

Feb. 1, 1966

R. L. SANDVIG
PNEUMATIC CYLINDER AND LINER HAVING COOPERATING
AIR-DIRECTING PASSAGES

3,232,178

Filed Aug. 10, 1964

3 Sheets-Sheet 1

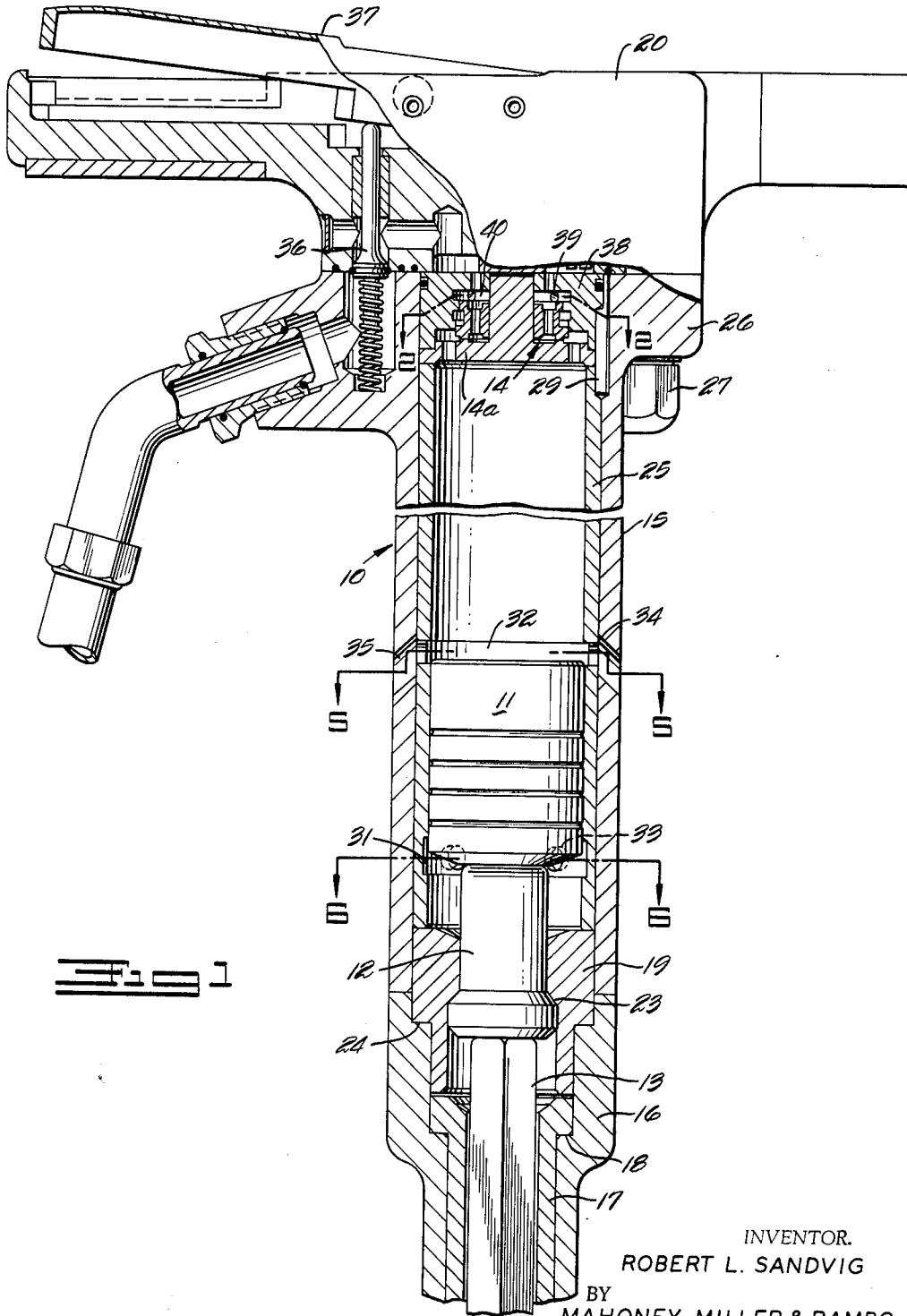


Fig. 1

INVENTOR.
ROBERT L. SANDVIG
BY
MAHONEY, MILLER & RAMBO
BY *Wm. V. Muller*
