ABSTRACT

The main control valve of this apparatus as well as the auxiliary control valve are both arranged in the axis of the working piston and its cylinder to obtain very short compressed air and waste air conduits, and also wide compressed air cross-sectional areas for the supply of compressed air to the interior of the working cylinder thereby essentially increasing the sequence of beats. The auxiliary control valve is arranged in a housing cover of the working piston and its cylinder.
The invention relates to a compressed air-operated drive-in apparatus to drive-in fasteners such as nails, staples or the like, comprising a working piston guided for to-and-fro movement in a working cylinder and a main control valve controlling the compressed air bias and compressed air release of the working piston, said main control valve being movable by means of a servo or pilot control valve actuated by a release valve and likewise biased by compressed air while disposed in coaxial alignment with the main control valve.

The invention is concerned with the problem of providing a drive-in apparatus of this type of especially high efficiency which may be selectively operated either to perform individual beats or to work repetitively.

In case of single beat operation the working piston performs one complete single-to-and-fro stroke after the actuation of the release valve. To perform the next individual beat the release valve must be actuated anew.

For repetitive operation, however, it is only necessary to depress the release valve permanently in order to perform automatically full stroke single beats in a quick succession.


In accordance with this parent patent, there is an auxiliary control valve arranged between the servo valve and the release valve, said auxiliary control valve comprising two biasing chambers effective in opposite directions, one (release valve chamber) of them being controllable by the release valve in such a manner that it may be connected with the high pressure source when the release valve is actuated and may be connected with the atmosphere when the release valve is not actuated, while the other chamber (main valve or repetition chamber) is connected with a control channel controlled in such a manner by the control valve unit formed of the main control valve and the servo valve that it is connected with source of the compressed air when the main control valve is open and is connected with the atmosphere when the main control valve is closed.

In the case of the drive-in apparatus of the parent patent, the release valve, the main control valve, the servo or pilot control valve and the auxiliary control valve are arranged on one axis outside the working piston and its cylinder. It has already been possible, it is true, with the aid of a servo or pilot control valve to increase the sequence of beats and, above all, the beating intensity of the individual beats. In spite of this, this arrangement left much to be desired in particular, when used with major drive-in apparatuses which have to perform beats of especially high energy.

To solve this problem, the invention starts from the drive-in apparatus of the parent patent. But now, in accordance with the invention, the main control valve as well as the auxiliary control valve are both arranged in the axis of the working piston and its cylinder. In this manner one obtains very short compressed air and waste air conduits and, above all, also especially wide compressed air cross sectional areas for the supply of the compressed air to the interior of the working cylinder thereby essentially increasing the sequence of beats.

In a preferred embodiment of the invention, the auxiliary control valve is arranged in the housing cover of the working piston and its cylinder.

In this arrangement it is recomendable, however, to interpose in the conduit communicating the control channel with the main valve or repetition chamber of the auxiliary control valve a delaying chamber which secures that the auxiliary control valve will switch to initiation of the next drive-in beat only after the working piston has performed its complete drive-in stroke.

Preferably, there is interposed in the conduit communicating the control channel with the main valve or repetition valve chamber, an adjustable shut-off device which is capable of throttling the passage and shutting it off. It is possible by this adjustable throttle additionally to adjust the moment at which the auxiliary control valve automatically prepares the next drive-in beat. If, however, the conduit to communicate the control channel with the repetition valve chamber of the auxiliary control valve has been shut-off, the repetition effect of the drive-in apparatus is abolished. It will then work only in single beat operation.

The subject matter of the invention is still distinguished for the fact that it is extremely easily possible by changing a few parts to establish, on the one hand, a drive-in apparatus working with single beats only and, on the other hand, a drive-in apparatus working with single beats as well as repetitively. To change the last-mentioned apparatus designed in accordance with the invention into a single beat apparatus it is necessary only to replace the housing cover, omitting in the new housing cover the auxiliary control valve.

