United States Patent

Moates

[15] 3,638,737

[45] Feb. 1, 1972

[54] **PNEUMATIC DRILL NOISE MUFFLER AND DUST REMOVAL APPARATUS**

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[21] Appl. No.: 2,538

[52] U.S. Cl. 173/60, 175/213

[51] Int. Cl. E21c 7/02

[58] Field of Search 175/211-213; 173/59-62

[56] References Cited

UNITED STATES PATENTS

1,023,594	4/1912	Prellwitz	173/60 X
1,084,152	1/1914	Kessel	173/60
1,223,027	4/1917	Brackett	173/60 X
1,334,430	3/1920	Ayotte	175/212 X
1,981,570	11/1934	Price	173/60 X
2,019,332	10/1935	Atkins	173/60
2,041,689	5/1936	Baumeister et al.	173/60 X
2,122,517	7/1938	Curtis	173/60 X
3,442,337	5/1969	Astrom	173/61

FOREIGN PATENTS OR APPLICATIONS

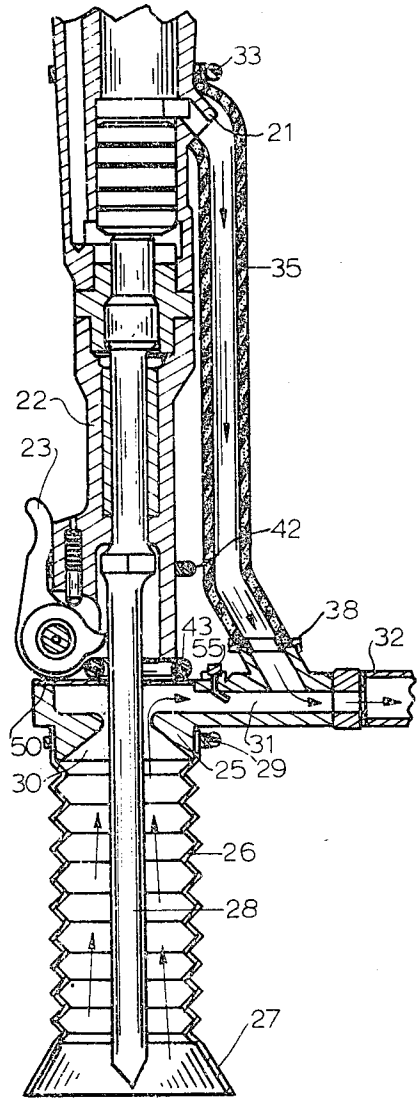
460,969	1/1951	Italy	173/60

Primary Examiner—David H. Brown
Attorney—B. B. Olive

[57] ABSTRACT

A modified pneumatic drill muffles the exhaust air noise and channels the air either by itself or combined with other compressed air to create a suction effect which removes drill dust, small rock bits and the like from the hole being drilled.

