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SINGLE STROKE AIR HAMMER

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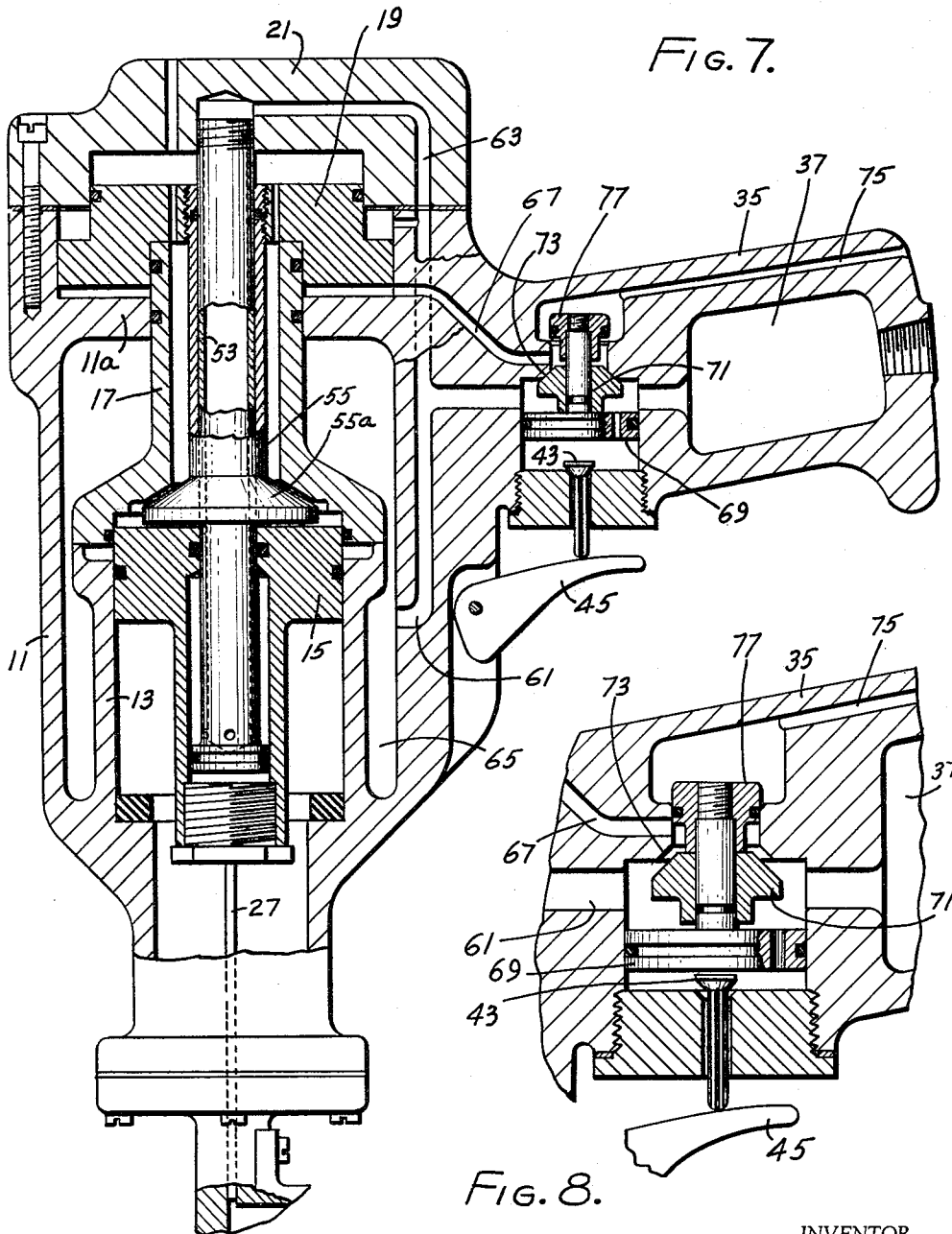


FIG. 7.

FIG. 8.

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SINGLE STROKE AIR HAMMER

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17 Claims. (Cl. 121—13)

This invention relates to an improved single stroke air hammer and has for one of its principal objects the provision of a device of the class described which will more efficiently drive staples, nails, or other fasteners.

The present invention contemplates an improvement over prior patent No. 2,774,968, granted to me and Oda J. Garant on December 25, 1956.

The invention also comprises a distinctive improvement and further developments over my invention entitled "Fluid-Actuated Fastener-Appling Machine," application for patent on which was filed on October 17, 1955, Serial No. 540,921, now United States Patent No. 2,854,953.

The structure of this invention also relates to a further development of another invention of mine entitled "Pneumatic Hammer and Nailer" for which invention I filed an application for patent on April 30, 1957, Serial No. 655,992.

One of the important objects of this invention is to provide a single stroke air hammer which operates under constant load or line pressure and where the actual driving operation results from an exhaust of a predetermined portion of air from a designated space in the apparatus.

Another important object of the invention relates to the fact that the exhaust valve for the air is so arranged that it closes completely before the main operating valve opens.