Further improvements and suitable embodiments of the subject matter of the invention are described by way of the enclosed drawing showing an embodiment of the invention in a simplified representation. In the drawings,

FIG. 1 is a sectional view of a drive-in apparatus in accordance with the invention, with all those parts which are not necessary for the invention omitted, the apparatus being shown in its position of rest with the release valve not yet actuated,

FIG. 2 shows the same sectional view of the drive-in apparatus, however, with the release valve actuated, the auxiliary control valve switched-on, while performing a working stroke through the drive-in piston,

FIG. 3 shows the same sectional view of the drive-in apparatus as shown in FIGS. 1 - 2, however, during the upward stroke of the drive-in piston, with the release valve still actuated and the auxiliary control valve switched-on as before.

Control of compressed air to the working cylinder is by means of a servo or pilot control valve which in the presently discussed example of embodiment is designed essentially in accordance with the German patent letter 1 285 959. The main control valve in this embodiment is constituted by a sealing ring 236 which is fastened to the underside of a control flange 234. In the closed position as shown in FIGS. 1 - 3, the sealing ring 236 places itself against the circumferentially extending end face 237 of the housing 281 which is effective as a valve seat, said housing having supported therein for axial
This housing cover 219 is provided with two central bores 220 and 221 separated from each other. The control piston 222 of the main control valve 223 is slidably supported in the bore 220. The auxiliary control valve 224 by means of which the repetition effect is automatically obtained, is arranged for axial displacement in the bore 221.

The housing cover 219 is provided with an upward extension 225. A partial region of the extension 225 is covered by a threaded sleeve 226 concentrically surrounding it. This threaded sleeve is threadably connected with a fine thread 227 formed on the outside of the extension and is axially adjustable over a small range. In the lower position, the bore 228 is closed by the sealing 229. In this position, the apparatus is adjusted for single beat operation. In the upper position, this bore 228 is exposed. The apparatus may then be operated with automatically repeating beats. The extension 225 terminates in a screw cap 230. The end face 231 of this screw cap serves simultaneously as an upper limit for the axial movement of the threaded sleeve 226. The cover 232 limits the bushing 205 in the bore 233 and takes over the function of an air baffle for the compressed air leaving the apparatus. FIG. 1 shows the apparatus in its position of rest, with the working piston 214 in its upper end position. The main control valve 223, comprising control flange 234 and control piston 222, blocks the communication between the cylinder and the line of compressed air for operation of the pressure chamber 235, in that the control flange 234 places itself against the end face 237 of the housing 236 by its sealing 238. The working chamber 276 of the cylinder 218 is in communication with the atmosphere via the bore 239, the chamber 240, several bores 241, the annular space 242, and the window 243.

Chamber 244 is constantly in communication with the line of compressed air for operation of the pressure chamber 235 through the annular channel 245, the aperture 206, annular channel 246, bores 208, annular channel 247, and bore 248. In the chamber 244, the end face 249, of the auxiliary control valve 224 is biased by compressed air thereby displacing said valve into the upper limit position. In this end position, the end face 250 of the auxiliary control valve 224 comes to lie against the end face of the screw cup 230. The sealing ring 251 of the servo valve member 224 in this arrangement is situated within the radial enlargement 252 of the bore 221 and thus out of engagement so that the main valve chamber 253 communicates with the chamber 244 via bores 254. The sealing ring 255 is in engagement in the bore 221 and blocks the communication of the chamber 244 via the annular space 279 and the bore 280 to the atmosphere. In the main valve chamber 253 the compressed air is effective against the end faces 257 and 258 of the control flange or the control piston, from which a downwardly directed force results. It is by this force that, as already described above, the sealing 236 is sealingly pressed against the end face 237 of the housing 238.

