United States Patent

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[72] Inventor Ted A. Arnold
Palo Alto, Calif.

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[73] Assignee Vacu-Blast Corporation
Belmont, Calif.

[54] SILENCER FOR AIR-BLASTING GUN
4 Claims, 3 Drawing Figs.

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[51] Int. Cl. B24c 3/00, F01n 1/08, F01n 7/08
[50] Field of Search 181/33, 33.01, 35, 36, 36.4, 47, 57, 36.1; 51/8, 11

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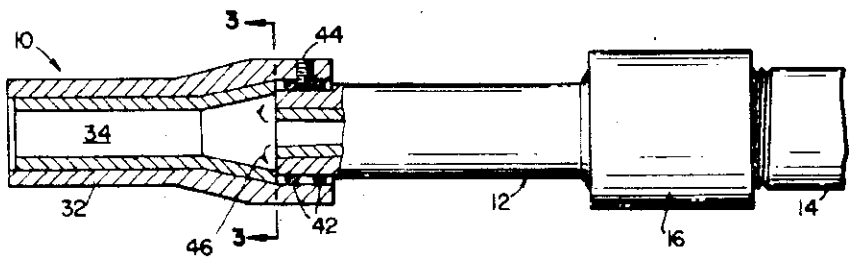
Primary Examiner—Robert S. Ward, Jr.
Attorney—Owen, Wickersham & Erickson

ABSTRACT: A silencer adapted to be attached to an abrasive blasting gun comprises a tapered end portion and a straight barrel portion. The end portion forms an annular tapered airspace around the outlet of the blast-gun exit opening which helps to absorb energy from the air-abrasive stream and suppresses the sound produced at the exit end of the silencer.



