June 30, 1953 P. E. SCHMID 2,643,731

ROTATABLY MOUNTED MUFFLER ASSEMBLY

Filed Oct. 30, 1948 2 Sheets-Sheet 1

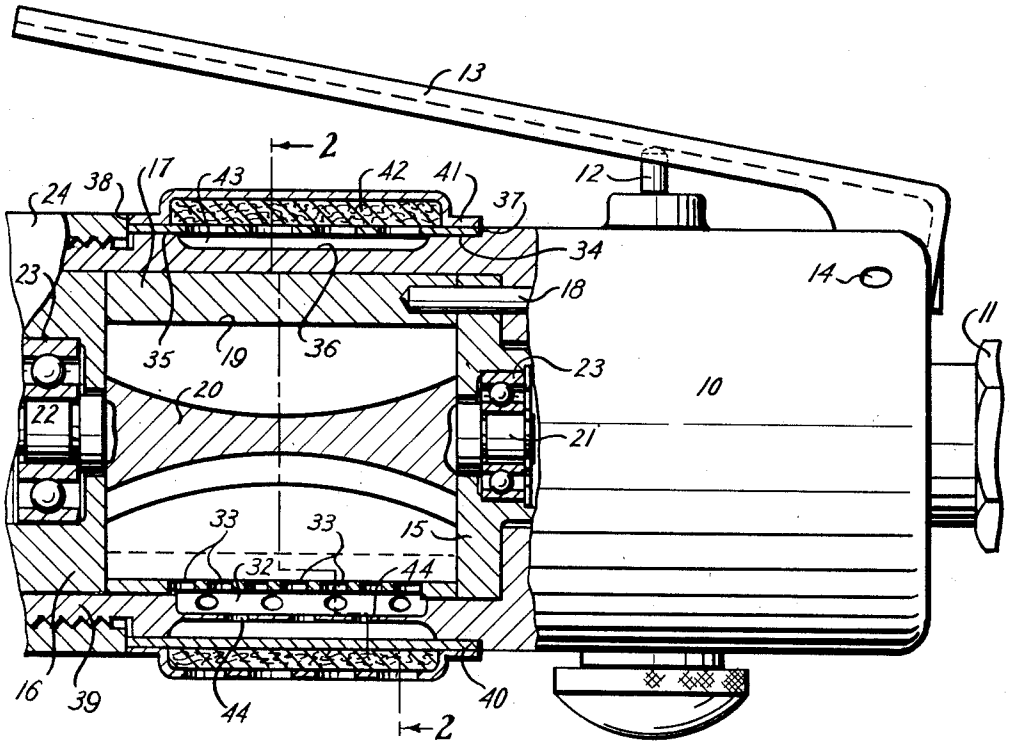

Fig. 1

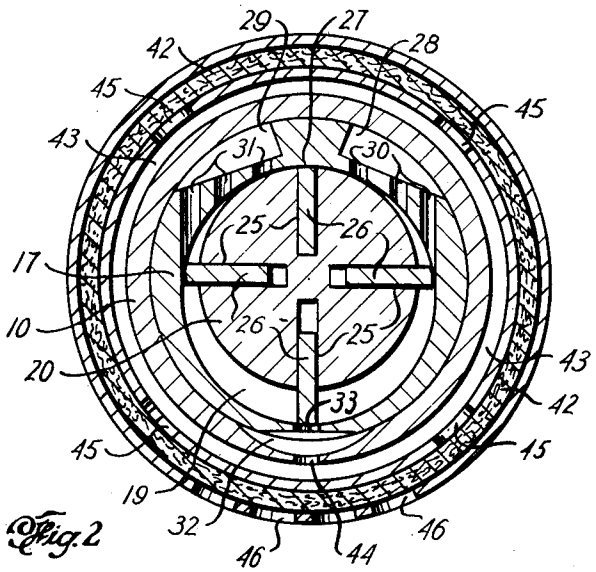

Fig. 2

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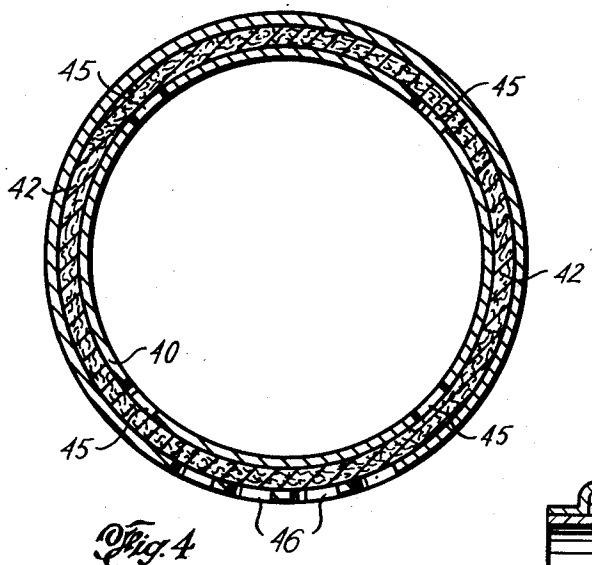


Fig. 4

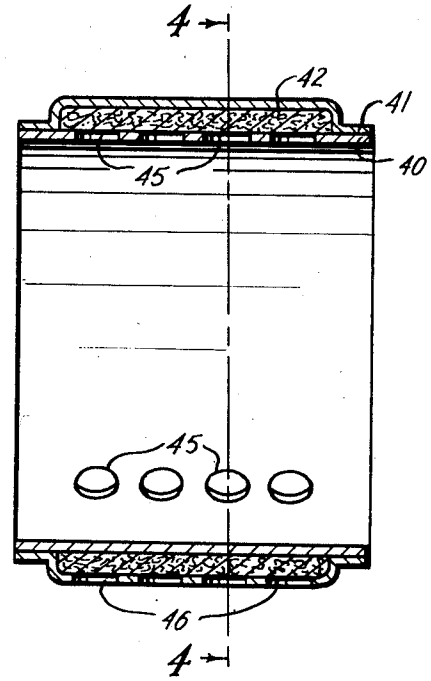
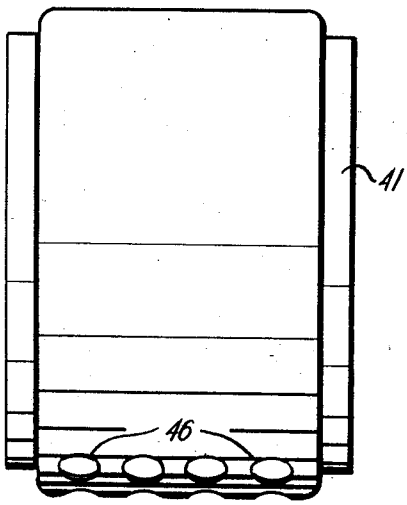


Fig. 3

Fig. 5



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ROTATABLY MOUNTED MUFFLER ASSEMBLY

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3 Claims. (Cl. 181—55)

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This invention pertains broadly to compressed air actuated tools, but more particularly to an exhaust muffler therefor constructed to reduce the noise of the exhaust air and mounted on the tool in a manner enabling the exhaust jet to be directed away from the operator.

In compressed air actuated tools or motors, either of the percussive or rotary type, the compressed air after having flown through the tool and acted upon parts to impart motion thereto, is suddenly released to the outside of the tool. This sudden exhaust and consequential expansion of the compressed air creates a considerable amount of noise which is annoying and detrimental to the operator and persons in his vicinity. In an effort to reduce such noise, several attempts have been made to equip such tools with exhaust mufflers, but their size, weight or complicated construction have rendered them impractical.

It is therefore one object of this invention to produce an exhaust muffler for fluid or compressed air actuated tools, which is of simple construction, small size and weight, and effective in reducing the exhaust noise.

Another object of this invention is to produce such a muffler which comprises only three inexpensive parts assembled together to form a single unit.

