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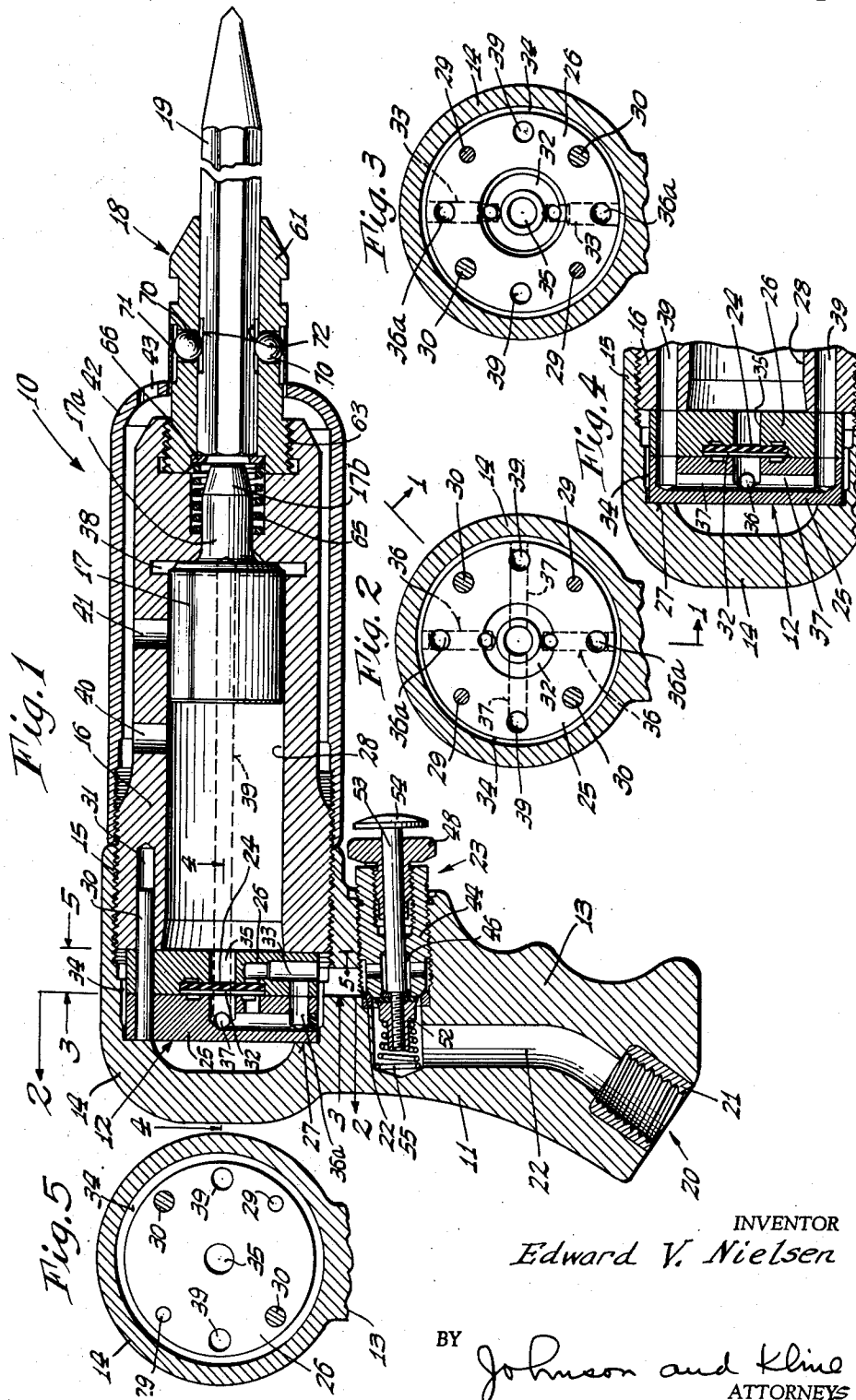
E. V. NIELSEN

