PNEUMATICALLY OPERATED POWER DRIVER

The invention provides a pneumatically driven power tool, particularly susceptible of use as a nailing device, but actually and additionally capable of many other uses, which has small dimensions, is of lightweight construction, and which utilizes short repetitive power strokes rather than a single long power driving stroke. These operational characteristics are the basis of utilization of the mechanism for many and varied purposes including sawing, chiselling, gouging, scribing or the like. The tool is operable from a normal compressed air supply line and does not require air pressure reservoirs of a type heretofore required to build-up a large air supply reservoir.

Valving mechanism is provided in the device which is operable from a source of gas under pressure as normally available in a factory, which can be provided by, portable compressors, or which can be supplied by operative connection with the usual and known types of containers having carbon dioxide under pressure contained therein.

Preferably the tool or device includes mechanisms which initiate actuation of the tool when contacted with an item or object to be moved. Means, however, can be incorporated which are selectively operable at the will of a user or operator of the mechanism, to selectively initiate actuation or cessation of operation of the device. This latter is desirable when using the mechanism for purposes other than power driving of nails, screws or the like, such as for operations including the use of chisels, saws, or gouging mechanisms.

As will be apparent from the foregoing it is a primary object of the present invention to provide a power tool operable from sources of air pressure or the like of varying natures, and which tool is of small dimensions, is operable from low air pressure supply sources, and has such weight as to render it easily maneuverable and operable in confined areas, while at the same time insuring rapid activation for use in any desired operation.

A further object is to provide a safety feature in the form of a retractable sleeve that extends beyond the end of the driving end of the driver, to eliminate the possibility of accidental contact of the driving end of the driver, and causing the tool to cycle. This sleeve also serves as a guide to keep the driving end in alignment with the item that is being driven, and is retractable upon contact with the receiving member into which the item is being driven, to facilitate continued driving of the item to its proper depth.

An additional object is to provide a movable mass in the interior of the tool, operable to move in the opposite direction of a driving member, during the downward, or driving stroke of the driving member. In the disclosed embodiment, the movable mass is in the form of a cylinder, partially closed at the upper end, and with the driving member slidable mounted in the interior of the cylinder. In other impact tools for driving fasteners and the like, there are forces moving the housing in a recoil direction, or opposite direction of the driving member, during the driving stroke equal to the forces moving the driving member. With a movable mass, or cylinder, as in the described embodiment, the forces acting on the housing and causing a recoil action are significantly reduced, since the major part of these forces are applied against the movable mass during the driving stroke. This feature permits the tool to operate more smoothly as it is driving a fastener into a workpiece and being moved toward the workpiece into which the fastener is being driven.

Another feature of the tool is the simplicity of construction and operation of the main valve which is operable to control flow of high pressure air from a reser-
voir chamber, through elongated ports in the movable cylinder, to the interior of the cylinder for movement of the driving member in its driving stroke. The construction of this main valve is particularly simplified because the means for returning the valve to its upward, or closed position is performed by the upward movement of the movable cylinder. This eliminates the need for a more complicated construction of the main valve, that would be required in order to close the valve by a remotely controlled valving arrangement or other means.

The invention is for the construction of a housing for the tool consisting of an upper cap portion and a lower body. These parts are designed to eliminate any internal coring of the parts, to facilitate the use of die casting in the manufacturing of these parts.

Additional objects and advantages of the present invention will be more readily apparent from the following detailed description of the preferred embodiments and modifications thereof, when taken together with the accompanying drawings in which:

FIG. 1 is a schematic view depicting utilization of the tool of the present invention in confined areas of operation;

FIG. 2 is a schematic view of a portion of a building roof and joist structure, illustrative of prefabricated type construction for which the tool is suitably employed;

FIG. 3 is a top plan view of the tool of the invention;

FIG. 4 is a sectional view through the tool showing the internal mechanism thereof;

FIG. 5 is a sectional view of the tool with the primary driving piston in a partially retracted position following initial movement of a power driver or stroke mechanism with an article or item to be driven thereby;