1 Claims, 11 Drawing Figures



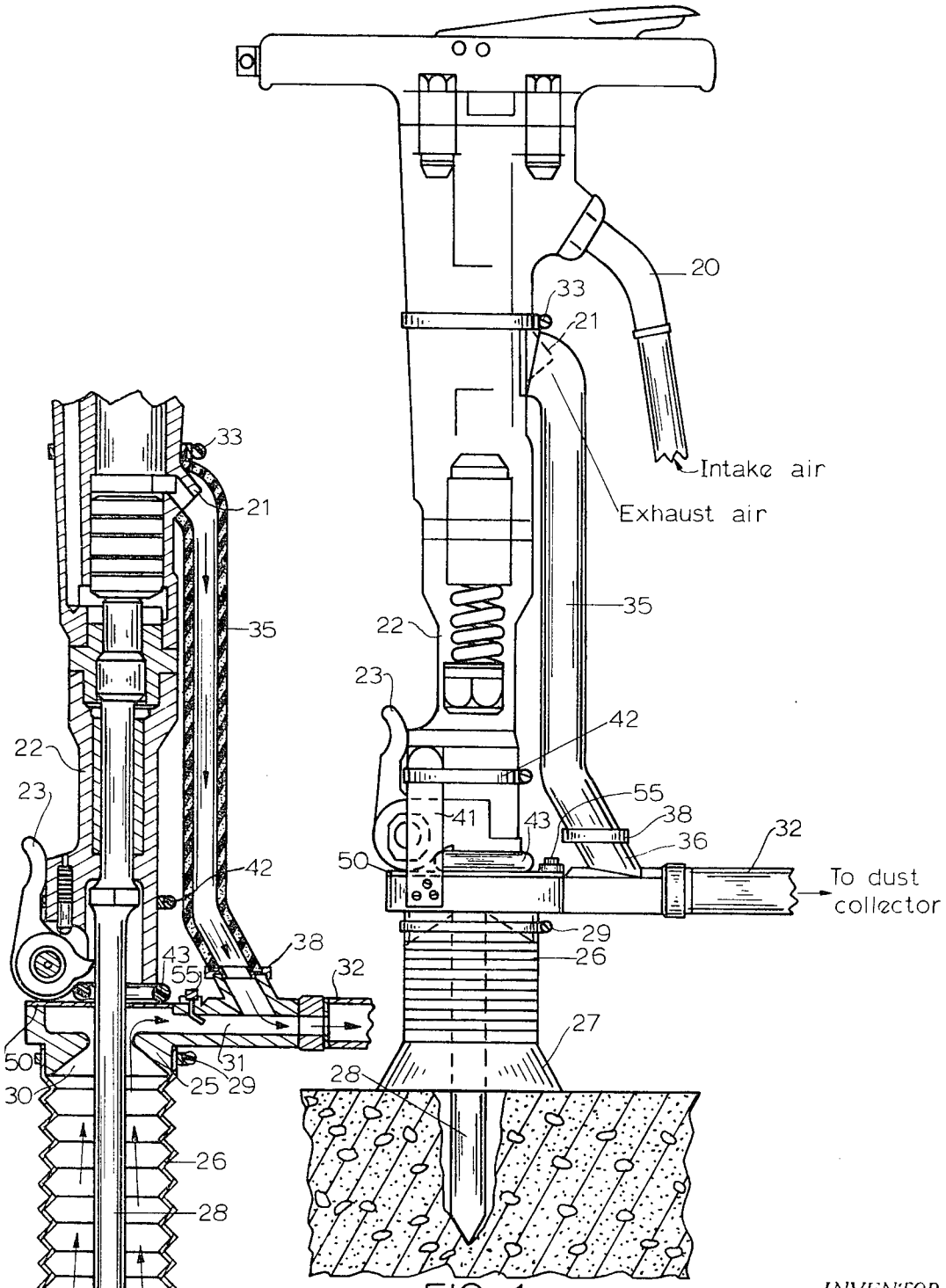


FIG. 1

FIG. 2

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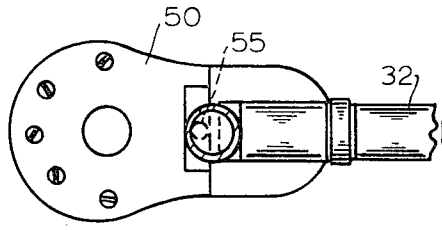


