United States Patent

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[54] **PNEUMATICALLY ACTUATED STAPLING TOOL**
5 Claims, 2 Drawing Figs.

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[50] **Field of Search** 227/130

[56] **References Cited**
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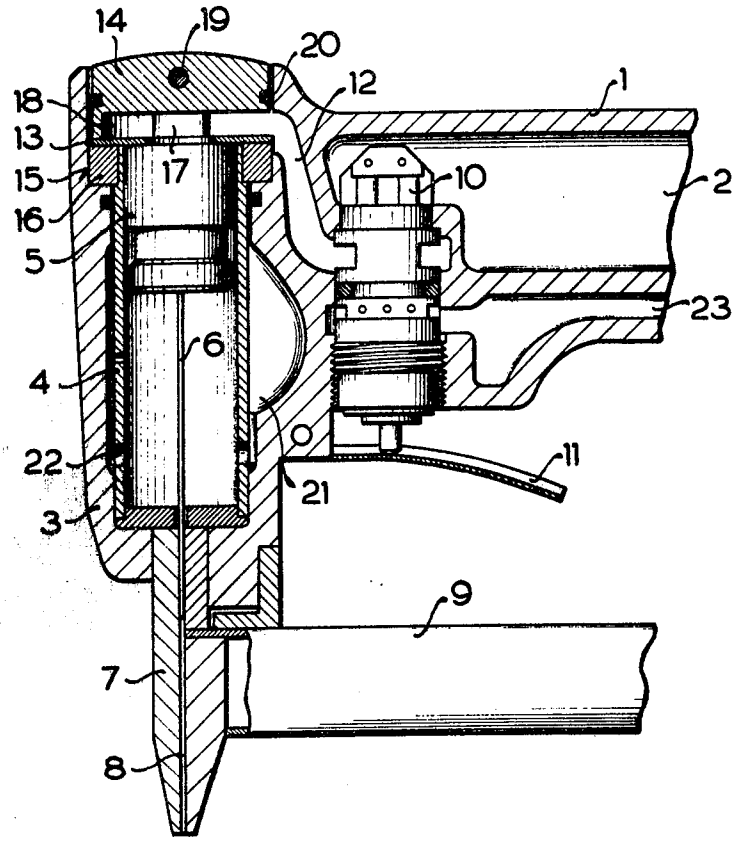
ABSTRACT: In a stapling device in which air under pressure is used both to actuate a piston on a staple driving stroke and to return the piston to its initial position, the piston is held in this position by a magnet which is mounted in a cylinder housing in such a manner that its magnetic field surrounds a portion of the piston when in its initial position.



