Jan. 1, 1963 C. S. HARDY, SR 3,071,114

PNEUMATIC IMPACT TOOL

Filed Nov. 7, 1960

Fig. 4.

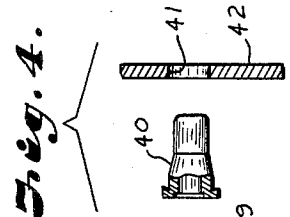


Fig. 1.

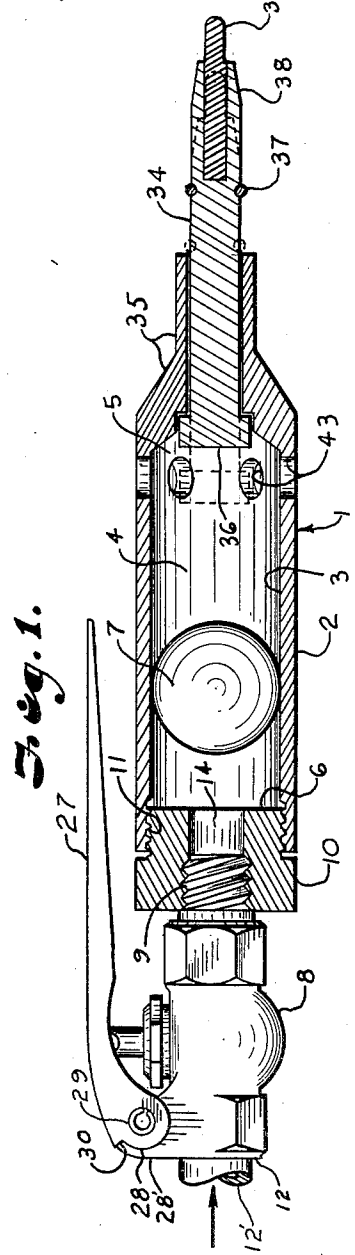


Fig. 2.

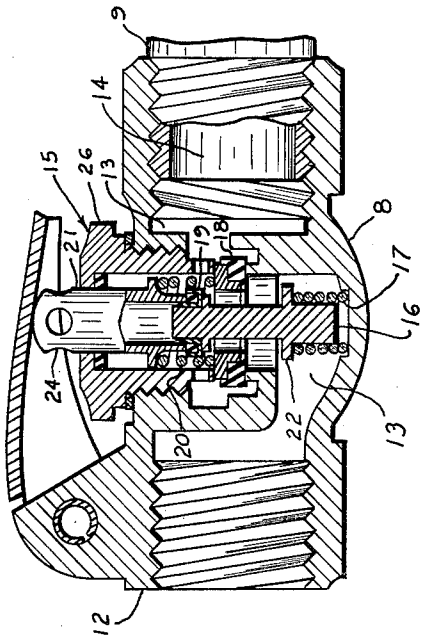
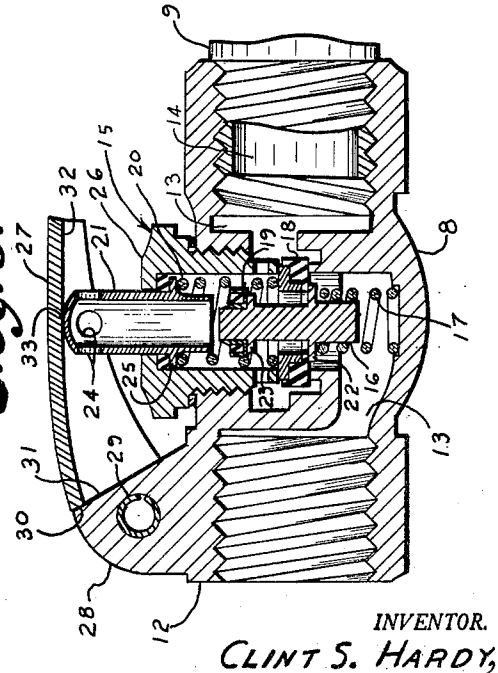


Fig. 3.



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United States Patent Office 3,071,114 Patented Jan. 1, 1963

3,071,114
PNEUMATIC IMPACT TOOL

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Filed Nov. 7, 1960, Ser. No. 67,600
3 Claims. (Cl. 121—21)

This invention relates to an impact tool, and more particularly to a pneumatic hammer or like device of simple and rugged construction.