FIG. 3

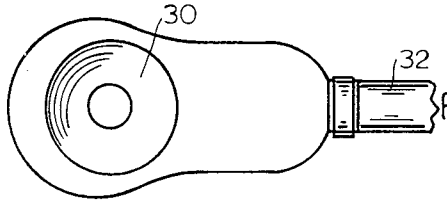


FIG. 4

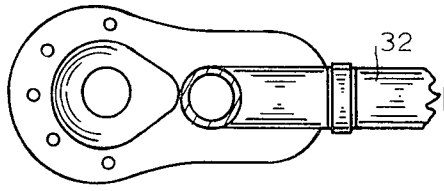


FIG. 5

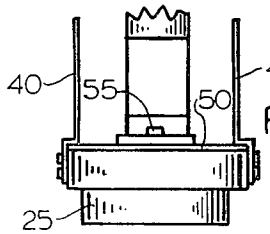


FIG. 6

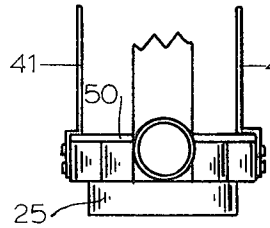


FIG. 7

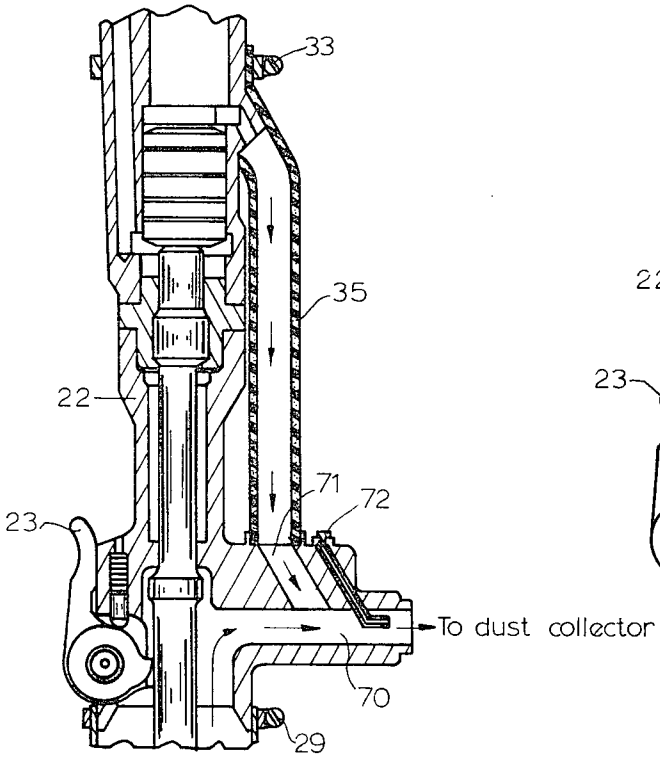


FIG. 11

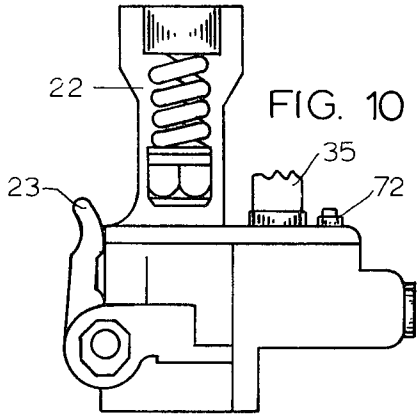


FIG. 10

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FIG. 9

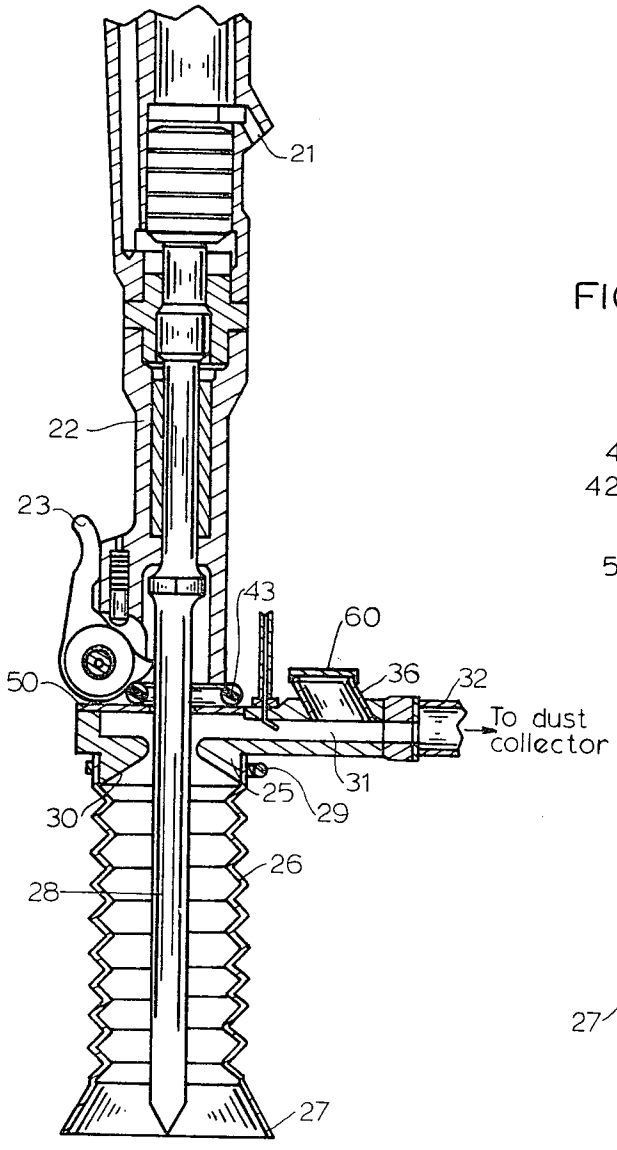
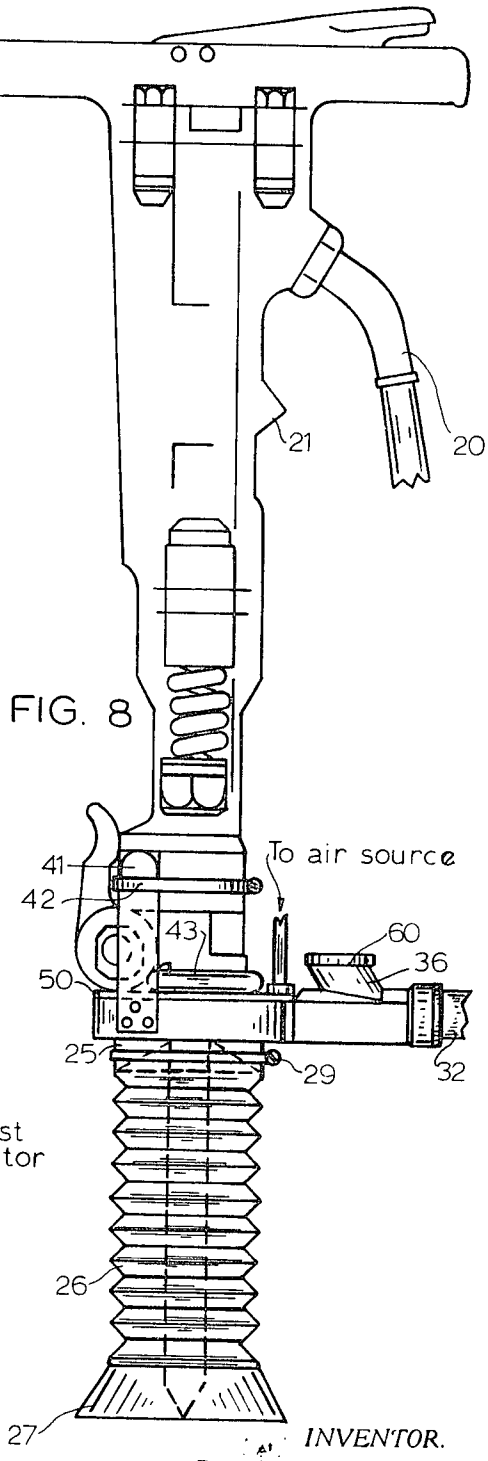


FIG. 8



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PNEUMATIC DRILL NOISE MUFFLER AND DUST REMOVAL APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to pneumatic drilling apparatus, to muffling devices for such apparatus and to vacuum apparatus for removing dust, small rock bits and the like from the work operation.

2. Description of the Prior Art

Pneumatic drills are inherently noisy both by reason of the noise created by the work tool engaging the work and also by reason of the exhaust air noise. It has been known to provide mechanical baffles and the like for muffling the exhaust air noise created by pneumatic tools. However, such mufflers inherently reduce the efficiency of the tool and may require periodic maintenance and replacement. In any event the exhaust air serves no useful purpose once it enters the muffling apparatus. It has also been known to use a collapsible tube around the work tool and to use a vacuum or suction effect in the tube to remove dust, small rock bits and the like from the work operation associated with pneumatic and electric drills, chipping hammers and the like. Typical prior art is to be found in my U.S. Pat. Nos. 3,220,742 and 3,368,633. Other prior art appears in mining tools.

In none of the prior art so far as is presently known is there any teaching of a pneumatic tool which both muffles the exhaust air and utilizes the exhaust air either with or without other compressed air to create a vacuum which is sufficient to remove dust, small rock and the like from the hole being drilled. The prior art also does not teach apparatus which allows noise abatement of the exhaust air either with or without dust removal as desired by the operator.

