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2,815,088

MUFFLER

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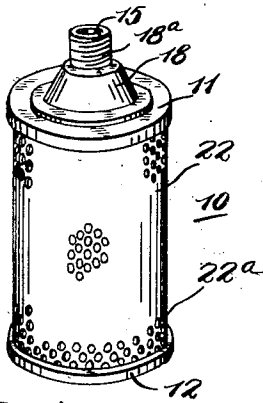


Fig. 1

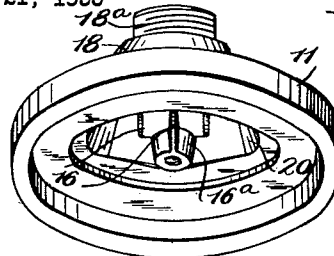
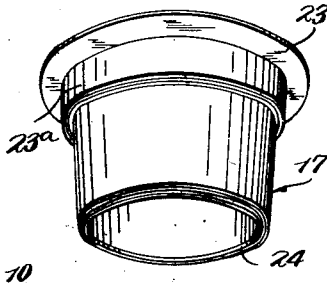
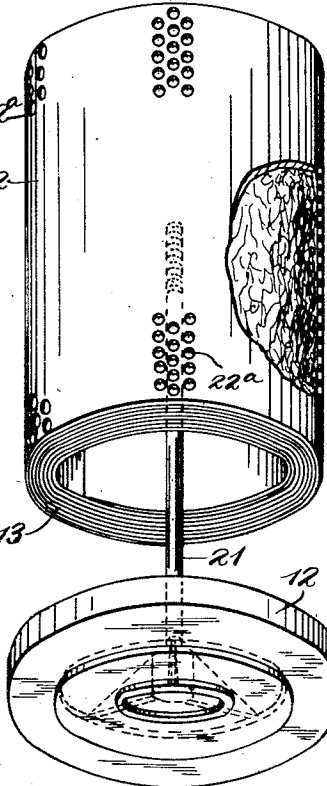


Fig. 4

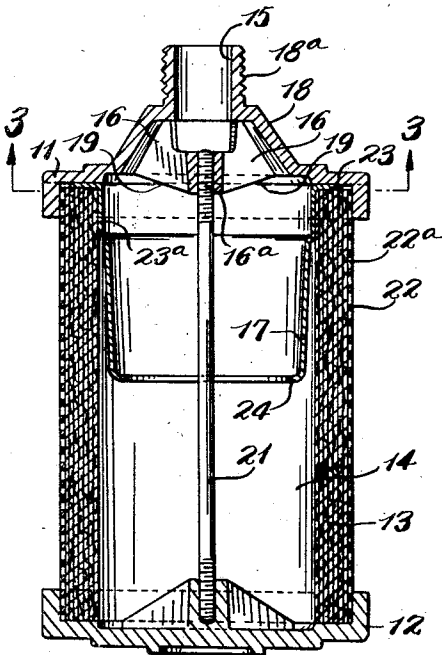


Fig. 2

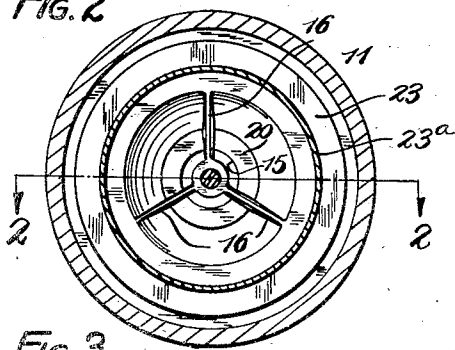


Fig. 3

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This invention relates to muffling devices for muffling of noises in a pressure fluid exhaust such as the exhaust from a compressed air operated power cylinder, tool or the like.

The present invention is an improvement over my earlier Patent 2,600,236, granted June 10, 1952, and has as a general object the provision of a novel and improved muffling device for silencing exhaust noises but which is of a relatively simplified construction for more economical manufacture and assembly.

Another object of this invention is to provide an improved muffler for silencing the noises of exhaust fluids through the division of the exhaust fluid into streams and the reverberation of the streams in a silencing chamber but wherein these functions are obtained by the use of a minimum number of parts and with minimum deterioration in the device.

Still another object of this invention is to provide a novel and improved exhaust silencing means wherein the division of the exhaust fluid into streams is produced by the fins or ribs of a spider means carried by, and preferably formed integral with, the inlet cover of the device.

A further object of this invention is to provide a novel and improved muffler of the kind wherein dissipation of exhaust fluid noises takes place in a silencing chamber defined, at least in part, by a porous wall through which the exhaust fluid is diffused, and wherein a deflecting means protects the porous wall against erosion by the streams of exhaust fluid.

This invention further provides a novel muffler of the above referred to character wherein the porous wall of the silencing chamber comprises cellulose fibre sheet material impregnated with a phenolic resin, the porous wall preferably being reinforced and protected by an exterior metal screen.

