March 22, 1966 C. O. L. OTTOSSON ETAL 3,241,622

MEANS FOR PREVENTING IDLE OPERATION OF PERCUSSION TOOLS

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Fig. 1

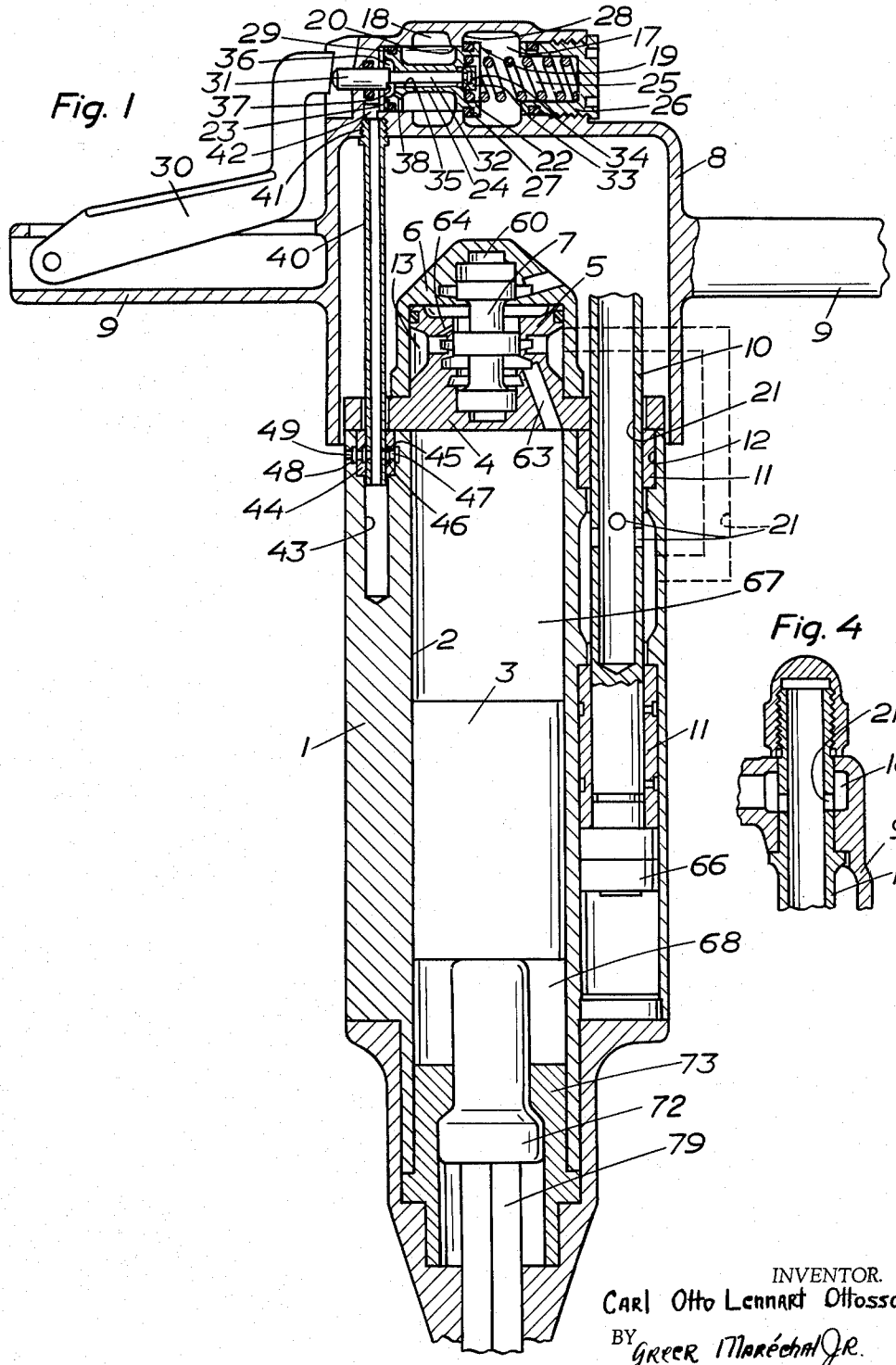

Fig. 4

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Fig. 2

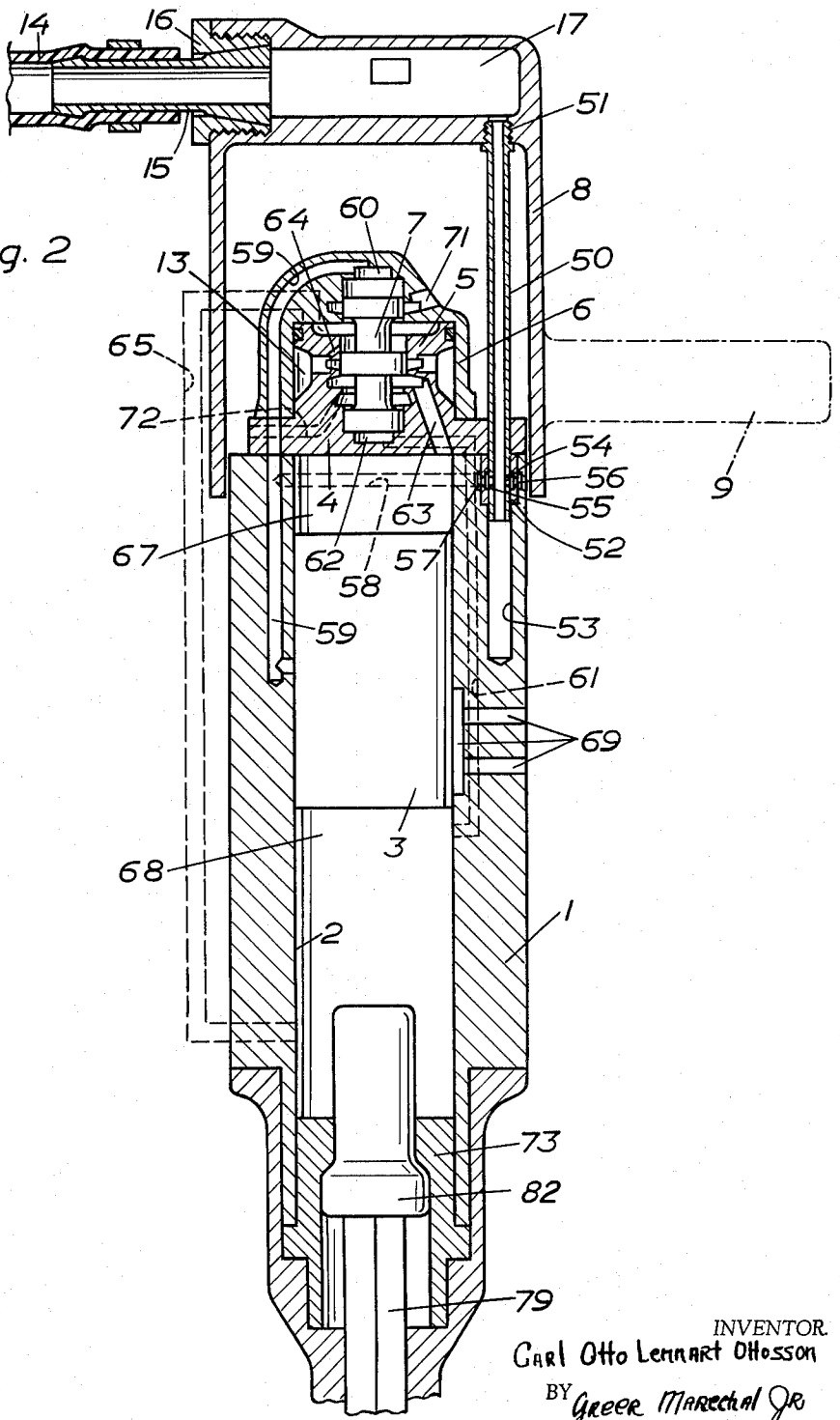

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Fig. 5

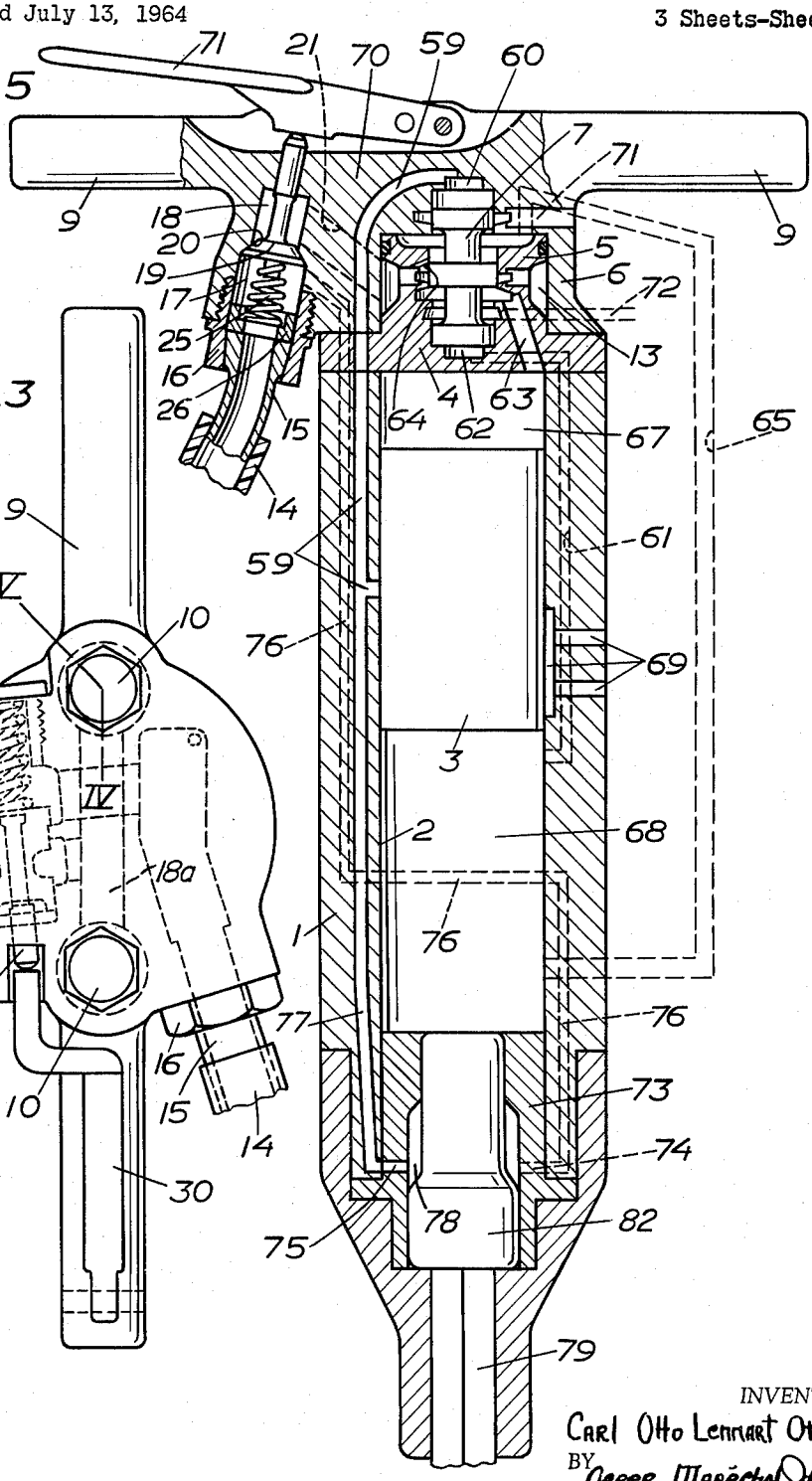

Fig. 3

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MEANS FOR PREVENTING IDLE OPERATION OF PERCUSSION TOOLS

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This invention relates to improvements in means for preventing idle operation of percussion tools having a cylinder housing, a working cylinder for a pressure fluid actuated hammer piston in the cylinder housing, and a handle member disposed upon the cylinder housing for holding and guiding the tool. Means of this type have been suggested in connection with concrete breakers and other pneumatic hammer tools in which it is desirable that the operation of the hammer motor be interrupted when the feeding force or feed pressure applied by the operator on the handle member is released or if the feed pressure of the tool implement against an object, such as a street pavement, a rock wall or roof, a building structure, or the like, is reduced or eliminated. Particularly in connection with large pavement breakers which produce heavy impacts it is desirable to stop the hammer motor when the feeding force is reduced or eliminated or if the tool is retracted by reverse feed from the work piece, since otherwise the hammer piston of such tools may injure the tool or other disadvantages may occur. In such tools having a handle movable substantially axially relative to the housing it is also desirable that the usually heavy hose for supplying large pressure fluid quantities for operating the hammer piston is connected to the handle member instead of the cylinder housing since the handle member usually vibrates less than the housing. A further object of the invention is to provide a tool in which the supply of pressure fluid to the hammer motor may be adjusted within wide limits and still the operation is interrupted when the tool is retracted by reverse feed or the handle member lifted.