FIGS. 6-10 are fragmentary sectional views, sequentially showing successive phases of actuation and motivation of the means operable for control of the power driver;

FIG. 11 is a fragmentary sectional view of the tool shown in association with a nail completely driven into a surface and at which point driving movement of the mechanism ceases;

FIG. 12 is a sectional view taken on line 12—12 of FIG. 4;

FIG. 13 is a fragmentary sectional view through an embodiment of the invention adapted for driving finishing nails;

FIG. 14 is a schematic elevational view of a device adapted for use in punching or cutting metal or the like; and

FIG. 15 is a fragmentary, partially schematic and partially sectional view of a mechanism adapted for selective operation of the tool by an operator.

Referring now in more detail to the drawings, there has been selected for a detailed showing and description of an operative tool unit, a power driver for nails or the like. The tool is generally indicated at 20, and as can be seen the tool is of small dimensions, so as to be readily and easily grasped by a hand 22 of an operator. The overall dimensions of the tool, viewed from the top, is shown in full scale in FIG. 3. The device is connected to a suitable pneumatic source, such as air under pressure by line or tube 24. Due to its size, and the fact that a repetitive short stroke driving cycle is utilized, the tool can be manipulated easily in restricted areas as well as open working area.

This is more clearly illustrated in FIGS. 1 and 2 of the drawings. In FIG. 1 a partial or fragmentary section of a building structure is shown, including a post 26 for supporting a beam 28. A fragmentary portion of a ceiling is shown at 30, and a fragmentary portion of a wall at 32. This view depicts the operation of installing or mounting a connecting and reinforcing plate or bracket 34 by means of nails 36, spikes or the like. There is sufficient power or force applicable by the tool of the present invention, primarily resulting from the short repetitive work stroke thereof, that it is not necessary in many instances to preform or drill holes prior to driving or inserting a fastener through a plate.

Another example of an area of use for which the present device has been found to be especially suited, due to the ease of manipulation thereof, is fastening together members to prefabricate a roof truss or support structure. An example of this is shown in FIG. 2, where roof beams or rafter members 38 and 40 are to be interconnected at the peak of the truss by means of a gusset plate 42, preferably formed of metal. Nails, screws and the like 44 can be rapidly driven through such plates to join the members 38 and 40 together. A cross-bracing joint or rafter 46 can also be readily secured to the members 38 and 40 by plates 48 and 50, at opposite ends, by means of nails or other fasteners 52. Use of the tool of the present invention results in very rapid connections of this type.

The tool 20 principally includes a two part casing or housing 54, including a lower portion 56 and a cap portion 58 having a plurality of exhausting ports or slots 60 formed therein. The two portions of the casing or housing can be formed of any desired material, preferably, of a lightweight metal and formed by stamping or casting. Bolts or screws 62, or the like, are adapted to interconnect the two portions of the casing in an obvious manner. Interposed between the cap 58 and the lower portion 56 there is a gasket or seal 59, in order to insulate an airtight relationship therebetween and include valving mechanism, as will be explained.

The lower portion 56 has an open bottom end at 66 which is internally screw-threaded at 68. An open ended insert 70, in the nature of a screw-threaded spigot, is threadably engaged with threads 68, with the upper portion thereof extending into the body portion 80. A spacer 72, preferably consisting of a metal or other hard material, is interposed between the inner end of the insert 70 and the bottom of the cavity formed in lower portion 56 through opening 66. As will be pointed out, this spacer 72 can be varied in thickness and serve as one adjustment means for controlling the depth that a fastener is to be driven.

A detection sleeve, generally designated 74, is slidably mounted in the insert 70 and has a peripheral collar 76 for engagement with parts 78 of the tool, and is adapted for engagement with a circular abutment 78 formed in the interior or bore of the insert 70, at the lower end of an enlarged diameter bore portion 80, and by interconnection therewith serves as a lowermost positioning stop for sleeve 74. A spring 82 interengages between spacer 72 and the peripheral collar 76 and serves to pre-spring bias sleeve 74 to an extended outermost position with respect to the insert 70. As will be described, the sleeve 74 serves as a guide for maintaining the positive alignment of the driving end with a head of a fastener during driving, while also providing positive limit stops.