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FLUID-OPERATED HAMMER

Filed June 24, 1959

2 Sheets-Sheet 1



INVENTOR

Edward V. Nielsen

BY

Johnson and Kline
ATTORNEYS

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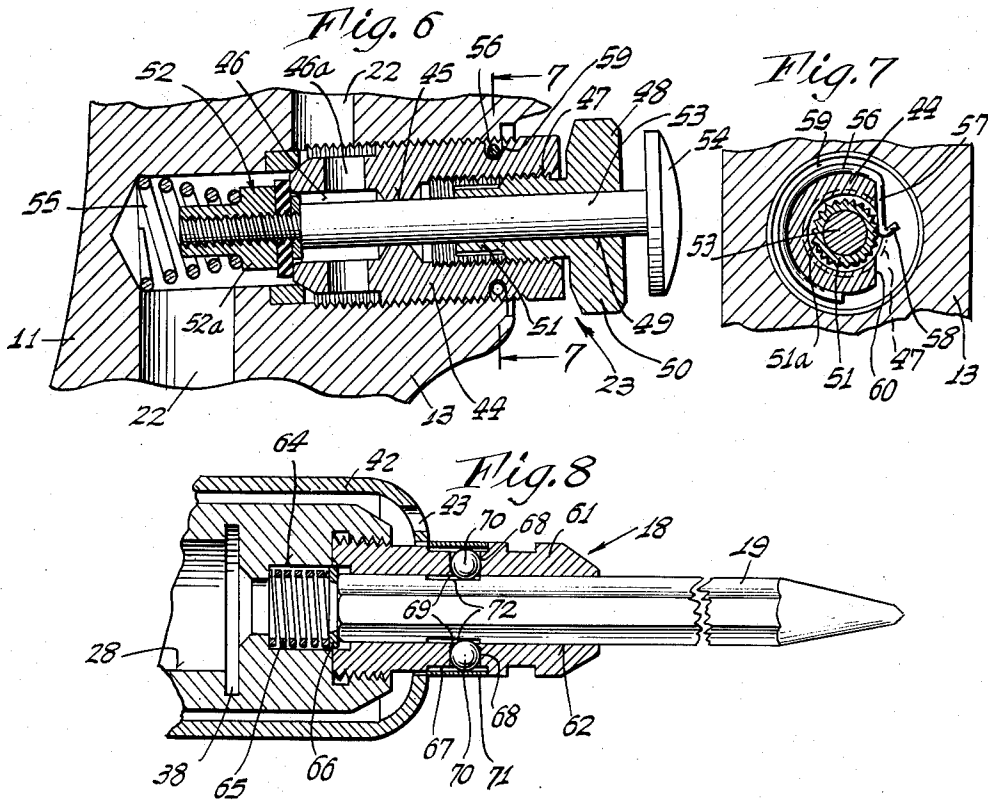
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Edward V. Nielsen

BY

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ATTORNEYS

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FLUID-OPERATED HAMMER

Edward V. Nielsen, Darien, Conn., assignor to
Henry E. Kyburg, Bridgeport, Conn.

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This invention relates to power operated hand tools. More specifically, it pertains to a fluid operated hammer wherein a piston is reciprocated in a barrel or cylinder for operating an impact tool or the like.

An important object of the invention is to provide an improved fluid operated hammer or the like which is reliable and positive in its operation, while being safe and adjustably accurate.

According to the invention, the fluid operated hammer is provided with a valve assembly having a movable valve disk therein which is adapted to be sequentially shifted between hammer driving and cocking positions so that fluid emanating from a source of fluid under pressure may reciprocate the hammer or piston. The valve disk is sequentially shifted in response to the position of the hammer in the barrel causing a reversal of a pressure differential which is created between opposite sides of the valve disk, so that fluid emanating from a source of fluid under pressure may be directed first against one side of the reciprocable hammer and thereafter against the other side for reciprocating the same. The sequential shifting of the valve disk is accomplished by communicating the interior of the barrel with opposite sides of the valve disk and providing means for opening or closing off such communication to increase or decrease the fluid pressure at opposite sides of the disk, as required.