Another object of this invention is to provide a compressed air actuated tool with an exhaust muffler fitted on the tool in a manner enabling the direction of the exhaust jet to be changed at will.

Other objects and advantages more or less ancillary to the foregoing and the manner in which all the various objects are attained will appear in the following description, which considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention.

In the drawings:

Figure 1 is a longitudinal view, partly in section, of a compressed air actuated tool embodying the invention.

Figure 2 is a cross-sectional view taken through line 2—2 in Figure 1.

Figure 3 is a longitudinal sectional view of the muffler assembly as shown in Figure 1.

Figure 4 is a cross sectional view taken through line 4—4 in Figure 3.

Figure 5 is a longitudinal view of the muffler assembly shown in the same position as shown in Figures 1 and 4.

Referring to the drawings in which like symbols designate corresponding parts throughout the several views, 10 represents the rear housing

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of a compressed air actuated rotary tool, which tool is of the usual type and includes a compressed air inlet connection 11 secured within the housing 10. Admission of the motive fluid to the tool is controllable by a throttle valve 12, adequately mounted within the housing 10 and operable by a throttle valve handle or lever 13, which has one end pivotally connected to the housing 10 by a cross pin 14.

Interiorly, the housing 10 is machined to accommodate two longitudinally spaced bearing plates 15 and 16 mounted coaxially and having a cylinder or stator 17 extending between them and held stationary relative to the housing 10 by a dowel 18 which extends through the bearing plate 15. The stator 17 is provided with a cylindrical rotor chamber 19 extending therethrough and closed at both ends by the bearing plates 15 and 16. This chamber is located with its center axis parallel to that of the bearing plates but in offset relation therewith.

Rotatably mounted within the rotor chamber 19, there is the main cylindrical portion of a rotor 20 which extends from one bearing plate to the other and has reduced end portions 21 and 22 extending into the bearing plates 15 and 16 respectively where they are adequately supported in bearings 23. The rotor end 22 extends into a front housing 24 where it is drivingly connected to the spindle of a work performing tool, not shown, for imparting rotation thereto.

As is customary in a rotary tool of this type, the main body portion of the rotor 20 is provided with four, equally spaced, radially extending slots 25, each having slidable therein a blade or vane 26 engageable with the inner wall of the rotor chamber 19. As clearly shown in Figure 2, the rotor 20 is disposed eccentrically within the chamber 19 to such an extent as to provide a line contact 27 with the inner wall thereof.

The exterior of the stator 17 is appropriately machined to form, after it is assembled into the rear housing 10, two chambers 28 and 29 located adjacent to and one on each side of the line contact 27. The chamber 28 is in constant communication with the rotor chamber 19 through a plurality of ports 30, while the chamber 29 is similarly in communication with the rotor chamber 19 through a plurality of ports 31.

Diametrically opposed to the line contact 27, there is provided, between the stator 17 and rear cylinder 10, an exhaust chamber 32 of substantially crescent shape cross section and extending longitudinally between the bearing plates 15 and 16 but falling short of the ends of the stator as

clearly shown in Figure 1. This chamber is in communication with the rotor chamber 19 through a plurality of aligned exhaust ports 33.

Since the construction above described is equivalent to that of the usual compressed air actuated rotary tool, no further description is thought necessary, other than pointing out that in tools of this type the exhaust ports, such as 33, generally lead from the equivalent of the exhaust chamber 32 to the atmosphere without any provision being made to muffle or reduce the noise thus caused by the exhausting fluid.