A driver is generally indicated at 84, having a driving rod 86 screw-threadably engaged with a piston 88 slidably mounted in an interior bore 90, formed within lower portion 56 of casing 54 with a shoulder surface 92. Interposed between the piston 88, and the lowermost surface 19 of the interior bore 90, is a resilient washer or pad 94 which constitutes and functions as a force absorbing bumper to dampen work strokes of the piston 88, to which is connected the driving rod 86, upon completion of its working stroke. The member 94 can consist of any resilient material, but preferably is of rubber or a synthetic material having substantially the same properties.

An enlarged bore 96 is formed in the lowermost end of sleeve 74, into which extends the lower end of driving rod 86, with a differential in diameters of the rod and bore being adapted for insertion therein and engagement by the tool of heads of securing of attaching items to be driven by the tool.

A cage valve in the form of a movable cylinder assembly 98 is slidably engaged with the inner surface of the
interior opening or bore 90, and consists of an upper portion or end 100 of generally frusto-conical configuration having a central opening or bore 102 therethrough. A cylindrical sleeve portion 104 is secured to the end 100 by means of screw threads or the like 106. Construction of the outer cage valve can assume different forms, but preferably is of a two part construction, interconnected one with another, to facilitate fabrication and insertion in the opening 90. The sleeve portion 104 has an enlarged ring 108 formed thereon. Annuar surface 110 at lower end of cylindrical sleeve 104 seals against surface 92, for purposes hereinafter to be described. A sleeve valve 114 is slidably mounted between the outer surfaces of sleeve 104 and bore 90. The air supply line 24 connects into main air inlet opening 120 into air supply chamber 118. A plurality of O-ring gaskets, generally designated 122, are positioned in, and between, various of the elements in order to insure an airtight seal therebetween. The piston member 88 has two spaced circumferentially O-ring seals 122a and 122b, which serve a vital function in the introduction of air for operating the over-all valve mechanism. An O-ring 122c is interposed between sleeve valve 114 and bore 90. An O-ring seal 122d is interposed between the exterior surface of ring 108 and the internal surface of opening 90. An upper O-ring 122e is interposed between the exterior surface of sleeve 104 and the internal surface of sleeve valve 114. A further O-ring seal 122f is interposed between the interior surface of cap 58 and the external surfaces of sleeve 104. The sealing gasket 124 insures an airtight seal between the cap 58 and lower portion 56 of casing 54.

A boss 126 is provided on the underside of cap portion 58, which serves in operation of the over-all valve mechanism to partially obstruct the central opening or bore 102, but is so dimensioned and shaped as to permit a bleeding of air therethrough during all periods of operation. A boss 128 is formed in the upper surface of the piston member 88, which serves during operation to close the lower end of opening 102. Its purpose will be subsequently described in more detail.

A plurality of ports are provided in the mechanism to permit admission of, and bleeding of air from, the interior of the tool whereby operation of the tool is effected. A port 130 extends from the interior of the air supply chamber 118 into a circular chamber 134 which is provided below the bottom of sleeve valve 114 and the upper surface of ring 108. A plurality of ports 136 extend through the wall of sleeve valve 114 and into annular surface 110 at lower end of cylindrical sleeve 104 contacting against surface 92. A multiple of elongated ports 142 are provided through the sleeve 104 for purposes of introducing air into chamber 144 formed by the upper side of piston 88 and the lower side of cylinder end 100. A port 146 extends through the open-ended insert 70 to permit air passage into a chamber 148, and permit atmospheric air to pass thereinto and through a flattened portion 150 on driving rod 86 to prevent a vacuum from being created on the lower side of piston 88 during operation.

An annular valve seal 64 is located in a recess on lower side of cap 58, and is made from a resilient material. The outer surface of upper end of valve sleeve 114 seats against seal 64 and the end of the sleeve valve is seated against surface 118, through elongated slots or ports 142 into chamber 144. The inner surface 18 at upper end of sleeve 114 does not contact seal 64 and remains exposed to chamber 144 for reasons which will be explained later.