A feature of the invention is the provision of an adjustable trigger assembly or control means for accurately regulating the flow of fluid under pressure to the valve assembly so that the rapidity of the hammer stroke and the force of the blow may be controlled. While adjustable trigger assemblies have been known prior to the instant invention, the present trigger assembly is novel in that the valve thereof may be accurately adjusted to deliver just the required amount of fluid to the valve assembly and is locked in adjusted position by resilient locking means. The resilient locking means prevent the trigger assembly from losing the desired adjustment as the result of vibration and shock, etc., yet enable an operator to readjust the assembly without difficult manipulation of the parts or having to resort to the use of tools or the like.

Another feature of the invention resides in the improved tool mounting means, which is adapted to support a cutting tool or the like in alignment with the reciprocable hammer to be operated thereby. Prior to this invention the problem has been encountered, in the mounting of tools, of the tool being driven out of its mount when it is struck by the hammer and is not in engagement with a workpiece. Various methods and devices have been utilized for overcoming this problem but so far as is known each of these require the reconstruction of the tool which is being operated by the hammer, or create problems in the mounting and removal of the tool in and from the hammer. The present mounting means comprises a supporting member in the form of a sleeve, adapted to slidably support the tool, connected to the barrel and cooperating with the barrel to house resilient means for normally biasing the tool away from hammer contacting position. The sleeve or support for the tool is provided with resilient means for gripping the tool when it is inserted therein for maintaining it in supported position, the resilient nature of the tool gripping means being adapted to facilitate the removal and insertion of the tool.

It is, therefore, also an object of the invention to pro-

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vide a fluid-operated hammer in which the driving and cocking operation of the hammer or piston is a function of a sequentially actuated valve assembly, thereby eliminating the usual extraneous cocking or return device, such as springs or the like.

Another object of the invention is to provide a fluid-operated hammer having a self-contained, self-locking, readily adjustable control mechanism or trigger assembly for regulating the flow of fluid to the valve assembly whereby any desired rate of reciprocation or force of hammer blow may be obtained.

Still another object of the invention is to provide a fluid-operated hammer having means for mounting a tool in alignment with the reciprocating hammer thereof which normally biases the tool away from hammer contacting position, so that the hammer may idle without danger when the tool is not engaged with a workpiece and which is adapted to facilitate the mounting and removal of the tool in association with the hammer.

A further object of the invention is to provide a fluid-operated hammer wherein the shock of hammer reciprocation is substantially absorbed and in which the air discharged from the barrel as the hammer reciprocates, is utilized to cool and clean the work and end of the working tool.

It is still further an object of the invention to provide a fluid-operated hammer which is simple in structure, readily assembled and disassembled for cleaning and repair and of such rugged character it will function over long periods of time with freedom from all difficulties.

Other objects and advantages of the invention will be apparent from the specification and claims when considered in connection with the attached sheets of drawings, illustrating one form of the invention, wherein like characters represent like parts and in which:

FIGURE 1 is a side elevational view, in section, taken in the direction of the arrows 1—1 in FIG. 2, showing a fluid-operated hammer embodying the concepts of the invention;

FIG. 2 is a fragmentary cross-sectional view taken in the direction of the arrows 2—2 in FIG. 1;

FIG. 3 is a fragmentary cross-sectional view taken in the direction of the arrows 3—3 in FIG. 1;

FIG. 4 is a fragmentary sectional view taken in the direction of the arrows 4—4 in FIG. 1;

FIG. 5 is a fragmentary cross-sectional view taken in the direction of the arrows 5—5 of FIG. 1;

FIG. 6 is an enlarged fragmentary view, in section, of the trigger assembly shown in FIG. 1;

FIG. 7 is a fragmentary cross-sectional view taken in the direction of the arrows 7—7 in FIG. 6; and

FIG. 8 is a fragmentary view, in section, of the tool mounting means of FIG. 1.

Referring now to the drawings, a fluid-operated hammer 10 is shown embodying the concepts of the invention. While it will be understood that the hammer 10 may be either operated by a liquid or gas under pressure, in the illustrated form of the invention, for purposes of explanation, an air-operated hammer is described.