ATTORNEYS

Feb. 1, 1966

R. L. SANDVIG
PNEUMATIC CYLINDER AND LINER HAVING COOPERATING
AIR-DIRECTING PASSAGES

3,232,178

Filed Aug. 10, 1964

3 Sheets-Sheet 2

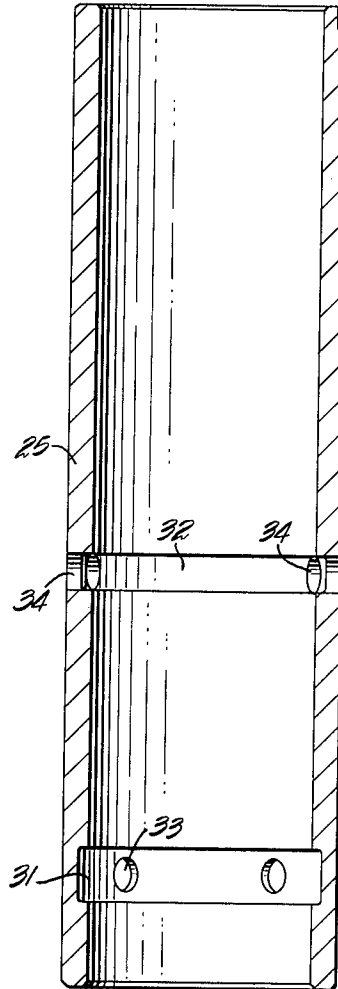
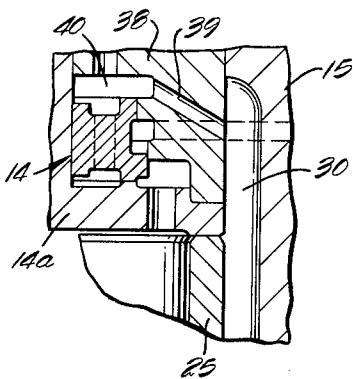
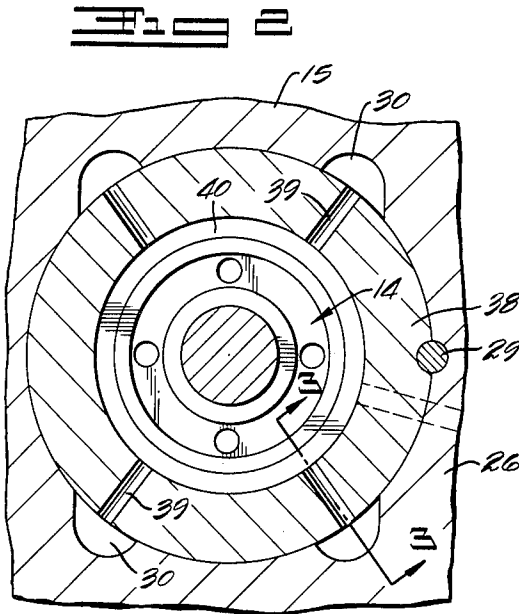


