

Nov. 21, 1961

T. E. MEAD

3,009,531

MUFFLER

Filed Aug. 1, 1958

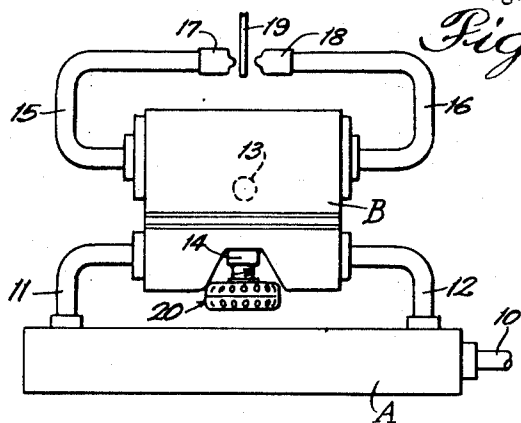


Fig. 1

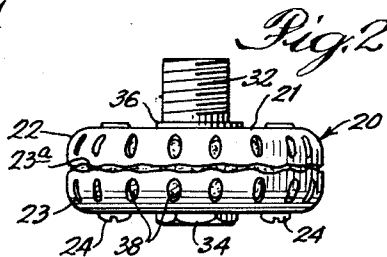


Fig. 2

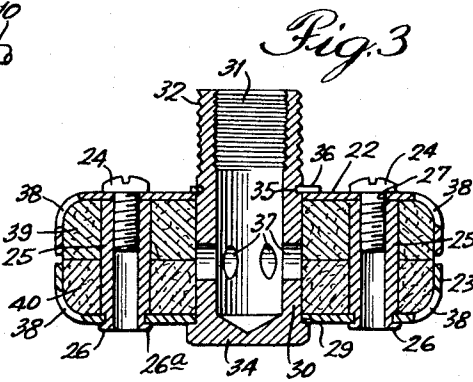


Fig. 3

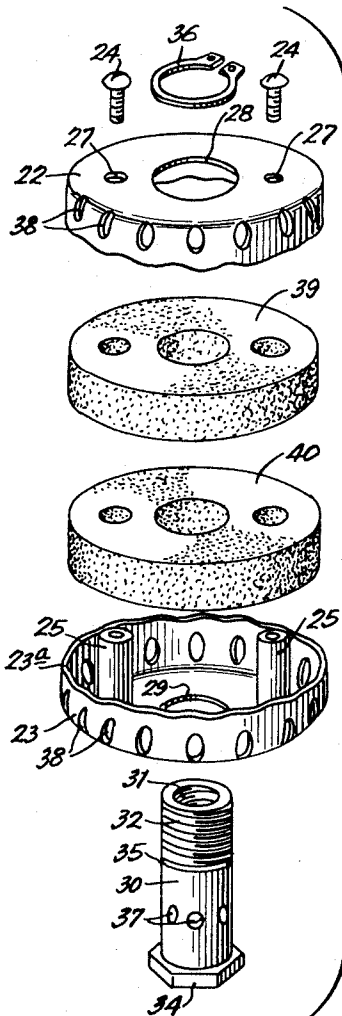


Fig. 4

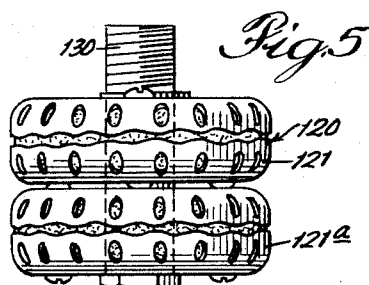


Fig. 5

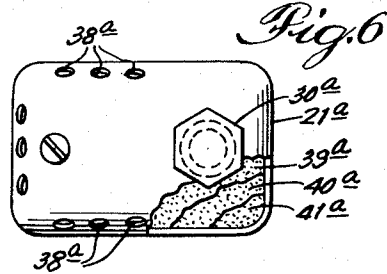


Fig. 6

INVENTOR:
Theodore E. Mead,

BY *Samuel L. Tilton, John H. Langmuir,*
ATTORNEYS.

1

3,009,531

MUFFLER

Theodore E. Mead, 1020 Michigan Ave., Wilmette, Ill.

Filed Aug. 1, 1958, Ser. No. 752,585

5 Claims. (Cl. 181-60)

This invention relates to a muffler, and, more particularly, to a muffler for a pneumatic device.