The air hammer 10 comprises a housing 11 having a valve assembly 12 therein. The housing 11, according to conventional practice, includes a pistol grip 13, to facilitate the handling of the air hammer, and an integral valve assembly mounting portion 14. The valve assembly mounting portion 14, which is substantially cylindrical in cross-section, is closed at one end and provided at the other end with an open threaded mouth 15 adapted to threadingly receive a barrel or cylinder 16, having a reciprocable hammer or piston 17 therein. Connected to the end of barrel 16 directed away from housing 11 is a tool mounting assembly 18 for supporting a tool 19 in operating alignment with the hammer 17. The housing

11 is provided with means 20, in the form of a screw threaded coupling 21 and conduit 22, for connecting the housing to a source of fluid, such as air, under pressure (not shown) and for transmitting the fluid to the valve assembly 12. Mounted in pistol grip 13 of housing 11 and dissecting conduit 22 between the source of air under pressure and the valve assembly, is a trigger assembly 23 adapted to control the flow of air to the valve assembly.

The valve assembly 12, which holds a movable valve disk 24 and includes a pair of complementary valve housing members 25 and 26, is removably mounted in valve assembly mounting portion 14 on a shoulder 27 formed therein in alignment with the bore 28 of barrel 16. Pins 29 extending through complementary bores in housing members 25 and 26 retain the members in aligned assembled position and further pins 30 adapted to be received in bores 31 of barrel 16 align the valve assembly with the barrel and maintain it against movement relative thereto in the assembled air hammer.

The valve housing members 25 and 26 form between them a central pocket 32 which is adapted to loosely house the movable valve disk 24 so that it may be shifted from side to side therein, for a purpose to be hereinafter more fully explained. The valve housing members are formed with a plurality of passages therein communicating with the pocket 32 and opposite sides of valve disk 24 for sequentially transmitting the operating fluid, in the present illustration air, first to one side of the disk and then to the other so that the disk is shifted to enable the fluid to reciprocate the hammer. The valve housing member 26 is provided with a pair of passages 33 communicating with pocket 32 at one side of the valve disk and with an annular passage 34 that is in open communication with conduit 22 from the source of air under pressure. A central bore 35 in member 26 opens pocket 32 to the bore 28 of barrel 16. Valve housing member 25 is provided with passages 36, similar to passages 33 but communicating with pocket 32 at the opposite side of the valve disk. The passages 36 communicate with annular passage 34 through passages 33, in member 26, and lateral passages 36a. Additionally, the member 25 is formed with passages 37 communicating with pocket 32 and with a compression chamber 38 formed in barrel 16 at the end directed away from valve assembly 12. The passages 37 are connected to the compression chamber through conduits 39 extending longitudinally of barrel 16.

The barrel or reciprocable piston cylinder 16 is formed with a pair of transverse vent openings 40 and 41 for communicating the bore 28 with the atmosphere and is provided with threads on its outer surface whereby a hood or vent shield 42 may be secured thereover. In the illustrated form of the invention, the hood 42 is secured to barrel 16 adjacent housing portion 14 and engages an extension of the threads which connect the barrel to the housing.

In the operation of air hammer 10, assuming at the start that hammer or piston 17 is in driving or tool contacting position as shown in FIG. 1, air under pressure is transmitted through conduit 22 to valve assembly 12. In the illustrated position of the hammer 17, valve disk 24 is positioned in pocket 32 to valve-off barrel 16 and passages 33 from the pocket. The position of the valve disk is the result of a pressure differential created between the opposite sides thereof. The barrel side of the valve disk is under less pressure than its opposite side because the bore 28 of the barrel and the bore 35 of valve housing member 26 are open to the atmosphere through vent 40, while the pressure of compressed air from chamber 38 is imposed upon the opposite side of the disk through conduits 39 and passages 37. In this position of the valve, the air being transmitted through conduit 22 travels the path of least resistance to pocket 32, that is, it flows from passages 33 through passages 36a to passages 36 and thereafter through conduits 39 into chamber 38. The pressure of the air entering cham-

ber 38 forces hammer 17 back along bore 28 of the barrel into cocked position adjacent valve housing member 26. As the hammer is cocked, the air trapped in the barrel ahead of it is partially vented through vent 40 until the hammer passes the vent and valves it off. Thereafter the remaining air trapped in the barrel by the hammer is compressed to absorb the impact of the cocking hammer. Simultaneously with the air being compressed at the valve side of the hammer, the pressure at the opposite side thereof is reduced by the escape of air through vents 40 and 41, the result of this being to slow down the movement of the hammer and reverse the pressure differential across the valve disk so that it is shifted in pocket 32 to open communication between passages 33 and conduit 22 and bore 28 of the barrel.