Operation of the tool

FIG. 4 shows the inoperative condition of the tool, an air supply is connected to the tool and fills chamber 118, passes through port 130 into chamber 134. Air pressure in chamber 134 forces upwardly on lower end of sleeve valve 114 and seats upper end of sleeve valve 114 against seal 64, preventing air in chamber 118 from passing through ports 142 and into chamber 144. Air pressure in chamber 134 also forces downwardly on upper side of ring 108 and seating annular surface 110, at lower end of movable cylinder assembly 98, sealing off ports 138 from chamber 156. Air in chamber 134 passes through ports 136 and is sealed beyond this point by O-ring seals 122a and 122b on piston 88.

To cycle the tool, the point of the nail to be driven is placed against the receiving member or work-piece and the tool is placed on the head of the nail with the nail head inserted into bore 96 and in contact with end 17 of driver assembly 84. The initial movement of the tool is now started by pushing the tool toward the receiving member. During this initial movement of the tool toward the receiving member, the nail and driver assembly 84 are stationary. As this initial movement continues, ports 136 in cylinder assembly 98, are moved downwardly closer to lower O-ring seal 122b on driver assembly 88.

This initial movement also increases the volume of chamber 156, and in order to prevent a vacuum from forming in this chamber, the chamber is vented to atmosphere by way of ports 150, forming hole 150, 98. The flow of high pressure air into chamber 156 accelerates the driver assembly 84 rapidly upwardly and lower end 17 moves away from the head of the nail. As the driver assembly continues to move upwardly, boss 128 begins to enter bore 102 at the upper end of cylinder assembly 98. This part of the cycle is shown in FIG. 5. During the upward travel of the driver assembly to this position, the atmospheric air in chamber 144 is vented to atmosphere through bore 102 and ports 60 as indicated by arrows 158 in FIG. 6.

As the upward movement of the driver assembly continues, boss 128 enters bore 102, closing off chamber 144 to atmosphere. The trapped air now in chamber 144 begins to compress and increase in pressure until upper end of the driver assembly contacts lower side of cylinder end 100. This contact begins the initial upward movement of the cylinder assembly 98 and unseats the lower end 110 from surface 92. This exhausts chamber 156 to atmosphere through ports 138 as indicated by arrows 162 in FIG. 7. This position of the cycle is shown in FIG. 7.

The venting of chamber 156 to atmosphere through ports 138, also vents chamber 134 through ports 136 to atmosphere. Although high pressure air continues to flow into chamber 134 through port 130, the air pressure in chamber 134 is reduced to near atmospheric pressure, since multiples of ports 136 and ports 138 are substantially greater in area than single port 130. This reduction of air pressure in chamber 134 reduces the upward force on the lower end of sleeve valve 114. Surface 18 at upper end of sleeve valve is exposed to the compressed air that is trapped in chamber 144. This increased pressure on surface 18 is greater than the pressure at lower end of the sleeve valve and moves the valve downwardly. This opens high pressure air chamber 118 to chamber 144 by way of elongated slots 142. The flow of high pressure air into chamber 144, as indicated by arrows 160 in FIG. 8, starts the driver assembly downwardly and continues to move cylinder assembly 98 upwardly. As these two members continue to move in opposite directions, boss 128 on driver assembly leaves bore 102 and air in chamber 144
flows into bore 102. In order to prevent the high pressure air flowing into chamber 144 from exhausting to atmosphere through bore 102, boss 126 enters the upper end of bore 102 as the cylinder assembly moves upwardly. Boss 126 does not completely seal the exhaust of air from chamber 144 for reasons which will be explained in greater detail. At this point the sleeve valve 114 has moved down and the lower end has contacted ring 108 on the cylinder assembly, and is being moved upwardly by the cylinder assembly. This position of the cycle is shown in FIG. 8.

The cylinder assembly 98 moves in the opposite directions to the driver contacts bumper 94 and upper end of sleeve valve contacts seal 64, sealing off chamber 118 from chamber 144. This position of the cycle is shown in FIG. 10.