Another and still further important object of the invention resides in the fact that the driving piston is not released until the main valve is fully opened, whereby the driving tool operates at a maximum efficiency.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings:

Figure 1 is a vertical section of the improved single stroke air hammer of this invention, showing the same in normal position for an immediate staple- or nail-driving operation.

Figure 2 is a horizontal section taken on the line 2—2 of Figure 1 looking in the direction indicated by the arrows.

Figure 3 is a smaller detail view illustrating the first step of movement of the related parts of the air hammer of this invention immediately following operation of the trigger to open the exhaust valve.

Figure 4 is a view similar to Figure 3 and illustrating the next position of the apparatus.

Figure 5 is a view similar to both Figures 3 and 4 showing the driving piston at the bottom or end of its operating stroke.

Figure 6 illustrates the parts in a return position following the staple-driving operation.

Figure 7 is a view somewhat similar to the showing of Figure 1, but illustrating a slightly modified form of the invention.

Figure 8 is a detail view of a portion of the structure of Figure 7 showing the release valve in open position as distinguished from the closed position of Figure 7.

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As shown in the drawings:

The reference numeral 10 indicates generally the casing of the improved single stroke air hammer of this invention which may be a casting, machined part or the like, and which is preferably cylindrical in cross section as shown in Figure 2.

The casing includes an intermediate cylindrical portion 12 in which a piston 14 operates, and a combination truncated cone and cylinder element 16 is fitted onto the upper end of the inner cylinder 12.

The upper end of the element 16 is surmounted by an annulus 18 fitted into the upper end of the case 10, and a closure cap 20 is held in position on the upper end of the assembled structure by means of bolts or the like 22.

The lower end of the main cylinder 10 is reduced, as shown at 10a, and this is closed by a plate or cap 24 through which the plunger 26 passes. The plunger drives staples, nails, or the like 30 in the usual manner from a magazine 32.

The main casing 10 includes as an integral or separate portion a handle element 34 which is hollow as at 36 to admit air under constant pressure from a source 38.

This handle element also includes a bushing 40 provided with a central opening for the reception of a valve and stem 42, the valve being operated by a trigger 44 pivoted at 46 in bifurcations 48 of the main casing 10.

A support 50 for the hammer element 26 is removably mounted in the cylindrical extension 14a of the piston 14, and this extension is hollow for the slidable reception of a tubular element 52. The upper end of the tubular element 52 is screw-threaded or otherwise fitted into a corresponding recess in the closure cap 20, and a combination truncated cone and cylindrical element 54—54a slidably supports the upper end of the tube 52. The upper end of the cylinder 54 is screw-threaded to fit into a tapped central opening in the annulus 18.

Proper sealing elements or gaskets, preferably in the form of O-rings or the like 56, are provided at strategic points in the construction.

In operation, it will be noted that air under constant predetermined pressure enters the chamber 36 in the handle 34 and thence passes through channels 58, 60 and 62 to the space 64 between the outer and inner cylinders 10 and 12 and to the interior of the tube 52, respectively. Openings 66 are provided at the bottom of the tube 52, whereby the air can enter a space 68 exteriorly of the lower end of the tube 52 and inside the cylindrical portion 14a of the main operating piston 14.

Air in the space 64 exits through a restricted opening 70 in the annulus 18 to a space 72 above the annulus 18 and thence through a passageway or line 74 to a space 76 in the handle 34, which space is provided for the operative reception of the valve 42.

It will be noted that the space 78 above the piston 14 is normally open to the atmosphere by way of an adjacent space 80 between the sleeves 16 and 54 thence through passages 82 in the annulus 18, the recess 84 and a further opening 86 in the cap 20. In this manner, air pressure in the space 68 maintains the piston 14 in the position shown in Figure 1. The space 88 below the piston is open to the atmosphere either by way of a vent or around the hammer element 26. A resilient bumper or cushion 90 is fitted onto a shoulder in the lower end of the cylinder 12 for cushioning contact by the piston 14 at the end of its stroke.

From Figures 3, 4 and 5 and the various arrows, it will be evident that as soon as the trigger 44 is operated to open the valve 42, air will escape from the space 72 through the passages 74 and 76. Compressed air from the inlet 38 and chamber 36 will pass through the channels 58 and 60 to the space 64 beneath the annulus 18, forcing it upwardly. This raises the elements 54, 54a

and 16, leaving a space between the lower edge of the element 16 and the upper periphery of the inner cylinder 12. Further upward movement allows air to enter the space above the piston 14, whereupon it, with the hammer 26, is driven downwardly. It will be noted that the upper edge of the piston 14 moves out of the recess in the lower end of the element 16 adjacent a sealing element 56.

When the piston reaches the bottom of its stroke and contacts the bumper 90, all as shown in Figure 5, the trigger 44 having in the meantime been released thereby reseating the valve 42, compressed air will reverse its flow through the tube 52 to initiate a return move of the piston and air will be exhausted through the passage 70 in the annulus 18 to move it downwardly, completing a contact between the upper edge of the cylinder 12 and the lower face of the element 16, whereupon the piston will continue to move upwardly, as shown in Figure 6, to reseat itself.