SUMMARY OF THE INVENTION

The present invention may be embodied either as an attachment for a conventional pneumatic drill or any similar tool, e.g., a breaker or the conventional pneumatic drill may be modified to incorporate the features of the present invention. In either case the invention is directed to channeling the exhaust air through a conduit which is enclosed by a tube of sound absorbing material, e.g., foam rubber, and which acts to dampen the noise produced by the exhaust air. The conduit is of sufficient size to provide substantially unimpeded flow of the exhaust air while in the state of being muffled. The exhaust end of the conduit is connected to a housing which may be attached to or form an integral part of the conventional pneumatic drill structure. The flow of the exhaust air through the housing creates a vacuum effect and this vacuum effect is used to draw dust, small debris and the like up through a collapsible tube which surrounds the work tool, e.g., the drill and acts to force the dust and small debris out through a discharge opening.

The invention apparatus may be used in any of several forms. In one form the invention provides only a muffling effect for the exhaust air. In another application the exhaust air in addition to being muffled creates a vacuum effect in a collapsible tube surrounding the drilling tool and this vacuum effect removes dust, small debris and the like from the work area. In another application the exhaust air is supplemented with a separate source of compressed air to create a higher vacuum effect and thus a more effective removal of the dust, small debris and the like. In a still further application the exhaust air is exhausted to the atmosphere without muffling or being used to create a vacuum effect and a separate compressed air source operates the vacuum dust removal apparatus of the invention.

A general object of the invention is therefore to provide means for muffling the exhaust air of a pneumatic tool and using the exhaust air to create a vacuum effective to remove dust, small debris and the like from the work area.

A more limited object is to provide means for muffling the exhaust air from a pneumatic tool in a manner which does not substantially reduce the operating efficiency of the pneumatic tool or require maintenance.

Another object is to provide a modified pneumatic tool with means for creating a dust removing vacuum effect by using either the exhaust air, a separate source of compressed air or the exhaust air and a separate source of air in combination.

The foregoing and other objects will appear from the description and drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view showing the invention in the form of an attachment secured to a conventional pneumatic drill, the exhaust air being shown muffled and directed to withdraw dust and debris from the hole being drilled.

FIG. 2 is a fragmentary section view of the drill and invention attachment shown in FIG. 1 but with the collapsible tube shown fully extended.

FIG. 3 is a fragmentary top view of the invention attachment but with the attachment holding straps removed.

FIG. 4 is a bottom view of the structure shown in FIG. 3.

FIG. 5 is similar to FIG. 3 but with a covering plate removed.

FIG. 6 is a front view of the invention attachment with the holding straps in place.

FIG. 7 is a rear view of the apparatus shown in FIG. 6.

FIG. 8 is an elevation view showing the attachment arranged for use of a separate air source to produce a vacuum effect for dust removal.

FIG. 9 is a fragmentary section view of the apparatus shown in FIG. 8.

FIG. 10 is a fragmentary side elevation view of a conventional pneumatic tool with a latch-type retainer block modified to incorporate the invention features.

FIG. 11 is a fragmentary section view of a pneumatic hammer showing the modified FIG. 10 retainer block installed, and with a collapsible collar or tube attached.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As previously discussed the apparatus of the invention can take the form of an attachment for a pneumatic tool or drill as illustrated by FIGS. 1 through 9 or may take the form of being an integral part of the pneumatic tool or drill as illustrated by FIGS. 10 and 11. In either case the invention apparatus in one form allows the exhaust air to be muffled as shown in FIG. 2 and FIG. 11. In another form the exhaust air is not muffled as illustrated in FIGS. 8 and 9. Further, the invention apparatus may be arranged so that the exhaust air is the only source of air producing the desired dust removing vacuum effect and this is illustrated by FIGS. 1, 2 and 11 or the exhaust air can supplemented by use of a separate source of air as indicated in FIGS. 8 and 9. A further arrangement allows the exhaust air to be exhausted directly to the atmosphere and the vacuum effect created solely by a separate air source as illustrated in FIGS. 8 and 9. The same basic structure of the invention adapts to all of the foregoing arrangements.