Fig. 3

Fig. 4

INVENTOR
ROBERT L. SANDVIG

BY
MAHONEY, MILLER & RAMBO

BY
Wm. V. Miller
ATTORNEYS

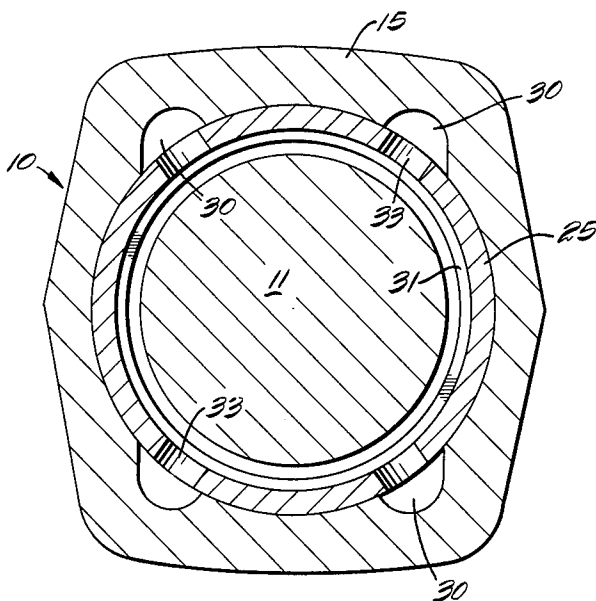
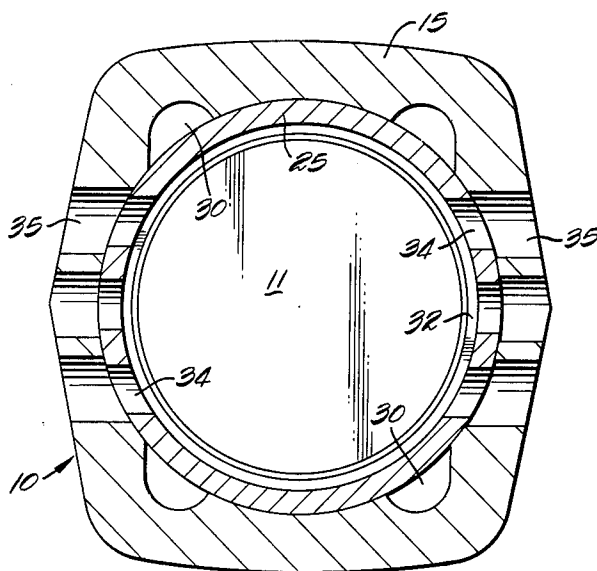
Feb. 1, 1966

6 R. L. SANDVIG 3,
PNEUMATIC CYLINDER AND LINER HAVING COOPERATING
AIR-DIRECTING PASSAGES

3,232,178

Filed Aug. 10, 1964

3 Sheets-Sheet 3



三三三

INVENTOR.
ROBERT L. SANDVIG
BY
MAHONEY, MILLER & RAMBO
BY *Wm. V. Miller*
ATTORNEYS

1

2

3,232,178

PNEUMATIC CYLINDER AND LINER HAVING COOPERATING AIR-DIRECTING PASSAGES

Robert L. Sandvig, Columbus, Ohio, assignor to The Jaeger Machine Company, Columbus, Ohio, a corporation of Ohio

Filed Aug. 10, 1964, Ser. No. 388,489

1 Claim. (Cl. 91—317)

This invention relates to a pneumatic cylinder and liner having cooperating air-directing passages. It has to do, more particularly, with a pneumatic tool which has a cylinder comprising a tough outer metal case with a removable wear-resistant liner disposed therein, the outer metal case being provided with air-routing or directing passages and the inner liner being provided with cooperating aligned air-directing openings or passages.

Conventional pneumatic tools are cased in hardened steel made from forgings. As wear occurs, it is necessary to discard the entire casing. Also, it is necessary to initially machine into the forging any air-directing passages needed. Since it is only necessary to have hardness at the inner wearing surface of the casing, it has been found desirable, according to this invention, to provide a removable liner for the cylindrical casing which can be hardened and which can be replaced when necessary without discarding the entire case. The case need not be a forging but may be made as a casting. Furthermore, it is not necessary to machine the air-directing passages therein but they may be merely cast therein. The liner will have air-directing ports or passages formed therein and, according to this invention, means is provided for positioning the tubular liner in a predetermined manner within the cylindrical socket of the casing to align the air-directing ports thereof with the air-directing passages in the wall of the liner-receiving socket.

Various other objects and advantages of the structure of this invention will be apparent from the attached drawings and the following description.

In the accompanying drawings, there is illustrated a preferred embodiment of this invention. In these drawings:

FIGURE 1 is an axial sectional view through the cylinder of a pneumatic tool, which is illustrated in part, embodying the replaceable bushing or liner structure of this invention.

FIGURE 2 is an enlarged transverse sectional view taken through an automatic-reversing valve of the tool along line 2—2 of FIGURE 1.

FIGURE 3 is a detail in section taken substantially along line 3—3 of FIGURE 2 through the valve.

FIGURE 4 is an axial sectional view through the liner showing it removed from the cylindrical case of the tool.

FIGURE 5 is an enlarged transverse sectional view taken along line 5—5 of FIGURE 1.

FIGURE 6 is an enlarged transverse sectional view taken along line 6—6 of FIGURE 1.