At this point in the operation of air hammer 10, with direct communication established between the source of air and the bore of barrel 16, the air will alter its course to follow the new path of least resistance and flow through passages 33 and bore 35 into the barrel. The force of the air striking the rear face of hammer 17 will drive the hammer toward the opposite end of barrel 16, into tool contacting position, with sufficient force to operate tool 19. As the hammer travels the length of the barrel, the air ahead of it is expelled through vents 40 and 41 so as not to adversely affect its movement. When the hammer has passed vent 40, some of the driving pressure behind it is relieved through that vent to initially slow the hammer and prepare for the subsequent cocking operation, as was previously described. Continued movement of the hammer toward tool contacting position causes vent 41 to be valved-off so that a quantity of air is trapped in the barrel and compressed in chamber 38 for absorbing the impact of the driving hammer. It will be understood that the hammer is again in driving or tool contacting position, as it was when its operation was begun, and that the pressure differential across valve disk 24 is again reversed for recocking of the hammer.

A feature of the invention which should at this time be noted, is the utilization of the air vented from barrel 16 through vents 40 and 41 during the reciprocation of the hammer for cooling tool 19 and blowing dust or similar particles away from the point of the tool. The air which is expelled through the vents is guided between the hood 42 and the outer surface of barrel 16 to a port or orifice 43 adjacent tool mounting means 18 from which it is discharged in the direction of the working end of tool 19.

By means of the sequentially operated valve assembly 12, above-described, which is actuated in response to the position of the reciprocable hammer within the barrel, a fluid operated hand tool is provided which is automatic and reliable and positive in operation which being relatively simple in structure.

In order to further facilitate the operation of air hammer 10 and to enable the rapidity of the hammer stroke and the force of the blow to be regulated, an adjustable trigger assembly 23 is provided for controlling the flow of fluid through conduit 22 to valve assembly 12. While it is conventional practice to utilize trigger assemblies or the like for opening and closing communication between a fluid-operated hammer and a source of fluid under pressure, in the instant invention it is contemplated that a trigger assembly will be utilized which, in addition to stopping and starting the hammer, will regulate the quantity of fluid flowing to the valve assembly.

According to the invention, the trigger assembly comprises a trigger mounting portion 44 adapted to be threaded into a bore in pistol grip 13 of hammer housing 11 for dissecting conduit 22. The mounting portion 44 is formed with a bore 45 having an enlarged portion 46 at its inner end providing an air pocket and an enlarged threaded outer bore portion 47 adapted to adjustably receive a threaded bushing 48. A lateral passage 46a is provided in mounting portion 44 opening

into air pocket 46 and communicating the same with one side of conduit 22. The bushing 48 is formed with an axially extending bore 49 in alignment with, and of equal diameter with the bore 45 of the mounting portion and is provided with an enlarged head 50 outwardly of the mounting portion. The inner end of the bushing is provided with an integral nose portion 51 of reduced diameter relative to the enlarged bore 47 of the mounting portion having a plurality of elongate teeth 51a extending parallel to the axis of the bushing. A valve 52 having a valve head 52a and a valve stem 53 provided with an enlarged head 54 is mounted by trigger mounting portion 44 with the valve stem slidably carried in the bore 49 of the bushing 48 and the bore 45 of the mounting portion. Resilient means 55 in the form of a coil spring or the like positioned within conduit 22 of hammer housing 11 bear on valve head 52a for normally biasing valve stem 53 outwardly of bushing 48 so that the valve head closes off air pocket 46 to sealingly divide conduit 22. When trigger assembly 23 is operated to open valve 52 and communicate separate portions of conduit 22, valve stem 53 is shifted inwardly of bushing 48 against spring 55 to move the valve head 52a so that air may flow through air pocket 46 and passage 46a. The engagement of enlarged head 54 of the valve stem with the enlarged head 50 of the bushing limits the inward movement of the valve stem, thereby controlling the amount the valve is opened with a resultant control of the amount of air which is permitted to flow through conduit 22.