The shifting rod 200 with the release valve 216 is kept in the lower limit position by means of the compressed air which is directed against its flange 203. In this limit position, the sealing ring 201 is in engagement while the sealing ring 202 is out of engagement in the radial enlargement of the bore 209. Consequently, the release valve chamber 259 is in communication with the atmosphere via bores 260, 261, annular space 262,
several bores 207, radial enlargement 263, bore 209, free space 256, annular space 242, and the window 243.

The repetition valve chamber 264 is likewise in communication with the atmosphere via the bore 265, delaying chamber 266, bores 228, 267, free space 268, bore 269, chamber 240, several bores 241, and the window 243.

When set for “single-shot” operation, the threaded sleeve 226 is disposed in its lower position (not shown); in this position the bore 228 is covered by the sealing ring 229 and, consequently, the repetition valve chamber 264 is blocked. An automatically repeating sequence of beats is not now possible.

When set for “Automatic” operation the bore 228 is exposed by the sealing ring 229, whereby the repetition valve chamber 264 may be alternately communicated with the atmosphere and the working chamber 276 of the working cylinder 218. The communication with the atmosphere has already been described; the one to the working cylinder 218 will be described later. In FIG. 2, both the safety bracket 212 and the valve lever 211 are actuated, namely against the constantly downwardly directed force of the shifting rod 200. The valve lever 211 is lifted so much that its end face 270 comes to lie against the housing 238. In this position the sealing ring 201 is in the radial enlargement 263 of the bore 209 so that the release valve chamber 259 is in communication with the compressed air line of operation of the pressure chamber 235 via 245, 206, 246, 271, 263, 207, 262, 261, 260. The sealing ring 202 is in engagement within the bore 209 and thereby blocks the passage of compressed air for operation to the atmosphere.

In the release valve chamber 259, the end face 272 of the auxiliary control valve 224 is biased with compressed air for operation, which by being effective on the end faces 272 and 249 exposed thereto, moves the servo valve 224 into the position as shown in FIG. 2 because of the greater end face 272. In this position, the sealing ring 251 blocks the entry of compressed air for operation to the main valve chamber 253. The sealing ring 255 which is disposed in the radial enlargement 252 of the bore 221, releases the communication with the atmosphere via 254, 252, 279, 280, 242, 243. The transition into this position takes place spontaneously so that the compressed air present in the main valve chamber 253 all of a sudden drops to zero. The result of this is that the force constantly directed upwardly which results from the bias of compressed air effective on the end face 273, spontaneously opens the main control valve 223. The path of the opening movement is limited in that the end face 274 of the control piston 222 comes to lie against the sealing 275 and thereby blocks the working cylinder 218 towards the atmosphere.

After the main control valve 223 has been opened, the end face of the piston 214 is biased with compressed air for operation inside the working chamber 276 of the working cylinder 218. The working piston is thereby caused to perform its working stroke with considerable acceleration. The return stroke of the piston into the position as shown in FIG. 1 will be described in the following in connection with the adjustment for “single-shot” operation.

When adjusted for this operation, the threaded sleeve 226 is in the lower position with the sealing ring 229 covering the bore 228. This adjustment is not shown in any one of the Figures. In this lower position of the threaded sleeve 226 the repetition valve chamber 264 is self-contained, so that the automatic control for a continuous or repetitive sequence of beats is switched off. At first, the compressed air-nailer is lifted from the workpiece and the valve lever is no longer actuated. The shifting rod 200 with the release valve 216 the flange 203 of which is constantly subjected to the compressed air for operation, consequently, moves downward together with the valve lever 211 and the safety bracket 212 into the position shown in FIG. 1. After this position has been reached, the sealing ring 202 of the release valve 215 releases the communication of the release valve chamber 259 to the atmosphere via 260, 261, 262, 207, 263, 209, 256, 242, 243. Immediately the pressure in this chamber has dropped to zero, the auxiliary control valve 224 due to the constant bias effective on the end face 249 moves into the position as shown in FIG. 1 above. When the servo valve has reached this position the sealing ring 251 which is now situated in the radial enlargement 252 opens the communication of the main valve chamber 253 with the source of compressed air for operation of the pressure chamber 235 via 245, 206, 246, 208, 247, 248, 244, 252, 254. After the pressure in the main valve chamber 253 has adjusted itself to the working pressure of the source of compressed air, the control flange 234 together with the cylinder 218 and the control piston 222 moves into sealing position such that the sealing 236 is sealingly pressed onto the end face 237 of the housing 238, thus blocking the working space 276 from the source of compressed air for operation. At the same time, however, the path to the atmosphere is opened so that the compressed air present in the working chamber may escape via 239, 240, 241, 242, 243. Thereafter, the piston is moved back into its starting position by means of compressed air in the usual manner.