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SHEET 1 OF 2

FIG.1

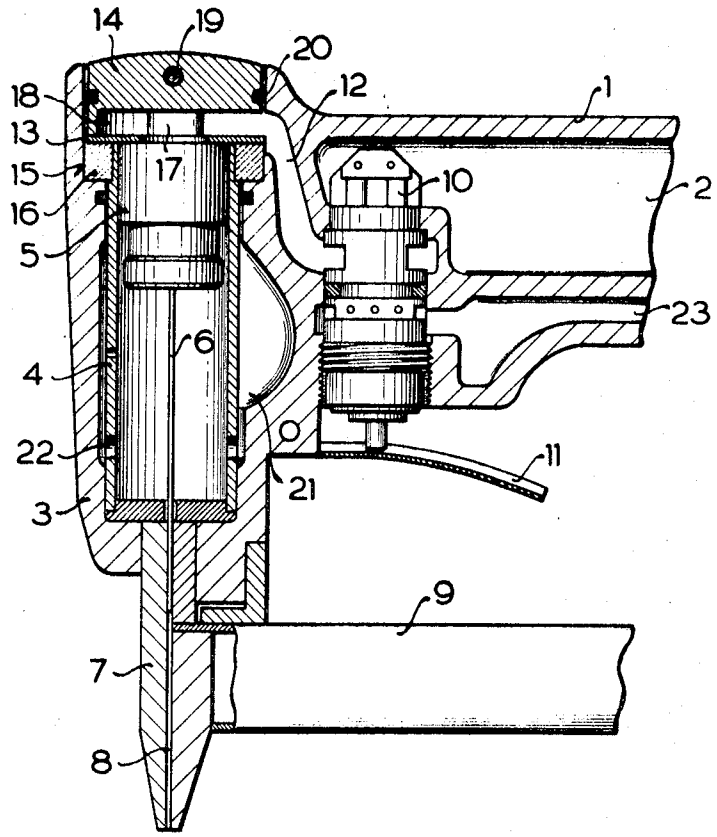

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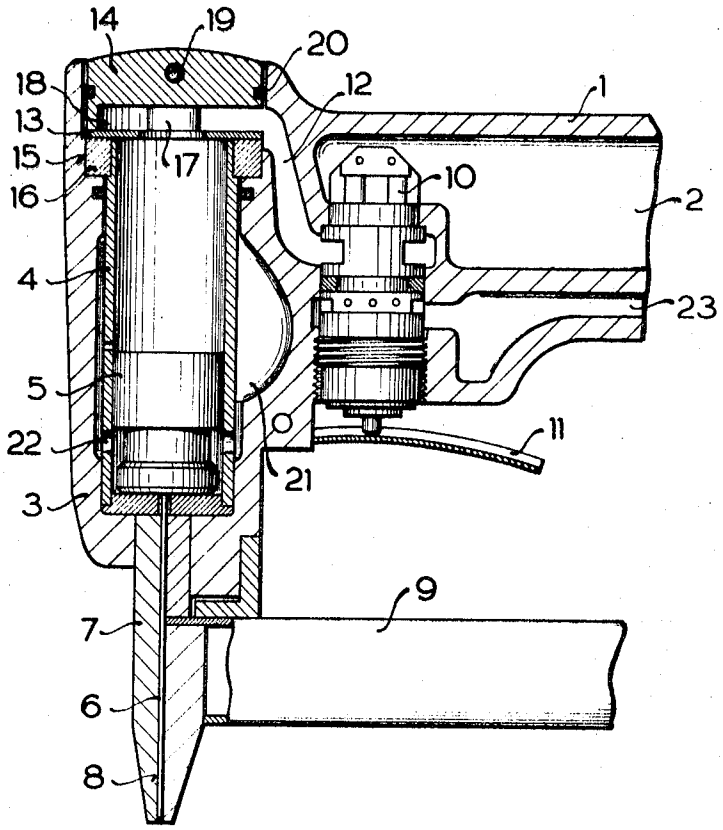
FIG. 2



PNEUMATICALLY ACTUATED STAPLING TOOL

Description

This invention relates to a pneumatically actuated stapling tool for driving staples, tacks, nails or other fasteners into a workpiece and more particularly to such devices which are provided with a magnet for maintaining a piston in its initial or retracted position into which the piston after preforming its driving stroke is returned by pressurized air. Said piston consists of ferromagnetic material. It is known in the art to locate an annular permanent magnet in a case cover of a working cylinder in such a manner that the piston is drawn in its initial position towards the face of the magnet. The piston abuts the magnet after every working stroke, so that the magnet is exposed to extensive mechanical strain and can, therefore, be easily damaged. Besides, the adhesion power of the magnet becomes gradually less due to the constant beating it receives.

Prior art devices of this type which have the magnet arranged in the cylinder cover require special construction, for it is necessary to have the magnet glued inside the cylinder cover and to assure that its face or frontal area pointing away from the piston makes metallic contact with the cylinder cover for closing the magnetic circuit. Furthermore, the magnet is of certain axial length and increases the overall height of the device when located in the cylinder cover, whereby the weight and handling of portable stapling tool is adversely affected.

An important object of this invention is to provide a stapler of the type described with a magnet for holding the piston in its initial position such that any damage of the magnet is prevented. A further object is to provide a stapling device which permits the use of commercial permanent magnets. Another object of the invention is to provide a pneumatic portable stapling tool with a low overall height and relatively small weight of the device.

These and other objects, features and advantages of the invention will be seen from the accompanying drawings, which represent by way of example a preferred embodiment of the invention.

IN THE DRAWINGS

FIG. 1 is a fragmentary sectional view of the device embodying this invention with a piston in the starting initial position

FIG. 2 represents the device according to FIG. 1 with the piston at the end of its working stroke.

A stapling device constructed in accordance with the invention includes a permanent magnet which is mounted in the housing containing the cylinder in a manner such that it encloses part of the piston when in its initial position. Due to this arrangement the magnet is not struck or contacted by the piston and therefore is not exposed to any mechanical stress from the piston. Therefore the magnet is of practically unlimited durability and unaltered adhesion power. Preferably the magnet has an annular shape and is lodged in an annular recess or slot of the cylinder housing.

It is possible to mount it loosely in this annular slot of the housing, thus avoiding special measures for attaching it. Likewise, the magnet may be made up of a plurality of parts or segments fitted together to form an open or closed ring. Similarly, several bar magnets can be arranged at the upper end of the cylinder such that the magnetic field surrounds the piston when in its initial position. For this reason it is possible to use commercial type permanent magnets, and this would lead to substantially lower manufacturing costs of said stapling tool. The magnet enclosing the upper end of the cylinder is preferably held by the cylinder cover via an interposed steel collar. The overall height of the device is not increased when using such annular, segment or bar type magnets, and the wall thickness of the cylinder cover can be kept low. The cylinder cover is appropriately equipped with internal studs to allow a channel to be formed between the steel collar, mounted on the upper end of the cylinder above the magnet, and the cylinder

cover for admitting compressed air from a reservoir into the cylinder.