With reference to the drawings, the present invention is shown embodied in a pneumatic tool of the demolition type but is not limited thereto. This tool is indicated as comprising generally a case or cylinder 10 which has a piston hammer 11 reciprocally mounted therein to strike an axially movable anvil block 12 that is adapted to engage the inner end of a workpiece or tool member 13 that is also slidably mounted in the cylinder at one end thereof. The valve arrangement for controlling this tool may be of various types but a suitable arrangement is illustrated generally at 14 at the opposite end of the cylinder and is described in detail in the copending application of Robert L. Sandvig directed to Pneumatic Percussion Tool, Ser. No. 388,488, filed August 10, 1964.

According to this invention, the case or cylinder 10 may be made as an ordinary casting. It preferably comprises the main section 15 and an outer axially aligned guide or front head section 16 which are suitably connected. The section 16 has a guide sleeve or front head bushing 17 removably mounted therein for receiving and guiding the tool 13, the sleeve 17 having a shoulder 18 for cooperating with a similar shoulder on the section 16 to prevent outward displacement of the sleeve. Directly behind the sleeve 17 is an anvil block seat guide or collar 19 in which the anvil block 12 is axially movable. This member 19 is removably mounted in the rear or inner end of the cylinder section 16 and the forward or outer end of the main section 15 of the cylinder. The collar 19 has an inner seat 23 which cooperates with a similar shoulder on the anvil block 12 and is provided with an exterior shoulder 24 which cooperates with a similar shoulder on the member 16.

The main section 15 of the cylinder has a cylindrical socket in which a separate removable bushing or liner 25 of tubular form is disposed. This liner 25 can be slipped into the socket from the forward or inner open end of the cylinder section 15. The section 15 can be mounted on a handle portion 20 of the tool casing by an attaching flange 26 at its inner or rear end and cooperating bolts 27 or in any other suitable manner. The removable liner 25 fits snugly into the socket in the cylinder section 15 and its outer or forward end abuts the rear end of the guide collar 19. The piston hammer 11 fits snugly in the liner 25 for axial sliding movement.

As previously indicated, the cylinder section 15 may be a simple casting being of suitable tough cast metal since it need not be a hardened and wear-resistant metal. The liner 25 is made of wear-resistant material, preferably hardened steel. Cast into the inner cylindrical socket wall of the section 15 are the necessary air-directing grooves or passages. In this instance, they are shown as being four grooves 30 (FIGURES 2, 5 and 6) formed at angularly spaced positions and extending longitudinally in the socket wall surface. Before the liner 25 is hardened, it is provided with a pair of annular inwardly opening grooves or recesses 31 and 32 on its inner surface. These annular recesses are spaced axially apart a distance slightly less than the axial extent of the piston hammer 11, as indicated in FIGURE 1. At the recess 31, the liner is provided with a group of radial bores 33 corresponding in number and angular position to the four grooves 30. At the recess 32, the liner is provided with a group of radial bores 34, for example six, the bores being angularly spaced in a predetermined manner. These bores also will be formed before the liner 25 is hardened. The respective bores 33, as indicated, communicate with the grooves 30, as shown in FIGURE 6. To insure that the tubular liner 25 will be positioned in the cylindrical receiving socket so that the bores and grooves thereof will be in angular alignment, a locating dowel pin 29 (FIGURES 1 and 2) is inserted at the inner or rear end of the cylinder section 15 and cooperates with radial aligned locating notches formed respectively in the outer surface of the liner and the inner surface of the cylinder section at their adjacent ends. Thus, the liner 25 will be located in a predetermined fixed angular position within the cylinder section 15. The six bores 34 communicate with corresponding radial bores 35 (FIGURE 5) in the wall of the cylinder section 15. The aligning bores 34 and 35 and the aligning bores and grooves 33 and 30 form part of the pneumatic system which actuates the piston hammer 11 and which is controlled by means including the reversing valve 14 previously mentioned.

The reversing valve 14 and associated controls do not form a specific part of the invention claimed in this ap-

3

plication and will, therefore, be referred to only to the extent necessary to bring out the function of the various air passageways and ports in the cylinder and cooperating liner. Air is supplied to the cylinder under the control of a throttle valve 36 actuated by a trigger 37 on the handle 20. The air passes to the reversing valve 14 which, as previously indicated, controls the reciprocation of the piston hammer 11. This valve 14 includes a tubular chest 38 which is formed as a separate sleeve or bushing and is disposed at the rear or inner end of the cylinder section 15 behind the liner 25 in axially spaced relationship thereto (FIGURES 2 and 3), a flange 14a of a valve guide being located between these members. The interior of the chest 38 communicates with the air passageways 30 in the cylinder section 15 by means of four radial bores 39 extending from an annular chamber 40 outwardly through the tubular wall of the chest 38 and aligned with the grooves 30 in the cylinder wall when the chest 38 is properly positioned in the cylinder section 15. The dowel pin 29 also locates the tubular chest 38 angularly within the cylinder section 15 cooperating with an aligning notch in the exterior of the chest, as shown in FIGURE 2, and similarly locates the valve guide cooperating with a notch in the flange 14a.