The above detailed description of the tool has been given in order to more clearly set forth the invention about to be described. To that end, it might also be well to briefly explain the operation of the tool, which operation is also common to all tools of this type, and is as follows:

Compressed air is admitted from a source of supply such as a compressor, into the rear housing 10 through the inlet connection 11. With the throttle valve 12 open, the compressed air is admitted through passageways, not shown, into one or the other of the chambers 28 and 29. Since the tool shown and described is of the reversible type, compressed air may be admitted into the chamber 28 for effecting rotation of the rotor 20 in a clockwise direction as seen in Figure 2, or in chamber 29 for effecting its counterclockwise rotation. Assuming that the compressed air is admitted into the chamber 28, it will flow therefrom through the ports 30 into the rotor chamber 19 and exert pressure successively on the blades 26 for imparting rotation to the rotor 20. As each blade uncovers the exhaust ports 33, the compressed fluid will escape or exhaust from the rotor chamber 19 through the exhaust ports, which ports or their equivalent, as previously mentioned, generally open directly to the atmosphere. In practice, the one of the two chambers 28 and 29, not used as an inlet chamber is generally transformed by means of a suitable valve, not shown, as an exhaust chamber through which, in this instance, compressed fluid still trapped in the rotor chamber 19 after it has flown over the exhaust ports 33, is free to exhaust through the ports 31.

Referring now more particularly to the invention, the external wall portion of the housing 10 which surrounds the exhaust chamber 32, is accurately machined to form two longitudinally spaced cylindrical bearings 34 and 35 of equal diameters having between them a cylindrical portion 36 of reduced diameter. The bearing 34 is ended by an annular shoulder 37 while the bearing 35 is ended by a similar shoulder 38 which constitutes the end wall of the front housing 24. This housing is preferably screwed on an extension 39 of the housing 10, with the result that the shoulder 38 can be moved toward or away from the shoulder 37.

Closely fitted on the bearings 34 and 35 but rotatable relative thereto, there is a muffler assembly which includes a cylindrical inner sleeve 40 and an annular ring 41 of substantially U shape cross section having its ends fitting closely on the inner sleeve 40 where they are preferably secured thereto by any suitable means such as a pressed fit or a spot weld. Between the inner sleeve 40 and the outer ring 41, there is provided an annular chamber 42 filled with porous material having sound absorbing qualities such as a strip of soft felt or the like.

When the muffler assembly is inserted over the bearings 34 and 35, the diametrically reduced

portion 36 located between the bearings, forms with the inner wall of the muffler inner sleeve 40 an annular auxiliary exhaust chamber 43 which has a volumetric capacity materially greater than that of the chamber 32. This last chamber is in communication with the exhaust chamber 32 through a plurality of ports 44 extending through the walls of the housing 10 which separates the chamber 32 from the chamber 43.

The auxiliary exhaust chamber 43 is in communication with the muffler chamber 42 through a plurality of holes or exhaust ports 45 provided through the wall of the inner sleeve 40. These ports, the number of which may vary, preferably include four groups, each having ports longitudinally aligned within the boundary of the auxiliary exhaust groove 43, with the groups equally spaced from each other.

Extending from the muffler chamber 42 to the exterior of the muffler, there is a plurality of ports 46 provided through the wall of the outer ring 41. These last ports have a combined area substantially equal to the combined area of the ports 45, but are concentrated within a small area of the outer ring 41 in order to limit the space from which flows the exhaust jet.

In the operation of the device, the exhausting fluid from the exhaust chamber 32 will flow into the auxiliary exhaust chamber 43 through the ports 44. Since the volumetric capacity of the auxiliary exhaust chamber 43 is materially greater than that of the exhaust chamber 32, the exhausting fluid will immediately expand in the auxiliary chamber 43, thereby reducing its pressure as well as its velocity from the chamber 43 to the exterior of the muffler. As the exhausting fluid enters the auxiliary chamber 43 through the ports 44, it will flow therein in all directions but generally circumferentially relative to the bottom of the chamber 43 in opposite directions, thereby enabling an unrestricted flow of the exhausting fluid into the chamber 43.

From the chamber 43, the exhausting fluid under reduced pressure will enter the muffler chamber 42 through the ports 45. The chamber 42 which is filled with porous material such as soft felt, has a volumetric capacity much greater than that of the auxiliary chamber 43, thereby effecting a further expansion of the exhausting fluid in the muffler chamber as well as reducing its pressure and velocity. In this last chamber, the exhausting fluid will flow through the porous material such as soft felt which acts as a medium for further retarding the flow of the exhausting fluid from the ports 45 to the ports 46 where it is finally free to reach the exterior of the muffler. The soft felt contained in the chamber 42 in addition to retarding the flow of the exhausting fluid has also noise absorbing qualities which are effective in greatly reducing the noise which would otherwise be occasioned by the flow of the exhausting fluid from the ports 45 to the exterior of the muffler through the chamber 42 and ports 46.