Referring now to the drawings, the pneumatically actuated stapling tool comprises a body or housing **1** made of light metal alloy in a manner well know, which body encloses a reservoir **2** for compressed air connected to a compressed air supply line. The front part **3** of the body **1** contains a tubular cylinder **4** in which a piston **5**, made of steel or light metal alloy surrounded by a steel envelope, reciprocates. The lower side of the piston **5** is secured to a driver or push rod **6** traveling in a drive track **8** mounted at the foot portion **7** of the device. A staple is cut off during the working stroke of piston **5** from a magazine **9** in a known manner and driven into a workpiece.

The compressed air reservoir **2** is connected to an air duct or channel **12** via a control valve **10** actuated by means of a trigger lever **11**. The air channel **12** runs above the upper end of the cylinder **4** between an annular plate or collar **13** and a cover **14** which closes said cylinder **4**. The annular collar **13** composed of ferromagnetic material such as steel, and a magnet element or an annular permanent magnet **16** in this instance, comprise magnet means. The annular magnet **16** is placed in an annular recess or slot **15**, below the collar **13** in the front part **3** of the body **1**. The upper face of the magnet **16** forms a common radial plane with the upper end of cylinder **4**. The annular collar **13** is spaced by means of studs **17** to provide on the lower side of the cylinder cover **14** a communicating channel **18** connecting the air channel **12** to the cylinder **4**. The cylinder cover **14** is releasably connected by means of a pin **19** to the body **1** of the tool and hermetically sealed with respect thereto by means of a sealing ring **20**. The center portion of cylinder **4** encloses, in a known manner, an adjoining air chamber **21** which communicates with the lower portion of the cylinder via ports **22**. An exhaust channel **23** is arranged in the tool body **1** beneath the air reservoir **2**.

After actuating the trigger lever **11** by hand, compressed air enters from the reservoir **2** via the opened control valve **10** into the channels **12** and **18** and increases the pressure therein to overcome the adhesion force of the magnet **16**, whereupon the piston **5** is snatched by the compressed air from the magnetic field of the magnet **16** and moves downwardly performing its working stroke, while the driver **6** takes a staple from the magazine **9** and drives it into a workpiece via the drive track **8**. After finishing its working stroke the piston **5**, in the position as shown in FIG. **2**, will be returned to its initial position by the compressed air entering from the adjoining chamber **21** via the ports **22** to the lower side of the piston **5**. The piston **5** abuts the annular collar **13** and is held by the magnet **16** until the operating cycle is resumed. The air displaced during the return stroke of the piston **5** is led off the outside via the control valve **10** and exhaust channel **23**. At the end of its return stroke the piston **5** only abuts the annular collar **13** while the magnet **16** is not exposed to any mechanical stress.

Since the magnet **16** is placed loosely in the annular slot **15** of the tool body **1** and maintained in position via the annular collar **13** by the studs **17** of cylinder cover **14**, it is not necessary to provide for special attachment or mounting means. Therefore, a commercial ring magnet can be used which is inexpensive and economizes on manufacturing costs of the device inasmuch as the face of the piston **5** need not to be superfinished. The same advantages are obtained when a magnet of several parts or a bar-type magnet is used.

Although the invention has been described in connection with a particular embodiment, it is to be understood that the invention is not limited to this particular embodiment except insofar as it is specifically set forth in the subjoined claims.

What I claim is:

1. In a pneumatically actuated device for driving fasteners into a workpiece having a housing containing a cylinder, a piston reciprocable in said cylinder between an initial position and a driven position, means for admitting air under pressure to said cylinder at one surface of said piston for moving said

piston in a driving stroke, means to admit compressed air at the opposite surface of said piston causing said piston to return to its initial position, and magnet means to hold said piston in said initial position; the improvement wherein said magnet means has at least one magnet element disposed in said housing adjacent one end of said cylinder and at the outside of said cylinder for retaining said piston in its initial position without said magnet element being struck by said piston.

2. The device as claimed in claim 1, wherein said magnet element is annular in shape.

3. The device as claimed in claim 1, wherein said magnet element is disposed in an annular recess of said housing.

4. The device as claimed in claim 1, wherein said device further comprises a cover for closing said cylinder and said magnet means includes an annular plate of ferromagnetic material, said magnet element being retained by said cover and said plate.

5. The device as claimed in claim 4, further comprising an air duct communicating with said end of said cylinder and being disposed between said annular plate and said cover.