The principal objects of the present invention are; to provide a pneumatic impact tool which does not require the use of springs or auxiliary pressure-directing devices to return the reciprocable piston to impact cycle beginning position; to provide a percussive instrument which is adapted to make use of an easily available ball as the reciprocable piston; to provide such a device which is extremely simple in construction and, thus, inexpensive to build and maintain; to provide such a device which is rugged in operation; to provide a movable piston impact tool in which air is automatically exhausted from behind the piston on the return stroke; and to provide such a device which is adapted to take advantage of gravity for return cycling.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a sectional view of the impact tool showing the reciprocal spherical piston therein, the retracted position of the punch being shown in broken lines.

FIG. 2 is a sectional view of the valve mechanism for controlling compressed air entering the impact tool chamber, said mechanism being shown in the air entering position.

FIG. 3 is a sectional view of the valve mechanism with the mechanism shown in the chamber exhaust position.

FIG. 4 is an exploded view showing a retaining cap positioned for insertion into a wall structure by means of the impact tool.

Referring to the drawings in more detail:

The reference numeral 1 indicates generally the pneumatic impact tool comprising this invention. The tool 1 is composed of a hollow elongated body member or cylinder 2 having an internal cylindrical surface 3 forming a piston chamber 4 of substantially constant internal diameter along the major length thereof. The piston chamber 4 has a front end 5 and a rear end 6. A piston 7 of spherical shape is freely reciprocal longitudinally in the chamber 4, but has only slight radial clearance therewith so as to provide a minimum of gas leakage therebetween. A valve body 8 is suitably secured in communication with said chamber 4 and in the illustrated structure is secured by means of a threaded nipple 9 and a reducing nut 10 to an internally threaded portion 11 of the rear of the cylinder whereby said nut 10 forms the rear end 6 of the chamber 4.

The upstream end 12 of the valve body 8 is connected to a source of air 12' under super-atmospheric pressure. The valve body 8 contains a passageway 13 therethrough which provides communication between the air source 12' at the upstream end 12 of the valve body 8 and the passageway 14 in the reducing nut 10 which leads into the piston chamber 4.

The valve body 8 contains a valve mechanism generally noted at 15 (FIG. 3) which is comprised of a valve stem 16, a valve closure spring 17, a pressure valve seat 18, an exhaust valve seat 19, an exhaust valve opening spring 20, and a hollow exhaust stem 21. The valve stem 16 carries a lower annular flange 22 which forms the pressure valve for obstructing the passageway 13. The valve

stem 16 also carries an upper annular flange 23 which supports the exhaust valve seat 19. The hollow exhaust stem 21 is pierced at the upper end thereof by exhaust ports 24 and exhibits at the lower portion thereof an annular flange 25 which contacts the exhaust valve opening spring 20. The valve mechanism 15 is maintained in proper relation in the valve body 8 by means of a hollow externally threaded nut 26 which screws thereinto.

A trigger or control lever 27 is pivotally secured at the rear end 28 thereof to a raised portion 28' of the valve body 8 by means of a roll pin 29 or the like. The rear and 28 of the trigger 27 exhibits an offset or step portion 30 which engages or interfaces with a wall 31 of the raised portion 28' to limit the pivotal motion of the trigger 27 in the direction away from the cylinder 2. The under side 32 of the trigger 27 contacts the upper end of the hollow exhaust stem 21 at 33.

An elongated punch 34 is maintained coaxial with the cylinder 2 at the front end 5 of the piston chamber 4 by means of an integral guide sleeve 35 extending forwardly from the cylinder 2. The punch 34 is freely longitudinally reciprocal with respect to the chamber 2 and has a rearwardly facing enlarged piston-contacting head 36 on one end thereof and an annular stop ring 37 on the body thereof. The head 36 and ring 37 are respectively alternately contactable with the guide sleeve 35 of the cylinder 2 to define the limits of reciprocation thereof. The forward or outer end 38 of the punch 34 retains a tool tip 39 of a suitable shape to perform a desired impact tool function.

In the device illustrated, the tool tip 39 is adapted to receive and retain a plastic cap 40 which is to be driven into a receiving bore or hole 41 extending through a plate or wall 42, the plastic cap 40 forming a socket for anchoring strip material or the like (not shown) to the plate or wall 42.

A plurality of radial ports 43 are located adjacent the front end of the cylinder 2 to permit the rapid exhaust of air trapped in the piston chamber 4 as the piston 7 moves toward the punch head 36.

The impact tool 1 is intended and adapted to be operated while tilted upwardly from the horizontal. Thus, the return of the spherical piston 7 and the punch 34 to a cycle-beginning position is effected by gravity.