The invention in any of the forms of application mentioned above is applicable to many and varied types of pneumatic tools. A typical collection of the types of pneumatic tools to which the invention is applicable is shown in the 1968 publication entitled "Kent Air Tools and Parts Catalog" published by the Kent Air Tool Company, 711 Lake Street, Kent, Ohio 44240. The drawings, as a matter of example, show a typical pneumatic breaker or hammer type tool well known in the art as to its general construction and only those parts of particular interest to the invention will be discussed.

The pneumatic tool shown for purpose of illustration includes an intake line 20 and an exhaust port 21 through which the exhaust air is conventionally exhausted. The tool also includes as a principal component the front head or retainer block 22 and which mounts a latch-type tool retainer 23. In FIGS. 1 through 9 the apparatus of the invention is in the form of an attachment and includes a main housing 25 to which is

attached a collapsible tube or collar 26 having a flared end piece 27 which engages the work surface around the tool. Collar 26 surrounds the tool piece 28 such that during operation the tool piece may descend into a hole as shown in FIG. 1 and the collar 26 may collapse so as to preserve an enclosure around the tool piece. Clamp 29 holds collar 26.

The housing 25 has an inverted frustoconical-shaped opening 30 surrounding the upper end of the tool piece 28 and which connects with the horizontal passageway 31. Passageway 31 in turn connects to an exhaust hose 32 leading to a tank or other means, not shown, suitable to receiving dust, debris and the like. A sound absorbing tube 35, e.g., a Neoprene foam tube, connects at one end to the exhaust port 21 and at the other end to a conduit 36 which in turn communicates with passageway 31, the connection between the conduit 36 and noise absorbing tube 35 being made through a suitable detachable coupling only generally indicated at 38. Housing 25 is secured to the front head 22 by means of a pair of bent holding straps 40, 41 which are held to the front head 22 by means of a hose type clamp 42. An O-ring 43 is used to effect sealing between front head 22 and housing 25. Clamp 33 holds tube 35.

With the embodiment thus far described when the noise absorbing tube 35 is in place and the exhaust air is directed into the passageway 31 a vacuum effect is produced in the interior of collapsible tube 26 such that dust, small rock and the like will be drawn up through the interior of the collapsible tube 26, into passageway 31 and ejected through the vacuum tube 32. Thus, in this form of application of the invention the exhaust air is both muffled and utilized for the highly desirable purpose of removing dust and the like from the work area. Two forms of pollution, namely, noise pollution and dust pollution are accordingly substantially reduced. Also of equal importance it is known that the removal of dust and debris from the work area will substantially increase the speed of this type of work and this results in considerably less time being required for the overall operation. In some concrete hole drilling operations dust removal reduces drill time from minutes to seconds.

To continue with the detailed description, housing 25 includes a cover plate 50 (FIG. 3) which can be removed (FIG. 5) for purposes of maintenance, repair and the like. In some instances it is desirable to supplement the pressurized air it will of course be understood that a venturi effect is created in passageway 31 which when acting even by itself as indicated in FIGS. 8 and 9 will create exhaust air with another source of pressurized air so as to increase the vacuum effect. The invention provides for this alternative by means of a venturi tube 55 which can be closed as indicated in FIGS. 1 and 2 or which can be connected to a separate air source as indicated in FIGS. 8 and 9. When the venturi tube 55 is connected to a suitable source of pressurized air it will of course be understood that a venturi effect is created in passageway 31 which when acting even by itself as indicated in FIGS. 8 and 9 will create a vacuum dust removing effect or when used in conjunction with the vacuum effect produced by the exhaust air will produce even a stronger effect, this latter arrangement not being specifically shown in the drawings. Where noise is not considered a problem and a separate air source is readily available the vacuum effect may be produced as illustrated in FIGS. 8 and 9 with the end of conduit 36 capped by a suitable cap 60. Note that in all of these applications the same basic structure is being employed.