The continued upward movement of the cylinder assembly 98 during the complete downward movement of the driver 84, as just described, significantly reduces the recoil action of the tool and is a very important feature of the tool.

Although the cylinder assembly 98 has a much shorter stroke than the driver 84, the time required for both to complete their strokes is equal because the cylinder assembly is a heavier mass, and has less force moving it upwardly than what the driver has in moving it downwardly. The weight of the cylinder assembly is preferably approximately four times that of the driver.

As shown in FIG. 15, the driver 84 is driven and O-ring seal 122B has returned to its location ports 136 and closing chamber 134 off to atmosphere. This permits air in chamber 134 to return by way of port 130.

The high pressure in chamber 134 exerts a force down on upper side of ring 108, tending to move cylinder assembly 98 downwardly. However, the area of ring 108 that the high pressure air is acting upon, and tending to move it down, is less than the area that the high pressure air in chamber 144 is acting upon and holding the cylinder assembly upwardly. Therefore, the air pressure in chamber 144 must be reduced before the cylinder assembly is able to move down. It is for this purpose that boss 126 does not completely restrict bore 102, thus enabling the high pressure air in chamber 144 to bleed to atmosphere, as indicated by arrows 16 in FIG. 10, and reduce the pressure in chamber 144. When this pressure has reduced sufficiently, the forces on ring 108 moves the cylinder assembly 98 downwardly to the position shown in FIG. 15 for the driving cycle of the tool.

The actual driving of the nail does not begin until the driver 84 is in the approximate position shown in FIG. 9. From the time the driver is accelerated upwardly away from the head of the nail until the driver has resumed its downward travel, the driving end 17 is not in contact with the head of the nail. This is illustrated in FIG. 6.

The tool repeats its cycle as long as it is continued to be moved toward the workpiece into which the fastener is being driven until the sleeve engages the workpiece. When sleeve 74 contacts the workpiece, it begins to retract, as shown in FIG. 6. As the tool is continued to be moved toward the workpiece, washer 72 contacts upper end of sleeve 74 and limits any further movement of tool toward workpiece. This position of the tool is shown in FIG. 11. At this time the tool ceases to recycle, since the head of the nail is driven to its predetermined depth, and will not permit the initial movement of the tool that is required to move O-ring seal 122B past ports 136.

As shown in FIG. 11, the tool will counter-sink the nail to a depth approximately equal to the distance that end 17 of the driver extends beyond the end of sleeve 74, when sleeve 74 is fully retracted. Since the fully retracted position of the lower end of sleeve 74, relative to end 17 of driver, is controlled by the thickness of washer 72, the depth that the nail is driven is controlled by the thickness of washer 72. A thinner washer will counter-sink deeper and vice versa.

The form of the invention which is shown in FIG. 13 of the drawings has the same basic structure as that described with reference to the other figures and corresponding elements are similarly numbered. This embodiment is adapted for driving finish nails, and includes a construction which permits setting of the finish nails as is usual practice. In this form, the driving rod 86a has a lower end 86b, of a cross-sectional dimension no larger than the size of a finishing head nail indicated at 174. The lower end of the driving rod is preferably provided with a bevelled portion to insure that the material, adjacent to the head of the nail into which the nail is being driven is not defaced. The sleeve 175 has a bore 180 which, as compared with the bore dimensions in the preceding embodiment, is smaller and adapted to accommodate the lower end 86b of the driving rod 86a.

A bumper guard 182, formed of resilient material such as rubber, encompasses the lower end 184 of sleeve 178, and when a nail has been substantially completely driven it engages with the upper surface of the material to prevent marring of the surface, while still permitting a setting of the finish nail in the material. Preferably a cavity 186 is formed between the guard 182 and the bore 180 as shown in the drawing.