In the modified form of the invention, shown in Figures 7 and 8, air under constant pressure in the chamber 37 in the handle 35 will pass through the channels 61 and 63 to the space 65 and the interior of the tube 53, respectively. The space 65 is between the walls of the cylinders 11 and 13 and the exterior of the cylinder and cone combination 17. The piston 15 is similar in construction to the piston 14 of Figure 1 and operates a hammer 27. A combination tube and frusto-conical element 55 and 55a is provided similar to the corresponding elements in Figure 1, and these are fitted into an annulus 19.

A channel 67 leads to a space beneath the annulus 19, and a web 11a, forming part of the outer cylinder 11 and a closure cap 21, is provided.

A valve 43 is operated by a trigger 45, and a piston 69 moves in a cylindrical aperture in the handle 35, this being fitted with a valve element 71 which in turn operates against the valve seat 73, formed in the upper end of the piston aperture.

An air exhaust line 75 is in the handle 35, and a control valve 77 operates on a seat in a space between the channels 67 and 75.

When the trigger 45 is operated to open the valve 43 (Figure 8), pressure from 37 will move the piston 69 downwardly, opening the valve 71, but simultaneously closing the valve 77. This causes a reversed flow of air through the channel 67, and the resultant operation of the piston, its hammer and appurtenances is substantially the same as that previously described.

It will be evident that herein is provided a novel and particularly efficient single stroke air hammer which operates a piston normally sealed in a cup-shaped space and a valve element which, when the valve is almost open due to trigger action, will contact the plug in the end of the piston, forcing a dislodgment of same from its cup-shaped receptacle and allowing a driving motion with a concentrated complete charge of compressed air operating on the piston head. The main valve seat is constructed so as to be larger than the bore in order to obtain the desired percussive action.

Obviously, other fluid action besides air can be employed in the construction of this invention with little or no change in the apparatus.

I am aware that many changes may be made and numerous details of construction varied throughout a wide range without departing from the principles of this invention; and I, therefore, do not propose limiting the patent granted hereon otherwise than as necessitated by the prior art.

I claim as my invention:

1. A single stroke air hammer comprising an outer cylinder, an inner cylinder, a piston reciprocably movable in the inner cylinder, an annulus movable in the outer cylinder above said piston, a frusto-conical closure normally in contact with the upper edge of the inner cylinder, a cup-shaped recess in the closure for the normal reception of the upper end of the piston, a driving

hammer connected to the piston, first air conduit means beneath said annulus, second air conduit means above said annulus, and valve means in operative relationship with said second air conduit means.

2. A device as described in claim 1, wherein a closure is provided for the upper end of the main cylinder and wherein a tube is centrally fixed in the closure.

3. A device as described in claim 2, wherein the piston is provided with a central chamber and wherein the lower end of the tube extends into and communicates with said central chamber.

4. A device as described in claim 3, wherein a sleeve slidably surmounts the upper end of the tube, said sleeve provided with a frusto-conical lower extension.

5. A device as described in claim 4, wherein the frusto-conical extension of the sleeve is in operative contact with the inner face of the cup-shaped recess in the closure for the inner cylinder.

6. A device as described in claim 5, wherein the upper cylindrical end of the cup-shaped closure is slidably fitted into a central recess in the annulus.

7. A device as described in claim 6, wherein passageways are provided in the annulus leading from the central recess.

8. A device as described in claim 7, wherein an additional passageway is provided in the annulus.

9. A device as described in claim 5, wherein the upper end of the sleeve is fixed in the annulus.

10. A device as described in claim 1, wherein the upper end of the piston moves out of its cup-shaped recess in the driving operation.

11. A device as described in claim 10, wherein the frusto-conical closure moves away from the upper edge of the inner cylinder to initiate the driving operation.

12. A device as described in claim 1, wherein a handle forms part of the cylinder construction, said handle having a recess therein for the admission of air under pressure to the cylinders.

13. A single stroke air hammer comprising a main cylinder, a secondary cylinder in the main cylinder, a piston reciprocably movable in the secondary cylinder, a transverse web in the main cylinder, an annulus above the web movable in the main cylinder, a closure for the upper end of the main cylinder, a cup-shaped recess in the inner face of the closure for the slidable reception of a portion of the annulus, a hollow stem for the piston, a tube fixed in the closure and extending into the stem of the piston, a space between the tube and the inner face of the piston stem, air passages between the tube and said space, first air conduit means beneath said annulus, second air conduit means above said annulus, and valve means in operative relationship with said second air conduit means.

14. A device as described in claim 13, wherein an operating handle is on the main cylinder, said operating handle having passages therein for air under pressure and exhaust air and a compound valve operating in both passages.

15. A device as described in claim 14, wherein a cylinder is provided in the handle for the reception of the compound valve, a piston movable in the cylinder and a trigger operated valve below the piston.

16. A device as described in claim 15, wherein the piston is provided with an opening therethrough for passage of exhaust air to the valve.

17. A device as described in claim 16, wherein the compound valve is connected to the piston, and wherein said valve simultaneously controls influx of air under pressure and exhaust air.

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