Yet another object is to provide a muffler of the aforementioned character wherein the deflecting means is located at the inlet passage end so as to receive the initial impingement of the exhaust fluid streams entering the silencing chamber, and wherein the deflecting means has a substantial portion thereof spaced from the porous wall to afford access by the exhaust fluid to a maximum surface area of the porous wall.

It is likewise an object to provide a muffler of the above-mentioned kind in which the porous wall defining the silencing chamber and the deflecting means are tubular and are coaxially disposed, and in which the deflecting means for the incoming exhaust fluid constitutes an integrally formed part of a cast or molded end member or cover.

Other objects and advantages of the invention will become apparent in the following detailed description and in the accompanying drawing forming a part of this specification and in which:

Fig. 1 is a perspective view showing a muffler embodying the present invention;

Fig. 2 is a vertical longitudinal section taken through the muffler as indicated by section line 2—2 of Fig. 3;

Fig. 3 is a transverse sectional view taken along the line 3—3 of Fig. 2; and,

Fig. 4 is an exploded view of the muffler with a portion of the outer metal screen broken away.

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As one embodiment of this invention the drawings show an improved muffler 10 comprising a pair of end members or covers 11 and 12, and a hollow body member or disseminator 13 disposed between the end members so as to define a silencing chamber 14. One of the end members, in this instance the member 11, is provided with an inlet passage 15 and a group of fins or vanes 16 for dividing the exhaust fluid into a plurality of streams for entry into the silencing chamber 14. A deflector member 17 is provided to receive the initial impingement of the exhaust streams during their entry into the silencing chamber 14.

The end members 11 and 12 are molded or cast members made of a hard rigid material, preferably metal. An aluminum casting has been found to be an inexpensive form of construction for these members. The inlet passage 15 of the end member 11 is defined by an outwardly extending stem portion 18 arranged substantially centrally of this member and which includes a cylindrical threaded end 18^a so as to adapt the muffler to be readily connected to an exhaust conduit. The portion 18 has an inclined annular wall defining an axially inwardly diverging cavity 20 which communicates with the silencing chamber 14 at the inlet end thereof. This arrangement of the inlet passage 15 allows the exhaust fluid to expand immediately upon being delivered to the muffler 10 to thereby lose some of its energy.

An important feature of the inlet passage 15 is the provision of the fin or vane-like elements 16, arranged in the path of the exhaust fluid entering the muffler 10. The fins 16 are made integral with the end member 11 during the molding, casting or forging thereof and are effective in the cavity 20, in combination with the divergently inclined side wall of the latter, to divide the exhaust pressure fluid into a plurality of streams and to direct those streams into the inlet end of the silencing chamber 14 in an axially and outwardly spreading or diverging relation. The fins 16 may be two or more in number and, as shown in the drawing, three of these fins are preferably provided. The sections into which the cavity is divided by the fins 16 constitute divergent passages 19 which, in this case, are three in number.

The fins 16 are connected substantially centrally of the end member 11 by a boss 16^a so that, with the latter, they form a spider in the cavity 20. The boss 16^a has a threaded axial opening therein for receiving a threaded rod or screw 21 by which the end members 11 and 12 are connected and are held in assembled relation against the ends of the tubular body member 13. The end member 12 may also have an internally threaded boss thereon to receive the opposite end of the rod 21. Both of the end members 11 and 12 have shallow recesses therein to receive the ends of the body member 13, the recesses being defined by annular flanges which overlap a portion of the ends of the body member so as to retain the latter in place, as shown in Fig. 2.

The body member 13 is preferably of tubular form of a material that is porous or has a plurality of small openings to allow the exhaust fluid to be diffused there-through under pressure. A material that has been found particularly desirable is a cellulose fibre which is commercially obtainable in the form of pliable sheets or strips. The body member 13 is a laminated body formed by winding a strip of this cellulose fibre into a tube. The cellulose fibre is impregnated with a phenolic resin such as phenol-formaldehyde and is cured under heat and pressure for the purposes of this invention. The treatment of the cellulose fibre in this manner results in the body member becoming relatively hard and rigid.

The body member 13 may be protected against damaging blows thereagainst by a reinforcing member 22, such as a tubular metal screen arranged to hug the outer

surface of the body member. It may be readily appreciated that the screen 22 not only protects body member 13 but prevents rupture thereof by internal pressure and also assists the body member in withstanding the clamping pressure of the end members 11 and 12.

Another important feature of this invention is the provision of the deflecting means 17 which is arranged adjacent the end member 11 and cooperates with the adjacent end of the body member 13. The deflector 17 in this instance is a one-piece tubular member which is preferably of sheet metal and can be formed by spinning or drawing. The outer end of the deflector 17 is provided with an annular flange 23 which is clamped between the end of the body member 13 and the end member 11. The adjacent portion 23^a of the deflector 17 is of a diameter mating with the diameter of the silencing chamber 14 so as to center the deflector coaxially in the latter. The remaining portion of the deflector 17 is of a reduced diameter from the portion 23^a so as to lie inwardly of the wall of the body member 13, as best seen in Fig. 2, to define an annular access space 25 such that the exhaust fluid can pass between the deflector 17 and the adjacent inner wall of the body member and have access to the maximum area of such inner wall.