When adjusted for “Automatic Operation” the threaded sleeve 226 is in the upper position which is shown in FIGS. 1, 2 and 3. In this position the bore 228 is exposed by the sealing ring 229 so that the repetition valve chamber 264 is opened. This chamber is now automatically connected either with the working chamber of the cylinder 276 or with the atmosphere from which a repetitive sequence of beats results.

Starting from FIG. 2, the valve lever 211 remains withdrawn and the safety bracket remains pushed-in so that the shifting rod 200 with the release valve 216 constantly take the position as shown in this Figure. Thereby, the release valve chamber 259 is constantly connected with the source of compressed air for operation and, consequently, the end face 272 of the auxiliary control valve 224 is biased by compressed air for operation; in this operational stage the servo valve at first takes the position in accordance with FIG. 2.

In order to move the main control valve 223 back into its closed position, the auxiliary valve 224 must be shifted, i.e. must assume its position as shown in FIG. 3; for this purpose, however, a control pulse is needed which is branched from the working chamber 276 of the cylinder after a communication has been established with the source of compressed air. This pressure pulse is passed into the repetition valve chamber 264 via 239, 269, 268, 267, 228, 266, 265 as shown in FIG. 2 and biases here the end face 277 of the servo valve 224. An upwardly directed force results from the bias.
with compressed air of the end faces 249 and 277 on the one hand and the end face 272 on the other hand, said force, however, becoming effective only with delay. The delay is determined by the size of the delaying chamber 266 and is selected to be such that the repetition valve chamber fills completely with compressed air for operation only when the working piston 214 has safely completed the path of its working stroke.

When this is the case, the auxiliary control valve 224 moves to its position as shown in FIG. 3. In this position, the sealing ring 251 is situated in the radial enlargement 252 of the bore 221 so that the main valve chamber 253 is in communication with the source of compressed air of the pressure chamber, as described above. The main control valve 223 is thereupon pushed into its closed position, i.e., the working chamber 276 of the working cylinder is blocked from the source of compressed air for operation but is at the same time communicated to atmosphere. The compressed air present in the cylinder now escapes via 239, 240, 241, 242, 243 to the atmosphere. The piston which is biased by compressed air from below on its way into the end position imparts to the compressed air discharging into atmosphere a certain overpressure, thus creating a pressure surge. This pressure surge continues to exist until the piston has reached its end position. Only thereafter may the pressure in the repetition valve chamber 264 disintegrate to atmospheric pressure. Only after the pressure in the repetition valve chamber 264 has reached atmospheric pressure will the auxiliary control valve 224 shift into its position as shown in FIG. 2. By this it is secured that the important task of the repetition control of reversing the piston in its end positions is fulfilled.

