a ram reciprocable within said cylinder and being provided with a reduced upper end having a groove therein, a control member reciprocable within said cylinder and having a downwardly and outwardly inclined cam surface in facing relation with said groove, a fixed member within said cylinder interposed between said reduced upper end and said control member and having an aperture therein, a locking ball within said aperture and being movable toward and away from said groove and being engageable with said cam surface, means biasing said control member downwardly to urge said locking ball into said broove and thereby constrain movement of said ram, means for admitting pressure fluid into the upper end of said cylinder to urge said ram downwardly, and means for admitting pressure fluid at a restricted flow rate into said cylinder below said control member for developing a force thereagainst in opposition to said biasing means, the downward force developed on said ram by pressure fluid admitted to said cylinder thereabove being effective to push said ram downwardly when the upward forces against said control member tend to balance the opposing forces thereon whereby it is moved upwardly by the force of said locking ball acting against the cam surface thereof.

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