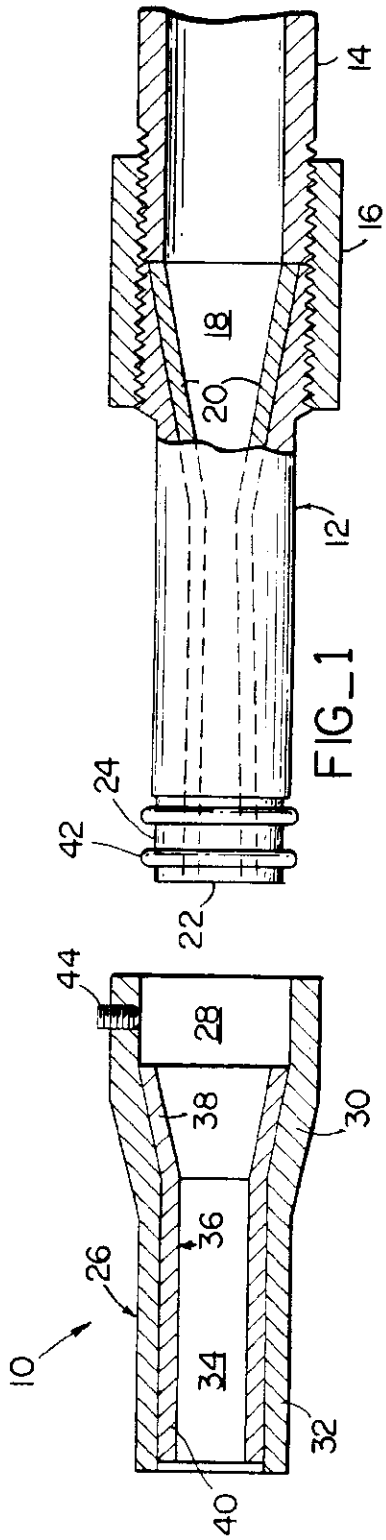


FIG_1

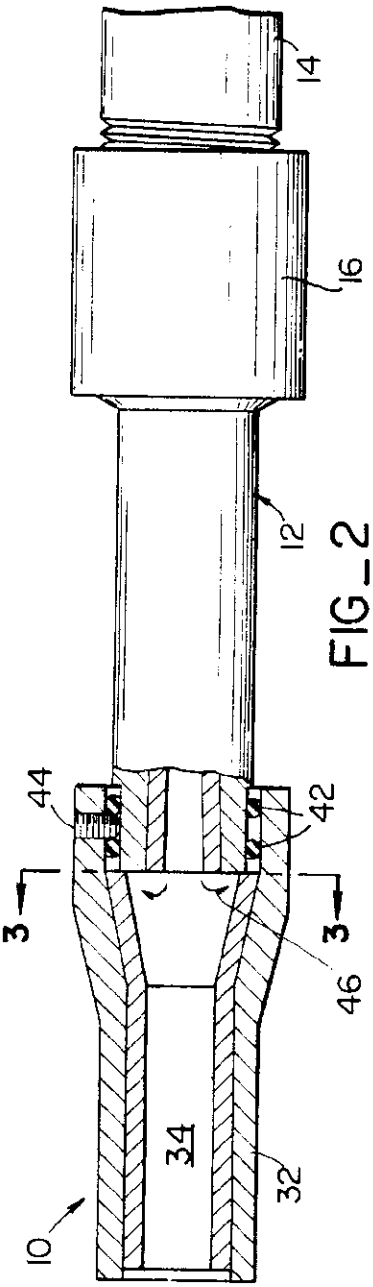


FIG_2

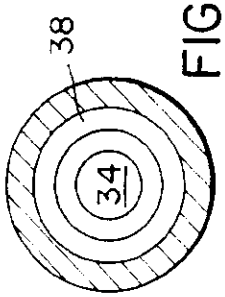


FIG_3

INVENTOR
TED A. ARNOLD

BY

Owen, Wickersham & Erickson
ATTORNEYS

SILENCER FOR AIR-BLASTING GUN

This invention relates to an improved silencer for an air gun used in the surface treatment of articles by abrasive blasting.

In various manufacturing and servicing industries, noise control and abatement is a serious problem. To protect employees from the effects of excessive noise exposure the Federal Government passed the Walsh-Healey Public Contracts Act, Industrial Noise Regulations (Federal Register, Vol. 34, No. 96). This Act establishes the acceptable noise level limits in decibels for band center frequencies from 100 to 8,000 cycles per second. In the field of abrasive blasting, the Walsh-Healey standards created serious problems for the designers of air blasting equipment because of the high sound levels inherently produced from operating blast guns or nozzles. Attempts to solve the problem by confining the blasting operations within heavily sound insulated enclosures proved ineffective and extremely costly.

The present invention provides a solution to the problem of reducing the sound level of an abrasive blast gun in operation by means of a novel silencer that can be connected directly to a conventional blast gun. Generally, the silencer comprises a tubular member having a relatively short tapered portion near the end which is connected to the blast gun and a longer cylindrical portion with a uniform bore extending from the tapered portion. When the blast gun is connected to the silencer an annular, tapered airspace is formed around the exit opening from the blast gun which provides an expansion and energy absorbing space. My silencer, in operation, reduces the sound produced by an airblast during normal abrasive blasting operations by a significant amount in the critical frequency range. Thus, it either completely eliminates or drastically reduces the need for expensive sound suppressing construction around a blasting operation.

Another object of the present invention is to provide a silencer for a blast gun or nozzle that is durable when used with all types of abrasive, easy to install and particularly well adapted for ease and economy of manufacture.

Other objects, advantages and features will become apparent from the following detailed description of one embodiment thereof presented with the accompanying drawing, in which:

FIG. 1 is an exploded view in elevation and in section showing a silencer embodying principles of the present invention when detached from an airblast gun;

FIG. 2 shows the silencer of FIG. 1 as it appears when attached to the airblast gun;

FIG. 3 is a view in section taken along line 3—3 of FIG. 2.

With reference to the drawing, FIG. 1 shows a silencer 10 as it appears when detached from a conventional airblast gun or nozzle 12 of the type normally used for abrasive blasting. The gun is connected to an airhose 14 by some suitable means such as a threaded coupling 16, and this hose extends from a compressed air source and an abrasive feeding means (not shown). Thus, abrasive particles such as glass beads or grit are entrained in the air flowing from the hose into the nozzle during normal use of the blast gun. The blast nozzle or gun normally has a central passage 18 formed by a tungsten carbide liner 20 which converges from its inlet end towards a central throat and then diverges towards its outlet end 22. At its outlet end, the nozzle has an outer cylindrical end portion 24 which is adapted to fit within the silencer.

The silencer 10 is comprised of a generally cylindrical jacket member 26 having an inlet end portion with a cylindrical cavity 28 that will receive the end portion 24 of the blast gun. Extending forwardly from the cavity 28 in the jacket member is a conical portion 30 forming a tapered bore with a gradually reducing diameter. Connected to the conical portion 30 is a straight cylindrical portion 32 having a bore 34 with a constant diameter that extends from the small end of the tapered bore to the silencer outlet. Fixed within the jacket member 26 is a liner 36 made of some extra hard material such as tungsten carbide which has a generally uniform thickness and will resist the wear which would normally occur from the constant passage of abrasive particles. At the inner end of this liner is a conical shaped portion 38 having an inner surface with substantially the same angle of taper as the tapered jacket bore 34. A cylindrical portion 40 of the liner extending from the conical shaped portion has a constant diameter equal to the smallest diameter of the tapered inner surface of the liner.