In the operation of pneumatic devices, as, for example, where compressed air is employed to operate an air cylinder, air is exhausted from time to time which develops considerable noise. The outrush of gas from pneumatic devices posed additional problems other than the generation of noise. For example, the gas might carry suspended particles. Muffling devices heretofore employed in this connection would rapidly fill up with the particles such as dirt, and thereby interfere with the operation of the device. In some cases, muffling devices were employed that used rigid matrices of metal fibers, or the like, and these, in addition to becoming clogged rapidly, evidenced a tendency to disintegrate under the corrosive influence of some of the gas-borne particles. A very persistent problem, however, with all of the previously employed mufflers was their basic inadequacy to achieve proper muffling of the sound generated by the escaping gas. Even when the devices were newly installed and therefore operating under maximum efficiency, their noise-deadening ability was low. Attempts were made to remedy this by enlarging the devices, with the result that the mufflers were all out of proportion to the size of the pneumatic equipment with which they were employed.

It is a general object of this invention to provide a novel muffling device that overcomes the above-mentioned problems and difficulties. Another object is to provide a muffling device which employs a foam material such as a urethane to deaden the sound generated by a gas flow. Still another object is to provide a device in which a casing is substantially filled with a urethane foam material and the exhaust from the pneumatic device passes therethrough. Yet another object is to provide a muffling device which is readily renewable at low cost and which operates more efficiently over longer periods than devices heretofore employed. Other objects and advantages of this invention can be seen as this specification proceeds.

This invention will be explained in conjunction with the accompanying drawing, in which—

FIG. 1 is an elevational view of a pneumatic device employing a muffler employing teachings of the invention;

FIG. 2 is an enlarged elevational view of the muffler seen in FIG. 1;

FIG. 3 is an enlarged cross-sectional view of the muffler seen in FIG. 1 and FIG. 2;

FIG. 4 is a view similar to FIG. 3 but with the parts thereof shown in exploded or spaced-apart relation;

FIG. 5 is an elevational view of a modified form of a muffler; and

FIG. 6 is a top plan view, partially in section, of yet another modified form of muffler embodying teachings of the invention.

Referring now to the drawing, A designates an air cylinder of the double-acting variety and which is equipped with a piston rod 10 reciprocable relative to cylinder A under the influence of an internal piston (not shown). The ends of cylinder A are connected to a control valve B by air conduits 11 and 12. Valve B is equipped with an air inlet port 13 and an air exhaust port 14. The valve is also equipped with conduits 15 and 16, which terminate respectively in poppet valves 17 and 18. The poppet valves may be energized by an actuator 19 suitably positioned on a frame which supports the rest of the apparatus and which has been omitted for the sake of simplifying the drawing. In the operation of

2

the device just described, valve actuator 19 is moved to contact one of poppet valves 17 or 18, whereupon air is delivered to the corresponding conduit 11 or 12 to reposition the piston of cylinder A, air from the opposite end of the cylinder being exhausted through the other of conduits 11 or 12, as the case may be, and through exhaust port 14 and a muffler designated generally by the numeral 20 secured thereto.

The muffler 20 is shown in enlarged form in FIGS. 2-4, and the muffler will now be discussed in connection with those views.

The muffler 20 includes a generally cylindrical casing 21, made up of generally cup-shaped mating sections 22 and 23 arranged in mouth-to-mouth relation. The bases of the cup-shaped portions 22 and 23 are spaced closer together than the radii of the members 22 and 23. The members 22 and 23 are releasably secured in mouth-to-mouth relation by means of bolts 24 threadedly received within internally threaded sleeves 25. For this purpose member 23 is equipped with inwardly-projecting sleeves 25 which may be clinched as at 26 in openings 26a in element 23 and bolts 24 extend through openings 27 in the member 22.

Each member 22 and 23 is equipped with an opening designated 28 and 29, respectively, which are axially disposed in the generally cylindrical element 21. The aligned openings 28 and 29 removably receive a gas inlet conduit 30.

The gas inlet conduit 30 is both internally and externally threaded at one end, as at 31 and 32, respectively. The other end of conduit 30 is closed by means of an annular flange equipped caps portion 34, which may conveniently take the form of a hexagonal nut configuration (best seen in FIGS. 2 and 4). The conduit 30 is provided with a groove 35 intermediate its length which receives a snap-ring 36, the snap-ring 36 and flange 34 co-operating to maintain conduit 30 against movement axially within cylindrical element 21.

Conduit 30 is equipped with ports 37, which communicate with the interior of cylindrical casing 21 and preferably a plurality of these ports are provided.

Gas, such as compressed air, entering conduit 30 flows out of ports 37 and through casing 21 until it reaches the outlet apertures 38 provided in the periphery thereof.