In the accompanying drawings three embodiments of the improved means according to the invention are illustrated by way of example. FIG. 1 is a longitudinal axial section of a portable concrete breaker in which a part of the chuck end is broken away, and FIG. 2 is a longitudinal axial section taken on a plane perpendicular to the plane of the handles of a concrete breaker according to another embodiment of an otherwise similar tool as in FIG. 1. FIG. 3 is an endview showing the rear end of the tools according to FIGS. 1 and 2. FIG. 4 is a broken away part of the tool in FIG. 1 in section taken on line IV—IV in FIG. 3. FIG. 5 is a longitudinal axial section of a tool according to a third embodiment of the invention. In the illustrated embodiments in the drawings equivalent parts have been indicated with the same reference numerals in order to avoid duplication of description.

The tools illustrated in FIGS. 1, 2 and 5 are concrete breakers of the same general design and have a cylinder housing **1** in which is formed a working cylinder **2** for a hammer piston **3** which is reciprocable in the working cylinder under the action of pressure fluid. The cylinder housing is provided with a rear head **4** which carries a boss **5** enclosed by a cover **6** and forming together with said cover a valve casing for a pressure fluid distribution valve member **7**. The tool in FIGS. 1 and 2 is provided with a separate handle member **8** which carries two handles **9, 9** for holding and guiding the tool and extending one from each side of the handle member **8**. The handle member **8** in these tools is guided for limited longitudinal movement axially of the cylinder housing **1** by means of guide tubes **10, 10** which are guided in suitable bushings

11, fitted in counter bores **12** in the cylinder housing. Said tubes may serve for conveying pressure fluid from the handle member to a chamber **13** in the valve casing.

In the embodiment of FIG. 5 the tool has a handle member **70** integral with the cover **6** and carrying the handles **9, 9**. Pressure fluid is supplied to the tools from a pressure fluid supply hose **14** attached to a fitting **15** secured to the handle member by a retaining nut **16**. The fluid passages from a fluid inlet chamber **17** communicating with the hose **14** to the chamber **13** in the distributing valve casing are indicated somewhat diagrammatically in FIGS. 1 and 5. Pressure fluid such as compressed air from the hose **14** supplied to the chamber **17** is admitted to a chamber **18** in the handle member upon opening of a main valve member **19** seated and movable in a bore **20** in the handle member **8**. As shown in FIG. 3, the chamber **18** and branches **18***a* thereof communicate with the chamber **13** through ports and passages **21** provided in the guide tubes **10** and extending therethrough, and in the cylinder housing in FIG. 1 and in the handle member in FIG. 5 and illustrated partly diagrammatically in FIGS. 1 and 3. The distributing valve member **7** controls the supply of pressure fluid from the chamber **13** through bores **63** to the working chamber above and through passages **64, 65** to a working chamber below the hammer piston **3** in the working cylinder **2** in a manner which does not per se form a part of the present invention and is therefor not described in detail.

In the embodiments of FIGS. 1–4 the main valve member **19** has two heads, one large head **22** and a small head **23** provided one at each end of a valve stem **24**. A spring **25**, which is retained in a spring retainer **26**, normally keeps the main valve member **19** with its large head **22** and a sealing ring **27** seated on a seat **28**. The valve member **19** has a further sealing ring **29** on the small head **23** which forms a seal with a portion of the bore **20**. The valve member **19** is operated by means of a trigger **30** provided and mounted on one of the handles **9** which trigger actuates a spindle **31** which extends with a reduced portion **32** with considerable clearance through the hollow valve stem **24** and carries an auxiliary valve head **33** cooperating with a seat **34** formed at the right hand end of the stem **24** in FIG. 1. The reduced portion **32** is carried through a bore **35** in the stem **24** with such clearance that air may pass from the chamber **17** to a space **36** at the left side of the small valve head **23**. The spindle **31** has a recess **37** which communicates the clearance in the stem **24** with the space **36** when the spindle is pressed toward the valve member **19** with the end of the portion **31** and the small valve head **23** has a restricted bore **38** for bleeding air from the space **36** to the chamber **18**. When the spindle **31** is moved to the right in FIG. 1 by the trigger **30** compressed air in the chamber **17**, which normally keeps the valve member **19** in closed position against any pressure applied by the operator, is admitted to the space **36** through the opening of the auxiliary valve member **33** and the clearance around the reduced spindle portion **32**, so that the operator may easily move the main valve member to open position. During such movement the right end of spindle portion **31** abuts on the valve head **23**.