I claim:

1. A compressed air-operated drive-in apparatus to drive-in fasteners such as nails, staples or the like, comprising a housing, a working cylinder having an axis in said housing, a driving piston mounted in said working cylinder for reciprocation along said axis, means to receive compressed air in said housing, said housing having atmosphere passage means leading to the atmosphere, main control valve means having means to control the application of said compressed air to the piston to move it in the working cylinder, and to allow said piston to move air in the cylinder to said atmosphere passage means, manually actuable release valve means to control actuation of said main control valve means, servo control valve means, said servo control valve means comprising two oppositely effective biasing chambers, one of them being a release valve chamber, said release valve means having means to connect said release valve chamber with the compressed air in the housing when said release valve is actuated, and to connect said release valve chamber to said atmosphere passage means when the release valve is not actuated, said other chamber being a repetition chamber, a control passage, said main control valve means comprising means to communicate said control passage with said compression means when the main control valve means is open and to communicate said control passage with the atmosphere passage means when the main control valve means is closed, means to connect said repetition chamber in communication with said control passage, both the main control valve means and the servo control valve means being arranged for movement along the axis of said piston and said cylinder.

2. The combination of claim 1, a housing cover for said cylinder and piston, said main control valve means being disposed within said housing cover.

3. The combination of claim 1, said means to receive compressed air in said housing comprising a compressed air supply chamber surrounding said cylinder, said main control valve means having means arranged coaxially with said cylinder, to block the inside of the cylinder from said supply chamber when said release valve is unactuated and said apparatus is in a condition of rest, said housing having an annular portion, said blocking means comprising annular means pressing against said annular portion to cause said blocking.

4. The combination of claim 3, said main control valve means having a greater effective area on one side exposed to compressed air from said supply chamber when said annular means is pressed against said annular portion, than the effective area of its other side exposed to the inside of the cylinder, means on said release valve to connect said release valve chamber with the compressed air in the housing and to the atmosphere passage means comprising means to relieve the air pressure from said one side upon actuating said release valve means to cause said annular means to lift from said annular portion to permit entry of compressed air from said supply chamber into said cylinder to cause said piston to move in a working direction in said working cylinder.

5. The combination of claim 4, said annular means and said working cylinder being fixed to each other and moveable together in the housing and constituting a unit, said housing comprising an integrally formed cylindrical guide for said unit, means to permit said unit to be moved as a unit in a hermetically tight manner inside of said housing, said annular means when said apparatus is in a position of rest, being pressed against an end face of said cylindrical guide which end face forms said annular portion, said cylinder being formed with air inlet openings in its upper region, which are exposed for entry of compressed air from said supply chamber into said cylinder, when the unit slides in one direction axially into open position due to said one side of said annular means being relieved from pressure, and to shut off said air inlet openings when said unit slides in an opposite direction upon subjecting said one side of said annular means to compressed air and communicating the space in the working cylinder and above said piston to said atmosphere passage means.

6. The combination of claim 5, said annular means comprising an annular flange to press said annular portion, said annular flange being part of said working cylinder and having a sealing ring at its underside contacting said annular portion, and a central circular plate member axially mounted in the upper end of said working cylinder, said member being provided with a cylindrical extension on its upper surface having a central passage extending therethrough for venting the inside of said working cylinder to the atmosphere on its return stroke.

7. The combination of claim 6, and means providing delaying chamber interposed in said means to communicate.

8. The combination of claim 7, and an adjustable shut-off device interposed in said means to communi-
cate to connect said control passage alternately with said main valve means and with said repetition chamber, said shut-off device having means to throttle or shut off said control passage.

9. The combination of claim 8, said control passage being connected with said atmosphere passage means, and means to connect the inside of said working cylinder to said atmosphere passage means.

10. The combination of claim 9, and trigger means to actuate said release valve means.

11. The combination of claim 10, and work engaging means to render the trigger means effective to actuate said release valve means when said work engaging means is actuated.