Interspersed in the path of gas flow are a plurality of layers 39 and 40 of a urethane foam material which are conveniently provided in the form of flat disks. This material is readily compressible, so that it substantially fills the interior of casing 21. The disks are so arranged that they provide an interface between adjacent layers aligned with ports 37, so that some of the gas entering casing 21 from conduit 30 has a tendency to enlarge the interface. Although superior results in the deadening of the exhaust gas from pneumatic devices is achieved through merely filling the chamber with a urethane foam material, even better results are obtained when the material is arranged in layers, providing an interface aligned with the conduit ports 37, as illustrated.

The urethane foam apparently provides the superior muffling action by providing passages that extend therethrough which permit the dissipation of the gas entering conduit 30 and without tending to obstruct the flow of gas unduly. Additionally, the urethane foam layers 39 and 40 are substantially resistant to disintegration by the usual corrosive materials, and because of the passages therein, do not tend to become clogged as did the previously-employed muffling devices. Thus, the device of the invention employing the urethane foam material is effective to provide a superior muffling action for a longer period than was previously thought possible.

In the installation of the device illustrated, a wrench, or similar tool, can be conveniently applied

to the flat surfaces of the flange 34 to tighten the threaded portion of conduit 30 to the exhaust port 14 of valve B. When replacement of the muffler is indicated, the muffler 20 can conveniently be detached again merely by applying a wrench to flange 34 and disengaging the conduit 30 from valve B. Thereafter, the snapping 36 can be removed, along with bolts 24 and the casing 21 separated into its component parts and the layers 39 and 40 of urethane foam material easily replaced. A suitable foam material for this purpose is marketed under the trade name "Polyfoam" by the General Tire & Rubber Company, of Marion, Indiana.

In FIGS. 5 and 6, alternative constructions of the invention are seen. In FIG. 6, the configuration of the casing 21a is generally rectangular in nature, and the conduit 30a is offset from the center thereof. The apertures 38a are in the walls of casing 21a remote from the wall 41a thereof closest to conduit 30a. The apertures in conduit 30a are aligned with the interfaces between adjacent urethane layers 39a, 40a and 41a.

In FIG. 5, a double muffler is seen, and is designated generally by the numeral 120. The conduit 130 therein is internally apertured to provide ports for the outlet of gas from conduit 130 in planes substantially aligned with the interfaces between adjacent layers of urethane material contained in casings 121 and 121a.

Each element 22 and 23 is preferably provided with a serrated edge 23a, as best seen in FIG. 4 and applied to element 23. This permits additional discharge of air which has its sound waves previously damped by contact with the adjoining faces of layers 39 and 40. Additionally, it permits a slightly compressive force to be applied to these layers.

While, in the foregoing specification, a detailed description of an embodiment of the invention has been set forth for the explanation of the invention, those skilled in the art will perceive that many variations in the details of the invention may be made without departing from the spirit and scope of the invention.

I claim:

1. In an exhaust muffler for a pneumatic device, a casing equipped with a gas inlet and a gas outlet spaced therefrom, and a plurality of layers of urethane foam material arranged in stacked, contiguous relation substantially filling said casing and positioned to require gas to pass through said material in flowing between said inlet and said outlet, said inlet being aligned with an interface between adjacent layers of said material.

2. In an exhaust muffler for a pneumatic device, a generally cylindrical casing equipped with a gas inlet conduit disposed axially thereof and having a port for discharging gas into said casing, gas outlet apertures in the side wall of said casing, the casing being substan-

tially filled with layers of urethane foam arranged in abutting, parallel relation, said port being aligned with the interface between adjacent layers of said foam.

3. In an exhaust muffler for a pneumatic device, an apertured casing providing an internal chamber, said casing having opposite parallel flat walls, a plurality of layers of acoustical urethane foam in said chamber disposed parallel to said walls with adjacent layers being in abutting relation, a gas inlet conduit communicating with said chamber interiorly thereof, said conduit being equipped with a port for directing gas flow between layers of said foam, said casing having a dimension parallel to said walls greater than the dimension between said walls.

4. In a pneumatic muffler, a casing comprising two generally cup-shaped elements, said elements each being equipped with an integral flat base at one end and an open mouth at the other end, said elements being releasably secured together in mouth-to-mouth relation, aligned openings in said base, a gas inlet conduit extending through said openings having one end closed and equipped with port means communicating with the interior of said casing, the other end of said conduit being equipped with means for connecting said conduit to a source of gas intended to be muffled, a plurality of gas outlet apertures in said elements, and a plurality of stacked, abutting layers of urethane foam material filling said casing and disposed parallel to the bases of said elements and being in the path of gas flow from said port means to said apertures, said port means being positioned to direct gas toward two adjacent layers of material.

5. The structure of claim 4 in which the elements adjacent the mouths thereof are equipped with serrated edges operative to provide additional gas outlets.

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