The deflector 17, constructed and located in the aforementioned manner, extends into the silencing chamber 14 a sufficient distance to receive the initial impingement of the plurality of fluid pressure streams entering from the divergent passages 19. It has been found desirable to employ a deflector to receive this initial impingement in order to prevent erosion of the inner wall of the body member 13 by the fluid streams.

The deflector 17 is provided with an inturned portion or lip 24 at the inner end thereof. The lip 24 stiffens the deflector sleeve and serves to impart to some of the fluid a criss-cross or reverberating directional characteristics as the streams pass from the deflector 17 into the main portion of the silencing chamber 14. The deflector also conducts the exhaust fluid into the chamber 14 for a sufficient distance that the velocity of the fluid will cause it to carry to the inner end of the chamber, such that the full area of the porous wall will be utilized in the diffusion of the fluid and in the dissipation of the noise.

From the construction and functioning of the muffler 10 as above described, it will be seen that the streams of exhaust fluid are directed into the silencing chamber 14 at one end thereof and are divided and angularly directed by the series of fins 16 so as to reverberate back and forth between the surface portions of the deflector 17 and then into the silencing chamber 14. The concentrated streams of exhaust fluid emerge from the deflector 17 and angularly impinge upon the inner wall of the body member 13 wherein the reverberations and criss-crossing action continues to expend the energy of the streams. The continued discharge of the exhaust fluid into the silencing chamber 14 causes a back pressure to be built up therein and the impingement of the plurality of streams against this back pressure causes them to further lose energy. The exhaust fluid is finally forced through the porous openings of the body member 13 and is thereby diffused into the atmosphere silently.

From the foregoing description and the accompanying drawings it will now be understood that this invention provides a novel and improved muffler construction for silencing the noises of a pressure fluid exhaust and in which the pressure and noise-producing energy is effectively absorbed or dissipated therein prior to its entry into the atmosphere. It will be understood further that the improved muffler requires a minimum number of parts which may be readily manufactured, and easily assembled so as to provide an economical article of manufacture.

Although the novel muffler of this invention has been disclosed herein to a detailed extent it will be under-

stood, of course, that the invention is not to be regarded as being correspondingly limited in scope but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In a muffler, a porous tubular member, closure members cooperating with the ends of said tubular member such that the latter defines a substantially closed chamber, inlet means on one of said closure members comprising a group of axially inwardly diverging passages for directing a plurality of streams of exhaust pressure fluid into said chamber in a divergent relation, the porous character of said tubular member providing numerous small passages for the diffusion of said fluid to atmosphere from said chamber, and a one-piece substantially cylindrical deflector member having a base flange at its outer end lying between said one closure member and the adjacent end of said tubular member and a sleeve portion extending into said tubular member substantially coaxially of the latter for protecting the wall of said tubular member from impingement erosion by said streams, said deflector member having an annular shoulder thereon adjacent said flange and in a centering and telescoping engagement in said adjacent end of said tubular member, the portion of said deflector member axially inward of said shoulder being spaced from the wall of said tubular member to define with the latter an access space for exposing the adjacent wall portion of said tubular member to said fluid.

2. A muffler for silencing pressure fluid exhaust noises comprising, a one-piece porous tubular member, closure members cooperating with the ends of said tubular member to form a substantially closed chamber, said closure members having annular axial flanges telescopically surrounding the end portions of said tubular member, one of said closure members having a substantially central hollow axial stem thereon providing an inlet passage for exhaust pressure fluid, said inlet passage having a delivery end in communication with said chamber at one end of the chamber and substantially on the axis thereof, the porous character of said tubular member providing numerous small passages for the escape of the exhaust pressure fluid from said chamber to atmosphere, rod means connecting said closure members and holding the same in clamping cooperation with the ends of said tubular member, said tubular member comprising a laminated sleeve of wound cellulose fibre sheet material impregnated with phenolic resin, a tubular metal screen disposed around said tubular member for reinforcing the latter and for absorbing a substantial portion of the clamping thrust of said closure members, and fins on said one closure member in an edgewise relation to the direction of fluid flow through the inlet passage and located relative to the delivery end of said inlet passage so as to divide the same into a group of delivery passages for directing streams of said exhaust fluid into said chamber in a divergent relation, said closure member and said fins comprising a one-piece molded member.

3. A muffler as defined in claim 1, in which said deflector member has a free inner end and is of a length in relation to said tubular member such that said free end is located intermediate the ends of said chamber, said free end having in-turned annular lip thereon.

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