According to the embodiment of the invention illustrated in FIG. 1 a tube **40** is screw-threaded into the handle member **8** at **41**, said tube communicating through a passage **42** in the handle member with the chamber **36**. The tube **40** extends through the rear head **4** into a bore **43** in the cylinder housing **1**. A bushing **44** is secured in the cylinder housing and the tube **40** has a number of transverse openings **45**, which in the retracted or lifted position of the handle member **8**, illustrated in FIG. 1, register with an annular groove **46** in the bushing **44** and

communicate through ports 47, a groove 48 and ports 49 with the atmosphere.

Consequently, when the handle member 8 is lifted or retracted from the cylinder housing 1 to the position illustrated in FIG. 1 the space 36 is vented to the atmosphere through the passage 42, tube 40, openings 45, groove 46, ports 47, groove 48 and ports 49 and said venting is such as to prevent any substantial pressure rise in the chamber 36 by operation of the trigger 30 to move the spindle 31 to the right in FIG. 1. Since the valve member 19 is pressure fluid biased in closing direction only when operator's pressure on the handle member is released the operator cannot run the tool motor. As long as the handle member is retracted or lifted and the space 36 is vented the operator cannot open the main valve 19 against the full network air pressure on the large valve head 22 and operation of the hammer motor is consequently prevented. On the other hand the design is such that application of pressure by the operator on the handle member and the trigger 30 interrupts venting of space 36 and thereby reduces fluid pressure bias on the valve member 19 giving the operator a possibility to manipulate valve member 19 and to run the tool.

In the embodiment of FIG. 2 the handles 9, 9, trigger 30, main valve 19 and air supply and guide tubes 10 and air passages 21 to the chamber 13 are arranged in the same way as in FIG. 1 and are therefore not illustrated or described again. However the passage 42 and the tube 40 with appurtenant details are not provided in the embodiment of FIG. 2. Instead thereof a tube 50 is screw-threaded into the handle member 8, as indicated at 51, said tube communicating with the air inlet chamber 17 and the pressure fluid network through the hose 14 as soon as the tool is attached to said network. The tube 50 extends axially of the tool through the rear head 4 and a bushing 52 into a bore 53 in the cylinder housing 1. The bushing 52 is fixed in the cylinder housing 1 between the cylinder housing and the head 4 and the tube 50 has a number of ports 54 which in the position illustrated in FIG. 2, in which the handle member 8 is retracted, register with a groove 55 in the bushing 52 and communicate through ports 56 with a groove 57 and a passage 58 leading to a passage 59 which communicates with a space 60 in the cover 6 at the rear end of the valve member 7. In the illustrated position of the handle member live air is supplied to the upper end of the valve member 7 in the space 60 keeping the valve member in the forward position illustrated in FIG. 2. A passage 61 in the cylinder housing and head 4 forms a communication between a space 62 below the valve member 7 and the lower end of the working cylinder below the piston 3, but the air pressure in said lower end is incapable of overcoming the live air pressure in the space 60. The valve member 7 is therefore kept in the low position illustrated in FIG. 2 as long as the handle member is lifted and the ports 54 register with the groove 55.