Adjustment of the trigger assembly 23 is achieved by threading bushing 48 into or out of mounting portion 44 a greater or lesser distance, thereby increasing or decreasing the length of the stroke of valve stem 53 and the separation between valve head 52a and the open end of the air pocket 46 in the mounting portion 44. In order to lock bushing 48 in adjusted position within the enlarged threaded bore portion 47 of mounting portion 44, resilient means are connected to the mounting portion for resiliently engaging the elongate teeth 51a of the bushing to prevent inadvertent movement between the bushing and the mounting portion. It is contemplated that the resilient means will comprise a substantially C-shaped spring element 56 having a flat arm or gripping portion 57 provided with a detent 58. An annular groove 59 formed in the mounting portion 44 and provided with a flat 60 is adapted to receive the spring element, with the arm 57 engaging the flat, so that the element is retained against movement relative to the mounting portion and the detent 58 engages the teeth 51a of the bushing. By means of the resilient locking means, adjustments of the trigger assembly are positively maintained during the operation of the air hammer, yet readjustment of the assembly may be accomplished without resort to tools or complicated and difficult manipulation of the parts.

Referring now to FIGS. 1 and 8 of the drawings, the tool mounting assembly 18 of the invention is shown. Heretofore, the problem has been encountered of mounting an impact tool or the like in operative position in a fluid-operated hammer so that it cannot be accidentally discharged therefrom when the hammer is operated and the tool is not in engagement with a workpiece. Prior attempts to solve this problem have required the redesign of the tools or have involved structures which complicate the mounting and removal of the tool from the fluid-operated hammer. According to the present invention, the tool mounting assembly is adapted to support the tool in axial alignment with the reciprocating hammer so that it is normally biased away from hammer contacting position, whereby the air hammer may idle, when the tool is not engaged with a workpiece, without danger of the tool being shot from its mount by the impact of the hammer thereon. The instant tool mounting assembly is adapted to facilitate the shifting of the tool into hammer

contacting position to enable it to be operated thereby. The retaining means for gripping the tool in mounted position are resilient in nature, thereby facilitating the ready mounting and removal of the tool from the air hammer.

The tool mounting assembly 18 comprises a sleeve or chuck 61 having a bore 62 therein adapted to slidably receive the shank of tool 19. The chuck is threaded into an enlarged bore 63 in the end of the barrel directed away from valve assembly 12 and is in alignment with the bore 28 of the barrel in which hammer 17 reciprocates. Inwardly of barrel 16, between enlarged bore 63 and hammer bore 28, is a bore 64 of reduced diameter openly communicating with the bores 28 and 63. The bore 64 is adapted to house a resilient member 65 in the form of a coil spring or the like which in turn is adapted to removably telescopically receive the tool contacting nose 17a of the hammer 17. An annular washer 66, having an external diameter slightly larger than the bore 62 of sleeve 61 and an internal diameter slightly smaller than the tool 19, is slidably positioned within bore 64 to be engaged by spring 65. The washer, which is adapted to telescopically receive the bevelled tip 17b of nose 17a of the hammer when spring 65 is compressed and the hammer is in driving position, is normally biased by the spring into engagement with the end of tool supporting sleeve 61. The sleeve is formed intermediate its length with a peripheral groove 67 having a plurality of bores 68 extending radially therefrom into tool receiving bore 62 of the sleeve. The bores 68, which are shouldered at their inner ends as at 69, are adapted to slidably receive ball bearings 70 for engaging the shank of the tool 19 when it is inserted in the mounting assembly. A resilient ring or clamp 71 is positioned in groove 67 for normally biasing balls 70 into bore 62 of the sleeve. It will be understood that while the tool 19 may be merely inserted in sleeve 62 and frictionally gripped by the balls therein, in the illustrated form of the invention the tool is shown as being provided with notches 72 for slidably receiving the balls.