In operation, the plastic cap 40 is inserted over the tool tip 39. The effects of gravity maintain the cap 40 on the tip 39 and the stop ring 37 against the guide sleeve 35, and the spherical piston 7 adjacent the rear end 6 of the cylinder 2. The tool tip 39 is then aligned with the hole 41 in preparation for driving the plastic cap 40 thereinto. The trigger 27 is then pressed toward the cylinder 2, urging the hollow exhaust stem 21 against the exhaust valve seat 19 and preventing communication between the exhaust ports 24 and the passageway 14. The further depression of the trigger 27 urges the lower annular flange 22 of the valve stem 16 away from the valve seat 18, permitting compressed air to pass through the passageways 13 and 14 into the chamber 4 and urging the spherical piston 7 against the punch head 36. The kenetic energy imparted to the piston 7 is transferred through the punch 34 to the tool tip 39 and forces the plastic cap 40 into the receiving hole 41. After the completion of the impact cycle, the trigger 27 is released, permitting the valve closure spring 17 and the exhaust valve opening spring 20 to urge the valve stem 16 and the exhaust stem 21 upwardly as a unit until the annular flange 22 seats against the valve seat 18 shutting off the flow of compressed air through the passageway 13. The exhaust valve opening spring 20, however, continues to urge the hollow exhaust stem 21 upwardly, separating same from the exhaust valve seat 19, thus permitting the air trapped between the pis-

ton 7 and the rear end 6 of the cylinder 2 to exhaust through the ports 24 as the piston 7 returns to the cycle-beginning position.

It is evident that the configuration of this impact tool is very simple as compared with tools which are known to be adapted for the same or a similar purpose. The spherical piston 7 may be in the form of a commonly available ball such as used in ball bearings, and the construction of the device permits gravity to perform the important functions which result in resetting the device for the next cycle. The intensity of the impact force may be easily controlled by regulating the pneumatic pressure in the air source 12'.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What I claim and desire to secure by Letters Patent is:

1. A pneumatic impact tool adapted to operate while tilted upwardly from the horizontal comprising in combination, a hollow elongated cylinder of substantially constant internal diameter along the major length thereof forming a piston chamber having a front end and a rear end, exhaust means located adjacent said front end, a spherical piston freely reciprocal longitudinally in said chamber, a valve for selectively delivering compressed air into said rear end of said chamber, said valve being adapted to alternately control the admittance of air into said chamber and permit the exhaustion of air contained in said chamber between said piston and said rear end, a trigger for actuating said valve, a punch, means maintaining said punch coaxial with said cylinder at the front end of said chamber, said punch being freely longitudinally reciprocal with respect to said chamber and having a rearwardly facing piston-contacting head on one end thereof and means defining the limits of reciprocation of said punch, whereby said piston and said punch are urged to an impact cycle beginning position due to gravity.

2. A pneumatic impact tool adapted to operate while tilted upwardly from the horizontal comprising in combination, a hollow elongated cylinder of substantially constant internal diameter along the major length thereof forming a piston chamber having a front end and a rear end, a plurality of radial ports located adjacent said front end, a spherical piston freely reciprocal longitudinally in said chamber, a valve body secured to said cylinder at the rear end of said chamber and provided with a source of air under super-atmospheric pressure, said valve body providing communication between said rear end of said chamber and said air source, a valve mechanism in said valve body, a trigger pivotally secured to said valve body for actuating said valve mechanism, and a punch, means maintaining said punch coaxial with said cylinder at the front end of said chamber, said punch being freely longitudinally reciprocal with respect to said chamber and having a rearwardly facing piston-contacting head on one end thereof and an annular stop ring on the body thereof, said head and ring respectively being contactable with said cylinder to define the limits of reciprocation of said punch, whereby said piston and said punch are urged toward an impact cycle beginning position due to gravity.

3. A pneumatic impact tool adapted to operate while tilted upwardly from the horizontal comprising in combination, a hollow elongated cylinder of substantially constant internal diameter along the major length thereof forming a piston chamber having a front end and a rear end, a plurality of radial ports located adjacent said front end, a spherical piston freely reciprocal longitudinally in said chamber, a valve body secured to said cylinder at the rear end of said chamber and provided with a source of air under super-atmospheric pressure, said valve body providing communication between said rear end of said chamber and said air source, a valve mechanism in said valve body adapted to alternately control the admittance of air into said chamber from said air source and permit the exhaustion of air contained in said chamber between said piston and said rear end, a trigger pivotally secured to said valve body for actuating said valve mechanism, and a punch, means maintaining said punch coaxial with said cylinder at the front end of said chamber, said punch being freely longitudinally reciprocal with respect to said chamber and having a rearwardly facing piston-contacting head on one end thereof and an annular stop ring on the body thereof, said head and ring respectively being contactable with said cylinder to define the limits of reciprocation of said punch, whereby said piston and said punch are urged toward an impact cycle beginning position due to gravity.

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