When the handle member is moved downwards against pressure fluid pressure or spring pressure, which may be interposed between the housing 1 and the lower heads 66 on the tubes 10, see FIG. 1, the communication between the chamber 17 and the space 60 through the tube 50 is interrupted and consequently air pressure in the passage 61 flowing to the space 62 is capable of lifting the valve member 7 so that it can admit compressed air from the chamber 13 through the bores 63 to the working cylinder for starting reciprocation of the hammer piston 3. The reciprocation of the hammer piston is produced by the compressed air which is directed to the rear working chamber 67 and front or return chamber 68 by the distribution valve 7 and exhausted through exhaust recess and ports 69 illustrated in FIG. 2 only, since they are cut away in the section of FIG. 1. 71 and 72 are air vent passages in the valve housing 4, 5. Passages 59, 61, 65, 69, 71, 72 are naturally provided in the embodiment of FIG. 1 but not shown. When compressed air is supplied through hose 14 in FIG. 2 and the handle member 8 is retracted as illustrated then live air through tube 50 and passages 58, 59 to space 60 keeps distribution valve member 7 pressed down as illustrated and air supply through restriction 64 and passages 65 keeps piston 3 floating near illustrated position so that air can escape from chamber 68 through 69 just enough to keep piston 3 floating but so that substantial pressure is not built up in chamber 68. When handle member 8 is depressed live air supply through 58 is interrupted and pressure fluid leaks out from space 60 reducing the fluid pressure bias on upper end of valve member 7 so that the pressure in 68 and 62 will now lift the valve member 7 to start piston reciprocation.

It is obvious from the above description that pressure fluid bias on 19, 22 or in 60 on 7 according to the invention keeps the main valve 19 closed or the distributing valve 7 in a depressed position, respectively, as soon as the handle member 8 is raised or retracted relative to the cylinder housing 1, whereas said pressure fluid bias on said valve members is reduced or eliminated when the handle member is moved down axially relative to the cylinder housing so that the hammer motor may then be operated to produce percussion work. It is also obvious that the change in said pressure fluid bias is fully automatic and independent of manipulation of triggers or other similar manipulating members and furthermore it is very quick in action so that the hammer motor will stop almost immediately upon release of the feeding force applied by the operator on the tool handles or handle member.

In the modification of the invention or third embodiment illustrated in FIG. 5 the same functioning of the fluid pressure bias on valve member 7 as in FIG. 2 is obtained in a tool in which a handle member 70 is provided which is fixed to the cylinder housing 1 by conventional bolts (not shown). In this case a trigger 71 is provided which upon depression opens the main valve member 19 to supply compressed air to the percussion motor. This tool has an anvil block 82 movable in a front head 73 provided with passages 74, 75 controlled by the anvil block. The passage 74 through passages 76 communicates with the compressed air inlet chamber 17 and the passage 75 through pasages 77 and 59 with the space 60. When the handles 9 and the cylinder housing 1 are lifted the anvil block takes the position in FIG. 5 and opens live air supply from 74 through space 78, passages 75, 77, 59 to space 60 producing a fluid pressure bias on valve member 7 which keeps said member in the shown lower position. Piston reciprocation is consequently interrupted and the piston 3 remains floating in or about the position shown in the same manner as described in connection with FIG. 2. When the handles 9 or the tool as a whole is pressed against the spike 79 or other implement the anvil block 82 is raised, live air supply through passage 74 is interrupted and air leaks from the space 60 so that fluid pressure bias downwards on member 7 is reduced until air pressure in 68 and 62 is sufficient to raise the valve member 7 to start operation of the percussion motor.

Other modifications of the invention may also be made within the scope of the claims.

What we claim is:

1. Means for preventing idle operation of percussion tools having a cylinder housing, a working cylinder in said cylinder housing, a hammer piston reciprocable in said working cylinder under the action of pressure fluid, and a handle member reciprocably disposed upon said cylinder housing for holding and guiding the tool, said means comprising a pressure fluid supply connection on the handle member for supplying pressure fluid for operating the hammer piston, conduit means in said handle member and said cylinder housing providing flow communication for pressure fluid from said connection to the working cylinder, a valve member in said conduit means for controlling fluid supply to said working cylinder, means in said valve member for pressure fluid bias-

ing thereof to a position which prevents operation of the hammer piston by said pressure fluid in response to reciprocation of said handle member away from said housing by release of feed pressure on the handle member, and means in said housing and connected to said handle member and responsive to reciprocation of said handle member toward said cylinder housing by application of pressure to said handle member for reducing said pressure fluid bias automatically in said valve member for moving said valve member into positions for admitting pressure fluid to the working cylinder for operation of the hammer piston.