12. A compressed air-operated apparatus to drive fasteners such as nails or staples, comprising a housing having a cylindrical guide formed with an annular edge, a working cylinder having an axis and slidable in said guide, a drive piston slidable in said working cylinder along said axis, said working cylinder having an annular flange to close on said annular edge, said housing having a compressed air chamber surrounding said cylindrical guide, said working cylinder having openings which open to said chamber upon said cylinder sliding in a direction to lift said flange off said annular edge, a central plate, means to fix said plate to the upper end of said working cylinder, said plate having a central passage, said housing having a passage which opens to the atmosphere and which connects to said central passage when said flange contacts said annular edge, said central plate having means to shut off said atmosphere passage from said central passage when said flange is raised off said annular edge, and servo control valve means mounted in said housing and disposed coaxially of said working cylinder for movement along said axis, manually actuable release valve means, and means controlled by said plate, said servo control valve means and said release valve means, to apply compressed air from said chamber alternately to the upper side of said plate to cause said flange to press down on said annular edge, and to open said side of said plate to said atmosphere passage to allow said working cylinder and flange to lift off said annular edge.

13. The combination of claim 12, said servo control valve means including a sliding valve member, and means to apply compressed air from said chamber to opposite ends of said sliding valve member.

14. The combination of claim 13, and a member adjustably mounted on said housing and having means cooperating with said servo control means to cause movement of said piston only once for each actuation of said release valve means when said adjustable member is in one position, and to cause repetitive reciprocations of said piston upon each actuation of said release valve means when said adjustable member is in another position thereof.

15. The combination of claim 14, said adjustably mounted member being coaxial with said servo control valve means and with said working cylinder.

16. A compressed air-operated drive-in fasteners, comprising a housing having cylindrical bore means to slidably receive a cylinder, a cylinder having an axis and slidingly received in said bore means, said cylinder having a sealing flange overlying the upper end of said bore means, a piston in said cylinder movable along said axis, means to receive a compressed air in said housing above said piston, said flange, when the cylinder is raised, opening said cylinder above said piston, to said compressed air receive means, a main valve plate in the upper end of said cylinder, means to cause said main valve plate to lift said cylinder when said main valve plate is raised, said main valve plate having a central through passage, means on the housing to guide said main valve plate for sliding vertical movement up and down, said housing being formed with a chamber disposed above said main valve plate and cylinder, and with a passage communicating the central passage of said main valve plate with the atmosphere when said main valve plate is in lowered position and said cylinder flange is in lowered position sealing the upper end of said cylindrical bore means, a seal fixed in said housing to seal the upper end of said through opening in said main valve plate when said main valve plate is raised, said main valve plate having means to close said passage which communicates the through passage of the main valve plate with the atmosphere when said main valve plate is raised, said housing being formed with an auxiliary valve chamber coaxial with said cylinder, a servo valve vertically slidable mounted along said axis in said auxiliary valve chamber, said auxiliary valve chamber having a first, upper, portion of relatively larger diameter, a second portion of relatively smaller diameter, coaxial with said first upper portion and disposed therebelow, and a third portion disposed below said second portion and of larger diameter than the second portion, and coaxial therewith, said servo valve having a first piston portion sealingly slidable in said first auxiliary chamber portion, a pair of upper and lower spaced piston portions carrying upper and lower sealing rings, respectively, and slidable in said second portion of said auxiliary valve chamber when said servo valve is in an "up" position, said servo valve having a reduced stem between said pair of spaced piston portions, said auxiliary valve chamber having a fourth portion below said third portion thereof, and of the same diameter as said second portion thereof, said servo valve having a sealing ring below the lower of said pair of sealing rings, and located in said third portion of said auxiliary valve chamber in unsealing condition when said servo valve is in its "up" position and adapted to have sealing engagement with said fourth portion of said auxiliary valve chamber when said servo valve is in a lowered position, in which position, the lower of said pair of upper and lower sealing rings is in said third portion of said auxiliary valve chamber and out of sealing engagement with respect to said second portion of said auxiliary valve chamber, said housing having means to constantly communicate the compressed air receiving means with said fourth portion of said auxiliary valve chamber, said housing having a passage which connects said third portion of said auxiliary valve chamber to the housing chamber above said main valve and flange of said cylinder, manually controlled valve means to establish communication between said first portion of said auxiliary valve chamber alternately to said compressed air receiving means and to the atmosphere, said housing being formed with a passage leading from said second portion of said auxiliary valve chamber, between said pair of pistons, to the atmosphere.