The operation of this embodiment of the invention is substantially identical with that of the preceding embodiment as far as driving and setting action is concerned. FIGS. 14 and 15 show a further embodiment utilizing the same principles of operation as in the preceding ones, but adapted for selective operation by a user. This construction is particularly suitable for use as a nibbler or punching tool, and a casing 188 therefor has a handle 190 with a trigger guard 194 thereon. A nibbler head 196 is attached to the lower end of the casing. This head 196 may be a nibbler rod 198 extending into a material receiving opening 200, and the nibbler rod is adapted for coaction with an anvil 202 or the like. The work stroke of nibbler rod 198 is substantially similar to that of the driving rods 86 and 86a in the other embodiments and it is adapted to the same driving mechanism, but its actuation is not effected by applying pressure against the lower end of the rod. A manual control means for actuation of the rod includes a pivotally mounted trigger 204, spring-biased to an inoperative position by a spring 206. The trigger at its inner end rotatably mounts a portal cylindrical valve 208.

An air inlet passage 210 is formed in the casing and enters into air chamber 118. An extension 212 of the air passage is also provided and which can be formed in any desired manner such as by drilling, with the ends being closed by plugs as indicated at 214. The inner end of passage extension 212 opens into port 156, which corresponds with the chamber 156 in the preceding embodiments. Upon actuating the trigger, the portal in cylindrical valve 208 opens communication from the air supply chamber to the passage extension 212, and thence air under pressure is admitted to chamber 156a. This serves the same function as placing a force upon the driving rod in the preceding embodiments. As will be obvious, operation of this form of the invention is selective at the discretion of the user upon actuation of the trigger.

The embodiment of the invention all utilize the same basic structure and their sequential operation will be readily understood.

Although the invention has been herein shown and described in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed but subject to the full scope of the claims herein and as so to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A pneumatically operated impact tool adapted for a reciprocating working movement, comprising a hous-
ing, a chamber containing air under pressure associated with the housing, means slidably mounted in the housing for controlling the passage of said air into and from the housing, a driving member having a portion thereof operatively extending into the interior of said housing, and having working end extension therefor for coaction with an item to be driven, and a piston slidably mounted in said means, said piston being operatively connected to said driving member for operation thereof, said means in said housing being operable for selective introduction of the air on opposite sides of said piston for recirculating movement thereof and to impart a reciprocating stroke movement to said driving member connected to said piston.

2. A tool as claimed in claim 1, said means having a port leading from said air chamber into the interior of said housing, said piston having spaced sealing means connected thereto, and operable in one position of said piston to prevent flow of air into said housing, said driving member being operable, when pressure is applied against the working end thereof, to move said piston to a position partially remote from the base of said housing with respect to said port, to admit air under pressure against a face of said piston and operable to further move said piston to a remote position.

3. A tool as claimed in claim 1, said means including a moveable cage valve having a top portion and a depending sleeve connected thereto, and being slidably mounted in the interior of said housing, said sleeve having a port therethrough, means defining a circular chamber interposed between said air chamber and said sleeve and adapted to permit airflow through said port from said air chamber into and through said ports in said sleeve.

4. A tool as claimed in claim 3 including a cylindrical sleeve valve slidably interposed between said air chamber and said sleeve on said cage valve, and being movable in said housing.

5. A tool as claimed in claim 4 including a ring formed on said sleeve on said cage valve at one end thereof, said ports in said sleeve being positioned substantially at the inner face of said ring, a foot portion formed on said ring at the extremity thereof, partially extending over the face of said ring, to form a contact surface thereon adapted for sealing engagement with an interior surface of said housing, and a plurality of ports in said housing peripherally disposed thereabout extending from said contact surface into said housing for venting to the atmosphere from beneath said piston when said cage valve is so moved as to space said foot portion from the contactable interior surface of said housing to thereby relieve air pressure under the piston in said housing.

6. A tool as claimed in claim 5 in which said piston is cup-shaped and directed into the interior of said housing with the side flange thereof carrying said sealing means, and a centrally disposed boss extending into the interior of the cup-shaped piston, said working end of said driving member being mounted in said boss.