In the operation of tool mounting assembly 18, the tool 19 is normally biased outwardly of sleeve 61 by spring 65 acting through washer 66 on its anvil end as shown in FIG. 1. In this position of tool 19 the air hammer may be operated without the hammer 17 striking the tool with the resultant danger of the tool being shot from its support. On the forward or driving stroke of hammer 17 the nose portion 17a thereof merely passes through coil spring 65 without contacting the tool 19. When it is desired to operate the tool it is only necessary to place the tip thereof against a workpiece with sufficient pressure to compress spring 65 so that the tool enters bore 64 and is in hammer contacting position, as shown in FIG. 8. On the forward stroke of hammer 17, in this position of tool 19, the nose 17a of the hammer passes through spring 65 and the end of the bevelled tip 17b passes through washer 66 and strikes the anvil of the tool to drive it forward. By means of the tool mounting assembly, herein above-described, a cutting tool or the like may be readily mounted and removed from a fluid-operated hammer and is normally supported therein out of hammer contacting position so that the air hammer may be idled without danger.

Thus, among others, the several objects and advantages of the invention as aforementioned are achieved. Obviously, numerous changes in the structure may be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. A fluid-operated hammer comprising a housing having a valve assembly mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve assembly, trigger assembly means mounted by said housing for controlling the flow of said fluid under pressure to said valve as-

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sembly, a barrel having a reciprocable hammer therein forming part of said housing, said hammer being reciprocated by said fluid in response to the operation of said valve assembly, means responsive to the position of said hammer in said barrel for sequentially operating said valve assembly to reciprocate said hammer, means mounting a tool on the housing for direct impact by said hammer, said means providing for sliding movement of the tool between a hammer contacting and an idle position, and means cooperating between said barrel and said hammer for forming an air trap cushioning the impact of said reciprocating hammer.

2. A fluid-operated hammer comprising a housing having a valve assembly mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve assembly, trigger assembly means mounted by said housing for controlling the flow of said fluid under pressure to said valve assembly, a barrel having a reciprocable hammer therein connected to said housing, said hammer being reciprocated by said fluid in response to the operation of said valve assembly, said valve assembly including a movable valve disk adapted to be shifted between hammer driving and cocked positions, vent means in said barrel for relieving the pressure therein as said hammer is reciprocated, means for sequentially shifting said valve disk for operating said valve assembly to reciprocate said hammer, said shifting means including means for creating a pressure differential between the opposite sides of said disk so that the fluid is enabled to enter said barrel and drive said hammer and reversing the pressure differential to shift the disk so that the fluid enters said barrel to cock said hammer, means mounting a tool on the housing for direct impact by said hammer, said means providing for sliding movement of the tool between a hammer contacting and an idle position, and means cooperating between said barrel and said hammer for closing said vent means so that fluid is trapped in said barrel ahead of said hammer for cushioning the impact of said reciprocating hammer.

3. A fluid-operated hammer as in claim 2, wherein said means for sequentially creating a pressure differential between opposite sides of said disk and reversing the same for shifting said disk comprises means for creating a pressure differential at opposite sides of said hammer and sequentially reversing the same, said means including said vent means and means for transmitting the fluid trapped in said barrel ahead of said hammer in tool contacting position to said disk.

4. A fluid-operated hammer comprising a housing having a valve assembly mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve assembly, trigger assembly means mounted by said housing for controlling the flow of said fluid under pressure to said valve assembly, a barrel having a reciprocable hammer therein connected to said housing, said hammer being reciprocated by said fluid in response to the operation of said valve assembly, means responsive to the position of said hammer in said barrel for sequentially operating said valve assembly to reciprocate said hammer, vent means for relieving the pressure in said barrel ahead of said hammer as the latter reciprocates, means connected to said barrel for mounting a tool adapted to be shifted between hammer contacting and idle position, hood means connected to said barrel and enclosing said vent means for controlling the flow of fluid vented thereby and directing it ahead of said tool, and means cooperating between said barrel and said hammer for trapping air and cushioning the impact of said reciprocating hammer.

5. An adjustable trigger assembly for use in regulating and controlling a flow of fluid to a valve assembly in a fluid-operated hammer having a housing comprising a trigger mounting portion connected to said housing, a valve having a valve stem, said stem being movably mounted by said mounting portion and being adapted to

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open and close said valve on movement thereof, means for adjustably limiting the movement of said valve stem in valve opening direction so that the trigger assembly is regulated and resilient spring means for locking said limiting means in adjusted position.