Thus, the flow of actuating air into the grooves 30 to move the piston is controlled by the valve 14. This air passes from the grooves 30 outwardly through the bores 33 and recess 31 into the lower end of the cylinder below the piston hammer 11 to give it an upstroke. During both the upstroke and the downstroke of the piston air will exhaust from the cylinder outwardly through the recess 32 and bores 34 and escape out to the atmosphere through the aligning vent outlets 35. During the downstroke, air will exhaust from the lower end of the cylinder through the bores 33 and grooves 30.

It will be apparent from the above description that this invention provides a pneumatic cylinder which need not be a hardened forging but may be a simple casting with the air-directing passageways formed therein. The cylinder is lined with a removable tubular lining which can be of hardened wear-resistant material and can be replaced if necessary. This liner is also provided with air-directing passages and the liner is fixed in a predetermined position within the cylinder to properly align the air passages of the liner with the air passages of the cylinder for communication with each other.

As previously indicated, the liner structure of this invention is not limited to a tool of the specific piston and cylinder type illustrated. For example, it may be employed in the tool structure disclosed in the copending application of Robert L. Sandvig, directed to Tool Retainer for a Pneumatic Hammer, Ser. No. 388,487, filed August 10, 1964, in which the piston and tool are rotated.

According to the provisions of the patent statutes, the principles of this invention have been explained and have been illustrated and described in what is now considered to represent the best embodiment. However, it is to be understood that, within the scope of the ap-

4

pended claim, the invention may be practiced otherwise than as specifically illustrated and described.

Having thus described my invention, what I claim is:

In a fluid-actuated cylinder and piston unit; a cylinder comprising an outer case in the form of a casting having a cylindrical socket formed therein, said socket having an inner cylindrical wall surface with cast fluid-directing grooves therein at angularly spaced positions around said wall surface which extend longitudinally of the wall surface and open radially inwardly therefrom, said case having radially extending, vent bores at angularly spaced positions, and independent of said longitudinally extending grooves; a tubular wear-resistant liner disposed in said cylindrical socket in contact with said inner cylindrical wall surface having a smooth outer cylindrical wall surface which contacts said inner cylindrical wall surface and covers the radially inwardly opening grooves in said surface, said liner having an inner cylindrical surface with annular recesses therein at longitudinally spaced positions, said liner having a first set of radially extending, fluid passage bores at one of said annular recesses and spaced angularly corresponding to the angular spacing of said longitudinal grooves in said socket wall inner surface, said liner having a second set of angularly spaced, radially extending, fluid passage bores in another of said recesses for cooperating with said angularly spaced vent bores in said case, said liner being removably received in said cylindrical socket; interfitting means between the said outer cylindrical surface of the liner and the said inner cylindrical surface of the cylindrical socket to locate the liner angularly within said socket in a predetermined position so that the said first and second sets of radially extending bores in the liner align respectively with the longitudinal grooves and the vent bores in said case; a tubular valve chest mounted in said cylindrical socket and having an inner end in contact with one end of the liner, said chest having radially extending, fluid passage bores angularly spaced therearound similar to the spacing of said longitudinal grooves in said case, said chest having an outer cylindrical wall surface which contacts with the inner cylindrical wall surface of said cylindrical socket of the case, said first-named interfitting means including interfitting means between said chest surface and said inner cylindrical wall surface for locating said chest angularly within said socket with said bores thereof in alignment with and communicating with the longitudinal grooves in said case.

References Cited by the Examiner

UNITED STATES PATENTS

1,453,252	4/1923	Rorive	91—317
2,613,646	10/1952	Gillerstrom	91—317
2,899,934	8/1959	Salengro	91—317

FOREIGN PATENTS

200,688	1/1956	Australia.
---------	--------	------------

SAMUEL LEVINE, *Primary Examiner.*

P. E. MASLOUSKY, *Assistant Examiner.*