The invention in the form of an attachment as illustrated by the previously explained FIGS. 1 through 9 allows the owner of the conventional pneumatic tool to enjoy the benefits of the invention without requiring any modification or replacement of his tools in inventory. All that is required is to simply attach the apparatus invention by means of the straps 40, 41 and the clamp 42. In another form of the invention illustrated by FIGS. 10 and 11 the front head or retainer block 22 is manufactured in its original form in a manner to include a passageway 70 which can be connected to the noise absorbing tube 35 and which further includes a venturi tube 72 which can be connected to a separate air source. In this embodiment dust and small debris can be collected either by using the exhaust air through noise tube 35 in conjunction with venturi air being admitted through the venturi tube 72 or the exhaust air can be used alone or the venturi air can be used alone. In either case the vacuum dust removing effect can be obtained either with or without the noise muffling feature of the invention. Note here again that the same basic apparatus adapts to all of these applications and that passageways 31 and 70 serve the same removal purpose and that conduit 36 and passageway 71 serve the same air entry purpose.

In summary, a principal advantage of the invention is that a pneumatic tool's exhaust air may be both muffled and used as a source of vacuum for withdrawing dust, debris and the like from the work area. The practical value of the invention is furthermore enhanced by the facility of being able to obtain noise muffling either with or without dust removal. Furthermore, the dust removal feature can be obtained either with or without the noise removal feature. Further versatility is to be found in the adaptability to use of exhaust air only as a vacuum source or to use of a separate source of air for vacuum dust removing purposes or to use in combination of both the exhaust air and a separate source of air. Since the invention apparatus can be made either in the form of an attachment or as an integral part of the original equipment the industry gains the advantage of not having to discard its conventional pneumatic tools since such tools can be easily converted simply by the addition of an attachment according to the invention as previously described.

While the invention is described in connection with a particular type of tool it should be understood that the invention is applicable either to an impact type pneumatic tool or to a rotary type pneumatic tool or to a combination impact-rotary pneumatic tool. Furthermore, while it is desirable to reduce the inherent noise of the exhaust air the dust removal feature of the invention can be obtained even though the conduit through which the exhaust air passes is not made of a sound absorbing material. That is, if the exhaust air is directed in such a way as to create a dust removing vacuum effect even though it does not pass through a sound absorbing material, e.g., a Neoprene foam-type tube but rather through a non-sound absorbing tube, e.g., a metal tube, the vacuum effect is nevertheless obtained. Also if noise is not considered a problem but dust is considered a problem it can be allowed to exhaust itself directly to the atmosphere and the desired vacuum effect can be created by connecting the described venturi tube to a separate source of pressurized air. As previously mentioned the same basic structure is sufficiently versatile to apply to all such applications.

Having described the invention what is claimed is:

1. A detachable dust remover and noise suppressing assembly for a pneumatic drill having a normally open exhaust port, a pneumatically operated elongated work tool and a front head releasably securing said tool, comprising in combination:

a. a rigid housing providing internally thereof and on one side an inverted frustoconical-shaped opening and on an opposite side an annular opening and a cavity connecting and between said openings, said housing further providing a passageway extending laterally from and communicating with said cavity and mounting both an exhaust gas ejector inlet and an auxiliary gas ejector inlet in said passageway thereby providing when gas is ejected from either inlet a partial vacuum in said cavity;

said passageway terminating in an exhaust opening;

b. holding means adapted to releasably secure said housing to the front head of said pneumatic drill with the tool of said drill passing through said annular opening, said cavity, and said frustoconical opening of said housing and with said front head positioned adjacent to and effecting a substantially airtight seal around said annular opening;

c. a collapsible type tube fixed at one end to said housing adjacent said frustoconical opening and arranged to normally enclose and provide a cavity surrounding said tool and in a manner which places the interior of said tube in communication with said frustoconical opening, said tube terminating in a bottom end designed to normally engage the work surface surrounding said tool;

d. conduit means formed of a sound absorbing material connecting the exhaust port of said drill to said exhaust gas ejector;

e. fitting means adapted to connect and open said auxiliary gas ejector inlet to an auxiliary gas supply when used and to close said auxiliary gas ejector inlet when not in use; and

f. conduit means adapted to be connected to said passageway exhaust opening and being effective to remove from the operating area of said drill exhaust gas and dust carried from said work surface through said collapsible tube, said frustoconical opening, said cavity, said passageway and said exhaust opening by means of said partial vacuum.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,638,737 Dated February 1, 1972

Inventor(s) David G. Moates

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, lines 43, 44, 45 and 46, "air it will of course be understood that a venturi effect is created in passageway 31 which when acting even by itself as indicated in Fig. 8 and 9 will create" should be deleted.

Signed and sealed this 30th day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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