6. An adjustable trigger assembly for use in regulating and controlling a flow of fluid to a valve assembly in a fluid-operated hammer having a housing comprising a trigger mounting portion connected to said housing, a bushing having an enlarged flange movably mounted by said mounting portion for adjustment toward and away from said housing, a valve having a valve stem provided with an enlarged head, said stem being movably mounted by said bushing and being adapted to open and close said valve on movement thereof, said head engaging said flange on said bushing for limiting the movement of said stem in valve opening direction and resilient spring means for locking said bushing in adjusted position relative to said mounting portion.

7. An adjustable trigger assembly for use in regulating and controlling a flow of fluid to a valve assembly in a fluid-operated hammer having a housing comprising a trigger mounting portion having a threaded bore there-through connected to said housing, a bushing adjustably threadedly connected within the bore of said mounting portion for adjustment toward and away from said housing, said bushing having an enlarged head outwardly of said mounting portion and a nose portion of reduced diameter relative to the bore of said mounting portion provided with elongate serrations extending parallel to the axis of said bushing, a valve having a valve stem provided with an enlarged head, said stem being movably mounted by said bushing and being adapted to open and close said valve upon the movement thereof, said head engaging said enlarged head on said bushing for limiting the movement of said stem in valve opening direction and a resilient spring element secured to said mounting portion against movement relative thereto and resiliently engaging said serrated nose portion for locking said bushing in adjusted position relative to the mounting portion.

8. In a fluid-operated hammer including a housing having a valve means mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve means, means mounted by the housing for controlling the flow of said fluid to said valve means, a barrel having a reciprocable hammer therein connected to said housing, said hammer being reciprocated by said fluid in response to the operation of said valve means, means for operating said valve means to reciprocate said hammer and means connected to said barrel for mounting a tool; the improvement wherein said tool mounting means includes resilient means comprising a coiled spring positioned in a recess between the barrel and the tool mounting means and aligned with the hammer to receive the same, an abutment means engaging the end of the spring adjacent the tool to engage the tool and yieldably bias the tool to an idle position, said abutment means having an aperture through which the hammer passes when the spring is compressed and the tool is moved in the tool mounting means from idle to tool contacting position to be directly engaged thereby.

9. In a fluid-operated hammer including a housing having a valve means mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve means, means mounted by the housing for controlling the flow of said fluid to said valve means, a barrel having a reciprocable hammer therein connected to said housing, said hammer being reciprocated by said fluid in response to the operation of said valve means, means for operating said valve means to reciprocate said hammer and means connected to said barrel for mounting a tool; the improvement wherein said tool mounting means removably mounts said tool and resiliently biases said tool away from ham-

mer contacting position, said tool mounting means comprising a sleeve having a bore adapted to slidably receive and support a tool in alignment with said hammer, said sleeve being connected to said barrel and cooperating therewith to form a recess to house resilient means for normally engaging the end of the tool and shifting said tool away from hammer contacting position and resilient means carried by said sleeve for slidably retaining said tool therein.

10. In a fluid-operated hammer including a housing 10 having a valve assembly mounted therein, means for connecting said housing to a source of fluid under pressure and transmitting the fluid to said valve assembly, means mounted by the housing for controlling the flow of said fluid to said valve assembly, a barrel having a reciprocable hammer therein connected to said housing, said hammer being reciprocated by said fluid in response to the operation of said valve assembly, means for operating said valve assembly to reciprocate said hammer and means connected to said barrel for mounting a tool; the improvement wherein said tool mounting means removably mounts said tool for direct engagement by the hammer and resiliently biases said tool away from hammer contacting position, said tool mounting means comprising a sleeve having a bore adapted to slidably receive and support the tool in alignment with said hammer, said sleeve being connected to said barrel and cooperating therewith to form a recess to house a coil spring adapted to telescopically receive an end of said hammer and having means to engage an end of said tool for normally 30 biasing the latter away from said hammer, said last-named means having an aperture therein through which

said hammer passes into said direct engagement with the tool when the tool is moved to compress said spring and ball bearing means resiliently mounted in said sleeve and projecting into said bore for movably engaging said tool and retaining it in mounted position.

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