Since the muffler assembly is rotatably mounted on the bearings 34 and 35, it may be turned at will to change the exhausting jet in any direction suitable to the operation. Normally the front housing 24 is screwed on the projection 39 of the rear housing 10 to afford frictional resistance between the ends of the muffler and the shoulders 37 and 38 which will enable the operator to turn the muffler in the desired position and will prevent its accidental rotation. If desired, the muffler, after adjustment to its desired position, can

be made immovable by clamping it between the shoulders 37 and 38 through the screw thread connection between the two housings 10 and 24.

Although the description of this device is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology employed is not intended to be restrictive or confining. It is also to be understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope and spirit of the invention.

I claim:

1. In a fluid actuating tool embodying a housing having two longitudinally spaced cylindrical bearings and an exhaust chamber into which flows exhaust fluid, the combination of an exhaust muffler comprising a sleeve, rotatably mounted on said bearings in concentric relation with said exhaust chamber to define between said bearings an intermediate chamber, said housing having ports therein providing communication between said exhaust chamber and said intermediate chamber, a ring secured to said sleeve in concentric relation therewith and defining a muffler chamber, porous material disposed in said muffler chamber, said sleeve having ports therein providing communication between said intermediate chamber and said muffler chamber, said ring having ports therein communicating with said muffler chamber, said intermediate chamber having a volumetric capacity greater than that of the exhaust chamber and said muffler chamber having a volumetric capacity greater than that of said intermediate chamber for discharging the exhausting fluid through the ports of said ring at a reduced pressure.

2. In a fluid actuating tool embodying a housing having two longitudinally spaced cylindrical bearings and an apertured exhaust chamber into which flows exhaust fluid, the combination of an exhaust muffler comprising a sleeve rotatably mounted on said bearings in concentric relation with said exhaust chamber to define between said bearings an intermediate chamber, a ring secured to said sleeve in concentric relation therewith and defining a muffler chamber, porous material disposed in said muffler chamber, said sleeve formed with a plurality of substantially equally spaced groups of ports providing communication between said intermediate chamber and said muffler chamber, said ring formed with a plurality of ports concentrated within a relatively small area and laterally spaced from the ports in said sleeve.

3. In a fluid actuating tool embodying a housing having two longitudinally spaced cylindrical bearings and a cylindrical portion of reduced diameter therebetween forming the outer wall of an exhaust chamber into which flows exhaust fluid, the combination of an exhaust muffler comprising a sleeve rotatably mounted on said bearings in concentric relation with said exhaust chamber to define with said portion of reduced diameter an intermediate chamber, a ring secured to said sleeve in concentric relation therewith to define a muffler chamber, porous material disposed in said muffler chamber, said housing having a plurality of aligned ports therein providing communication between said exhaust chamber and said intermediate chamber, said sleeve formed with a plurality of substantially spaced groups of aligned ports arranged circumferentially of the sleeve with respect to the exhaust chamber ports, said sleeve ports providing communication between said intermediate chamber and said muffler chamber, said ring formed with a plurality of ports concentrated within a relatively small area and laterally spaced from the ports in said sleeve.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
291,762	Nason	Jan. 8, 1884
681,522	Very	Aug. 27, 1901
713,536	Tobias	Nov. 11, 1902
723,111	Winton	Mar. 17, 1903
806,714	Porter	Dec. 5, 1905
1,115,704	Manes	Nov. 3, 1914
1,613,322	Goetz	Jan. 4, 1927
2,128,742	Fuehrer	Aug. 3, 1938

FOREIGN PATENTS

Number	Country	Date
341,083	Italy	June 9, 1936