7. A tool as claimed in claim 6 in which said housing has a chamber formed between an inner surface thereof and the outer end of the top portion of said cage valve, said housing having a plurality of vents opening from said chamber to the exterior of said housing and constituting vents to the atmosphere for air between the top portion of the cage valve and the interior surface of the housing adjacent thereto during operation of said tool, said top portion of said cage valve having a bore there-through interconnecting the interior of said housing between said top portion and said cup-shaped piston with said chamber above said top portion extending into and through the bore having a smaller diameter, said reduced diameter end portion being adapted for engagement with the top of a finish nail, a resilient collar mounted on and surrounding the end of said base extending beyond the outer face thereof, and adapted for resilient contact with a surface into which a finish nail may be driven, adapted to be driven through a portion of said housing from the outside, while permitting setting of a finish nail into material into which driven.

8. A tool as claimed in claim 7 in which said cage valve has a peripheral slot therein between said top portion and said cylindrical sleeve, operable upon downward movement of said sleeve valve to permit entry of air from said air chamber through said peripheral groove to the space between the inner surface of said piston and inner surface of said top portion of said cage valve, to create a zone of high air pressure therebetween to impel said piston and working member connected thereto in a working stroke direction and movement.

9. In a tool as claimed in claim 8, means comprising a resilient bumper in said housing interposed between the surface of said cup-shaped piston adjacent to the interior surface of said housing, and adapted to resiliently absorb impact forces upon completion of a working stroke of said driving member.

10. A tool as claimed in claim 9 including an open ended insert secured to an end of said housing having a bore therethrough, into and through which said working end of said driving member extends a sleeve slidably mounted in said bore in said open ended insert, a circular flange on said sleeve intermediate the ends thereof, spacer means between the inner end of said sleeve and said boss, a spring engaging above said bore and resilient means interposed between said spacer and said flange biasing said sleeve to an outermost position with respect to said open ended insert.

11. A tool as claimed in claim 10 in which said working end of said driving member comprises a rod having a flattened portion thereon, said resilient means and said housing having a passage therethrough connectable with said flat portion on said rod, and a vent opening extending through said open ended insert and in open communication with the passageway formed by said flattened portion and passageway therebetween.

12. A tool as claimed in claim 11 in which said slidably mounted sleeve has an enlarged end bore therein, and into which extends the outer working end of said driving member, said enlarged end bore being adapted to receive an item to be driven by said tool and permit engagement therewith and the end of said working member said sleeve being resiliently retractable into the interior of said open ended insert against the pressure of said resilient means upon contact with a surface into which an item is to be driven by means of said tool, coaction between said flange and said open ended insert constituting an outermost position stop means for extension of said sleeve outwardly of said open ended insert.

13. A tool as claimed in claim 12 including sealing means on the interior surfaces of said housing, sealing means on the external surfaces of said sleeve portion of said cage valve, and the exterior surface of said sleeve valve, adapted to prevent leakage of pressurized air between said members during operational phases of said tool.

14. A tool as claimed in claim 13 in which said sleeve has bores of different diameters therein, said working end having a reduced diameter portion extending into and through the bore having a smaller diameter, said reduced diameter end portion being adapted for engagement with the top of a finish nail, a resilient collar mounted on and surrounding the end of said base extending beyond the outer face thereof, and adapted for resilient contact with a surface into which a finish nail is to be driven, adapted to be driven through a portion of said housing from the outside, while permitting setting of a finish nail into material into which driven.

15. A tool as claimed in claim 1, said piston having axially spaced sealing means connected thereto and operable in one position of said piston to prevent flow of air
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into the interior of said housing, said piston having a peripheral chamber at the outer edge thereof, air inlet duct means extending between said air supply chamber and said peripheral chamber, a slotted cylindrical valve in said housing, operating means connected to said cylindrical valve, and resilient means urging said operating means and said cylindrical valve to a position closing said duct means, being selectively operable to rotate said cylindrical valve to intercommunicate the port therein with said duct means for introduction of air under pressure from said air supply chamber through said duct means into said peripheral chamber on said piston, adapted to move said piston to a position partially remote from the base of said housing with respect to said port, to thereby open said port to admit air under pressure from said air supply chamber against a face of said piston, and operable to further move said piston to a remote position for subsequent initiation of a work stroke thereby.