In making the silencer, the jacket member 26 which preferably is of some suitable metal such as a mild steel, is first formed and machined. The liner 36 is then formed and machined with dimensions that allow it to be driven into the jacket and thereby held in place by a press fit.

When the silencer is attached to the blast gun 12, as shown in FIG. 2, its cylindrical end portion 24 is placed within the end cavity 28 of the silencer 10. A pair of O-rings 42 seated in grooves on the end of the blast gun are sufficient to provide an airtight seal at this silencer-gun connection. Also, when the blast gun end portion is fully inserted within the silencer, a set screw 44 in the silencer jacket can be taken up to hold it firmly in place on the blast gun. With the silencer properly installed on the gun, as shown in FIG. 2, the annular end face 44 of the gun abuts against the inner end of the liner 26 within the silencer. At this point it should be noted that the outlet end of the blast nozzle or gun has a diameter that is considerably smaller than the inlet diameter of the silencer liner. Thus, an annular space 46 having a tapered cross section is formed within the silencer just outside the outlet end of the gun. It should further be noted that the inside diameter of the straight bore portion 40 of the liner 26 is also somewhat greater than the outlet diameter of the blast gun or nozzle.

Actual tests performed with a silencer prototype embodying the principles of my invention have established that certain dimensional relationships produce particularly good results under certain conditions that are typical for air-blasting operations. For example, for a conventional blast gun or nozzle having an outlet diameter "A," the inlet diameter of the silencer liner 36 should be around 2.4 times "A" and the outlet diameter of the liner should be around 1.6 times "A." The length of the tapered liner portion 38 in this example should be around 2.5 times "A" and the length of the straight bore portion 40 should be around 7 times "A."

In tests heretofore performed with a silencer constructed according to my invention, a conventional blast gun having an "A" dimension of five-sixteenths inch was used with a throat bore of one-fourth inch. Air was supplied from a pressure source at 80 p.s.i. and aluminum oxide abrasive of 180 mesh was fed into the airstream at a feed rate of approximately 2.8 lbs./min. Under the foregoing conditions, which are typical for abrasive blasting operations, an average reduction of around 10 decibels in the sound level was measured in the three critical octave frequency ranges, where abrasive blasting normally generated the most noise. This amounts to a substantial noise level reduction. In some instances my silencer alone will be sufficient to reduce the noise level below the upper limits prescribed by the Walsh-Healey Public Contracts Act. In other situations where additional noise sources contribute to the overall level, the use of my silencer will greatly reduce the amount of other sound-suppressing structure that is normally required to comply with established regulations regarding industrial noise.

While it cannot be determined precisely why my silencer is as effective as it is to reduce sound, it would appear that the annular space 46 which it provides around the outlet end of the blast gun is a critical factor. As the air and entrained abrasive exit from the blast gun, the airstream diverges somewhat and its energy is diffused in the annular space. The entrained abrasive remains primarily in a central cylindrical airstream. Since the straight bore portion of the silencer has a larger diameter than the blast gun outlet, an air jacket is formed around the central abrasive stream as it moves through the straight bore portion. It is believed that this air jacket in combination with the annular, tapered chamber at the inlet end of the silencer provides the energy dissipation that reduces the noise level at the outlet end of the silencer.

From the foregoing, it should be apparent that the foregoing provides an effective silencer or sound suppressor for air-blasting guns or nozzles that is effective in use and yet relatively inexpensive to manufacture.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A silencer device for reducing the level of sound produced by an abrasive blast gun having an exit opening with a diameter "A," said device comprising:

an inlet end portion with a tapered bore having a diameter substantially larger than "A" and a conical inner surface that converges forwardly to a smaller diameter but still larger than "A," thereby being adapted to form an annular airspace around the exit opening of the gun aligned with the device;

and an extended barrel portion integral with said end portion and having a cylindrical bore with a diameter equal to said smaller diameter and extending from said tapered bore to an exit opening.

2. The device as described in claim 1 wherein said inlet end portion with a cylindrical cavity axially aligned with the larger end of said tapered bore and adapted to receive the cylindrical end of a blast gun.

3. The device as described in claim 2 including a tungsten-carbide liner of substantially uniform thickness within said tapered bore and said cylindrical bore, said liner within said tapered bore forming a shoulder for locating the blast gun axially within said cavity.

4. The device as described in claim 2 wherein the larger diameter of said tapered bore is around 2.4 times the diameter "A," its smaller diameter and the diameter of the cylindrical bore is around 1.6 times the diameter "A," the length of said tapered bore is around 2.5 and the length of said cylindrical bore is around 7 times the diameter "A."

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