2. In percussion tool apparatus of the character described for the prevention of idle operation thereof during periods of non-application to a work surface and having a cylinder housing, a working cylinder in said housing with a hammer piston reciprocable therein under the action of pressure fluid, and a handle reciprocably movably disposed on said housing for holding and guiding said apparatus and movable substantially axially relative to said housing, the combination which comprises a pressure fluid supply connection disposed in said handle, conduit means disposed in said handle and said housing providing flow communication between said connection and said working cylinder, a main valve disposed in said conduit means for controlling flow communication therethrough to said working cylinder, large and small oppositely directed pressure surfaces on said main valve, said large surface being pressure fluid biased to close said main valve through the action of pressure fluid in said conduit means, a pressure fluid chamber in said handle partially defined by said small pressure surface of said main valve, a restricted passage between said fluid supply connection and said chamber, an auxiliary valve operable to open said restricted passage, an operating lever on said handle and connected to said auxiliary valve for the operation thereof to open said restricted passage to allow pressure fluid into said chamber and against said small pressure surface for reducing pressure fluid bias on said main valve, a vent passage providing flow communication between said chamber and the atmosphere, and means disposed in said vent passage and connected to said handle for blocking flow therethrough during reciprocation of said handle toward said cylinder housing and for allowing flow therethrough irrespective of the position of the said auxiliary valve during retraction of said handle away from said cylinder housing.

3. Apparatus as described in claim 2 and including a restricted bore leading from said chamber for the evacuation thereof of pressure fluid upon release of said operating lever for returning said main valve to closed position.

4. Apparatus as described in claim 2 and including a longitudinal bore in the cylinder housing, a tube carried by the handle member, the vent passage being formed partly by said tube which telescopes into said bore in the cylinder housing, and ports and pasages in said tube and housing providing flow communication for said vent passage and operative to lead to the atmosphere in a retracted position of the handle member relative to the cylinder housing and to interrupt said venting in a less retracted position of the handle member relative to the housing.

5. Means for preventing idle operation of percussion tools having a cylinder housing, a working cylinder in said cylinder housing, a hammer piston reciprocable in said working cylinder under the action of pressure fluid, and a handle member movably disposed upon said cylinder housing for holding and guiding the tool and movable substantially axially relative to the housing, said means comprising a distributing valve member for controlling fluid supply to the working cylinder for causing reciprocation of the hammer piston, first and second oppositely directed pressure surfaces on said distributing valve member for pressure fluid biasing the distributing valve member into a first and a second position for admitting pressure fluid to the upper or lower side of the hammer piston, respectively, a pressure fluid supply conduit, a passage for conveying pressure fluid from said conduit to said second pressure surface for biasing the distributing valve member towards said second position by pressure fluid in said supply conduit in response to reverse feed pressure on the handle member causing a retraction of said handle member relative to said housing, and means for closing said passage to reduce said pressure fluid bias upon displacement of the handle member in feeding direction relative to the housing.

6. Means according to claim 5, in which a longitudinal bore is provided in the cylinder housing, said passage being formed partly by a tube secured to the handle member and telescoping in said bore in the cylinder housing with ports and ducts being provided in said tube and housing leading to said second pressure surface in a retracted position of the handle member relative to the cylinder housing, said ports being brought out of register when said tube is moved in feeding direction relative to said housing.

7. Means for preventing idle operation of percussion tools having a cylinder housing, a working cylinder in said cylinder housing, a hammer piston reciprocable in said working cylinder under the action of pressure fluid, an anvil block axially movable a limited distance in an anvil block chamber in said cylinder housing and adapted to transmit percussion energy from said hammer piston to a working implement such as a spike, and a handle member disposed upon said cylinder housing for holding and guiding the tool, said means comprising a distributing valve member for controlling fluid supply to the working cylinder for causing reciprocation of the hammer piston, first and second oppositely directed pressure surfaces on said distributing valve member for pressure fluid biasing the distributing valve member into a first and a second position for admitting pressure fluid to the upper or lower side of the hammer piston, respectively, a pressure fluid supply conduit, passages for conveying pressure fluid from said conduit to said second pressure surface for biasing the distributing valve member toward said second position by pressure fluid in said supply conduit in response to reverse feed pressure on the handle member causing a retraction of said handle member, said passages extending through said anvil block chamber so as to be open when the anvil block is in forward position due to retraction of the handle member and is closed when the anvil block is in rear position in response to feeding pressure on the tool.

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