17. The combination of claim 16, said housing being formed with a chamber above said fixed seal, said fixed seal having a center hole communicating with said last mentioned chamber, said housing being formed with a
passage leading to said last mentioned chamber, a ring, means to mount said ring on said housing for movement up and down on said housing, said ring being formed with an internal annular chamber, said housing having a passage connecting said last mentioned passage with said annular chamber and also being formed with another passage connecting the first portion of said auxiliary valve chamber with said internal annular chamber.

18. The combination of claim 17, said means to movably mount said ring on said housing comprising a threaded connection between said ring and said housing, said internal chamber being located to adjustably overlap said passage which connects said internal chamber with the passage that leads to said last mentioned chamber.

19. The combination of claim 16, said cylinder, main valve and auxiliary valve being coaxial.

20. A compressed air-operated drive-in apparatus to drive-in fasteners, comprising a housing having a cylindrical wall, a cylinder having an axis and slidably in said cylindrical wall, said cylindrical wall having an upper edge, said housing having a pressure chamber surrounding said cylinder, said cylinder having a hole establishing communication between said pressure chamber and the interior of said cylinder, a piston slidably in said cylinder and below said opening, said housing having a passage leading from said pressure chamber to said edge, said cylinder having a flange adapted to be seated on said edge to close said passage when said cylinder is down, a valve plate in the upper end of said cylinder and above said piston, said valve plate having an upwardly extending central sleeve formed with a central through opening, said housing having a bore slidably receiving said sleeve and a relief passage extending to the atmosphere and leading to the upper end of said sleeve when said plate is in a lowered position and said relief passage being adapted to be closed when said plate is raised, means to cause said plate to raise said cylinder when said plate is raised to uncover the passage closed by said flange, a centrally apertured seal fixed in said valve housing and spaced above said sleeve, coaxially thereof, and adapted to be contacted by said sleeve when said plate is raised, said housing being formed with a chamber above said seal, said valve housing being formed with a servo-valve chamber spaced above said last mentioned chamber, said servo-valve chamber having a first upper end portion, a second portion therebelow, a third portion below said second portion and a fourth lower end portion below said third portion, a servo-valve in said servo-valve chamber, said servo-valve having a first piston portion sealingly slidable in said first portion of said servo valve chamber, a second piston portion sealingly slidable in the second portion of said servo valve chamber and a third piston portion sealingly slidable in the second and fourth portions of said servo valve chamber, said housing having a passage connecting a space at the upper end of said cylinder with the third portion of said servo valve chamber, said third portion of said servo valve chamber being of a diameter greater than the diameters of said second and third piston portions of said servo valve, a ring on said housing and having an internal annular chamber, said housing being formed with a passage extending up from the chamber above said seal, and with a passage connecting said last passage with said internal annular passage, and also being formed with a passage connecting the second portion of said servo valve chamber with the atmosphere, said housing being formed with a passage extending to the upper end of the first portion of said servo valve chamber, and with a passage connecting the lower end of said first portion of said servo valve chamber with said last mentioned passage, said housing having a compressed air chamber continuously communicating with said upper edge of said cylindrical wall, said valve housing having a passage leading to said fourth portion of said servo valve chamber, and manually actuable trigger means to continuously open communication between said compressed air chamber and said last mentioned passage and to open the passage which goes to the upper end of the first portion of said servo valve chamber alternately to said compression chamber and to atmosphere.

21. The combination of claim 20, said servo-valve chamber and said servo-valve being coaxial with said cylinder.

22. The combination of claim 20, said ring including means mounting said ring for axial movement on said housing and having means to block the passage which connects to said internal annular chamber.