16. A tool as claimed in claim 15 including a nibbler head secured to the outer end of said housing, said nibbler head having a slot formed therein into which said working end of said driving member operatively extends, and an anvil disposed at the opposite surface of said slot adapted for working engagement with said working end during said oscillating stroke movement of said driving member, oscillating stroke movement of said working end being selectively controlled by rotation of said cylindrical valve to control work cycles of said tool.

17. A tool as claimed in claim 1 in which sliding of said means is initiated by coaction of said working end of said driver with an item to be driven.

18. A tool as claimed in claim 1, said means including a mass movable in an opposite direction with respect to said driving means during an item driving stroke of said driving member for reducing the recoil of the housing.

19. An impact tool comprising a housing, a driver mounted in the housing for movement between an extended position and a position inwardly therefrom, powered drive means mounted in the housing and connected to the driver adapted to motivate the driver in successive impact and retraction strokes for performing work on a workpiece, actuation of said means being initiated by displacement of the driver inwardly from the extended position thereof, and means operatively connected to said means for detecting when the driver has reached the inner limit of its movement, said means including an elongated chamber extending longitudinally of the driver and having an inner limit of movement precluding inward displacement of the driver for automatically interrupting motivation thereof.

20. The impact tool of claim 19 in which the driver is adapted to drive an element into a workpiece, and the inner limit of movement of the detection means is adjustable for predetermining the extent to which the element is driven into the workpiece.

21. The impact tool of claim 19 in which the detection means includes a sleeve moveable between predetermined extended and retracted positions, and resilient means urging the sleeve into extended position.

22. An impact tool comprising a housing; an elongated driver mounted in the housing for reciprocal longitudinal movement between predetermined extended and retracted positions and having an end extended from the housing; powered drive means mounted in the housing and connected to the driver for reciprocating the driver between its extended and retracted positions, said drive means being rendered inactive when the driver is in extended position and actuated sequentially to move the driver to retracted position and thence to extended position whenever the driver is displaced inwardly from extended position, as by engagement with an element to be driven into a workpiece; a detection sleeve having an extended end outwardly disposed for workpiece engagement mounted on the housing in circumferential relation to the driver for reciprocal longitudinal movement between an extended position with its extended end in predetermined relation to the extended end of the driver when the driver is in extended position and a retracted position inwardly of its said extended position; resilient means urging the detection sleeve into extended position; and means interconnecting the detection sleeve and the drive means rendering the drive means inoperable when the detection sleeve is displaced inwardly from its extended position.

23. The impact tool of claim 22 in which the extended end of the detection sleeve is outwardly disposed from the extended end of the driver when the sleeve and driver are in their respective extended positions and is adjacent to the extended end of the driver when the driver is in extended position and the detection sleeve is in retracted position.

24. An impact tool comprising a housing, a driver mounted in the housing for movement between an extended position and a retracted position, powered drive means mounted in the housing and connected to the driver adapted to motivate the driver in successive impact and retraction strokes for performing work on a workpiece, control means interconnecting the driver and the drive means actuating the drive means in response to displacement of the driver inwardly from the extended position thereof, and detection means mounted on the housing adjacent to the driver and disposed for workpiece engagement at a position in predetermined longitudinal relation to the driver such that when in workpiece engagement the detection means precludes inward displacement of the driver sufficiently to actuate the drive means.

25. In an impact tool comprising a housing having an elongated chamber therein providing opposite ends, a driver mounted in the chamber for reciprocal movement longitudinally thereof, a mass member mounted in the chamber adjacent to the driver for reciprocal movement longitudinally of the chamber, a workpiece engaging element connected to the driver and extended from the housing, a source of gas under pressure, and a valve system responsive to the source of gas to control engagement of the workpiece and the mass member sequentially to supply gas under pressure and to release the same at said connections oppositely to reciprocate the driver and the mass member whereby the workpiece engaging element is reciprocated in successive drive and retraction strokes and the mass member minimizes recoil effect of the driver.

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